THE ROLE OF COST ESTIMATORS IN UK CONSTRUCTION; A CASE FOR AND STEPS TOWARDS AN ESTIMATING PROFESSION

By

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To Fran – her love and passion for her “mature ladies”, dogs, birds, whales, dolphins, wild animals, organic vegetables, plants, garden, compost heaps and cooking, knows no bounds. She has many other interests and desires but I’m drawing a line at donkeys, goats and chickens - for all she does and all the dark times that she’s fought her way through I dedicate this thesis with all my love.

Abstract

Estimators and Quantity Surveyors (QS) have pivotal roles in the profitability of construction contracts; however, only QSs have professional recognition. Comparisons between these groups suggested that this may be an anomaly. The purpose of this thesis was to consider the role of the Estimator relative to the accepted criteria attaching to professional status.

To achieve this, definitions of a profession were used to compare QSs and Estimators in terms of remuneration, education and professional representation. A statistical analysis on each of these conditions suggested that there was no significant difference in terms of salary offered or education required, by employers. Further investigation, however, did reveal considerable differences in educational and professional opportunities, favouring QSs. With regard to the key defining criteria of a profession and the consideration given by employers, the results indicated that there was no difference between the two groups.

Further surveys developed proposals for an Estimator "Body of Knowledge" (BoK) and Training Needs Analysis (TNA) and also found a changing role in meeting diverse client-driven procurement methods and employer requirements. As this demonstrated a case for professional recognition to be considered then these proposals could be used as a platform for further development.

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Chapter 1 - Introduction

For over twenty years computer software programs have been made available that were designed to improve the standards of estimating and greatly increase the speed of flow of tender information between clients' representatives, contractors, sub-contractors and suppliers. From personal experience and discussions with peers in the UK construction industry (CI), there were increasing frustrations that full advantage was not being taken of these advances. As it was difficult to know whether this was due to a lack of investment by employers or the inability of Estimators to adapt to new technologies it was originally decided to investigate the problem to discover the reasons for the perceived slow take-up of information technology (IT). The research quickly unearthed what appeared to be a major deficiency in the estimating role with evidence of neglect in the fundamental area of specific education and training for Estimators. This would partially explain the slow take-up of IT, particularly with the adoption of computer aided estimating (CAE). If this was factual, it meant that CI employers were taking serious risks by allowing Estimators to carry out such a vital financial function without the benefit of specialised education and training. As the accuracy of a nett cost estimate was pivotal to the success and/or failure of every CI company, the emphasis of the research was placed onto discovering what Estimators do.

Given that almost every CI engineering and construction company relies upon Estimators to win contracts, it would be expected that these employers would place a high value on the estimating role. It would also be assumed that they would want to have confidence in the capability of their Estimators to carry out the work to the highest standards, with the ability to operate CAE software and other software programmes within their IT networks.

Therefore, if the estimating role merited a specific education and training programme (ETP) then it may also be worthy of acquiring professional status. If that was feasible, the upgraded position of the role would benefit employers by attracting individuals with assured ability. It would also present estimating in a more attractive light to prospective candidates of the required ability.

Researching available literature gave indications of reasons for the deficiency in Estimator ETPs. Some authors regarded estimating as being both a hit-and-miss procedure and one that had too many variables for it to be carried out with consistent accuracy. Others emphasised the vital nature of the role in construction company profitability. Literature was also found that highlighted changes in the way in which the CI was carrying out its projects. These changes were shown to be increasing the demands and attribute requirements of Estimators from both clients and employers. In general, these appraisals presented a picture of the CI as one heavily reliant for its survival and prosperity upon an apparently unreliable procedure. Despite this, the industry did not appear to be sufficiently concerned that it felt it necessary to change its approach to Estimator training, even though the difficulty of producing accurate estimates was widely acknowledged and the challenges of changes in procurement methods were extending the range of Estimator skills. At best, the CI appeared to be expecting Estimators to get what education and training they could from courses designed for other roles, which may or may not be sufficient but inevitably would be scattered across a variety of courses and higher education (HE) facilities. With such a vital role being carried out in such an unreliable way, this ought to lead to the conclusion that as much as possible should be done to minimise the resultant risks by providing specifically designed Estimator ETPs.

Authors' observations on the role and the ways in which it was changing, the necessity and difficulty of accurate estimating and the risk of financial damage when estimates were not accurate are shown below:

The Estimators' role and changing function

Reviewing literature from 1995 to 2009 it was apparent that there was little change in the core role of producing a nett estimate. Harris and McCaffer (1995) and McCaffer and Baldwin (1995) (in Smith (ed.) 1995) produced work on this core practice which differed only slightly from that produced by Holdroyd (2002), Harris, et al, (2006), Brook (2008) and the Chartered Institute of Building (CIOB) (2009). The work from Harris and McCaffer and McCaffer and Baldwin can be seen in Chapter 7, an Estimator-QS job attributes comparison.

A code of practice published by the CIOB, *op. cit.,* documented the Estimators' role as preparing:

- Net unit rate calculations
- All-in labour rate estimate
- All-in plant rate estimate
- Quotations for plant, materials and sub-contractors
- Calculations for unit rates
- Insertion of PC and Provisional sums
- Calculation of preliminaries and overheads
- Summaries
- Calculation checks
- Risk analyses
- Settlement meeting
- Reports
- contract negotiations if tender successful
- transfer of estimate information to site and management teams

In broad agreement with this code were Holdroyd, Harris, et al, and Brook, all above.

While that framework set out the core estimating procedure, changes in the Estimators' function were made apparent by Brook, *op. cit.,* who produced a comprehensive study on estimating and tendering in construction. He described how the estimating function had changed since the early 1990s in that its core duties were being performed by assistants using computers. Estimators, he said, were managing the process and producing management reports

The CIOB, above, said that the core Estimator role remained basically unchanged. They also said that competitive tendering was still the favoured route for many clients seeking to obtain the best value for their projects. However, they pointed out that changes brought about by the introduction of new procurement methods had meant that CI contractors were being placed under pressure to be more innovative. This, they said, had added to demands on the tendering procedure and meant more complex tender submissions which were designed to:

- Demonstrate design and "buildability"

- Provide value engineering
- Calculate project duration
- Demonstrate best-value
- Provide cost planning, design-to-cost exercises and whole life costing
- Provide risk management information
- Provide value management information
- Provide information on health and safety issues
- Provide supply chain management information

The additional demands, they continued, had led to the development of multi-skilled bid management departments where Estimators were part of the team. These demands had, in turn, been placed onto contractors' sub-contractors, resulting in closer Estimator/sub-contractor relationships.

The CIOB's code of practice was used by Brook, above, to provide explanations and examples of methods by which Estimators could use those codes in practice. He highlighted changes in procedures that would affect Estimators, which had occurred since the mid 1990s, with the changes gathering pace from the early years of the 21st century. These were that:

- Many Estimators duties were being carried out by assistants using word processors, spreadsheets and CAE
- The process was managed by the Estimator who then produced reports for management
- Financial budgets and cost allowances for use during construction were being produced by the Estimator
- Computers were becoming essential for use in estimate preparation
- Changes introduced with Standard Method of Measurement 7 (SMM7) and other principles of Coordinated Project Information had reduced the items being measured in a bill of quantities (BQ). Because of this, item descriptions were not providing information on which Estimators could rely for pricing and they, therefore, had to refer to specifications and drawings in a far more detailed way than previously.
- Responsibility for preparing BQs was increasingly being passed to contractors

In mirroring the opinions of the CIOB Brook said that these changes had been brought about by varying procurement paths which had been introduced to allow the flexibility considered to be essential to the process of modernisation in the CI. Therefore, contractors' involvement had adapted in order to meet the needs of clients' demands. Some of the procurement methods he described are shown below:

- Partnering
- D & B
- Management contracting
- Construction management
- PFI as a major initiative under the Public-Private Partnership system (PPP)
- Prime contracting
- Lump Sum contracting
- Fixed/Firm Price contracting
- Measured contracting
- Cost Reimbursement contracting

Reinforcement of the changing Estimator function due to the increased use of these procurement methods came from Ashworth and Willis (2008) and Buchan, et al, (2003).

Producing accurate estimates

Carr (1989) bemoaned the lack of sound theoretical and empirical evidence available, on which estimating policy and practice could be based.

Akintoye and Fitzgerald (2000) noted the dearth of literature that related to cost estimating, without which they considered that it was difficult to inform the process in a systematic and rational way. Therefore, they added, the consequence was that recent developments in estimating techniques had not been adopted.

A survey undertaken by the Construction Industry Computing Association (CICA) and Klynveld Peat Marwick Goerdeler (KPMG) (1989) emphasised major causes of inaccuracy in cost estimating. Problem areas highlighted were:

- A lack of practical knowledge of the construction process by those responsible for estimate production
- Insufficient time at the tender stage
- Poor tender documentation
- A wide variability in sub-contract prices

On the absence of information to guide the practice of estimating, Uman (1990) said that there could be no national standard guidelines from which cost estimating systems could be produced. The problem, he said, was further exacerbated by practical factors such as extreme diversity in:

- Building systems
- Methods
- Projects
- Suppliers
- Contractors
- Workforce

Harris and McCaffer (1995) described the function of Estimators as building up the estimates "from scratch" to arrive at a final price that was accurate, competitive and workable.

Estimators were constrained by the need to achieve economically competitive costings and, consequently, must present socially acceptable forecasts, (Skitmore and Wilcox, 1994).

Standardised costing models may be inappropriate in an industry where the actual costs of construction will depend upon many factors, including contractors' individual selection of resources, methods, and the timing and sequence of operations, (Bennett and Barnes, 1979).

A description from Ashworth (2010) was that it was the principal function of the Estimator to calculate the cost of a proposed construction project as accurately as possible but it was not the Estimators' responsibility to calculate the right price.

Holdroyd, above, was concerned that some clients were pressurising contractors into accepting "standard rates" for their work. He gave a simple example of a large authority that set fixed prices for cutting down a 1m girth tree, irrespective of the geographical location or the working conditions.

Brook, *op. cit.,* considered the Estimator to be vital to any contracting organisation's success as they were responsible for preparing the most economical cost for construction work.

Estimators' capacity for causing financial damage

Given the pivotal role which the process had in the profitability of any project, there was particular concern that impediments to improving the accuracy of estimating exacerbated the problem, (Hicks, 1992).

Due to the difficulties in carrying out the task it was of little surprise that, in comparison to other industries, profitability in the CI was said to be low, (Akintoye and Skitmore, 1991).

While all construction operations were important and all had a contribution to make to the profitability or otherwise of any project, the centrality of estimating should not have been undervalued. However, as a single discipline in a conglomeration of pre-tender and construction management functions, Smith (1995) wrote of the indispensable nature of cost estimating by emphasising its importance in enabling construction companies to determine their 'bottom line' project costs.

The opinion of McCaffer and Baldwin (1991) was that estimating and tendering in the CI were major management functions. They added that with the relentless progression of new technology the work of estimators, as with most other business functions, would be under pressure to change

Concern was expressed by Holdroyd, *op. cit*., of contractors' Estimators being pressured into quoting prices in too short a time-span which he termed "*a guesstimate*" (p.76). He quoted an example of an Estimator disagreeing with a price that had been calculated by a colleague for the construction of a 400m access road and

Bailey bridge to carry heavy construction plant. The calculated cost of over £1.5m was reduced to less than £0.5m on the Estimator's 'gut feeling'. The company won the contract but suffered financially.

Estimating literature from the last two decades demonstrated that:

- Increasing demands had raised employers' expectations of Estimators' requirements.
- The extreme difficulty involved in producing consistently accurate estimates in order to achieve company profitability and avoid financial loss had not changed

Although accuracy and consistency could probably be improved by the adoption of suitable CAE packages, the role of cost Estimators should not be overlooked since, with or without the aid of technology, these individuals are salient to the success or otherwise of the process. Cost estimating is probably the core activity in pre-contract operations and also the fulcrum around which many construction management activities operate. Its importance was considered by Harris, et al, *op. cit.*, to be "*of central importance to the commercial success of the contracting organisation*" (p.185) and by Brook, *op. cit.,* to be vital to the success of the contractor's organisation. Therefore, for estimators in the CI to speak in accord and to inter-relate with other management and professional activities it would seem that changes needed to be made. An estimating professional body (PB) or conjunction into an existing construction-related PB, plus the opportunity to achieve specifically designed higher-level educational qualifications would be a development. Its inception would provide immeasurable benefits both for the industry as a whole and for Estimators individually. In their absence, the variability in practice was likely to continue.

An article by Hackett and Hicks (2007) covering the work in this thesis up to and including the Delphi Study (Chapter 9) was published in the Engineering, Construction and Management Journal (ECAM) and can be seen in Appendix 7. On completion of the thesis a further study was carried out which provided examples of how estimating courses could be introduced into Universities and PBs by using many of the course modules that exist within other role structures. This study may well be

of benefit to any education and training organisations interested in setting up such courses and can be seen in Appendix 9.

Literature on research methods had varied opinions on how a literature review should be presented in a thesis. Kumar (1999) strongly recommended that it should not be found in one heading but, instead, be written around its emerging themes. There was agreement on this by Pole and Lampard (2002) who advocated:

> "*adopting an integrated approach to the literature, which sees it discussed throughout the thesis or the research report rather than merely in the introduction*" (p.17).

As this research covered a wide range of methodologies and studies it was considered to be more appropriate to follow the advice of these two authors by relating the literature to specific areas under investigation rather than providing a single literature review.

While, particularly with the literature from Brook, above, there was detailed information available on 'how Estimators perform their tasks' this thesis was concerned with discovering 'what Estimators do' and, as such, sought to investigate and alleviate the problems highlighted above with a view to making recommendations for the specialised training of Estimators that could lead to the professionalisation of their role. Therefore, the main research aim was:

- To establish whether or not the estimating role in the UK CI justified eligibility for professional status

This was met with four objectives together with sub-objectives for each which are shown in Tables 1-4 below:

Table 1 Objective 1

Objectives and Sub-Objectives			
Objective 1	**Item**	**Sub-Objective**	**See Chapter**
To determine the general requirements for professional status and to assess the likelihood or otherwise of Estimators' abilities in meeting these requirements, which would be a pre-requisite to professional recognition	a)	To determine definitions of what is meant by a profession by conducting a literature review	3
	b)	To discover whether estimating was regarded as being a profession by conducting a literature search	3
	c)	To highlight those key criteria that could form a pre-requisite for professional Estimator status by using the list of professional definitions obtained at a)	4
	d)	To form a general assessment of possible Estimator professional attainment by creating a further list, of key QS professional criteria, which would allow a comparison to be made between the two groups.	4
	e)	To develop a comparative list of core job attributes for Estimators and QSs by conducting a literature review, an internet search and collating attributes from a "snapshot" job advertisement survey	7
	f)	To develop a hypothesis and use the attribute lists obtained at e) above to statistically test the the difference in attribute requirements between the two groups	7
	g)	To carry out a Delphi study to statistically test attribute information which will provide a clear comparison between of the level of attribute requirements expected of Estimators and QSs and also determine whether or not there is correlation between the groups	9

Table 2 Objective 2

Objectives and Sub-Objectives			
Objective 2	**Item**	**Sub-Objective**	**See Chapter**
To determine the regard held by the UK construction industry for Estimators	a)	To carry out a UK-wide "snapshot" job advertisement survey of Estimators and QSs	6
	b)	To develop a hypothesis based on salary levels and use information extracted from the survey at a), above, to statistically test the difference between the two groups.	6
	c)	To develop a hypothesis based on benefits offered and use information from the survey at a), above, to statitically test the difference between the two	6
	d)	To provide a comparison between education and training availability in the UK and the USA	Appendix 8

Table 3 Objective 3

Objectives and Sub-Objectives			
Objective 3	**Item**	**Sub-Objective**	**See Chapter**
To research education and training available to Estimators	a)	To carry out pilot interviews with Estimators in order to obtain views on the availability, and of their attitudes to, education and training for their role	5
	b)	To research and compare the education and training available for Estimators and QSs in higher education (HE), at PB levels and by other CI training organisations, in the UK	8

Table 4 Objective 4

Objectives and Sub-Objectives			
Objective 4	**Item**	**Sub-Objective**	**See Chapter**
To develop an Estimator Training Needs Analysis (TNA) and Body of Knowledge (BoK)	a)	To obtain the information required in order to produce a comprehensive, informative and workable TNA, by conducting a literature review	12
	b)	To collect Estimator attributes obtained from the pilot interviews	5
	c)	To collect Estimator attributes from the job attribute comparison	7
	d)	To Collect Estimator attributes from the Delphi study	9
	e)	To gather information on Ethnography by conducting a literature review	10
	f)	To collect Estimator attributes from the information obtained while carrying out the Ethnographical studies	10
	g)	To discover the most appropriate method of carrying out structured interviews by conducting a literature review	11
	h)	To develop a format for the structured interviews and include information gathered from a), b), c), d), and f), above	11
	i)	To use the form developed at h) above and carry out structured interviews in order to obtain information pertinent to this thesis and extend the Estimator attribute list	11
	j)	To produce a standard TNA format and collate the information on Estimator attributes obtained from a), b), c), d), f) and i), above	12

Research Design

The design framework for this research is based on the "Criterial Framework" methodology proposed by Gerring (2001) and explained in Chapter 2. It used qualitative and quantitative methodologies as a means of extracting information on Estimators and QSs and having an aim based on professional recognition for Estimators also sought to discover the levels of attainment required in order to achieve this. Each Chapter's contributions to the main aim are as follows:

1. Chapter 3 - Professions - researched what defines a profession, what was required of a group in order to gain professional recognition and discovered

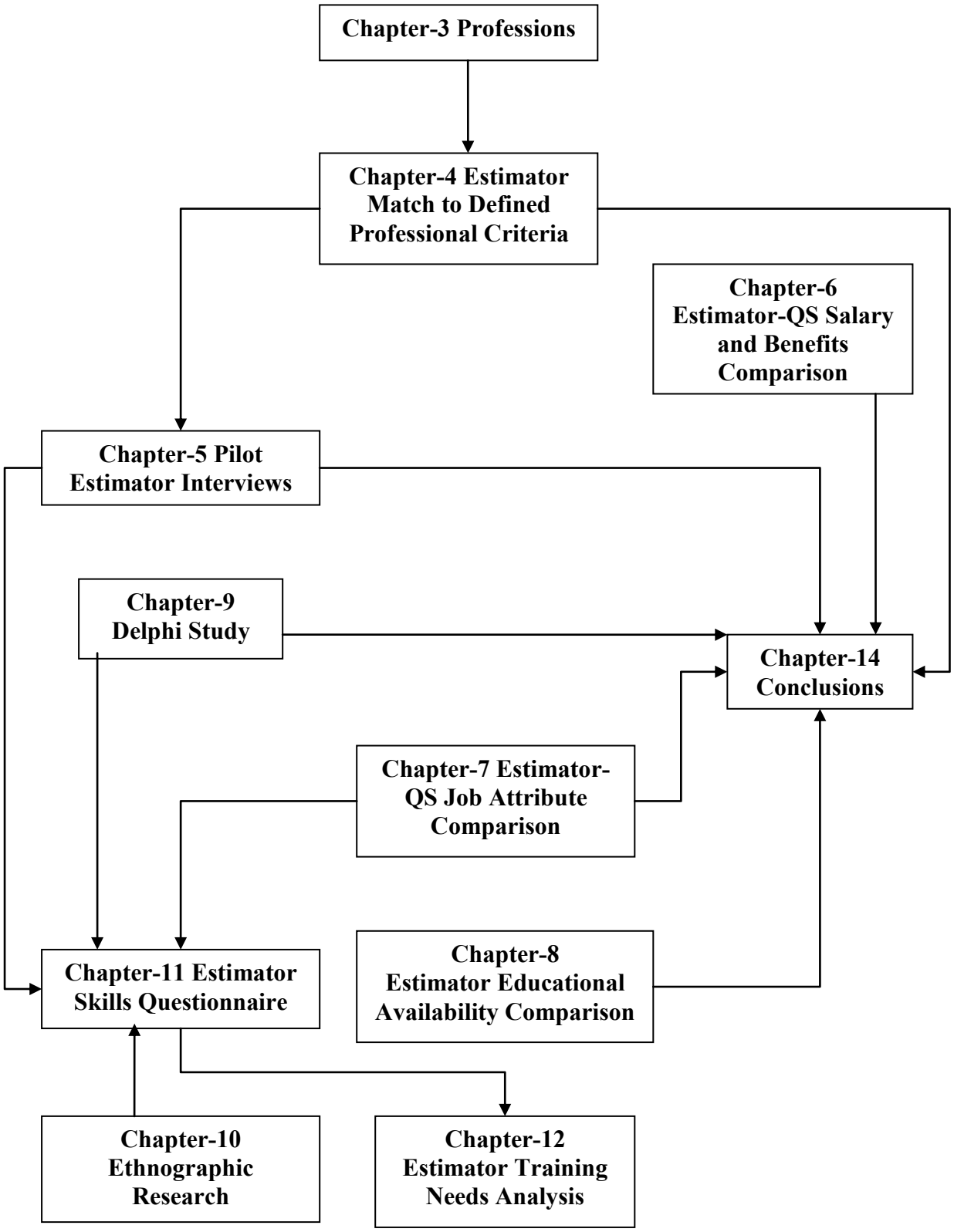
the position of Estimators as that of an occupation and not a profession. This provided information for Chapter 4

2. Chapter 4 - Estimator Match to Defined Professional Criteria - made an assessment regarding the likelihood or otherwise of estimating being able to meet these professional conditions. A positive appraisal led the research into gathering information on Estimator attributes (Chapter 5) and contributed to the justification for professional recognition in the Conclusions (Chapter 14)
3. Chapter 5 - Pilot Estimator Interviews - contributed to the information required for the Estimator Skills Questionnaire (Chapter 11) and onwards to the Training Needs Analysis (TNA) (Chapter 12). It also added to the information concerning the CIs regard for their position in the Conclusions (Chapter 14)
4. Chapter 6 - Estimator-QS Salary and Benefits Comparison – compared Estimators' and QSs remuneration which also offered an insight into the CIs perception of their role. This contributed to the information justifying professional recognition in the Conclusions (Chapter 14)
5. Chapter 7 - Estimator-QS Job Attribute Comparison - contributed to the information required for the Estimator Skills Questionnaire (Chapter 11) and onwards to the TNA (Chapter 12). It also provided information justifying professional recognition in the Conclusions (Chapter 14)
6. Chapter 8 - Estimator-QS Educational Availability Comparison – added to the information concerning the CIs regard for their position in the Conclusions, (Chapter 14)
7. Chapter 9 - Delphi Study – contributed to the development of the Estimator Skills Questionnaire (Chapter 11) and onwards to the TNA (Chapter 12). In addition it aided the justification of professional recognition in the Conclusions (Chapter 14)
8. Chapter 10 - Ethnographical Research - contributed to the development of an Estimator Skills Questionnaire (Chapter 11) and onwards to the TNA (Chapter 12).
9. Chapter 11 - Estimator Skills Questionnaire –contributed to the development of the TNA (Chapter 12). It also added to the information concerning the CIs regard for their position in the Conclusions, (Chapter 14)

10. Chapter 12 - Estimator Training Needs Analysis – collated all of the attributes discovered from this research, together with attributes from updated literature, and tabulated the information into a format suitable for use by CI education and training providers in addition to providing, within it, an Estimator Body of Knowledge (BoK).

The research design and links described above are shown in the form of a flow chart at Chart 1, below:

Chart 1 Research Links



Chapter 2 - Research Method

To discover whether the estimating role was theoretically eligible for professional status the work required of Estimators was first evaluated so that a complete picture of the role, functions and boundaries could be clearly presented. Therefore, this research was, in part, designed to determine 'what people do'. The means of discovering what individuals choose, think and do was described by authors such as Bhargava (1992) and Della Porta and Keating (2008) as Methodological Individualism (MI). Although Bhargava considered that MI has a broader context than 'choosing, thinking and doing' he nonetheless categorised its methodology within the sphere of social science. Therefore, although the people about whom this research intended to discover information were involved in the UK construction and civil engineering industry the most appropriate methodologies used were those belonging in the field of social science. This was considered by Fellows and Liu (2003) to be an acceptable approach. Writing about the development of a unique BoK within the sphere of the CI, which was a major proportion of this research, they said that in this regard research could draw on natural- and social- science, engineering and management. For the outcome to produce as much information as possible these methodologies used different techniques by the application of pure and applied research and sought information of a quantitative and qualitative nature which, therefore, mixed the type of methodologies employed and created a research design structured in the following way:

The nature of the research question being asked was complex in that it comprised researching the Estimator function in relation to the criterion of professionalism by using a variety of approaches:

- Interpretation of its definitions
- Structured interviews
- Semi-structured interviews
- Surveys
- Role comparisons
- Delphi study
- Ethnography
- Task analyses

- Case studies

A consequence of this was that the research was not given solely to experimental/quantitative methods nor would it be sufficient to use qualitative/interpretive approaches. Therefore, in order to make recommendations to the CI on Estimator ETPs, qualifications and professional status the overall research method needed to be of a generalised nature. Given that both methods make invaluable contributions to the research then combining them would be the logical approach. This multi-method approach was favoured by authors whose opinions are given below:

Scarbrough and Tanenbaum (1998) quoted as one of their objectives that they wished to "*encourage social researchers to engage in methodological pluralism*" (p.2). They considered that it was better to make full use of all possibilities when collecting data rather than limiting the research to employing a single technique or a limited number of techniques with which the researcher may be familiar.

Writing on methods in social research, Neuman (1994) considered that social science and the accumulation of knowledge needed to be viewed qualitatively and quantitatively in order to produce good research. He added that these two methods should not have a rigid distinction but should be considered as complementing each other with any distinctions being used principally as organisational tools. In this way, he continued, each could be judged on its values and accepted for its strengths.

According to Pole and Lampard (2002) social research is about discovering the unknown, since, if information was already known then further research would be unnecessary. This, they said, meant using a flexible approach to accommodate necessary changes during the research process which would occur as more information was unearthed. Keating and Della Porta (2011) said that there were always choices needing to be made during the research process and highlighted positivism versus interpretivism and quantitative versus qualitative methods. They claimed that there was no need to be singular in selection but that a number of choices could be made. In the same pluralistic way, they added, social science lay as an alternative between natural science and humanities, making it possible to borrow from one or the other or both. Using quantitative techniques to analyse qualitative

data was considered by Fellows and Liu, *op. cit.*, to be essential in ensuring that thoroughness and objectivity are maintained in research.

Had a completely quantitative method been used then there were strengths and weaknesses to be taken into account. Some of these strengths include:

- Allowing for a greater objectivity and providing results of greater accuracy
- Involving fewer variables and ensuring validity and reliability by using prescribed procedures
- Avoiding personal bias
- Being ideal for answering what, when, where and who questions

(Analyse This, 2011)

Fellows and Liu, above, said that the essence of quantitative approaches was in collecting data and using it to make measurements. Rowntree (1981) saw an advantage in this method in that it allowed the use of statistics to collate, process and interpret quantitative data. This was added to by Kumar (1999) who said that the nature of the data made it useful for computer analysis. According to Blaikie (2000) researchers commonly believed that quantitative data produced greater accuracy and reliability. In specifying the quantitative method of unstructured interviews Pole and Lampard (2002) said that these made it possible to produce information with depth and detail. They also added that the use of surveys was considered to be, exclusively, a quantitative method.

Weaknesses in the quantitative methods are that they:

- Provide numerical descriptions and therefore are less elaborate narratives of human awareness
- Often need to ensure a controlled environment in order to carry out the research which may not replicate that of a real-world situation
- Can use pre-set answers which may not reflect the true feelings of the subject
- Can use standardised questionnaires that run the risk of an interviewer bias where the interviewer has set up the questionnaire

(Analyse This, 2011)

That there was a concern regarding concepts and measurements was highlighted by Blaikie, *op. cit.,* who said that the problem was in knowing what should be measured and how it should be measured. He added that this led to a concern over validity and reliability which was in contrast to Analyse This, *op. cit.,* who proposed this to be a strength of the method.

Similarly, a completely qualitative method would also have strengths and weaknesses to be taken into account. Some of these strengths are:

- The ability to gain a greater insight into the subject in question by being able to record human behaviour
- The ability to encourage respondents to expand on their responses
- The ability to display reasons for human behaviour

(Analyse This, 2011)

Qualitative research allowed for an extensive variety of approaches and means of data analysis (Neuman, 1994). Pole and Lampard, above, highlighted structured interviews as being a qualitative method that made it possible to produce a general level of reliable information.

Weaknesses in the qualitative methods are:

- Collecting data can take longer and requires either a greater financial expenditure or a reduction on study size
- A reduced study size can not be reliable as a measure of the population as a whole
- Making comparisons in a systematic way can be difficult
- Conducting interviews and making observations is heavily reliant on the researchers' skills

(Analyse This, 2011)

Because qualitative data relied on forms of words it had a tendency toward imprecision and could mean different things (Neuman, 1994). This meant, said Kumar, *op. cit.,* that the nature of the data made it difficult to analyse by computer.

The strengths of quantitative methods link with the following areas of the research by:

- Collecting and numerically measuring the data from Professions (Chapter 3)
- Collecting, numerically measuring and analysing the data from the Defined Attributes of Professions (Chapter 4), the collated job attributes from the Pilot Estimator Interviews (Chapter 5), the Estimator Educational Availability Comparison (Chapter 8), the Ethnographic Research (Chapter 10), the Estimator Skills Questionnaire (Chapter 11), the Estimator Training Needs Analysis (Chapter 12)
- Conducting surveys for the Estimator-QS Salary and Benefits Comparison (Chapter 6), the Estimator-QS Job Attribute Comparison (Chapter 7), the Estimator Educational Availability Comparison (Chapter 8) and the Delphi Study (Chapter 9)
- Collecting, numerically measuring, analysing and performing statistical calculations on the data from the Delphi Study (Chapter 9)
- Hypothesising, collecting, numerically measuring, analysing and performing statistical calculations on the data from the Estimator-QS Salary and Benefits Comparison (Chapter 6), and the Estimator-QS Job Attribute Comparison (Chapter 7)

The strength of qualitative methods link with the following areas of the research by:

- Making assessments of the collected data from the Defined Attributes of Professions (Chapter 4), and the Estimator Training Needs Analysis (Chapter 12)
- Developing and undertaking structured interviews from the Pilot Estimator Interviews (Chapter 5) and the Estimator Skills Questionnaire (Chapter 11)
- Collecting data from Professions (Chapter 3), the Pilot Estimator Interviews (Chapter 5), the Estimator-QS Job Attribute Comparison (Chapter 7), the Estimator Educational Availability Comparison (Chapter 8), the Delphi Study (Chapter 9), the Ethnographic Research (Chapter 10) and the Estimator Skills Questionnaire (Chapter 11) and collating it into a format for the Estimator Training Needs Analysis (Chapter 12)

Even though the decision to use mixed methodologies was considered to be the most appropriate for this research there were alternative views from authors who not only disagreed with mixing methodologies but did not necessarily agree with each other. A remark from Kerlinger, quoted in a book by Miles and Huberman (1994) said that "*There's no such thing as qualitative data. Everything is either 1 or 0*" (p.40). Miles and Huberman then quoted an opposite view, from Campbell, who said "*All research ultimately has a qualitative grounding*" (p.40). An article by Howe (2011) pointed to authors such as Guba (1987), Smith (1983) and Smith and Heshusius (1986) whom he said argued that the compatibility of quantitative-qualitative methods relied on the principle of "*what works*" (p.10) which, they said, was an "*epistemologically suspect criterion*" (p.10). Howe disagreed with their views and believed that the opposite was true in that there were "*important senses in which qualitative and quantitative methods are inseparable*" (p.10). In writing in the same article about pure research he thought that it was impossible to imagine such research without qualitative elements in its data.

The message that emerged from these texts was that there was no single methodology which would answer all of the research questions. Therefore, a multi-methods approach, which triangulates data and methodology, would be the most suitable means of gathering evidence in a field with the complexity of task analysis and occupational roles – as is the case with this research.

Given confirmation from authors, reviewed *op. cit*, of the acceptability of using mixed methodologies, a specific method was chosen for the overall research which its author titled "A Criterial Approach" (Gerring, 2001), and is reviewed below:

Gerring, *op. cit.,* wrote of work on social science methodology as being considered to be composed of four general approaches, these being:

1. Theoretical frameworks
2. Rules
3. Mathematics
4. Philosophy of science

He argued that while each of these methods offered a great deal none provided an overall framework for social science. In order to provide a complete social science

methodology he said that the research needed to employ both quantitative and qualitative methodologies. His method offered the opportunity to use statistics as a tool, where necessary, which he considered to be a more comprehensive method than applying "*the insufficiencies of* a *rulebook methodology*" (p.22) where there were difficulties in creating a comprehensive set of rules for all disciplines and, thus, rules developed for one methodology were unsuitable for another. The Criterial Approach, he said, provided a structure for organising quantitative and qualitative research. He further described it as a method of organising local knowledge and intuition into general knowledge without losing contact with "*the workaday tasks of academic inquiry*" (p.19) by rearranging what was personally known, or considered to be known, into a framework that would be of more use, described by him as "*a compendium of common sense*" (p.19).

This Criterial Framework was divided into three tasks:

1. Concepts
2. Propositions
3. Research Design

Gerring described these tasks as:

- Concepts - the "*what*" of the research and gives it a name. Its formation requires a selection of criteria such as coherence, validity and resonance
- Propositions - formulating statements of an empirical nature such as arguments, hypotheses and inferences
- Research Design - involving the selection and treatment of cases, forming methods of analysis and discovering evidence in order to demonstrate a proposal

The framework provided for a flexible approach to producing methodologies by following pathways to see where they lead. This research utilised this as it allowed for a degree of flexibility to enable changes in direction to be accommodated, if necessary, when dependent upon the results of other studies during the research process: a point also made by Pole and Lampard, *op. cit.* Therefore, the use of Gerring's multi-method "Criterial Approach" enabled the provision of a richer data-set which considered the problem from a range of different angles. In doing so, it

produced an investigation of greater thoroughness than could have been achieved had a singular method been employed.

Given the financial and time constraints of a single researcher the research aimed to ensure that the maximum amount of information possible was found on what Estimators do. In order to achieve this, the data collection employed mixed methodologies, which were:

- Literature reviews
- Personal interviews
- Surveys
- Ethnography
- Questionnaires

While these methodologies would, inevitably, be constrained in size they were, by using mixed methodologies, intended to be a reasonably exhaustive means of discovery and, as such, offered a broad range of insights into the research topic.

This research was strengthened by three supervisors, operating in different fields, who provided specialist guidance across all aspects of the thesis, in covering:

- Civil engineering and construction – Professor J. G. Perry (2006-11)
- Social science – Professor C. M. Hicks (2003-5)
- Philosophy and ethnography – Doctor J. Lamb (2003-4)

Chapter 3 - Professions

3.1 Introduction

Within the UK CI the practice of estimating was regarded as an occupation rather than a profession and, as such, any investigation into whether or not professional status was merited and attainable needed first to discover the characteristics which define professions and from this an assessment of its suitability, for upgrading, could be made.

3.2 Research Aims

As, at this stage, the lack of Estimators' professional status had not been unambiguously established the intention was to:

- Determine definitions of a profession
- Discover what was required of a group in order to gain professional status
- Confirm the assumed position of Estimators as an occupation and not a profession

The stages of the research were, therefore, as follows:

1. To find information on the historical development of professions (results to be found at 3.5.1, below)
2. To discover the defining criteria of professions (results to be found at 3.5.4, below)
3. To determine how professional status was attained and find evidence of the existence of an estimating profession in the UK (results to be found at 3.5.5, below)

3.3 Research Method

A revised Inductive Research Strategy (IRS) from Blaikie (2007) was the method chosen for this study as a research strategy which would specifically answer the "what" questions in research. As this study needed to know 'what defines the requirements of a profession' then it was considered to be suitable. Blaikie said that there were four types of revised strategies, so called because he considered the original strategies to be flawed. These revised strategies are:

- Inductive - To establish descriptions of characteristics and patterns

- Deductive – To test and corroborate theories
- Retroductive – To discover mechanisms that explain regularities
- Abductive – To describe social life in terms of peoples' reason and understanding

One of the major differences between the original and the revised IRS, he explained, was that the original aimed to make discoveries on phenomena, in a generalised manner, without any specific focus and draw conclusions from its data collection, whereas the revised version had more specifically focused aims from which to collect data. These techniques were relevant to this study in discovering data on definitions of professions ideologies, ideal economic conditions for entry into professions and known PBs within the UK CI. They have also been used extensively in social science and health literature - for example, Radwin, et al, (2005) who wrote an article on cancer patients' descriptions of their nursing care for the Journal of Advanced Nursing, The advantages of the revised IRS are that:

1. It allowed for decisions to be made in advance on what to look for and, therefore, to limit the collection of data to a specific field
2. Detailed descriptive data could be drawn from people and gathered into general statements, which was useful for answering the "what" question
3. Any means of collecting the desired information was acceptable.
4. Established descriptions of characteristics
5. Collected data on these descriptions
6. Generated descriptions
7. Related descriptions to the research questions
8. The method is not restricted to qualitative data
9. Descriptions can include an analysis of patterns relating to some of the characteristics

(Blaikie 2007)

The intention was to provide as clear a definition as possible on what was required of a profession and of professional people and, therefore, this was a suitable strategy for this study and would make a contribution to the main research aim but would not

offer conclusive evidence, at this early stage, on Estimators attaining professional recognition.

The disadvantages of the revised IRS that were taken into account are shown below:

1. Sampling:
    - Guidance was required on the choice of characteristics to be included in the data-base
    - The researcher would need to decide on the scope of the research

(Blaikie 2007)

2. Experimenter Bias Effects where the researcher can influence results by:
    - The choice of characteristics to be included in the data-base
    - The researcher would need to know what to look for and the extent of the research

(Blaikie 2007)

- Classification of initial responses under broader headings may involve arbitrary assumptions and decisions
- Categories may reflect researcher's personal agenda

(Hicks 2009)

These points notwithstanding, the use of the revised IRS was, therefore, considered to be an appropriate tool for use in this study provided a sound and justifiable methodology was adopted.

3.4 Methodology

3.4.1 Design

The revised IRS method was used to discover data on professions and the means of collecting data was by conducting a literature review.

The revised IRS method disadvantages, described above, were addressed in the current study by the following means:

1. Sampling
    - Guidance on information for the data-base was not required as the supervisor, researcher and third party were all members of PBs with knowledge of the CI
    - The size of the data-base was not an issue as the objective was to discover as many relevant definitions as possible
2. Experimenter Bias Effects
    - Reliability of establishing main themes was enhanced by two people, supervisor and researcher both familiar with the subject, identifying these themes independently and obtaining agreement on them. This work was then checked independently by a third person also familiar with the subject
    - Distilling the initial responses into themes by using two independent researchers to categorise the data and a third independent party to check their work
    - No outlying views were excluded

For the purpose of consistency, "Experimenter" will describe the researcher of this thesis in all Chapters where this term is required when referring to bias. This will include Chapters such as this one where there are no measurements being taken.

3.4.2 Sample

Information on definitions of a profession and gaining professional recognition was obtained from a literature review of 38 authors writing on historic and modern professions. Information on professional organisations was obtained from 3 authors writing on professions and from 22 established CI and governmental organisations

3.4.3 Procedure

3.4.3.1 Identification of Profession Definitions

Definitions were extracted from the literature review and crystallised into main professional criteria in relation to each quoted author. This thematic analysis was then independently checked by a third party, unaware of the purpose of the exercise, in order to provide objectivity and additional verification. Further research was

carried out to discover ideologies and economic conditions that were judged necessary to enable occupations to develop their roles into professions, using the same procedures as above. The information was distilled into core themes using a protocol from Jones "et al" (1997).

3.4.3.2 Identification of CI Professional Organisations

To confirm the position of Estimators as an occupation or a profession, literature was reviewed, together with publications from the Construction Industry Council (CIC) and the Department of Trade and Industry (DTI), which displayed groups that were considered to hold CI professional status in the UK CI. This information was then tabulated for clarity.

3.5 Results

3.5.1 Historical Development

The Middle Ages

The formation of Guilds, according to Krause (1996), goes back through a considerable period of time. Between the years 1100 and1200, Guilds were social groups, institutions created by workers around their skill or craft. The majority of these were formed to oversee and regulate the activities of specific practitioners in different areas. However, there were also Guilds covering judicial, social, political and religious aspirations, formed with the economic motive of establishing corporate monopolies. These Guilds were the first professions that Larson (1977) said had originated from medieval times. She added that during that period the Church had been the great educator, very closely associated with the development of Universities and, consequently, with the "learned professions". From this association, the established professional "elites" developed the notion that a "liberal education" was what distinguished them from traders and artisans; based on classical culture rather than practical skills.

The Renaissance

Krause, *op. cit.,* said that during the 16th century, Guilds were established for Lawyers and Doctors, which apparently required a University degree as an entrance

qualification and enabled the practice undertaken by their members to be controlled. These Guilds flourished in Europe and Scotland at that time but were suppressed in England by the Universities during and beyond the reign of Henry V111. The system was such that Lawyers were trained by the Inns of Court and Doctors by the London Hospitals, not by Universities. A Scholars Guild was also established, during the same period as the Craft Guilds, developed from small schools attached to Cathedrals and local Churches and titled *Universitas Magistribus et Pupillorum* or "Guild of Masters and Students".

A point made by O'Day (2000) was that professions did not emerge from a vacuum but were instead formulated in response to basic social forces such as those of the Renaissance and Reformation periods. An example was given of the clerical profession being historically related to religious settlements, where people became concerned about their spiritual needs and looked for religious services to help them. However, simultaneously, they became more litigious and more anxious for their physical well being. In fulfilling these concerns and needs there was a drive for specialists to provide the desired services.

The Reformation

It was during a considerable period of the 16th century, beginning in Germany in 1517 and then extending throughout a large area of Europe and Britain, that the power of the Craft Guilds began to diminish, according to Krause, *op. cit*. Countries were establishing reforms, with powers moving from sovereign heads of state to national governments. Capitalism was also a major influence and governments and capitalist controllers worked vigorously to reduce the power held by these Craft Guilds, gradually wresting authority from their control. Scholastic Guilds, however, were composed mainly of people from middle and upper class backgrounds. Many of these families had wealth and influence, so protecting those Guilds, and also the Universities, from the embryonic 'nation states'. A relationship then developed whereby the Lawyers' and Doctors' Guilds looked upon the Universities as a training ground and thus an apprenticeship for future Guild members, who would then receive further training from them, following their graduation. Therefore, whilst the Craft Guilds were losing power, the Scholastic Guilds and Universities maintained their position by linking with Doctors and Lawyers to form an unofficial

power base. Capitalist societies had, at this time, no interest in these Guilds as they were not 'materially productive' although the nation states had become sponsors of both the Scholastic Guilds and the Universities. Consequently, a triumvirate evolved with nation states, capitalism and the professions each working with the others to maintain their own positions.

Pre- and Post-Industrial Revolution

There were two defining features of professions that remained throughout the Renaissance and Reformation periods and beyond, according to O'Day, *op. cit.;* these being the concept of work as a service to society as opposed to a means of production and an expertise based on a theoretical "body of knowledge".

Prior to the Industrial Revolution, during the latter part of the 18th century and the early part of the 19th, Larson (1977) observed that there were three recognised "gentlemanly" professions, Divinity (University teaching was seemingly an offshoot of this), Law and Medicine. During this time a defined profile of people able to operate in an independent way was developed with Lawyers, Physicians and, to a lesser extent, Architects. These people, called "free practitioners" by Larson, developed their 'ethical concept of work' from the Reformation, extending it into training and examinations. This formed what was considered to be a characteristic of the modern professions, which she described as "impartially legitimised capability". Larson continued by saying that, initially, passage through a University or membership of a Guild distinguished Physicians from other kinds of 'healers' but that this did not establish their superiority with the public in general. Their better education, whilst setting them apart, did not allow a monopoly on healing the sick. Eventually, during the early part of the 20th century, this monopoly was gained by the professions of that period but without the aid of the Physicians. These Physicians were, apparently, sheltered in their privileged positions and had no urgency in being at the forefront of the drive for a progressive development in professionalism. Larson then pointed out that this modern model of a profession would incorporate pre-Industrial Revolution criteria of status and ideology. Any concrete historical process such as this, she said, bound together elements of different structural complexes from different periods.

20th Century and the Technological Revolution

Etzioni (1969) contended that power was strength and there was strength in numbers. He backed this with what he claimed to be an old assertion in sociology, being that a united group could gain that which an individual could not and, as such, an individual's investment in a group may ultimately pay off. It was possible, he added, that skill and time invested in the formation of a Guild might provide an occupational monopoly from which an individual advantage may be gained. Etzioni also thought that the raising of educational standards in medicine (1910-1920) required an investment in power, money and friendship, which in turn raised the prestige, ranking, power and income levels of Physicians. However, he also said that there were many other occupations where similar efforts had been made that had probably brought about a more friendly interaction among members but no increase in prestige, power or income. Eventually, he added, economic supply and demand were the most likely factors in the determination of any increase in these three aspirations. Therefore, occupations that were seeking recognition as professions needed to engage in all three stated aspirations, although their main priority in order to gain this recognition would be a need to change.

Krause (1996) suggested that, much later on in this history of alliances, the power situation had altered to the point that professional bodies no longer controlled their specific workplace. This control had been transferred to the state and to capitalism, with the professions allowed only that control granted by the other two. He also considered that politics had an effect on the professions in that socialist governments in the UK tended to be against fee-for-service practice and in favour of professions within the welfare state. This system, he thought, would reverse in the hands of conservative governments whose philosophies leaned more toward the free market economy and away from state control.

In approaching the 21st century, Weber (1958) (cited in Krause, 1996, p.281) said that professions, professionals and professionalism appeared to have evolved to a position where they all embraced, and were embraced by, capitalism. There were, seemingly, no longer any organisations or institutions who could claim to work independently, for their own interest, in competition with the values and aims of capitalism. It seemed that medicine and law had also increasingly developed an

acceptance of the capitalist model. Universities, the sources of professional training, had progressively been made over in the capitalist image, whereby programmes with little capitalist application had been dropped or sidelined in favour of training for the "foot soldiers" of capitalism.

Continuing, Weber declared that the distinction between the professions and other occupations had been eroded, together with the surrender of the positive Guild values of group concern, ethics beyond mere profit and collegiality. In the main, he said, they were all left as middle-level employees of capitalism.
In the world of today, said Krause, *op. cit*., the majority of new jobs were salaried. They were either under direct capitalist control or under the control of capitalist professionals. In such a situation, it was said, the powers of Guilds faded into insignificance. The state and capitalists provided sufficient pressure to take away the control of Guilds, which placed the power in their own hands. It was not thought that professions were dying, but that their Guild power to control the nature and quality of PBs had been taken from them.

Such a loss of control, argued Derber "et al" (1990) (cited in Krause, 1996, p.283), threatened the soul, values and sense of purpose of the professionals, as their old workplace was one of freedom and creativity and it had been replaced with problems of technique. As such, their function changed from being masters of their domain to becoming state or capitalist controlled technicians.

To illustrate this transfer of control, Krause looked at the existence of:

- Freedom for all in obtaining justice
- Treatment and proper aftercare for all irrespective of the degree of illness or disability
- A level of education that would provide everyone with the opportunity to fulfil their potential

A different view was taken by Perkin (1996) who considered that the rise of the professional society raised living standards not just for the professionals but for

everyone by improving efficiency through technological advances. It was argued that this had happened in two previous periods, these being the:

- Agricultural advances in the Neolithic age
- Mechanical advances in the Industrial Revolution

During these periods the majority of the workforce had been freed up to do other things as well as lowering production costs, thereby making goods more affordable. A characteristic of this society was meritocracy, allowing larger numbers of working class people the opportunities of rising through professional hierarchies. He added that since the 1970s professionals had increasingly relied on formal education and training to facilitate their careers.

3.5.2 Historical Criteria of a Profession

Regard was paid to Olesen and Whittaker, writing in Jackson (ed.) (1970), who cautioned that attempts at discovering what was and was not a profession had led sociologists and professionals into areas from which there was no clear way out. Their judgement seemed sound as there would appear to be no classic definition of professions or professionals. Authors' explanations of their considered opinions differed in language or content but nonetheless their ideas helped formulate a collective view of what they considered to be the original meanings of profession. Inevitably, every author's observations were independently described and so, to provide some clarity and simplification of arrangement, to a wide range of works, their views were condensed into five main categories. These categories were determined on the collation of 119 independent authors' definitions which were, initially, grouped into 31 distinct characteristics that have been tabulated in the first three columns of Table 5. The allocation of those definitions into each of the five designated main categories is shown in the last two columns of Table 5, below:

Table 5 Historic Attributes of Professions

Item	Attribute/Need/Ability	Times Mentioned	Main Descriptive Categories	Category No
1	Knowledge	17	Possession of a specific knowledge and skill base	1
2	High Level of Study/Training	15	Rigorous training	4
3	Ethics	11	Service, ideology and attitude toward the client, the community, the profession and society	3
4	Service to Client	11	Service, ideology and attitude toward the client, the community, the profession and society	3
5	Skill	8	Possession of a specific knowledge and skill base	1
6	Create Monopoly	6	Independence, autonomy and the creation of a monopoly	5
7	Culture/Ideology	5	Service, ideology and attitude toward the client, the community, the profession and society	3
8	Influence/Power	4	Independence, autonomy and the creation of a monopoly	5
9	Technique	4	Possession of a specific knowledge and skill base	1
10	Autonomy	3	Independence, autonomy and the creation of a monopoly	5
11	Creativity	3	Possession of a specific knowledge and skill base	1
12	Judgement	3	Innate qualities	2
13	Prestige	3	Independence, autonomy and the creation of a monopoly	5
14	Socialisation	3	Innate qualities	2
15	Abstract/Tacit Concepts	2	Innate qualities	2
16	Consciousness	2	Innate qualities	2
17	Devotion to Group	2	Independence, autonomy and the creation of a monopoly	5
18	Mediating/Fiduciary Role	2	Service, ideology and attitude toward the client, the community, the profession and society	3
19	Personal Responsibility	2	Independence, autonomy and the creation of a monopoly	5
20	Proper Remuneration	2	Independence, autonomy and the creation of a monopoly	5
21	Achievement Before Personal Gain	1	Independence, autonomy and the creation of a monopoly	5
22	Complete Identity	1	Independence, autonomy and the creation of a monopoly	5
23	Core Meaning of Life	1	Independence, autonomy and the creation of a monopoly	5
24	Etiquette	1	Independence, autonomy and the creation of a monopoly	5
25	Gravity	1	Independence, autonomy and the creation of a monopoly	5
26	Inject Innovation	1	Possession of a specific knowledge and skill base	1
27	Promulgate Attitudes	1	Innate qualities	2
28	Promulgate Outlook	1	Innate qualities	2
29	Promulgate Values	1	Innate qualities	2
30	Quality	1	Innate qualities	2
31	Theorise	1	Innate qualities	2

The main categories were then arranged in order of the number of times each was mentioned (shown in the third column of Table 5), see Table 6 below:

Table 6 Historic Main Attributes of Professions

Main Descriptive Categories	Category No	Times Mentioned
Possession of a specific knowledge and skill base	1	33
Service, ideology and attitude toward the client, the community, the profession and society	2	29
Independence, autonomy and the creation of a monopoly	3	27
Innate qualities	4	15
Rigorous training	5	15

Authors' definitions, categorised from the main heading in Table 6, were as follows:

1. The Possession of a Specific Knowledge and Skill Base

Macdonald (1995, p.1) considered professions to be "*occupations based on advanced, or complex, or esoteric, or arcane knowledge*". Continuing, he thought that professions became possible where knowledge emerged as a socio-cultural

entity in its own right and that they became viable when the market reached a sufficient size for the private provision of knowledge based services.

An intricate suggestion came from Murphy (1988, p.245) of "*formally rational abstract utilitarian knowledge*".

From Cogan (1953, pp. 35-50) there was a more comprehensive but possibly less comprehensible definition, which was:

> "*A profession is a vocation whose practice is founded upon an understanding of the theoretical structure of some department of learning or science and upon the abilities accompanying such understanding. This understanding and these abilities are applied to the vital practical affairs of man. The practices of the profession are modified by knowledge of a generalised nature and by the accumulated wisdom and experience of mankind, which serve to correct the errors of specialism*".

A proposal by Parsons (1966, quoted in Wells, 1970, pp.91-92) was:

> "*The characteristics required of the professional were that they were in command of a high degree of specialised skill, knowledge and judgement and that they should have the ability to make correct decisions in situations that may be complex*"

He added:

> "*These skills, knowledge and judgement should be publicly warranted e.g. by a diploma from a body of high standing, which had been awarded after the successful completion of a specialist course of study*".

An endorsement of Parsons came from Foley "et al" (1981) who said that minimum educational standards should be set at levels that restricted entry into professions.

The importance of specialised knowledge was also acknowledged by Freidson (2001) who proposed that this should be attained through vocational schooling that required a thorough education in concepts and theories of an abstract nature. He also suggested that unrestricted specialisations that required a great deal of formal knowledge in their training identified with historic professions.

Ehrenreich and Ehrenreich (1979) (cited in Krause, 1996, p.17), thought that professionals had been defined as having a "*specialised body of knowledge; ethical codes and a measure of autonomy from those outside the profession*".

In discussing semi-professionals, Etzioni (1969) considered that a distinction ought to be made between three labour groups; one being the group with no professional knowledge, another with highly specialised knowledge and a third was in between and regarded as semi-professional. He continued by making a comparison between administrators and professionals, which furthered his definition of professionalism, by saying that administrators assumed a power hierarchy in which the more highly ranked controlled and co-ordinated the lower ranked. Professionalism, he stressed, was knowledge-based and as such was largely an individual property and not transferable by decree, from one person to another. Creativity was, apparently, looked upon in the same light as knowledge. The application of this knowledge was therefore seen as an individual act in that professionals were viewed as those who took the ultimate responsibility for their decisions. The classic justification of the professional act was that it was, to the best knowledge of the professional, the right act. In comparison the ultimate justification of an administrative act was that it should align with rules and regulations of the organisation, approved by a superior rank.

2. *Service, Ideology and Attitude toward the Client the Community, the Profession and Society.*

A further extract from Cogan (1953, pp. 35-50) added the view that "*The profession, serving the vital needs of man, considers its first ethical imperative to be altruistic service to the client*".

In a more simplistic vein Etzioni (1969, p vii), stated, "*All professions serve*".
An additional opinion, offered by Moore (1970), was that they typically dealt with specific clients and that the welfare of those clients was vitally affected by the competence and quality of the service given.

Parsons (1966, quoted in Wells, 1970, pp 91-92), had a lot to say on this. He felt that the role of the professional should be the same, even though Doctors differed

from Lawyers, who differed from Accountants, who differed from Architects etc. What should be common to all was a peculiar relationship to society. As a 'desire for profit' characterised the businessman, so the professional should be characterised by the 'ideal of service'. Both characterisations offered means of achieving success but for the professional this 'ideal of service' was socially necessary because society required that some occupations should provide a mediating and fiduciary role. Finally, they should be members of a professional institution or society. The role of these institutional bodies was to maintain standards amongst their members, maintain the level of learning and possibly act as a status symbol. These requirements were intended to secure prestige and authority in the professionals' relations with clients and communities. With the client they were in a position of authority and trust but equally there was a need to deal with the client in such a way that would gain the approval of the community. They should represent the client before the community but also represent the community to the client. Typically embodied within the codes of practice would be that they became an 'institutionally legitimate means of tension release' and a 'mechanism of social control'.

Carr-Saunders and Wilson (1933) considered that the attitude of the professional toward his client or employer should be painstaking. In addition, it should be characterised by a sense of responsibility, extending to pride in a service provided rather than interest in opportunity for personal gain. The term "professional pride", should indicate a code of behaviour whereby the primary considerations were the needs of the client and the quality of the work. However, professionals should not be viewed as philanthropists and should be properly remunerated for the services which they perform.

According to Freidson, *op. cit*, professionals should adopt an ideology based on a work ethic even when this meant the work would become arduous and unpleasant. In this way their satisfaction would be derived from giving their clients more attention and increased service rather than looking for economic reward. Doing this, he said, would improve their standing and with it their powers of persuasion in obtaining greater influence. He considered persuasion to be a major method of 'elite control'.

In evaluating the degree of professionalism of a role, Harries-Jenkins, writing in Jackson (ed.) (1970), said that it was essential for the type of work carried out within an organisation to relate to tasks that required specialised skill and knowledge. As these tasks necessitated the possession of a specialised body of knowledge then these should be undertaken by people holding specific competence and qualifications to enable them to perform such work.

A moral justification for an occupation's professional entitlement was the development of the right attitude towards clients. (Olesen and Whittaker, *op. cit.*)

3. Independence, Autonomy and the Creation of a Monopoly

Macdonald (1995) held the opinion that professions were independent of established social institutions.

An ideology offered by Johnson (1972) was termed as a proposed analysis of professionalism. This was that a professional should consider that the core meaning of life was central to the work situation and that their occupational skills were regarded as non-transferable, belonging instead to a specific community. In addition, practice could only be unqualified where there was an existence of a monopoly of skill by one group.

That there could be a trait in the way that professions were formed came from Caplow (1954) (cited in Krause, 1996, p, 15). This suggested that professions began by the establishment of an Association, which then changed its name and asserted a monopoly.

Larson, *op. cit.,* wrote of this inception during the early part of the 20th century, initially being gained by Lawyers and Architects. The creation of a monopoly was then cemented by setting up codes of ethics and obtaining legal recognition, firstly to monopolise the work and later to criminalise others attempting to work in that field.

This view met with agreement by Wilensky (1964) (cited in Krause, 1996, p, 15) who added the proviso that this monopoly could only be achieved by traditional

professions and that semi-professions attempting this route would be unlikely to succeed.

Further concurrence came from Freidson, *op. cit.*, who constructed an argument based around the theory that monopoly was essential to professional organisations and directly opposed the view that there should be competition in a free market economy. This he developed by suggesting that these professional occupations could only be recognised as such where they came close to fully controlling their own work, as the specific tasks performed would differ fundamentally from those of any other workers. Expanding further, he considered that professional organisations had exclusive rights to determine the qualifications and nature of the work to be performed.

A profession was described by Foley, *op. cit.*, as being a group of individuals granted powers of monopoly with one of its objectives being to ensure constraints on the pricing of services which would enable the improvement of quality standards.

4. Innate Qualities

King, writing in Gould (ed.) (1968), offered the opinion that professionalism created occupations that had a high degree of consciousness and a complete identity.
On a similar theme, Freidson (2001) considered that discretion in performance was inherent in the work of professions, in contradiction to the managerial concept that minimising discretion increased efficiency.

Freidson also suggested the importance of knowledge being tacit, giving as an example knowing how to interpret the sounds of machinery or how much tension to apply when physically turning something.

At various stages in her book on early professions, O'Day (2000), mentioned the professional's need to be personable and moral, using descriptions such as, honesty, virtue, honour, decorum, gravity, prudence, justice, ethics, fortitude, self knowledge, temperance and esprit de corps.

That it was essential that the reputations of professionals and professions be maintained through honesty and integrity was the consideration of Cogan, *op. cit.*, if they were to retain influence with their clients and communities.

5. Rigorous Training

In an article entitled "Professions", Hughes (quoted in Lynn 1967, pp 1-14) wrote,

> "*Culture and technique, the etiquette and skill of the profession, appear in the individual as personal traits. In general we may say that the longer and more rigorous the period of initiation into an occupation, the more culture and technique are associated with it and the more deeply impressed are the attitudes upon the person*".

Again from Etzioni (1969 p.82), he referred to "*a person who by virtue of long training is qualified to perform specialised activities autonomously, relatively free from external supervision or regulation*".

Concurring with Hughes and Etzioni, Harries-Jenkins, *op. cit.*, considered that one of the characteristics of professionalisation was the length of training demanded of professional group members.

Such training, according to Freidson (2001), was essential but ought not to rely on individual companies for its provision; instead it should be developed by external sources, organised, administered and financed by others.

That professionals acquire their power from formal academic training combined with elements of socialisation and class ideology, was a view put forward by Jackson (ed) (1970) when writing about the framework around which professionalism was built.

Schmidt (2000) gave his explanation of what he thought it was that made an individual a professional. He said that technical knowledge and skill played a part but someone gaining these abilities "on-the-job" was not usually reclassified as a professional. Almost without exception, he thought, a professional was a 'product of the schools' in being educated in the career role within a formal structure of

College, University or both. Off-the-job schooling, he added, was the most likely way of distinguishing between a professional and a non-professional. The non-professional was more likely to learn while carrying out tasks at the workface, with possibly some addition of formal training within an educational environment. Schmidt then gave an example of a teacher as being a professional. A teacher's main role, he said, was to present the official curriculum to the students, which was work that could be undertaken by a computer or a television. What made the difference was that the teacher could add socialisation and promulgate values, outlook and attitudes as, beyond a particular point, a training manual would not provide the answers. In order to complete the task properly from the employers' perspective the work needed an injection of creativity and innovation, things which could not be described in a manual. This, Schmidt said, then changed the ordinary employee into a professional.

3.5.3 Modern, Additional Criteria of a Profession

In contrast to older professions the following authors' definitions, categorised here as the 'modern profession', seemed to have a different goal, based upon some but not all of the original criteria and with an added acceptance that the principles of a profession could also fit within the confined framework of capitalism. As before, there was no authoritative definition. Many authors, defining modern professions, mirrored definitions of those required of older professions e.g. knowledge, training, education and innate qualities. However, there were seven distinct criteria found when researching modern professions that contrasted with definitions from older professions. These are shown, in order of times mentioned, in the first three columns of Table 8 below. It was considered that these would condense into two main categories. A distinction has been made between *working within a capitalist organisation* and *adopting employers' ideologies*. With some modern professionals both categories would apply but consideration was given to professionals employed by non-profit making organisations e.g. Local Authorities (LA). In these cases the professionals would be required to adopt their employers' ideologies but would not be working within a capitalist organisation. The allocation for these categories is shown in the last two columns of Table 7 below:

Table 7 Additional Attributes of Modern Professions

Item	Attribute/Need/Ability	Times Mentioned	Main Descriptive Categories	Category No
1	Fit Within Capitalist Organisation	6	Working Within a Capitalist Organisation	1
2	Service for Economic Gain	2	Working Within a Capitalist Organisation	1
3	Act as Functionaries	1	Adopting Employers Ideology	2
4	Act as Technicians	1	Adopting Employers Ideology	2
5	Adopt Employers Ideology	1	Adopting Employers Ideology	2
6	Client not First Priority	1	Adopting Employers Ideology	2
7	Serve Employers as well as Clients	1	Adopting Employers Ideology	2

The main categories were then arranged in order of the number of times each was mentioned (shown in the third column of Table 7), see Table 8 below:

Table 8 Main Attributes Categorised by Order

Main Descriptive Categories	Category No	Times Mentioned
Working Within a Capitalist Organisation	1	8
Adopting Employers Ideology	2	5

Authors' definitions, categorised from the main heading in Table 8, were as follows:

1. Working within a Capitalist Organisation

Krause (1996), writing about researching from sociological and general literature and from the experience of everyday life said that professions and professionals had a dual motive of providing a service and using their knowledge for economic gain. The more modern professions and professionals were working in areas of capitalism where the work could become profitable when organised in a capitalistic form. This, he said, meant that for these specific professions the clients were no longer the first priority.

Expanding on Krause's viewpoint, albeit succinctly, Derber (1982) said that modern salaried professionals served their employers' and clients' goals. This suggested that both employers and clients are having their individual needs met by modern professionals, whose salaries are paid by the employers. Therefore, if the professionals are helping them achieve their goals then employers and clients can expect their required services without a need for a claim on priority from the clients or a need for the professionals to feel an obligation that there should be.

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Reinforcement of the need for professionals to integrate within organisations came from Etzioni (1969) who saw that the professions were once looked upon as being those of medicine or law, where decisions made by the practitioner may possibly result in life or death for their patients or clients and which therefore required a very high degree of responsibility and knowledge. Other occupations were now also considered to be professions where the amount of knowledge measured in years of training and the degree of personal responsibility may be less than those older professions but were more easily integrated into capitalist organisational structures than private practices.

This idea that new professions need not conform to original concepts, was developed by Engel and Hall, (quoted in Freidson, 1973, pp, 76-78) who pointed out that societal changes had led to the breakdown of the 'old system' and opened the way for the reorganisation of production. Among the changes that had occurred were:

- An increase in knowledge and technology
- Increased demand for more and newer products
- Economic necessity to increase output and reduce unit costs
- Pressures by occupations whose entry into the 'old system' was blocked

Freidson (1973) found that many professionals worked as employees in larger organisations and therefore did not conform to earlier definitions that viewed the professional as serving clients on an individual basis with independent knowledge and skill.

The conclusion of Engel and Hall's paper, *op. cit.*, was that they considered that the professional working within an organisation had an opportunity to be more faithful to the ideals of professionalism in several ways, which were described thus:

- Being a salaried employee within an organisation freed the person from the economic pressures that may be encountered by a sole practitioner and such freedom could lead to the work being an achievement in itself rather than a means to personal gain.

- Unlike the sole practitioner, the professional within an organisation must interact with superiors, peers and subordinates, within a more formally structured setting. This organised team approach could lead to increased visibility of professional performance and make performance evaluation more transparent. Employment of this method had also become a part of traditional professions. Often, in medicine, specialists in different fields combined their knowledge to solve a patient problem. This could be equally so for Lawyers with their clients and University Lecturers with their students.

In opposition to professionals working within capitalist structures was Merton (1975). He viewed what he termed 'new professionals', as being indistinguishable from bureaucrats and felt that there was agreement that the professional was solely the only one capable of making the decisions required for properly serving his client. Therefore, he said, the administrative work required made these 'new professionals' dependent upon the organisation for which they worked which in turn controlled their knowledge and skills and, thus, their ability to serve the best interests of their clients.

In a more obscure reference to professionals working within an organisation, Schon (2002, p.13) looked from a different perspective stating, *"Professionals are unionising in increasing numbers, apparently in recognition of their status as workers in a bureaucracy rather than as autonomous managers of their own careers".* In making the statement he did not clarify his position on whether or not he thought workers operating within a bureaucracy capable of claiming professional status, only that he had observed that it was happening.
Being from the USA, Schmidt (2000) was in possession of statistics relating to his own country. These statistics may or may not have mirrored those of the UK but in today's global market where professionals, managers and executives are very often working in many different countries in the same year they were probably indicative, and therefore worthwhile including. His quoted statistics were that since the early part of the 20th century the number of professionals in the USA had increased considerably. In 1920 the proportion was 1:20 of the total workforce but by the beginning of the 21st century the proportion was approaching 1:6. On a broader

spectrum he said that of every nine professionals working in the developed world, eight were salaried and one was a free practitioner.

2. Adopting Employers' Ideologies

For employees working for capitalist organisations it would be inevitable that they would be required to adopt their employers' ideologies. Therefore, the definitions under W*orking for a Capitalist Organisation* could equally be encompassed within this section. Below, then, are two contrary observations of employees' attitudes and reactions to employers' ideologies.

As was mentioned when setting out the additional main attribute categories, organisations such as LAs would not have profit as their goal. This research led to the discovery of a viewpoint from Perkin *op. cit.* with regard to carrying out work for the benefit of the community as a whole; as would be expected from employees working for a LA. Perkin felt that in defining a professional as one working for the benefit of the community was a proposal put forward more by public professions. He thought that their expectation was that to achieve that goal would require increased public expenditure from taxes, provide an increased reliance on the state and inevitably improve job security.

There was also a warning sign from Haug (1980) (cited in Foley *et al,* 1981, p.49), with regard to employers expecting employees to accept their organisations ideologies. He felt that new entrants into professions would often bring with them egalitarian ideas. This, he also thought, was an attribute more likely to cause a decline in the power of the professions.

3.5.4 Summary of Professional Criteria

The combined defined criteria, placed in historical order (from Table 6) and with the modern criteria, also in order (from Table 8), added beneath, are shown in Table 9 below. Authors, whose quoted definitions were collated into the main categories, are shown in the right hand column:

Table 9 The Quoted Criteria of a Profession (Historic and Modern)

Item	Criteria	Authors
1	**The Possession of a Specific Knowledge and Skill Base**	Macdonald (1995), Murphy (1988), O'Day (2000), Smith (1976)
		Cogan (1953), Etzioni (1969), Schmidt (2000),
		Abbott (1988, cited in Freidson, 2001, p 30), Jackson *et al (eds)* (1970)
		Harries-Jenkins (writing in Jackson *et al* (eds) 1970)
		Parsons (1966, cited in Wells, 1970, pp91-92),
		Olesen and Whittaker (writing in Jackson *et al* 1970)
		Freidson (2001), Perkin (1996), Foley *et al* (1981)
		Ehrenreich and Ehrenreich (1979, cited in Krause, 1996, p17)
2	**Service, Ideology and Attitude to Client/Community/ Profession**	Cogan (1953), Etzioni (1969), Moore (1970), Freidson (2001)
		Parsons (1966, cited in Wells, 1970, pp91-92),
		Turner and Hodge (writing in Jackson *et al* (eds) 1970)
		Olesen and Whittaker (writing in Jackson *et al* 1970)
		Carr-Saunders (1933), O'Day (2000), Perkin (1996)
		Harries-Jenkins (writing in Jackson *et al* (eds) 1970)
3	**Independence, Autonomy and Monopoly**	Macdonald (1995), Johnson (1972), O'Day (2000)
		Caplow (1954, cited in Krause, 1996, p15), Freidson (2001)
		Wilensky (1964, cited in Krause, 1996, p15)
		Foley *et al* (1981)
4	**Innate Qualities**	King (1978), O'Day (2000), Freidson (2001)
		Olesen and Whittaker (writing in Jackson *et al* 1970)
		Cogan (1953), Etzioni (1969), Perkin (1996)
		Turner and Hodge (writing in Jackson *et al* (eds) 1970)
		Haug (1980, cited in Foley *et al* 1981, p 49)
5	**Rigorous Training**	Hughes (1958, cited in Lynn, 1967, pp1-14), Etzioni (1969),
		Harries-Jenkins (writing in Jackson *et al* (eds) 1970)
		Olesen and Whittaker (writing in Jackson *et al* 1970)
		O'Day (2000), Freidson (2001), Jackson et al (eds)(1970)
6	**Working within a Capitalist Organisation**	Krause (1996), Etzioni (1969),
		Engel and Hall (1973, cited in Freidson, 1973, pp75-88),
		Merton (1975), Freidson (1973), Derber (1982), Schon (2002, p13),
		Weber (1958, cited in Krause, 1996, p281)
7	**Values Adopted from Employers' Ideologies**	Schmidt (2000), Weber (1958)

3.5.5 Gaining Professional Status

In addition to the need for occupations to acquire knowledge, skills and abilities (KSAs) it was found that there was also a social process that had to be undergone in order to develop the cultural and structural characteristics of a profession. This process was sometimes referred to as professionalisation, (Webref 2003). In a paper written for "the Professions and their Prospects", Ritzer (quoted in Freidson, 1973, p 62) used medical practice and taxi-driving as a demonstration of what he thought professionalisation meant with:

> *"On a scale of occupations, it can be said that, at one end there is medicine, which is a professional occupation and further along the scale, there is taxi driving which is not considered to be a profession".*

However, whilst understanding that most people would accept medicine as a profession but not taxi driving, this explanation did not appear to be completely convincing as, individually, doctors will not all be considered as being professional in the way in which they work. Some will be highly skilled, some of average ability,

others will violate ethical codes. Taxi drivers can also be extremely professional individually in their knowledge of the area around which they drive, their driving ability and courtesy. They can also be rude and sometimes even dangerous. It would seem that professionalism might therefore depend, initially, upon the individual rather than the occupation.

In their book, "Professionalization", Vollmer and Mills (1966, p.v) quoted Everett C. Hughes as saying that in his own studies:

> *"I passed from the false question, is this occupation a profession to the more fundamental, what are the circumstances in which people in an occupation attempt to turn it into a profession and themselves into professional people"*?

By way of an answer, one such circumstance was suggested by Larson (1977) in that professionalisation had its roots in times of radical and rapid change, quoting ten professional associations being formed between 1825 and 1880 in the UK and eleven between 1840 and 1887 in the USA. This period, she said, coincided with the rise of industrial capitalism, its crises, consolidation and the evolution of capitalism in its corporate form. From this came the deduction that a given society determined the 'social technology' that would be available for the invention of new forms of organisation. In addition to these economic and technical conditions Larson felt that ideological conditions should also be included. There was a similar suggestion from Stinchcombe (1959) who put forward the theory that organisations in new forms had a tendency to appear at a time when it was precisely possible to found them and when they could effectively function within a new structure. Continuing, he said that organisational structures, developed at the right time, had good prospects for stability provided that the economic and technical conditions were in place for this to happen.

Professions in General in the UK

As this research was focused on a perceived deficiency in Estimator ETPs it assumed that estimating did not have professional recognition in the UK. To determine that this was the case authors and CI organisations were researched to unearth recognised UK professions. The information discovered is displayed below:

A list was compiled by Butler and Savage (1995, p.103), categorising the professions. This was divided into what they termed "Top" and "Lower" groups. See Table 10, below:

Table 10 Professions in the UK determined by Butler and Savage

Group	Profession
Top	Doctors
	Lawyers
	Accountants
	Architects
	Surveyors
	Pharmacists
	Engineers
	Stock and Insurance Brokers
	Company Secretaries
	University Teachers
	Airline Pilots.
Lower	Work Study Engineers
	Computer Programmers
	Draughtsmen
	Laboratory Technicians
	Clergy
	Journalists
	School Teachers
	Civil Service Executive Officers
	Social Workers
	Nurses
	Public Health Inspectors.

The designation of top and lower professions in Table 10 will not meet with everyone's agreement. That the Clergy, Schoolteachers, Social Workers and Nurses should be classified as lower level professionals is very arguable. Indeed, classifying any kind of professional organisation would no doubt meet with objections. The purpose in publishing the Table was to demonstrate the range of activities that Butler and Savage had regarded as being of professional stature and not the ranking that they applied to it.

Professions in the Construction Industry

Fleming (1980), in a book of statistics in the CI, said that there were three occupational types that were classified as professions. These being:

- Architects
- Surveyors
- Engineers

The regulating bodies controlling these professions were described by Betts (1991) as:

Architects

The statutory registration body was the Architects Registration Council of the United Kingdom (ARCUK), established in 1931 under "the Architects Registration Act" of that year. Under this Act no one could call themselves an Architect unless they were registered with this Council. People were allowed, however, to undertake the design of buildings at any level without this title, if they were not registered. At this time the only professional Association recognised by ARCUK, as an examining body, was the Royal Institute of British Architects (RIBA). Other recognised examining bodies introduced since then have been schools of architecture both inside and outside Universities, which also recognised by the RIBA. Qualification as an Architect was by set examinations under the control of the RIBA and entitled successful candidates to use the letters ARIBA in recognition of their professional ability. Employment was in private practices, local authorities and CI contractors. In 1997 the Architects Act 1997 repealed the 1931 Act and replaced it with the Architects Registration Board (ARB) (Office of Public Sector Information (OPSI) 2008).

Surveyors

There does not appear to have ever been a specific registration body or any restriction on surveyors using the title. However, there were, up until 1974, two main professional organisations, which were; the Royal Institution of Chartered Surveyors (RICS), covering a wide range of surveying specialisations including quantity surveying and the Institute of Quantity Surveyors (IQS), which mainly, but not specifically, represented Quantity Surveyors (QSs) in employment with

contractors[1]. Qualification for both bodies was by set examinations, entitling the successful candidates to use either ARICS or AIQS. Employment, as with Architects, was in private practices, local authorities and contractors. Their website, at the time, showed the IQS being absorbed into the RICS (2003). Although this website no longer provides that detail, from personal knowledge, all members of the IQS had the opportunity to transfer to the RICS at the time of the merger.

Engineers

Within the CI the professions were broadly divided into two groups, Civil and Structural in one and Service Installations in the other. The first group was represented by the Institution of Civil Engineers (ICE) and the Institution of Structural Engineers (ISE), while the second was represented by the Institution of Mechanical Engineers (IME) and the Institution of Electrical Engineers (IEE). The IEE was incorporated into the Institution of Engineering and Technology (IET), according to the IEE website (2006). A Council of Engineering Institutions (CEI) was established in 1962, representing 14 Engineering Institutions and forming an Engineers Registration Board (ERB) operating a register of Chartered, Technical and Technician Engineers, although this was not a statutory body. Qualifications were set out in a similar fashion to both Architects and Surveyors, together with the use of letters. Employment also followed a similar path. The Engineering Council UK, known as EC(UK), replaced the CEI in 2002 (EC(UK), 2003).

Building

A fourth group, Building, was created from the Chartered Institute of Building (CIOB) (2003). According to their website's history section this Institution had been in existence for over 170 years, originally as The Builders Society in 1834, becoming the Institute of Builders in 1834. In 1965 the name changed to the Institute of Building and, in 1985, it gained the chartered status (CIOB 2010).

[1] There is now a further organisation for QSs, the Quantity Surveying Institute (QSi) (2010), which has not been included in any of the studies in this thesis. Its foundation occurred only in March 2004 (information obtained from a direct request to the Institute as it was not available on their website) and, as yet, it has no examination structure but relies, instead, on qualifications for entry, attained elsewhere.

Additional CI Profession Categories

Further 'profession recognition' came from information abstracted from a questionnaire provided by the Construction Industry Council (CIC) in conjunction with the Department of Trade and Industry (DTI) (2002), in the form of the Professional Services Survey 2001/2002. Section 2 of this questionnaire detailed six categories for the provision of professional services together with a list of occupations within each category. See Table 11 below:

Table 11 CI Professional Services and Groups determined by the CIC/DTI

Profession Group	Professions within Group
Planning services	Environmental Studies
	Urban/Regional Planning
	Planning Applications, Appeals, Enquiries
	Traffic and Transport Planning and Studies
	Site Appraisal: Technical/Geotechnical
	Project Feasibility Studies (including Financial Appraisal)
Architectural and Design services	Urban Design
	Landscape Architecture
	Architectural Design
	Space Planning
	Interior Design
	Dedicated Environmental/Sustainability Projects
Engineering services	Geotechnical Engineering
	Structural Design
	Fire Engineering
	Building Services Design (Mechanical, Electrical and Lighting, Public Health)
	Civil Engineering
	Highways Engineering
	Water Management Engineering
	Waste Management Engineering
	Dedicated Environmental/Sustainability Project.
Surveying services	Land Surveying
	Building Surveying
	Quantity Surveying
	Dedicated Environmental/Sustainability Projects
Management services,	Strategic Management Consultancy
Financial and Legal services	Value Engineering/Value Management
	Risk Management
	Financial Management
	Project Management
	Project Programming
	Quality Control/ Assurance
	Planning Supervisor
	Other Health and Safety Advice
	Contract Administration
	On-Site Supervision of Works
	Strategic Environmental/ Sustainability Projects
	Dispute Resolution Claims
	Adjudication
	Arbitration/Litigation
Facilities Management and	Facilities Management
Other services	Property Portfolio Management
	Research, Testing and Development

Section 6 of the survey form asked for professional staff profiles and then listed the categories that they considered fitted those profiles. See Table 12 below:

Table 12 CIC/DTI Professional Staff Profiles

Designation	Category
Managers	Business Managers
	Contract and Project Managers
Designers	Architects
Engineers	Building Services Engineers
	Civil Engineers
	Other Engineers
Surveyors	Building Surveyors
	Quantity Surveyors
Planners	Planning Professionals
Business	Legal/Business Professionals
	Administrators
Research	Scientists
General Construction	Other Construction Professionals
	Technicians

Also from CIC was a list of Associations and Institutions that had full or Associate Membership of the Council, which included all of the Institutions named above and some additions. See Table 13 below:

Table 13 CIC Member Associations and Institutions

Group	CIC Member Association
Planning	Royal Town Planning Institute (RTPI)
Architecture	Association of Consultant Architects (ACA)
	British Institute of Architectural Technologists (BIAT)
	Landscape Institute (LI)
	Royal Institute of British Architects (RIBA)
Engineering	Association of Building Engineers (ABE)
	Association of Cost Engineers (AcostE)
	Association of Consultant Engineers (ACE)
	Chartered Institute of Building Services Engineers (CIBSE)
	Institution of Civil Engineers (ICE)
	Institute of Highways Incorporated Engineers (IHIE)
	Institution of Highways and Transportation (IHT)
	Institution of Structural Engineers (IStructE)
Surveying	Association of Consulting Building Surveyors (ACBS)
	Consultant Quantity Surveyors Association (CQSA)
	District Surveyors Association (DSA)
	Institution of Civil Engineering Surveyors (ICES)
	Royal Institution of Chartered Surveyors (RICS)
Management	Association of Project Management (APM)
	Association of Planning Supervisors (APS)
	Chartered Institute of Building (CIOB)
	Institute of Construction Management (ICM)
	Society of Construction Law (SCL)
Facilities Management	British Institute of Facilities Management (BIFM)
	Institute of Maintenance and Building Management (IMBM)
Others	Institute of Clerk of Works of Great Britain (ICWGB)

The CIC questionnaire included such occupations as Planning Supervisor and "Other Health and Safety Advisors" in its listings, which helped confirm Larson's theory of professions developing in times of radical change, as the Planning Supervisors role had been in existence only since the introduction of the Housing Grants, Construction and Regeneration Act, 1996, according to the Office of Public Sector Information (2003). This role speedily took on a professional status as the Association of Planning Supervisors (2003), since absorbed into the Association for Project Safety (2008). The CIC members listing did not show a specific estimating Association/Institute/Institution, but did have an Association of Cost Engineers (AcostE) (2004), some of whose members were said to be Estimators but which did not have an examination structure for them, AcostE (2006). However, there was a

later development, AcostE (2010) which showed pathways to achieving Certified Cost Engineer qualifications, the route being through National Vocational Qualifications (NVQ). There was also an offer of 17 hours online training in five subject areas. The role appeared to be one of cost control from project conception through to completion and involved the necessity for being able to prepare design cost plans, project cost estimates and also control of the process through the construction phase. In the CI this work is generally considered to be divided between Consultant QSs, Estimators and Project QSs. A brief look at job vacancies for Cost Engineers showed four advertisements in the UK by Jobsite (2010) and 30 by Jobrapido (2010). Where the industry advertising the vacancies was clear, 31 of these were in the energy industry working for oil, gas and electrical supply companies. None were requested by construction or civil engineering companies and it may be, therefore, that the role is energy industry specific. Job descriptions gleaned from the advertisements aligned with that described by AcostE.

Anecdotal evidence, at this stage, suggested that some Estimators were members of the CIOB and the RICS but from their websites and 'phone calls to both organisations there were no indications of examination structures or specific sectors for Estimators within their organisations.

In addition, there was an international group with UK affiliations but based in the USA, the Association for the Advancement of Cost Engineering (AACE) (2003), which provided support and education for their 'cost professionals', who they named Cost Engineers, Project Managers, Planners and Schedulers, Estimators, Bidders and Value Engineers with 5,500 members worldwide.

3.6 Conclusions

The literature review found that there was no specific, classic definition of a profession but, rather, a plethora of descriptions that provide varied, widespread and even contradictory views. Overall, definitions displayed an evolvement from, historically, a tightly constrained concept to a modern approach of adapting to a broader range of attributes and core criteria. The historical concept severely restricted the number of roles that were able to claim professional status to just three, these being Medicine, Law and Divinity. With these constraints now lifted

many more occupations had been given the opportunity of achieving professional recognition and new professions were being created as the world integrated into the technological age. A broader, more flexible range of acceptable professional criteria have enabled professions to be employer-oriented and to work within teams as well as autonomously and specifically for clients. With capitalism controlling a great deal of society, there were still areas within older professions, Doctors, Lawyers, Architects and others, all within private, quasi-capitalist practices, where some of the original rules probably still applied and, as such, demonstrate that all professions, under whatever ideologies, could operate successfully alongside each other.

The conditions under which professions could materialise were found to be those where rapid, radical changes were occurring and where social and economic conditions provided a sound base. From sources displaying information on considered professions within the UK, estimating had not been shown to be an occupation that held professional status. Lack of recognition, however, should not preclude estimating or any other occupation from seeking professional acceptance if this was deserved and if an occupation could meet the criteria required of a profession. As regards its viability the criteria discerned was tested in Chapter 4 against perceived Estimator attributes. This would provide a preliminary assessment of the likelihood or otherwise of professional recognition for Estimators and act as a "signpost" to indicate the direction in which the research should proceed.

Chapter 4 - Estimator Match to Defined Professional Criteria

4.1 Introduction

With Chapter 3 providing information on the requirements of a profession then a view needed to be taken on whether the perceived estimating role would dovetail into these requirements. At this stage, having researched information on professional criteria but without concrete evidence on Estimators' abilities or requirements to hold any of these criteria, this Chapter would not confirm their legitimacy in this regard. What it would do was offer an experience based indication of the extent of Estimators' abilities to achieve defined levels of professional criteria.

4.2 Research Aims

The intention was to consider the degree to which estimating possessed the features essential to professional status by establishing the key criteria that would be prerequisites to its progress (results to be found at 4.5, below).

4.3 Research Method

To assess the definitions of a profession that were collated in Chapter 3 a comparison was made with QSs. This was an experience-based assessment and not a statistical analysis and, therefore, adopted the same research method as Chapter 3, a revised IRS, from Blaikie (2007). He approved this approach by writing that in addition to collecting data this method could include analyses of relationship patterns between definitions. The comparison was intended to show whether Estimators held a comparable number of professional criteria to an established professional group, QSs.

Therefore, having selected a suitable strategy for this study a methodology was needed in order to provide a guide to the next stage of the research. Advantages and disadvantages mirror those of Chapter 3.

4.4 Methodology

4.4.1 Design

The revised IRS method was used to assess the possibility of Estimators attaining professional status and the disadvantages were addressed as in Chapter 3.

4.4.2 Sample

Information on professional attributes was taken from Tables 5 and 7 in Chapter 3

4.4.3 Procedure

4.4.3.1 Identification of Attributes for Assessment

A Table was created that used information from Tables 5 and 7 of Chapter 3 which contained 38 professional attributes that had been defined by various authors. In Chapter 3 these attributes had then been condensed into seven main categories for simplifying the presentation of these definitions. For the purpose of testing Estimators' abilities in attaining attributes thematic analyses were carried out independently by supervisor and researcher which helped with verification and broadened the list into 13 main categories. These core themes were determined by using the protocol from Jones "et al" (1997) used in Chapter 3

4.4.3.2 Assessment of Estimator Professional Capability

In assessing Estimator professional capability QSs were used as a comparison as they were deemed to be a group which had similar job attributes and, in addition, professional recognition. The assessment was done by supervisor and researcher independently comparing the two groups and indicating, with a yes or a no, whether each main professional attribute category could be met by each. The results were then compared to discover how Estimators perceived professional attributes compared to those of QSs.

4.5 Results

4.5.1 Identification of Attributes for Assessment

A table of professional attribute requirements was compiled with columns 1-3 indicating item numbers, historic professional categories 1-31, from Table 6 and modern categories 1-7 from Table 8 and times mentioned. Columns 4-5 show the condensed categories and their positions in regard to the number of times mentioned by authors, which was information from Tables 7 and 9 of Chapter 3. This produced information for assessment of Estimator professional capability of 13 main categories. See Table 14, below:

Table 14 Condensed Professional Attributes

Item	Attribute/Need/Ability	Times Mentioned	Main Descriptive Categories	Category No
1	Knowledge	17	Knowledge	1
2	High Level of Study/Training	15	Knowledge	1
3	Ethics	11	Ethics	2
4	Service to Client	11	Service to Client	4
5	Skill	8	Knowledge	1
6	Create Monopoly	6	Monopoly	3
7	Culture/Ideology	5	Ethics	2
8	Influence/Power	4	Monopoly	3
9	Technique	4	Knowledge	1
10	Autonomy	3	Monopoly	3
11	Creativity	3	Creativity	6
12	Judgement	3	Judgement	10
13	Prestige	3	Prestige	8
14	Socialisation	3	Ethics	2
15	Abstract/Tacit Concepts	2	Ethics	2
16	Consciousness	2	Ethics	2
17	Devotion to Group	2	Devotion to Work	9
18	Mediating/Fiduciary Role	2	Mediation	11
19	Personal Responsibility	2	Personal Responsibility	12
20	Proper Remuneration	2	Proper Remuneration	7
21	Achievement Before Personal Gain	1	Service to Client	4
22	Complete Identity	1	Ethics	2
23	Core Meaning of Life	1	Devotion to Work	9
24	Etiquette	1	Ethics	2
25	Gravity	1	Ethics	2
26	Inject Innovation	1	Creativity	6
27	Promulgate Attitudes	1	Ethics	2
28	Promulgate Outlook	1	Ethics	2
29	Promulgate Values	1	Ethics	2
30	Quality	1	Ethics	2
31	Theorise	1	Creativity	6
1	Fit Within Capitalist Organisation	6	Working Within a Capitalist Organisation	5
2	Service for Economic Gain	2	Proper Remuneration	7
3	Act as Functionaries	1	Technical Role	13
4	Act as Technicians	1	Technical Role	13
5	Adopt Employers Ideology	1	Working Within a Capitalist Organisation	5
6	Client not First Priority	1	Working Within a Capitalist Organisation	5
7	Serve Employers as well as Clients	1	Working Within a Capitalist Organisation	5

4.5.2 Assessment of Estimator Professional Capability

The categories in Table 14 were then re-arranged into a further table separated into the item number (category number), the attribute category, number of times that the item was mentioned by authors, attributes that would be considered necessary and achievable for Estimators and QSs indicated with a 'Y' for yes and those that would be considered unlikely or unachievable with an 'N' for no. These columns separated employees into those working for construction companies and those working for consultants. See Table 15, below:

Table 15 Assessment of Estimator Professional Capability

Item	Attribute/Need/Ability	Number of References	Achievable for Estimators Y/N		Achievable for QSs Y/N	
			C¹	C²	C¹	C²
1	Knowledge	44	Y	Y	Y	Y
2	Ethics	30	Y	Y	Y	Y
3	Create Monopoly	13	N	N	N	N
4	Service to Client	12	Y	Y	Y	Y
5	Fit Within Capitalist Organisation	9	Y	Y	Y	Y
6	Creativity	5	Y	Y	Y	Y
7	Proper Remuneration	4	Y	Y	Y	Y
8	Prestige	3	Y	Y	Y	Y
9	Devotion to work	3	N	N	N	N
10	Judgement	3	Y	Y	Y	Y
11	Mediation	2	N	N	N	Y
12	Personal Responsibility	2	N	Y	N	Y
13	Technical Role	2	Y	Y	Y	Y

Key:

C¹ - Construction Employee

C² - Consultant

It was considered that Estimators working for construction employers could achieve professional status in nine of the attribute groups (over 69%) which compared equally to construction QSs. For consultants the number thought achievable for Estimators was 10 (almost 77%) compared to a possible 11 (almost 85%) for QSs.

As an indication of whether estimating could be considered as meriting professional status, the assessment showed that this could be achievable. An explanation should be provided for two of the less obvious judgements. Consultant QSs were allotted an additional yes to consultant Estimators as it was felt that they would need to undertake the "mediating/fiduciary" role as part of their service in liaison between client and contractor, sometimes termed Conflict Management, which would not normally be expected of Estimators. A view was also taken on Personal Responsibility in electing to make this a requisite for consultants and not for contractors' employees. This gave consultants in both occupations one more 'yes' than both construction employee roles. The criterion for this was in considering whether or not personal professional indemnity insurance (PI) was required. For employees within industrial organisations in the UK, including recognised professional people, it was not normally needed but following the outcome of the England and Wales Court of Appeal (Civil Division) Decisions, Merrett v Babb (2001) it could be construed that consultants, even those

working as employees in consultancies, may be held personally responsible for their work in certain circumstances, making PI advisable and therefore imposing on them a level of personal responsibility. A summary of this case can be read on the British and Irish Legal Information Institute website (2006).

4.6 Conclusions

The results gave a clear indication that estimating could be worthy of consideration as an occupation capable of holding a professional position. The assessment showed that whilst consultant QSs seemed to qualify on almost 8% more attributes than construction employees this variation occurred due to role differences rather than Estimator limitations in capability. It was also confined to attributes required in consultancy work as employees working for contractors showed that there were no perceived differences in attribute requirements between the two groups.

Some of the ideals that had been put forward relating to the standards expected of older professions and shown above and in Chapter 3, such as service to the client, etiquette, culture, autonomy, developing a monopoly and the core meaning of life, if applied, would undoubtedly exclude this study progressing any further. From this assessment, all the attributes required of the modern profession and professional offer a sufficient evidential basis from which to develop this research with a more extensive and detailed investigation. Table 15, showing the assessments, will also provide guidelines which Estimators can use as reference points. In the event that the statistically and ethnographically based research that follows, in Chapters 5-7 and 9-12, fails in any form to meet these assessments then weaknesses can be used as targets for improvement in any bid for the attainment of a professional structure.

Chapter 5 - Pilot Estimator Interviews

5.1 Introduction

The thesis, having received encouragement from the outcome of the research in Chapters 3 and 4, continued along the path of determining Estimator professional viability by collecting data on what Estimators do and how they were perceived by their employers. This study was originally intended to research information from Estimators on their attitudes to using IT, which was separate research on the uptake of IT in the CI. That study was excluded to help meet the thesis size limitation but knowledge gained during the study provided information which contributed to the TNA and BoK in Chapter 12, insights that would be useful to the conclusions drawn in Chapter 14.

Prior to this stage there were opinions and feelings that estimating was a job which required a high level of KSAs to ensure the accuracy of project cost estimates and where the outcome was often crucial to the future prosperity of CI employers, with the risk of financial damage or, in some cases, liquidation if the estimate was badly miscalculated. It seemed, also, that Estimators were in an unusual situation in that so much depended upon their ability to perform with accuracy and also competitively and yet there appeared to be no clear training path to educate, guide and develop their required expertise. Therefore, by surveying Estimators directly responsible for project estimates, in a semi-structured way, an insight into how they operated, coped with new technologies, developed work skills and were viewed by their employers, would provide guidelines for the development of the proposal.

5.2 Research Aims

To contribute to the research on developing an Estimator TNA/BoK, ETPs and the thesis conclusions, three aims were set which:

1. Gauged attitudes towards education and training and holding professional status with the ongoing demands that continuous professional development (CPD) would bring (results to be found at 5.5, Q7-9, and Q13-19, below)
2. Obtained opinions on and the usage of IT in general and CAE in particular, plus electronic trading, education, training and desire for cooperation with other disciplines across a broader spectrum than appeared to have been

covered by the CI to date (results to be found at 5.5, Q10-12, and Q15-19, below)

3. Gleaned attributes required by Estimators in order for them to carry out their work (results to be found at 5.5.1, below)

5.3 Research Method

The revised IRS that was described by Blaikie and used in Chapters 3 and 4 was adopted for this study as a means of helping to discover what Estimators do, what their perceptions of their roles were and what regard was shown to them by their employers. As such, the same advantages and disadvantages were considered.

These techniques are relevant to this study in establishing Estimator job attributes, role perceptions and employer regard. The technique has also been used extensively in social science and health literature - for example, Fei-Ling “et al” (2011) wrote an article for the Journal of Clinical Nursing on the dilemma of diabetic patients living with hypoglycaemia

This was the chosen method for this study with the methodology, below, addressing its disadvantages, which were described in Chapter 3.

5.4 Methodology

5.4.1 Design

To discover information on Estimators the revised IRS method, described in Chapter 3, used semi-structured interviews as a means of collecting data. The decision for using this particular strategy was helped by Robson (2002) who described alternative and extensive methods of working which are included in Appendix 1 Research Strategies (items 1.1-1.4). In order to obtain answers to attitudes, it was felt that the use of a survey would probably be the most appropriate strategy to adopt. The purpose was exploratory, explanatory and descriptive and there was a need to find out, seek new insights and ask questions but also to seek explanations of situations and problems. As such, personal semi-structured interviews were considered to be the most appropriate method.

The revised IRS disadvantages, described in Chapter 3, were addressed in this study by the following means:

1. Sampling
    - Guidance on information for the questionnaire was not required as the supervisor and researcher were members of PBs with knowledge of the CI
    - As this was a pilot study intended to gain experience in interviewing as well as an insight into Estimators' and employers' work and perceptions the number of companies was deliberately restricted to six.
2. Experimenter Bias Effects
    - The researcher was familiar with the work carried out by Estimators and therefore understood what questions to ask and which characteristics to look for.
    - Reliability of establishing information on "what" questions was helped by the researcher preparing a standardised questionnaire that was checked and approved by the supervisor. This also aided verification
    - Using the standardised questionnaire meant that all interviews were performed under the same conditions
    - Collection of external data, attributes obtained by observation and listening, were all done by the same researcher
    - The use of a questionnaire during the interviews meant that the views recorded were those of the interviewees and not the researcher

5.4.2 Sample

It was considered that a small pilot scheme would be the most suitable approach for two reasons:

1. As a means of gaining experience of interviewing techniques
2. To be able to carry out the study with a feasible time and cost resource

A number of different methods of survey sampling were looked at. The intended pilot scheme being very small scale meant that it was possible to carry out interviews with known company Estimators and/or Estimators introduced by peers, which would be

more expeditious than “cold calling”. For this purpose the method employed was taken from three different sample techniques:

1. Convenience, as some of the companies chosen were local and the estimators known personally
2. Purposive, as personal judgement was used in the choice of some of the interviewees
3. Snowball, for the intention to obtain recommendations and introductions to companies not known personally but known to peers

(Robson 2002)

The companies were chosen for the survey were from a range of company sizes categorised as small, medium and large by information from the Department for Employment and Trade in the Regions (DETR) (2000). The basis for these categories wan that small companies would be those whose turnover fell within the maximum of £1,000,000, medium companies within the maximum of £10,000,000 and large companies with turnovers exceeding £10,000,000 per annum, see Table 16, below:

Table 16 DETR Definition of Company Size

Key:

Lowest-companies with least employee numbers

Highest-companies with most employee numbers

Size	Number of Employees		Number of Companies		Total Turnover (£) (3rd Qtr)		Average Company Turnover (£)	
	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest
Small	1+	8+	87,712	3,790	1.415b	605m	65,740	638,520
Medium	14-24	60-79	3,104	364	882m	619m	1,136,596	6,802,196
Large	80-114	1,200+	271	35	694m	1.123b	10,243,544	1,283,428,500

The average company turnover figures from the table above are approximated as the DETR Survey was carried out using 3rd quarter figures for each year and these have therefore been prorated by multiplying by four. Six Estimators from different companies, specifically responsible for construction cost estimating, were chosen from across this range.

5.4.3 Materials

To create a personal interaction, ensure reliability and negate, as much as possible, the inexperience of the researcher at this early stage, a questionnaire was developed for use during the interviews. It was designed to obtain information from Estimators who used CAE, those who used both CAE and manual methods and those who used only manual methods. To inform the content of the questionnaire a review of the literature was conducted. This gave rise to the following generic themes, from which the interview questions were constructed:

Training for IT use

Training was discussed by Sher (1996) under the heading "Training to use CAE systems". He said that there was general agreement amongst educators that computers should be integrated into education at an early age. This process had been put into place with younger generations but it would be many years before the CI was totally staffed by computer-literate individuals. He then indicated the divergence of backgrounds from which people arrived at becoming Estimators. It was unlikely, he said, that many estimators would have received a formal education in computer systems or a theoretical background in software.

This led to the development of questions on training, qualifications, employer requirements and employer training:

Membership of Professional Body

Sher, again under Training for CAE, indicated that the routes by which people arrived at estimating were, in general, from progress through construction trades, completing diplomas or degrees, or via professions such as CIOB or RICS.

From this, questions on professions were added with requests for opinions on advantages and disadvantages:

Computer Aided Estimating

Also from Sher was an overview of CAE and its ramifications. In his view, estimates could, if necessary, be carried out using CAE as if they were being done manually but with the added advantage of not needing to check calculations. Once this had been

completed the estimate could offer a wide range of advantages in being able to be linked to other programmes, being quickly and easily modified, offering resource information on labour plant and materials and being very quickly converted into a tender with almost instantaneous changes to accommodate variations in percentage "mark-ups". In addition, should the tender be successful the information could readily be extended to provide detailed data for the production of valuations, final accounts and contract works programmes. A higher level of consistency and speed could be achieved by creating and developing databases of historical costs but that some estimators did not consider this to be advantageous. McCaffer and Baldwin (1991) also made this last point. As some Estimators may not be using CAE, there was a need to know why, whether it had been given consideration and, if so, the reasons for rejection.

Questions on using CAE derived from this, including, again, opinions on advantages and disadvantages of:

Electronic Trading

The pros and cons of electronic trading were detailed, again by Sher, where he highlighted the attitude of some contractors towards sending out enquiries to sub-contractors, in that they continued carrying out the operation in an accepted, traditional way by photocopying drawings and specifications and sending these by post. Almost up to the end of the 20th century, this was not only the accepted method but also the quickest and most time saving. However, as Paulson (1995) stated, computers, both in terms of software and hardware, had made astounding progress in recent years and could now provide alternatives to this accepted practice. Turner (1995), however, seemed to lean toward tradition in that he saw an advantage in paper and in being able to "step back" from the screen in order to take stock and maybe find anomalies that would not otherwise be seen. Harrison (1993) discussed the relevance of transferring information by disc and said that this was a preferred method for a number of engineers, clients and QSs, although not so for contractors receiving this information, who had to purchase expensive and often separate software because of its inflexible exclusivity to the supplier. One software supplier, Masterbill (2003), having spent seven years on just such a project, agreed with this and saw little point in

continuing with a system where all the interest and most of the benefit accrued to only one side of the industry.

This information helped produce questions on demand and the perceived advantages and disadvantages for electronic tendering.

5.4.4 Procedure

As the procedure for each interview was the same, these have been combined as follows:

1. Personal contact was made with the Estimator to be interviewed during which the reason for the interview was explained, a time and date arranged and an indication given of the likely length of the interview period
2. The prepared questionnaire was used by the researcher to obtain the requisite information
3. During the interview:
    - Questions were put and the questionnaire completed by the researcher
    - Observations were made of the work going on around the office
    - Records of these observations together with any other pertinent items of information ensuing from the interview were made
4. Estimator attributes found were recorded for transfer to the Estimator Skills Questionnaire and onwards to the TNA/BoK

5.5 Results

From the interviewees answers the data was collated and is shown in descriptive form and in Tables 17-32, below:

Q 1 What is your age?

The average age of Estimators interviewed was just over 44, see Table 17, below:

Table 17 Age of Estimators in survey

Company	Age
1	60
2	41
3	37
4	52
5	44
6	32
Total	**266**
Avg age	**44.33**

Q 2 What is your company's turnover?

Company size consisted of one small, three medium and two large with turnovers ranging from £900,000 to £200m. The larger company's turnover was a region of a company with a total turnover of £450m, see Table 18, below:

Table 18 Company turnover

Company	Company turnover (£m)
1	0.9
2	32
3	5
4	2.1
5	12
6	200

Q 3 How many Estimators are employed?

The number of Estimators employed ranged from one part time to twelve full time, see Table 19, below:

Table 19 Number of Estimators in each company

Company	Estimators employed	
	Part-time	Full-time
1	1	
2		6
3	3	
4	2	1
5	1	2
6		12

Q 4 What is your official job title?

Their job responsibilities varied between a shared Estimator/Surveyor role to company Managing Director, see Table 20, below:

Table 20 Job titles of interviewees

Company	Job title				
	MD	Estimator	Estimating Manager	Estimator/ Surveyor	Senior Estimator
1	1				
2			1		
3				1	
4		1			
5				1	
6					1

Q 5 How long have you been an Estimator?

Estimating experience was wide ranging, one Estimator having been full time for just one year but part time for twenty nine and another with thirty years full time experience, see Table 21, below:

Table 21 Time interviewees have been Estimators (years)

Company	Estimating time (years)	
	Part-time	Full-time
1	29	1
2		17
3	20	
4		30
5	10	
6		12

Q 6 How long have you been with this company?

Time spent working with their current employers was, in the main, less than ten years, see Table 22, below:

Table 22 Time interviewees have been with present company (years)

Company	Time with company (years)
1	28
2	9
3	4
4	2
5	3
6	13

Q 7 What training have you received?

More than 50% were trained as QSs but the training diversified from a bricklaying apprenticeship to a University education. Formal estimating training received was very low with only one Estimator having been given any training at all and that for only .2 of a year. Even practical estimating training was low, averaging .85 years overall with the most any Estimator given being 1.6 years. QS training, totalling 20 years at a formal and practical level, was where most of their knowledge was gained, see Table 23, below:

Table 23 Length and type of training received (years)

Company	Training received (years)					
	Formal Estimating	Practical Estimating	Formal Construction	Practical Construction	Formal QS	Practical QS
1	0	1	2	0	3	3
2	0	0	1	2	2	3
3	0	0	0	0	2	4
4	0.2	2	3.8	0	0	0
5	0	0.5	2	0	0	3
6	0	1.6	1	2.4	0	0
Total	**0.2**	**5.1**	**9.8**	**4.4**	**7**	**13**
Average	**0.03**	**0.85**	**1.63**	**0.73**	**1.17**	**2.17**

Q 8 What qualifications do you have?

All interviewees had attained qualifications, four of the six to a professional level and one to degree level, see Table 24, below:

Table 24 Qualifications obtained

Company	Qualifications				
	ONC	HNC	BSc	MRICS	CIOB
1	1	1		1	
2		1			
3		1			
4			1		1
5					1
6	1	1			1
Total	2	4	1	1	3
%age	33.33	66.67	16.67	16.67	50.00

Q 9 What qualifications were required for this job?

Their present employers had very little requirement for qualifications when advertising the posts-most had not asked for qualifications and only one had made a stipulation, an HNC; in the majority of cases employers looked for experience, see Table 25, below:

Table 25 Qualifications required by employer

Company	Qualifications required						
	ONC	HNC	BSc	MRICS	None	Ability	Experience
1					1		
2					1		1
3					1		1
4					1	1	1
5					1		1
6		1					1
Total	0	1	0	0	5	1	5
%age	0.00	16.67	0.00	0.00	83.33	16.67	83.33

Q 10 What experience do you have of IT?

Experience of IT was strong, particularly estimating-related software with Excel spreadsheets and specialist CAE packages, see Table 26, below:

Table 26 Estimators' experience of IT

Company	IT experience							
	CAE	Word	Excel	Project Mgment	E-Mail	Internet	Power Point	Valuation
1	1	1	1	1	1	1		
2	1	1	1		1	1	1	
3	1	1	1	1	1	1		1
4	1		1					
5		1	1	1	1	1		
6	1	1	1		1	1	1	
Total	5	5	6	3	5	5	2	1
% age	83.33	83.33	100.00	50.00	83.33	83.33	33.33	16.67

Q 11 What software packages do you use at work?

The availability of IT in the workplace did not match Estimators' handling capabilities, with Excel and CAE software available in only 50% of offices, see Table 27, below:

Table 27 Software provided by employer

Company	Software currently used							
	CAE	Word	Excel	Power Point	Project Mgment	Acrobat	Valuations	None
1	1	1	1	1	1	1		
2	1						1	
3		1	1		1			
4								1
5		1						
6	1	1	1	1				
Total	3	4	3	2	2	1	1	1
% age	50.00	66.67	50.00	33.33	33.33	16.67	16.67	16.67

Q 12 With what frequency are these used?

Excel and CAE were shown to be regularly used by Estimators when the software was available, see Table 28, below:

Table 28 Regularity of software use

Company	Frequency of use						
	CAE	Word	Excel	P Point	Project	Acrobat	Valuations
1	regularly	daily	daily	occasionally	occasionally	occasionally	
2	daily						regularly
3		daily			weekly		
4							
5			monthly				
6	daily	daily	daily		daily		

Q 13 What advantages do you think there are in belonging to a professional institution?

In general there were mixed reactions toward belonging to a profession with a maximum of 50% for any specific advantage, see Table 29, below:

Table 29 Advantages of a profession

Company	Advantages of a profession							
	Credence	Information access	Cheaper seminars	Confidence to others	Informative meetings	None	Obtaining work elsewhere	Little
1	1	1	1	1				
2						1		
3							1	
4		1			1			
5		1			1		1	
6							1	1
Total	1	3	1	1	2	1	3	1
% age	16.67	50.00	16.67	16.67	33.33	16.67	50.00	16.67

Q 14 What disadvantages do you think there are in belonging to a professional institution?

There was strong feeling and a consensus that the cost of belonging to a professional body was a disadvantage and almost as strong was the antipathy toward the demands the CPD would require, see Table 30, below:

Table 30 Disadvantages of a profession

Company	Disadvantages of a profession		
	Cost	CPD Demands	Experience discounted
1	1	1	1
2	1	1	1
3	1	1	
4	1		
5	1	1	
6	1	1	
Total	6	5	2
% age	100.00	83.33	33.33

Q 15 What additional training is undertaken to improve your estimating skills?

Skill development was undertaken in a formal manner by 1/3rd of the estimators with a further 1/3rd considering that they learned new skills as they developed their working experiences, see Table 31, below:

Table 31 CAE Skills training provided

Company	Additional CAE skills training				
	Practice on the Job	Training courses by software supplier	None	Personal effort	"In House" Team Training
1	1				
2		1			
3			1		
4			1		
5	1			1	
6		1			1
Total	2	2	2	1	1
% age	33.33	33.33	33.33	16.67	16.67

Q 16 What additional training is undertaken to improve your estimating techniques?

Employer provision of CAE technique training was even lower at 1/3rd and here 2/3rds of Estimators found that work experience was their main avenue for improving technique, see Table 32, below:

Table 32 CAE technique training provided

Company	Additional CAE technique training			
	Practice on the job	"In House" training	Software supplier training	Personal effort
1	1			
2		1	1	
3	1			
4				
5	1			1
6	1			
Total	4	1	1	1
% age	66.67	16.67	16.67	16.67

5.5.1 Estimator Attributes

During the interviews, Estimator attributes emerged from general discussions and casual observations. These amounted to 25 individual items which were recorded and transferred to aid the development of the Estimator Training Needs Questionnaire and, consequently, the TNA/ BoK.

5.6 Conclusions

The results showed that while the study was small it was composed of Estimators who were mature, experienced, in responsible positions, well qualified and working across a broad spectrum of company sizes, which suggested that their opinions were to be valued.

Sher, *op. cit.,* noted that there was a tendency for people to move into estimating from other jobs and these interviews confirmed this in that Table 23 showed an average of less than one year of Estimator training compared to more than 2 years of general construction and more than three years of QS training. While this would provide a more rounded preparation, Sher also pointed out that it would mean less likelihood of gaining a background in computer systems applications and theories, which would be advantageous to them when using CAE software. However, a high percentage of interviewees were experienced, not only with CAE software but also with other applications, all of which would be advantageous to their work. Their experience surpassed the level of IT being offered by their employers. For those using CAE it seems that the tendency was for employers to let them develop their own skills and techniques as little was offered in the way of training. It was found that Estimators

demonstrated a desire to learn, gain qualifications and use IT, particularly CAE. Their employers were shown to be less ambitious and while over 83% of Estimators were capable of using CAE software only 50% of employers were providing it.

While most Estimators had gained good qualifications, 50% professionally and 16.67% to degree level, with a minimum of HNC, none of the qualifications was specifically channelled towards estimating.

Opinions on professional membership were not high. While some merit could be found in the credence that it would give to them, accessibility to necessary information and an advantage if applying for work elsewhere, no more than 50% of Estimators saw any advantages in membership. Much stronger reactions were expressed with cost of membership and CPD demands, which the overwhelming majority considered to be disadvantages.

From this, a picture was beginning to emerge of CI employers failing to meet the requirements of a section of the industry whose accuracy in cost calculations is vital to the industry's financial health. This failure appeared to be at several levels with:

- A lack of education provision
- A lack of training
- Failure to provide specific IT software

This failure by employers was despite the fact that they employ Estimators who have demonstrated the ability, ambition and desire to obtain an education and to use IT.

Chapter 6 - Estimator-QS Salary and Benefits Comparison

6.1 Introduction

This study views the estimating role from two perspectives, these being:

1. Gaining an insight into how Estimators were perceived by their employers
2. Discovering whether there was a difference in the perceptions of Estimators and QSs by their employers. Such a comparison would highlight any differences between the non-professional role (Estimators) compared to the professional role (QSs)

An Estimator-QS salary comparison was highlighted by Delargy (1999) who commented on what she perceived to be inflated Estimator salaries and suggested that Estimators were once viewed with scorn by professions such as QSs but that this was fading due to an emerging skills shortage which had created an unprecedented demand for Estimators. Recruitment agency Hays Montrose produced a salary comparison that was used within this article and the most relevant section is shown in Table 33, below:

Table 33 Building Contractors' Salary Guide (1999)

Occupation, Age and Qualification	National Average Salary £
Senior Quantity Surveyor aged 35 (ARICS)	28,060
Contract Quantity Surveyor aged 27 (HND/ARICS)	23,429
Estimator aged 30 with 5-10 years experience	25,643

At this time, according to the agency, areas such as South Wales, the S.W, Midlands and N.W. England apparently had 8 vacancies for every Estimator. Delargy continued by saying that Estimators were a "*dying breed with an image problem*" (p.38) and that the shortage was particularly acute with large contracts where contractors were not prepared to entrust their estimating to people with limited experience. The CI had difficulty attracting young people in general and particularly Estimators who, she added, "*suffered from a commonplace attitude that they are boring, shut away in dark*

offices with only numbers for company" (p.38) and that the stereotype was of "*a 50 year old man in a grey suit who is anything but dynamic and go-getting*" (p.38). She stressed the seriousness of the issue, blaming the Estimator shortage for a resultant increase in salaries that could "*have a knock on effect for inflation*". (p.38). The concluding remarks were that:

> *"Estimators may once have been the poor relations of QSs but in the current climate they were finding themselves with a financial power previously unheard of and if they are accused of being boring they can cry all the way to the cash machine"* (p39).

The purpose of Delargy's article was to emphasise the rise in Estimator salaries in greater proportion to those of other occupations in the CI, due solely to the scarcity of Estimators. As that article was published four years before this study then there was a possibility that if there was still a scarcity of Estimators at the date of this study then there would be the risk of a distortion in the results. However, at a time close to that of this survey a "joint media release" was published on the Conduit Recruitment website (2003) which highlighted the demand in the UK for QSs as well as Estimators. Therefore, Delargy's claim that Estimator salaries were being inflated because of a high demand for their services, ought, at this period, to be negated by a high demand for QS services. It was judged that these salary and benefits comparisons would not to be distorted by a bias toward Estimators and would, therefore, provide a fair comparison between the two groups.

6.2 Research Aims

As part of the research into discovering the perception of Estimators by CI employers, the aim, based on Estimator-QS comparisons, was to determine and compare salary levels and other benefit packages being offered by employers (results to be found at 6.5.1 and 6.5.2, below). This research contributed to the second objective of the thesis and the results would also add to the information used when considering estimating in the context of a professional role.

6.3 Research Method

The revised Deductive Research Strategy (DRS) from Blaikie (2007) was the chosen method for this study. Its principal aim was to gather information using sampling

techniques, develop hypotheses and statistically test those hypotheses using the collected data. In this case the need was to establish the regard held by the CI for Estimators by comparing it to that held for QSs. The information chosen as an appropriate measure to achieve this was salary and benefits offered to each group. The revised DRS, revised because the focus can concentrate on a specific rather than a general field, was the second of four strategies identified by Blaikie in Chapter 3 and was deemed appropriate for this study based on his description that it:

- Aimed to test theories
- Collected data
- Constructed theories and developed hypotheses
- Tested the hypotheses by matching them with the data
- Can be used with qualitative as well as quantitative data

These techniques were relevant to this study in establishing the regard in which CI employers hold Estimators. The technique has been used in the field of information systems literature – for example, Todd and Brent Gallup (1995) produced an article for the Management Information Systems Quarterly on the evolution of information systems job skills. The data gathered and analysed for this was extracted from information systems job advertisements over a 20 year period. The advantages of the revised DRS are:

1. They explain a pattern between two concepts by proposing a theory and testing its validity
2. While the original DRS was considered tentative and open to modification the revised DRS aimed to meet the research objectives in their specific context and provide useful results which would provide validation.
3. The data collected can be a mix of qualitative and quantitative in its nature

(Blaikie 2007)

4. Collecting data by probability sampling methods means:
    - The data can be subjected to statistical inferences about the population from which the sample is obtained
    - The data can be taken as representative of the population being sampled

- The data can be collected from a wide-ranging area and can, therefore, be limited only by the volume of data available
- Large volumes of data can be collected cost effectively
- The larger the sample the less likelihood of errors from generalising

(Robson 2002)

As the intention was to discern data on salary and benefits offered then these advantages make the method ideal for this study.

There are disadvantages that have been taken into account and these are shown as follows:

1. Sampling:
    - Difficult to associate the size of the sample with genuine population size

(Hicks 2009)

- Constant Errors can occur without careful data management, design considerations and sampling techniques
- Random Errors are inevitable and occur by virtue of the individual differences present in all samples

(Hicks 1999)

- Probability samples allow sample-to-population generalisations, which can be problematic if they do not identify the section of the population to which the studies are aimed
- Random sampling could distort the results if the samples chosen at random missed the population being sought
- Collection of data is ideally carried out by an independent researcher

(Robson 2002)

2. Reliability and Validity:
    - Quantitative methods will require the researcher to devise measures of the characteristics which are valid and reliable

(Blaikie 2007)

- Testing the data required an appropriate test of inferential statistics that is matched appropriately to the research design. An incorrect test selection, could negate the conclusions reached

(Hicks 1999)

3. Experimenter Bias Effects where the researcher can influence results by:
    - Excluding outlying views which may eliminate valuable perspectives
    - Categories may reflect researchers personal agenda

(Hicks 2009)

Taking these points into consideration, the revised DRS was regarded as an appropriate tool. The methodology selected to justify this method is described below.

6.4 Methodology

6.4.1 Design

The revised DRS, described above, was carried out using job advertisements seeking applications from the fields of estimating and quantity surveying. The revised DRS disadvantages, described above, were addressed in the current study by the following means:

1. Sampling:
   To overcome the disadvantages shown above the method of data collection was carefully selected by taking note of authors' views on sampling of evidence. Job advertisements for Estimators and QSs were the chosen way of discovering information on salaries and benefits offered as this information could be obtained from a wide source and would be comprehensive. Decisions needed to be made on the sampling method or methods that would be most appropriate. The factors taken into consideration before making such decisions were:
    - That it was intended to be a survey of the CI between July and November2003
    - Sample size should cover at least 100 advertisements with a minimum of 50 for each subject i.e. QSs and Estimators, overall.

- There should be comparable numbers of QSs and Estimators as a whole, sub-divided into skill levels which should also contain comparable numbers. These two groups could also be defined by company types, sizes and divided into public, private consultancies and construction sectors ie the evidence base was stratified
- Random selection of samples from these subgroups should use as impartial a method as possible-see below for sample method

From this, it would seem that a combination of sample methods would be helpful. A random method would provide fairness and, because of the need to sub-divide the groups, this should be a stratified random sample. To ensure that each sub group was adequately represented, an element of quota and dimensional sampling also required consideration.

2. Reliability and Validity:

In this regard Fisher (1935) (quoted in Robson, 1994, p.46), said that:

"Random sampling from known populations allows the use of probability theory to estimate error and through this the development and use of statistical tests of significance"

- This approach, according to Robson, above, provided a solution to two very important issues of validity, external and internal which are defined in Research Strategies Appendix 1 (item 1.5).Alternative methods of statistical test selection are explained in more detail by various authors in Research Strategies (items 1.6 and 1.9).
- Validity of the data was helped by selecting only advertisements that contained all the information required to perform the tests
- Reliability of the data collected by the researcher was helped by the supervisor checking the transfer of this data from the job advertisements found to the job advertisement tables shown in detail in Appendix 2. The supervisor's checks also aided verification
- Establishing comparisons between the two groups on salaries offered was measured by an Unrelated *t* test and a Non-Parametric Mann-Whitney U test thus providing an objective inferential analysis of the data-set

- Establishing comparisons between the two groups on benefits offered was measured by a Chi-squared test thus providing an objective inferential analysis of the data-set

3. Experimenter Bias Effects
    - Using an additional researcher to check the data transfer
    - Using objective statistical tests to establish differences between the groups; this excluded researcher interpretation of responses and thus reduced bias
    - No outlying views were excluded

6.4.2 Sample

Details of salaries and benefits offered by employers, during a specific time period, were extracted from job advertisements. This "snapshot" survey used information from 108 advertisements placed in:

- "Building" magazines (2003)
- Internet websites of construction recruitment agencies.
- The "Express and Star" newspapers (2003), chosen as a random source of local advertising

These advertisements, while being randomly chosen, were selected by sampling advertisements from each region of the UK. The job levels for each group were chosen in even numbers of advertisements, as follows:

- Trainee/Assistant Estimators 16
- Trainee/Assistant QSs 16
- Standard Estimators 18
- Standard QSs 18
- Senior Estimators 18
- Senior QSs 18
- Chief Estimators 2
- Chief QSs 2

Selected advertisements therefore totalled:

- Estimators 54
- QSs 54

While there was an even spread at each job level this could not be continued across all job levels as the maximum amount of advertisements available at Trainee and Chief levels reached fell below those at Standard and Senior levels.

6.4.3 Materials

Tables were created to contain complete sets of information collected from job advertisements, which contained headings for:

- Job level
- Job description
- Region
- Employer type and company size
- Date advert was found and source
- Salary and benefits offered
- Qualifications required

6.4.4 Procedure

6.4.4.1 Identification of Job Advertisements

The Building magazines and Express and Star newspapers were purchased and searched during the specified time period along with an internet search of job recruitment agencies. Advertisements that contained all the required information were selected in the groups described in Sample, above. This information was recorded in the tables, described in Materials, above, for each group and job level.

6.4.4.2 Creation of Hypotheses

Two hypotheses were developed based on the assumption that the QS, being a professional occupation, would receive greater remuneration and supplementary benefits than the Estimator. Therefore, the information on salary and benefits, contained in the advertisements, would be further developed here by analysing them in order that a comparison could be made between the roles.

Tests were performed to establish that the samples provided and the information gleaned from those samples was reasonable. The information was then collated and

the statistical package for social sciences (SPSS) software package was used to make the required comparisons. Using SPSS would enable this information to be divided into a variety of segments so that any differences could be highlighted. Both disciplines could be shown in an overall average and broken down into regions, size of company, type of organisation, whether the work was in the private or public sector and into skill levels, provided that there was a sufficient volume of information available. The statistical compilation was intended to reveal "significance factors" to help determine any perceived differences in the way in which employers viewed Estimators and QSs.

Once the samples had been established as being reasonable, two hypotheses were tested created and tested, the first based on salaries offered and the second on benefits offered, as follows:

6.4.4.3 Hypothesis 1

H_1 QSs, belonging to a recognised and accepted profession, are offered salaries in excess of those offered to Estimators, who are not recognised as belonging to a profession

H_0 QSs, belonging to a recognised and accepted profession, are not offered salaries in excess of those offered to Estimators, who are not recognised as belonging to a profession

To test this, Hicks, *op. cit*, explained the process required in order for the data to be analysed. The analysis involved using statistical tests to determine the probability of support for the hypothesis. She said that there was no single, all-purpose test, that would enable the data to be analysed, but instead that an appropriate test required selection in a way that ensured its capability of matching itself to the research design. An incorrect test selection, Hicks explained, could negate the conclusions reached, so it was therefore vital to ensure that a great deal of care was taken when making the necessary test selection. The procedure for selecting a statistical test is set out under Statistical Test Selection Procedure in Research Strategies Appendix 1 (item 1.6). Initially the Design type was selected from information on Designs. With the hypothesis being used there were two variables - the job type and the salaries being

offered. The statement was that the salaries offered depended upon the job type. Therefore, the salaries offered were a dependent variable (DV) and the job type an independent variable (IV), with the IV being manipulated between QSs and Estimators. The prediction was that there would be a difference in offered salaries between the two parts of the IV and not a relationship between them, so the acceptable design for this test was an Experimental one. The development procedure is described below:

1. Conditions

This study, taken on an overall basis, would have two experimental conditions:
Experimental Condition 1
QSs (IV) Salary Level (DV)

Experimental Condition 2
Estimators (IV) Salary Level (DV)

With job levels were broken down so that each discipline (IV) had 4 groups, trainees, project, seniors and heads, then there would be a total of eight conditions (four Estimator and four QS)

Measures were taken to take account of Effects and Errors (see Sources of Error, Appendix 1 (item 1.6.3)) and these are explained below.

1. Order Effects

The study was based on the collection of data that, with the analysis, would show this data placed in sequence. However, if data was collected in a totally random way it could produce far more advertisements for trainee QS than for trainee Estimators. In contrast the reverse may apply to senior positions. Therefore it was essential to ensure that equal numbers of advertisements were obtained, even though randomly selected, at all job levels in both disciplines in order to provide a fair comparison.

2. Experimenter Bias Effects

It was impractical to utilise the resources of an independent researcher to collect the data but an even balance of all advertisements, mentioned in Order Effects, was

achieved by collecting data in as random a way as possible, with a regular interchange of sources and extraction from all sections of available material and not just the first advertisements that were found.

3. Constant Errors

These were guarded against by diversification, with the UK being divided into nine regions and data samples taken from both disciplines across all regions. Salaries were also categorised by being subdivided into £5000 bands, i.e. £15,000-£20,000, £30,000-£35,000 etc. in addition to highest, lowest and mid-salary points, required by the SPSS tests.

4. Random Errors

As this study concerned the collection of data compiled from many disparate, independent and widely dispersed individuals and organisations it would be impossible to gauge the mood of any particular individual when preparing to place an advertisement. In some cases companies may have been so desperate to recruit an Estimator that they may possibly have increased their optimum salary levels in order to make the position more attractive. On the other hand a company may have used a recruitment agency to help them find the right staff. Recruitment agencies apparently receive fees of between 20% and 50% of each successful recruit's first year salary (information given by two employees from Severn Trent Water during a discussion on staff recruitment). This factor alone may influence the salary level in either direction, with the possibility of the agency looking to increase the level and the company trying to hold it down. Therefore, in providing a reasonably large sample with an even spread, in which QSs and Estimators job advertisements have wherever possible been drawn from similar sources and finding an alternative survey for comparison, it was considered that the likelihood was that this kind of error would even itself out between the roles.

5. Fitting the Design to a Statistical Test

The decisions made above led to the following sequence:

- The design was Experimental
- The format was a Different Subject Design

For a total overview there were two different groups, therefore the possible tests were:

- Chi-squared test
- Mann-Whitney U test
- Unrelated *t* test

The table for Experimental, Different Subject Designs is displayed in Research Strategies Appendix 1 (item 1.6.6.3), reproduced in Table 34, below, for ease of assessment:

Table 34 Experimental Different Subject Designs

Subject Group		**Condition**		**Non-parametric Test**	**Parametric Test**
Subject Group 1	takes part in	Condition 1	Compared for Differences Between Conditions	Chi-squared test (if data is nominal) or Mann-Whitney U test (if data is other than nominal)	Unrelated *t* test (if data is interval/ratio)
Subject Group 2	takes part in	Condition 2			

From this table, Subject Group 1 would be QSs under Experimental Condition 1 (salary levels) and Subject Group 2 would be Estimators under Experimental Condition 2 (salary levels). The data was compiled using SPSS software and tabled indicating Interval/Ratio, Nominal and other than Nominal. This showed the Interval/Ratio data as Scale and the data that is other than Nominal was shown as Ordinal. Therefore, from this table, comparisons could be made using Parametric tests on mid-point, minimum and maximum salaries. On these levels the Unrelated *t* test was used. There was also data calibrating salary levels in £5000 bands as described under Constant Errors, above, classified as Ordinal data, requiring a Non-Parametric Mann-Whitney U test.

With this information the hypothesis was tested on overall salaries at their mid-point, maximum and minimum levels and advice was taken from Hicks, under Significance

Levels (item 1.6.5) in Research Strategies Appendix 1, with a level of 5% (.05) used as a maximum below which the salary level of QSs would be deemed significantly higher than those of Estimators.

6.4.4.4 Hypothesis 2

H_1 QSs, belonging to a recognised and accepted profession, are offered a greater range of benefits than those offered to Estimators, who are not recognised as belonging to a profession

H_0 QSs, belonging to a recognised and accepted profession, are not offered a greater range of benefits than those offered to Estimators, who are not recognised as belonging to a profession

A decision on the design followed the same path as that set out above. With the hypothesis being used there were two variables - the job type and the range of benefits being offered. The statement was that the benefits offered depend upon the job type. Therefore, the benefits offered are a DV and the job type an IV with the IV being manipulated between QSs and Estimators. It was predicted that there would be a difference in offered benefits between the two parts of the IV and not a relationship between them, so the acceptable design for this study should be an Experimental one. Therefore, having decided that an Experimental Design was right, within that area the choices were between Different-, Same- and Matched- Subject Designs. The only Design that could fit in this instance would be the Different Design.

On an overall basis the number of experimental conditions remained as two.
Experimental Condition 1
QSs (IV) Range of Benefits (DV)

Experimental Condition 2
Estimators (IV) Range of Benefits (DV)

If the job levels were broken down so that each discipline (IV) had 4 groups, there would again be eight conditions (four Estimator and four QS).

From Table 34, above, for a comparison of benefits offered this data was classified as Nominal and would therefore be a Chi-squared test.

Taking into consideration Pallant's additional explanation on Chi-squared tests, Appendix 1 (item 1.6.6.3), there are two categorical variables within this study - QSs and Estimators - and therefore the second test would apply. Information provided from this test with SPSS showed the percentage of job adverts offering each benefit and the Significance value. As with the *t* tests, this value would be Significant if it was of 5% or less (.05). This study used a comparison of the two groups as an overall sample which contained seven categories to each of the two variables (2 x 7).

6.5 Results

Complete details of job advertisements selected are shown in tables in Estimator-QS Job Advertisement Details, Appendix 2.

Recruitment was not evenly balanced as the CI requirement for QSs appeared to be much greater than for Estimators at a ratio of 5:1. This information was taken from recruitment agencies used to compile the job advertisements wherever this information was available. Only two agencies were unable to supply such information - U Recruit and Judd Ferris Property Recruitment, see Table 35, below:

Table 35 Estimator:QS Job Advertisements at Recruitment Agencies (2003)

Agency	Number of Jobs Advertised (Estimator)	Number of Jobs Advertised (QS)
Anders Elite	110	615
Cordon Recruitment	6	29
Construction Jobs UK	82	538
Henry Recruitment	1	8
CALCO	2	42
Elliot Marsh	5	23
Hays Personnel	61	193
Hill McGlynn	33	65
Coyle Personnel Recruitment	5	13
Total	305	1526

This table shows an Estimator/QS proportion of almost exactly 1:5.

Descriptive Statistics

Statistical tests were carried out to establish that the survey sample was reasonable. These are shown in Tables 36-38, below:

Table 36 Statistics

		Job Description	Level of Job	Region
N	Valid	108	108	108
	Missing	0	0	0
Minimum		1.0	1.0	1.0
Maximum		2.0	4.0	9.0

The above table demonstrated that the information provided from all 108 advertisements was valid and that there was no missing data.

Table 37 Frequency Table (Overall)

Key: Frequency = Number of advertisements

Percent = Percentage of total advertisements

Valid Percent = Valid percentage of overall total

Job description		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Estimator	54	50.0	50.0	50.0
	Quantity Surveyor	54	50.0	50.0	100.0
	Total	108	100.0	100.0	

The above table shows that there was an even balance of Estimator-QS advertisements and that all the information provided was valid.

Table 38 Frequency Table (Skill Level Breakdown)

Job Description

Level of Job			Frequency	Percent	Valid Percent	Cumulative Percent
Trainee/Assistant	Valid	Estimator	16	50.0	50.0	50.0
		Quantity Surveyor	16	50.0	50.0	100.0
		Total	32	100.0	100.0	
Project	Valid	Estimator	18	50.0	50.0	50.0
		Quantity Surveyor	18	50.0	50.0	100.0
		Total	36	100.0	100.0	
Senior	Valid	Estimator	18	50.0	50.0	50.0
		Quantity Surveyor	18	50.0	50.0	100.0
		Total	36	100.0	100.0	
Head	Valid	Estimator	2	50.0	50.0	50.0
		Quantity Surveyor	2	50.0	50.0	100.0
		Total	4	100.0	100.0	

The above table demonstrates that, when broken down into job levels, this "spread" remained even.

6.5.1 Hypothesis 1

There are two separate *t* test significance values, one under the heading "Equal variances assumed" and the other under "Equal variances not assumed". The method of determining which Significance value to use was explained by Pallant (2003), as looking at the information on Levene's Test for Equality of Variances within the Independent Samples Test box. If the Significance Value in this section was larger than .05 then the line to use was Equal variances assumed but if the Value is .05 or less then the line to use would be Equal variances not assumed. The number of QS and Estimator salaries used in each test varied due to the way in which each job was advertised, some showing maximum and minimum salary levels some showing maximum levels only etc.

Salary Comparison (Overall)

The hypothesis under consideration predicted a direction in which the salary would go and was therefore a single-tailed hypothesis. This comparison covered all four job levels across all nine regions and results are displayed in Tables 39-41, below:

Table 39 Mid-point salary comparison (t-test 1)

Comparison	t	df	Average Mid Point Salary QS £	Average Mid Point Salary Est. £	p	Implications
Mid Point Salary	-.226	84	28565	28,175	.411*	Using an unrelated *t* test on the data (p > 0.05 for a one-tailed hypothesis) the results were found to be not significant and therefore the hypothesis was not supported.

* The p value shown is 50% of the value shown in the *t* test table, which was based on a two-tailed hypothesis.

Table 40 Minimum Salary Comparison (t-test 2)

Comparison	t	df	Average Minimum Salary QS £	Average Minimum Salary Est. £	p	Implications
Minimum Salary	-.047	87	26,509	26,418	.481*	Using an unrelated *t* test on the data (p > 0.05 for a one-tailed hypothesis) the results were found to be not significant and therefore the hypothesis was not supported.

* The p value shown is 50% of the value shown in the *t* test table, which was based on a two-tailed hypothesis.

Table 41 Maximum Salary Comparison (t-test 3)

Comparison	t	df	Average Maximum Salary QS £	Average Maximum Salary Est. £	p	Implications
Maximum Salary	-.332	103	31,270	30,725	.370*	Using an unrelated *t* test on the data ($p > 0.05$ for a one-tailed hypothesis) the results were found to be not significant and therefore the hypothesis was not supported.

* The p value shown is 50% of the value shown in the *t* test table, which was based on a two-tailed hypothesis.

The remaining data on salaries is where the data was divided into £5,000 salary bands and classified as Ordinal Data which required the use of a Mann-Whitney U Test, see Table 42, below:

Table 42 Average Salary Bands

Comparison	u	n^1	n^2	Average Salary Band QS	Average Salary Band Est.	p	Implications
Salary Band	1434.5			Not Given	Not Given	.441*	Using a Mann-Whitney U Test on the data ($p > 0.05$ for a one-tailed hypothesis) the results were found to be not significant and therefore the hypothesis was not supported.

* The p value shown is 50% of the value shown in the *t* test table which was based on a two-tailed hypothesis.

In all of the tests undertaken there was found to be no significant (5%) difference between the groups and therefore the hypothesis was not supported.

As a comparison, the recruitment agency Hays Personnel (2003) undertook a salary survey which was published in 2000 and another in 2005, covering several CI disciplines. This information was compiled using the average salary level across the UK; see Tables 43-44 below:

Table 43 Hays Personnel Salary survey 2000

Average UK Salary	E £	QS £
Assistant	20,068	19,260
Contract	28,730	28,095
Senior	33,680	33,790

Table 44 Hays Personnel Salary survey 2005

Average UK Salary	E £	QS £
Assistant	24,288	23,907
Project (Contract)	32,907	32,192
Senior	38,846	38,846

The 2000 survey indicated that the salary gap highlighted by this company in 1999, Table 33, *op. cit.,* had been eroded by 2003. In two of the three skill levels, Assistant and Contract, Estimators were shown at this time as being offered between 2% and 4% more in salary and in the third, Senior, QSs were being offered about 0.33% more. By 2005 Assistant Estimators were still earning more but the gap had narrowed slightly to just over 1.5%. Similarly Contract Estimators, their gap narrowing to around 2.25%. Senior levels had by then reached parity.

The mean results from this study are shown in Table 45, below, to offer an "eyeball" comparison with the Hays Personnel surveys from the tables above:

Table 45 Average Salary Levels from "Snapshot" Survey

Average UK Salary	Est £	QS £
Assistant	19,250	18,464
Project (Contract)	28,928	30,053
Senior	35,071	35,588

These figures suggest that there was sufficient similarity between the two surveys for the figures used in the statistical analyses to be looked at with a degree of confidence as the gap from the 2005 survey, two years following this work had, overall, appeared to have closed even further.

6.5.2 Hypothesis 2

Benefits Comparison (Over all levels)

The hypothesis under consideration predicted a direction in which the benefits would go and was therefore a single-tailed hypothesis. Whilst data was collated across all four job levels the statistical comparisons were done on an overall basis. This was because it was considered that the results could show a higher level of accuracy by utilising the maximum amount of information available rather than reducing it to smaller, more discrete sets of data. The results are displayed in Table 46, below:

Table 46 Benefits Offered (Over all levels)

Comparison	Value	df	p	QS Count Y	QS Count N	Est. Count Y	Est. Count N	Implications
General Benefits	0.148	1	.350*	27	27	25	29	p > .05 therefore the results were not significant and the hypothesis was not supported.
Car or Allowance	3.086	1	.034*	18	36	27	27	p < .05 therefore the results were significant but in the direction of Estimators and the hypothesis was not supported.
Bonus	0.375	1	0.27*	5	49	7	47	p > .05 therefore the results were not significant and the hypothesis was not supported.
Pension	4.421	1	0.032*	5	49	12	42	p < .05 therefore the results were significant but in the direction of Estimators and the hypothesis was not supported.
Health Care	5.252	1	0.011*	3	51	11	43	p < .05 therefore the results were significant but in the direction of Estimators and the hypothesis was not supported.
Profit Scheme	0.000	1	.500**	0	54	1	53	p > .05 therefore the results were not significant and the hypothesis was not supported.
Study Time	0.000	1	.500**	1	53	2	52	p > .05 therefore the results were not significant and the hypothesis was not supported.

* The p value shown is 50% of the value shown in the *t* test table, which was based on a two-tailed hypothesis.

** Two cells had an expected count of less than five and failed to reach the "minimum expected cell frequency", therefore violating the assumption. In such a situation, results were obtained by using a Fishers Exact Probability Test.

In three benefits there were significant results for Car/Allowance, Pension and Health Care but these were significant in favour of Estimators; therefore, with these results and none of the others showing any significant difference, the hypothesis was not supported.

6.6 Conclusions

All the statistical tests used to compare salaries and benefits offered by prospective employers failed to show any significant difference and the two hypotheses, which proposed that QSs would be offered greater remuneration and benefits, were therefore unsupported. This demonstrated that even though QSs had professional status employers held each discipline in similar regard by offering similar pay and benefit levels.

Assistance towards verifying the work was gained by statistical tests and checks carried out by the supervisor.

The conclusion from this study was of the UK CI appearing to value its Estimators as it had shown a willingness to offer them parity in pay and benefit structures with QSs. Therefore, if Estimators were held in such regard financially then there may be willingness for the industry to underpin this with a move toward better Estimator ETPs.

Chapter 7 - Estimator-QS Job Attribute Comparison

7.1 Introduction

It was known that QSs' work in the CI was based around construction costs, as was that of Estimators. QSs' and Estimators' work was also known to be interlinked at both the tender and construction stages of projects. With QSs' holding professional status, if Estimators were to be given serious consideration for a similar position their work had to be able to stand comparison on its required levels of KSAs. There was a need, therefore, to research additional information on what attributes the CI required of its Estimators and QSs.

7.2 Research Aims

Two main aims were developed with the purpose of adding to the overall list of Estimator core competencies and aiding the evidence on the possibility of Estimators gaining professional status. These two aims were:

1. To develop a list of core competencies for QSs and Estimators. The Estimators' list would contribute to the TNA and BoK (results to be found at 7.5.1, below)
2. Compare the attributes of each group and discover whether QSs would require a greater number of competencies (results to be found at 7.5.2, below)

7.3 Research Method

As with Chapter 6, the revised DRS from Blaikie was the chosen method for this study. The research had the same principal aims but, unlike Chapter 6, the data collected was of a qualitative nature. However it still proposed theories, developed hypotheses and tested their validation with the data. This meant that its advantages and disadvantages also applied here. The attributes collected were also used in the development of the TNA/BoK.

Combining the principle aims defined above with collecting data for the TNA was, decided as the most suitable method for use with the methodology shown below.

7.4 Methodology

7.4.1 Design

The revised DRS, described above, was carried out using job advertisements seeking applications from the fields of estimating and quantity surveying, from literature and the internet, all of which provided details describing their work The disadvantages of the revised DRS method were addressed in the same way as that described in Chapter 6 with the exception of:

Reliability

- Establishing comparisons between the two groups on attribute requirements was measured by an Independent-samples *t* test thus providing an objective inferential analysis of the data-set

7.4.2 Sample

The information used to test the hypotheses was gathered during the period 2003-4. Details of Estimator and QS job attribute requirements were extracted from the job advertisement survey described in Chapter 6. Further job descriptions were obtained from:

QSs:

Literature:

- Cornick and Osbon (1994)
- McCaffer and Baldwin (b) (1995) (in Smith (ed.) 1995, pp.60-68)
- Smith (1995)
- Tyler and Smith (1995) (in Smith (ed.) 1995, pp.28-33)

Internet:

- Birmingham City Council (2003)
- The RICS (2003)
- The RICS (2004)

Recruitment agencies:

- Anders Elite (2003)
- Calco (2003)
- Construction Jobs UK (2003)
- Cordon Recruitment (2003)

- Judd Farris (2003)

Estimators:

Literature:

- Bower (1995) (in Smith (ed.) 1995, pp.81-90)
- Harris and McCaffer (1995)
- Jobling (1995) (in Smith (ed.) 1995, pp.11-27),
- McCaffer and Baldwin (a) (1995) (in Smith (ed.) 1995, pp.34-50)
- McCaffer and Baldwin (b) (1995) (in Smith (ed.) 1995, pp.60-68),
- Skitmore and Lowe (1995) (in Smith (ed.) 1995, pp.91-100), Smith (1995)

Internet:

- The Association of Cost Engineers (AcostE) (2006)
- The Chartered Institute of Building (CIOB) (2004)
- Learn Direct website (2003)

Surveys:

- RICS (2002)

Recruitment agencies:

- Anders Elite (2003)
- Coyle Personnel plc (2003)
- Hays Personnel (2003)
- Hill McGlynn (2003)

7.4.3 Materials

The tables of information used in Chapter 6 also contained information on job attribute requirements. This information was used here.

7.4.4 Procedure

7.4.4.1 Identification of Job Attributes

Attribute requirements were identified from the job advertisement tables, the literature review, internet searches, recruitment agencies and an RICS survey. Information was taken from each source and recorded in two independent tables, one for QSs and one for Estimators which showed the competencies found and their source. The tables

produced were then condensed into a single table to display any similarities in their job attributes.

7.4.4.2 Job Attribute Comparison

Further tables were produced to compare job attributes on the basis of attributes discovered and also by grouping the attributes in order that any overlaps in requirements could easily be identified.

7.4.4.3 Creation of Hypothesis

A hypothesis was developed based on the assumption that the QS, being a professional occupation, would be expected to hold a greater number of attributes than the Estimator. Therefore, the information on job attribute requirements contained in the tables described above was further developed here by analysing them in order that a comparison could be made between the roles. This produced the following hypothesis:

H_1 Potential employers who are looking to employ QSs belonging to a recognised and accepted profession expect them to have more job attributes than would be expected of Estimators, who are not recognised as belonging to a profession

H_0 Potential employers who are looking to employ QSs belonging to a recognised and accepted profession do not expect them to have more job attributes than would be expected of Estimators, who are not recognised as belonging to a profession

The hypothesis was tested using the processes undertaken in Chapter 6 to determine the most suitable statistical test. The decision was made to use the Experimental Different-subject design, as with salary and benefit levels in Chapter 6. Unlike salary and benefits, however, the data could not be treated dichotomously or ranked but could be counted. It could therefore be tested with an Independent-samples *t* test.

7.5 Results

7.5.1 Identification of Job Attributes

7.5.1.1 QSs

The RICS website (2003) considered quantity surveying to be a dynamic profession requiring a good commercial brain, first class management skills and a thorough knowledge of the CI. It added that tight margins made the role of the QS critical both to the success of the project and to the CI in general.

Further information from the RICS website (2004) provided a framework for this role without entering into a detailed description. This framework also divided QSs into roles in private practice as consultants and in working for construction companies, either with main contractors or sub-contractors, shown at a) and b) below:

a) ***Consultants***

In this capacity QSs work on behalf of the client, advising on costs and contractual matters. Their responsibility therefore was to ensure that the client was fully informed at all stages of the process on the probable final construction cost and on the likelihood of contractual disputes and their nature. There was also a section on guidance for Assessment of Professional Competence (APC) which was a route for qualification as a Member (MRICS) and within the Construction Section (pp 14-16), a more detailed description of QS work which suggested that a construction surveyor must be skilled in the whole construction process and throughout the building life cycle from inception to final account and have the ability to manage cost, together with the ability to equate quality and value with individual clients. The attributes for this are shown in Table 48, items 1-20, below.

A specific example was offered by McCaffer and Baldwin (b), *op. cit.,* on the work involved analysing and assessing tender returns from contractors. While this paper was written under a banner of project cost estimating, it is included here as this work would also be carried out by QSs, as the clients' representatives, at the project pre-contract stage. The work involves:

- Checking that contractual conditions are met by the bidders

- Scrutinising priced BQs for errors, omissions or unusual rates
- Providing reports on the bids
- Recommending the most advantageous tender
- Issuing a comparison between the recommended tender value and the budget estimate
- Offering recommendations for dealing with tender errors and qualifications
- Providing a cash flow forecast

b) *Contractors*

Continuing with information from their 2004 website, the RICS said that employment in this position involved assessing the value of work done, as well as works to be done, monitoring costs and progressively managing these costs. This responsibility is categorised under items 5, 17, 20 and 34 of Table 47, below.

A further assessment of the QS role was offered by Cornick, *op. cit.*, in an article on contractors QS practice during construction. The results of his investigation presented broadly defined areas of responsibility and these are shown in items 21-25 of Table 47, below.

The outcome of Cornick's assessment was that the work assumed by the contractors' QS would produce information for the contractor that could be defined in the form of a financial flow chart. Cornick's chart was reproduced in Chart 2, below:

Chart 2

QS Financial Information Flow Chart

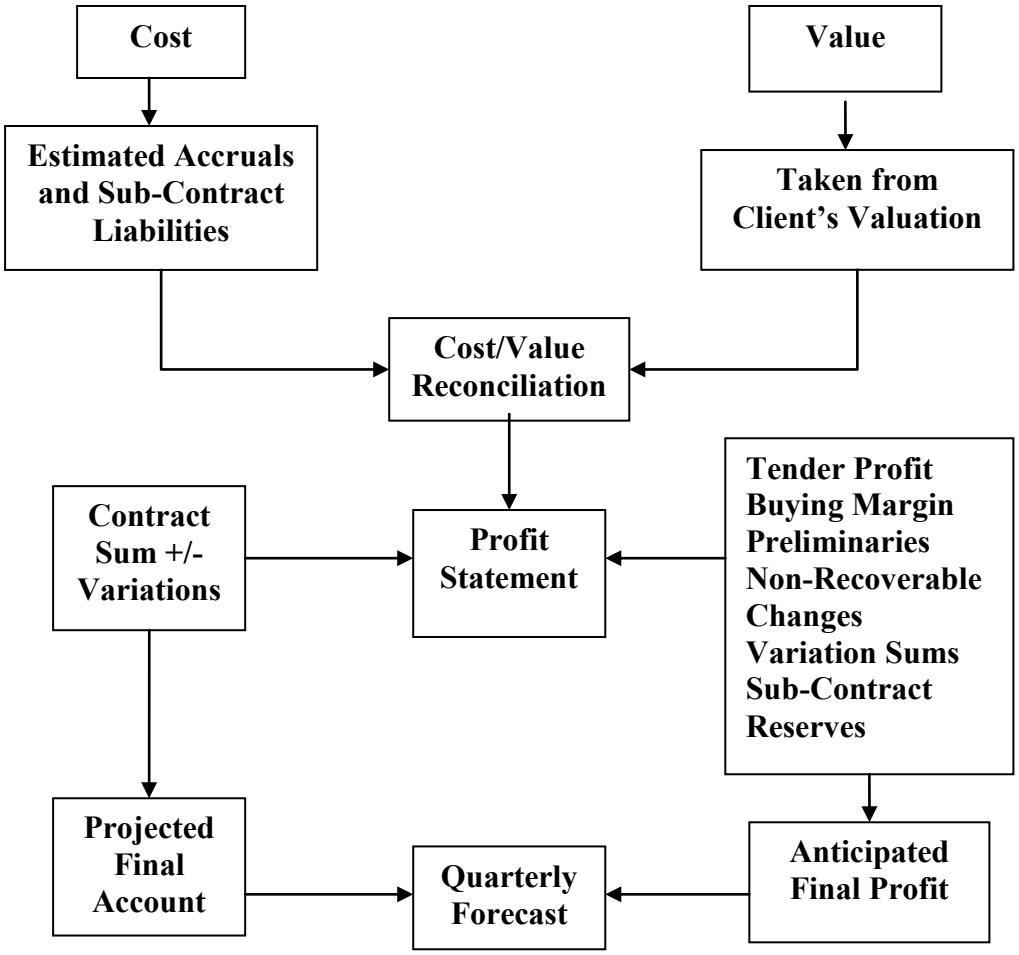


Table 47 QS Competencies

Item	Competencies	Source
1	All aspects of construction contract and management	RICS/Hays/T & S
2	Providing financial advice to the client from conception	RICS/Smith/T & S
3	Advising on procurement options	RICS/T & S
4	Being involved from the project design stage through to final commissioning	RICS/T & S
5	Agreeing stage payments, additional costs and final accounts	RICS
6	Settling contractual disputes	RICS
7	The preparation of site appraisals	RICS
8	Assessment of capital and revenue expenditure effects	RICS/T & S
9	Life cycle costing	RICS/T & S
10	Assessing the implications of grants and taxation	RICS
11	Providing advice on the project brief, preferred procurement routes, cost and cash flow	RICS/Birmingham CC /Smith
12	Planning the construction process	RICS/T & S
13	Monitoring and controlling pre-contract costs	RICS
14	The preparation of tender and contractual documents	RICS/Cordon
15	Selecting contractors from tender returns	M & B/RICS/Cordon
16	Appraising tender returns	M & B/RICS/Cordon
17	Controlling the project on behalf of employers	RICS
18	Providing programme and financial reports	RICS
19	Undertaking risk and value management	RICS
20	Giving contractual advice in the event of disputes	RICS
21	Autonomy in the carrying out of valuations for payment from the client and to sub- contractors.	Cornick
22	Providing financial reports and the feedback of cost information to higher management.	Cornick
23	Determining the value of variations in the cost of change and agreeing these figures with the client and with sub-contractors.	Cornick/ Anders Elite
24	The allocation of preliminary cost items (site overhead costs), to various sections of the work.	Cornick
25	Cost accounting and breakdowns for labour, plant and materials used during the project.	Cornick
26	Target new opportunities	Anders Elite
27	Working on own initiative	Anders Elite

Table 47 QS Competencies (contd.)

Item	Competencies	Source
28	IT Skills	Anders Elite
29	Commercial Astuteness	Anders Elite
30	Liaising with board of directors	Anders Elite
31	Ability to work under pressure	Anders Elite
32	Communication skills	Anders Elite
33	Management skills	Judd Farris/ Anders Elite
34	Negotiating skills	RICS/Anders Elite Construction Jobs UK/Judd Farris
35	Working in teams	Anders Elite
36	Construction knowledge	Calco

7.5.1.2 Estimators

Cost estimating in the UK CI is mainly, although not exclusively, undertaken for or on behalf of contractors; this being estimating to provide the base cost for tenders. From the sources used at this stage there was no information found for Estimators working as consultants for clients, where it is widely acknowledged that cost estimates provided on their behalf and for their benefit are carried out by QSs, in the main. Therefore, definitions of the work of Estimators was categorised under the banner of contractors only.

a) *Contractors.*

QSs are not the only surveyors included within the body of the RICS but their position is clear and they are identified as a group in their own right. Estimators, on the other hand, were found to have a position within the CIOB and the AcostE but were not clearly identified as a group in either organisation. Obtaining a definition of their role from these sources was not possible either from their websites or from contact with staff involved in education, as it was explained that while they knew that Estimators were members of their organisations, they were not offered specific educational routes or examination programmes.

The website of Learn Direct (2003), which covered estimating within manufacturing and process industries in addition to construction, suggested that Estimators

calculated the final cost of supplying products, ensuring that the prices charged would cover costs. This process, they said, took into account basic materials that would be used, labour, vehicle, plant and special equipment, services, overheads, administration and power. The information required was sourced from internal records, quotations, hire and transport companies and the use of inflation figures and exchange rates from government statistics and banks. In large companies, they added, Estimators may be professional engineering technicians, or incorporated/chartered Engineers, smaller companies could have Estimators from craft backgrounds and that most people entered estimating following previous experience in other areas of the industry. Normally, it was said, the requirement was to qualify in a professional capacity, gain experience and then move into estimating.

Jobling, *op. cit.*, considered that the objective of producing estimates was of predicting the contract's likely cost while recognising that there were a range of possible costs within this probability.

An estimate was described by McCaffer and Baldwin, *op. cit.* (a), as, a "*base-cost*" (p.34), and a tender as, a "*bid-price*" (p.34), made up of a, "*base-cost + mark-up*" (p.34). The estimate part of this they said contained

- Cost data
- Selection of method
- Selection of required resources
- Determination of productivity factors
- Creation of cost calculations

It was stressed that, while the determination of the mark-up needed commercial judgement, this could only be made with confidence provided that the estimate was accurate. They pointed out that the estimate section of the tender was of considerably greater value than the mark-up and that errors in the estimate could have considerably greater impact on the overall cost than mark-up adjustments. This highlighted the importance of accurate estimating. That importance was reinforced with a point that, due to the general low profit margins included in tenders, suggested as around 3%, an error of just 1% in an estimate could make a difference of 30% to the achievable profit on the project.

A job description from Harris and McCaffer (1995) was that Estimators are the people whose responsibility it is to manage the estimating process and produce the estimates. This process, they suggested, applied to projects where the client had prepared contract documents and a BQ, arguably the most common type of document in the UK. Other types of contract would vary this procedure. A suggested procedure taken from Harris and McCaffer and McCaffer and Baldwin (a) was:

1. Making the decision to tender
2. Programming the estimate
3. Collection and calculation of cost information
4. Project study

   Stage 1;

   - Ascertainment of main quantities
   - Development of an approximate estimate
   - Selection of work to be sub-contracted
   - Production of itemised list for materials and plant requirements
   - Calculation of critical dates for returns by sub-contractors and suppliers
   - Consideration for design alternatives

   Stage 2;

   - Provision of a detailed analysis of contract documents
   - Production of a list for use during the site visit. Such items might include, positions of services, access restrictions, ground conditions, security, temporary work requirements, soil disposal, labour availability and any other intelligence that may be of use
   - Preparation of method statement defining the methods and procedures to be adopted during the project. This statement usually being prepared in conjunction with the programme planner.
5. Estimate preparation
6. Costing site overheads
7. Estimators' report

The procedures detailed above were those used when estimating for projects where the client provided contract documents that included BQs prepared by QSs working directly for them. However, a survey undertaken by the RICS (2002) indicated that

this was unlikely now to be the most usual way. The survey was commissioned by the RICS Construction Faculty to try to establish "who measures construction works" and was focused on the following guidelines:

- The provision of measurement with tender documents
- Where measurement is not provided with tender documents, the extent to which contractors undertake the work
- When is the measurement undertaken and by whom?
- What measurement conventions are used?
- The relevance of the SMM7

Of relevance to the report's conclusions were the observations, some of them conflicting, that:

- Most people recognised the importance of accurate measurement
- Consultants surveyed reported that they prepared measurement for tendering purposes on 55% of projects
- Contractors surveyed claimed that they received measurement with the tender documents on 23% of projects
- With tenders that did not provide measurement, contractors undertook the process "in house" on 86% of projects and used private QSs on 8%
- Local Authorities acting as clients confirmed that they commissioned measurement from consultants on 44% of all projects

Commenting on the discrepancy between consultants' responses and those of contractors, the RICS referred to a previous survey, also carried out by the Construction Faculty, entitled "Contracts in Use", which indicated that between 20% and 25% of contracts were let on projects requiring measurement. This, they considered, gave a measure of support to the contractors' view, above, that 23% of documents had measurement included. As a possible explanation for this incongruity, the RICS suggested that consultants who did not carry out measurement were unlikely to have responded and that there may be contractors who received requests to tender on projects where no QSs were involved. The response rate to the survey is shown below:

- Consultants returned 462 questionnaires (20% response)

- Contractors returned 160 questionnaires (12% response)
- Local Authorities returned 49 questionnaires (27% response)

Whatever the reason for the discrepancy, the survey signified that a large majority of BQs were being prepared by contractors. The RICS suggested that where this work was done directly it was by Estimators and QSs working for the contractor and where sent out to consultants by the contractor that 65% of all consultants have been commissioned in this way. As the Estimator would be responsible for pricing the quantified document that would be prepared, it seems to be logical that the Estimator would be the more likely to create the BQ where the work is done "in house", rather than the QS, because the QS role for a contractor revolves around the project process during the construction phase and beyond. Therefore, any pre-contract work would, presumably, only be convenient for QSs at times when their normal work was in short supply. On the assumption from the survey information that a total of approximately 66% of all tenders are measured "in house", then measurement and preparation of BQs has to be added.

A list of competencies and the sources from which the information was obtained is shown in Table 48, below:

Table 48 Estimator Competencies

Item	Competencies	Source
1	Making the decision to tender.	H & M/M & B/Skitmore
2	Estimate programming.	H & M/M & B /Skitmore
3	Collecting and calculating cost information.	H & M/M & B /Skitmore
4	Studying the project.	H & M/M & B /Skitmore
5	Estimate preparation.	H & M/M & B /Jobling /Skitmore
6	Costing site overheads.	H & M/M & B /Skitmore
7	Preparing the Estimator's reports.	H & M/M & B /Skitmore
8	Measuring work from tender drawings	RICS/Smith
9	Preparing BQs from measurements	RICS/Smith
10	Strong numerical skills for calculating and analysing	Learn Direct
11	Experience in CAD	Learn Direct
12	Understanding architectural drawings and principles	Learn Direct
13	Detailed knowledge of construction processes and costs	Skitmore/Learn Direct
14	Logical, methodical approach to problems	Learn Direct
15	Ability to work within a team	Learn Direct
16	Awareness of changes in price and exchange rates	Learn Direct
17	Holding a clean, current driving licence	Learn Direct
18	Work in close contact with Clients to Enable Co-ordination with Site Staff/Contract Managers/S/Contractors	Anders Elite
19	Using computer software	Hays Personnel
20	Negotiating contracts	Anders Elite/Hill McGlynn
21	Communication skills	Anders Elite/Learn Direct
22	Working on Design and Build projects	Anders Elite
23	Operating CAE software systems	Bower/Anders Elite
24	Man management skills	Anders Elite/Hays Personnel/Personnel plc
25	IT skills	Bower/Hill McGlynn
26	Commercial skills	Hays Personnel
27	Strategic decision making	Anders Elite
28	Working autonomously	Learn Direct/Anders Elite
29	Able to Provide Pre Contract Finance and Construction Advice to Client/Employer	Skitmore

7.5.2 Job Attribute Comparison

Details of job specifications, above, gave a clear indication that both disciplines deal primarily with construction costs, viz:

- Consultant QSs at the design, pre-tender and construction stages of the project with the provision of budgetary information for the client, the supply of measurement and contractual details with the tender documents for tendering contractors and budgetary and cost control during the post-tender stage
- Construction Estimators at the pre- project and tender stages sharing, with construction QSs, the majority of project measurement, carrying out financial advice, together with pricing of the estimate and at the post-tender stage with supplying measurement and cost information to the client and to the construction management team
- Construction QSs at pre-tender stage sharing, with construction Estimators, the majority of project measurement and at post-tender stage taking responsibility for the construction cost control

Although these roles are regarded as distinct there would appear to be an overlap of skills and a dovetailing of work, wherein each discipline has a reliance on the other to enable each to function. A comparison of core competencies for Estimators and QSs is shown in Tables 49 and 50, below. Table 49 showing individual, distinct competencies and Table 50, shared competencies, identified in 11 groups. For ease of reference the item numbers allocated in Tables 47 and 48 have been retained.

Table 49 Estimator-QS Competency Comparison (Individual Distinct Attributes)

Item	Individual Estimator Competencies	Item	Individual QS Competencies
1	Making the decision to tender.	1	All aspects of construction contract and management
2	Estimate programming.	3	Advising on procurement options
7	Preparing the Estimators' reports.	4	Being involved from the project design stage through to final commissioning
10	Strong numerical skills for calculating and analysing		
12	Understanding architectural drawings and principles	5	Agreeing stage payments, additional costs and final accounts
14	Logical, methodical approach to problems	6	Settling contractual disputes
16	Awareness of changes in price and exchange rates	7	The preparation of site appraisals
17	Holding a clean, current driving licence	8	Assessment of capital and revenue expenditure effects
18	Work in close contact with clients to enable co-ordination with site staff/contract managers/sub-contractors	9	Life cycle costing
		10	Assessing the implications of grants and taxation
		11	Providing advice on the project brief, preferred procurement routes, cost and cash flow
		12	Planning the construction process
		13	Monitoring and controlling pre-contract costs
		17	Controlling the project on behalf of employers
		18	Providing programme and financial reports
		19	Undertaking risk and value management
		20	Giving contractual advice in the event of disputes
		21	Autonomy in the carrying out of valuations for payment from the client and to sub-contractors.
		22	Providing financial reports and the feedback of cost information to higher management.
		23	Determining the value of variations in the cost of change and agreeing these figures with the client and with sub-contractors.
		26	Target new opportunities
		31	Ability to work under pressure

Table 50 Estimator-QS Competency Comparison (Comparative Attributes)

Group	Item	Comparative Estimator Competencies	Item	Comparative QS Competencies
1	3	Collecting and calculating cost information	24	The allocation of preliminary cost items (site overhead costs), to various sections of the work.
	4	Studying the project.		
	5	Estimate preparation	25	Cost accounting and breakdowns for labour, plant and materials used during the project
	6	Costing site overheads		
2	8	Measuring work from tender drawings	14	The preparation of tender and contractual documents
	9	Preparing BQs from measurements	16	Appraising tender returns
	22	Working on Design and Build projects	15	Selecting contractors from tender returns
3	13	Detailed knowledge of construction processes and costs	36	Construction knowledge
4	15	Ability to work within a team	35	Working in teams
5	19	Using computer software	28	IT skills
	25	IT skills		
	23	Operating CAE software systems		
	11	Experience in CAD		
6	20	Negotiating contracts	34	Negotiating skills
7	21	Communication skills	32	Communication skills
			30	Liaising with board of directors
8	24	Man management skills	33	Management skills
9	26	Commercial skills	29	Commercial astuteness
10	27	Strategic decision making	27	Working on own initiative
	28	Working autonomously		
11	29	Able to provide pre-contract finance and construction advice to client/employer	2	Providing financial advice to the client from conception

7.5.3 Hypothsis

Details of the Independent-samples *t* test are shown in Table 51, below:

Table 51 Overall Comparison

Comparison	t	df	Average Number of Attributes Per Source QS	Average Number of Attributes per Source Est.	p	Implications
Attributes	.684	106	.617	.759	.247*	Using an unrelated *t* test on the data ($p > 0.05$ for a one-tailed hypothesis) the results were found to be not significant and therefore the hypothesis was not supported.

- The p value shown is 50% of the value shown in the *t* test table which was based on a two-tailed hypothesis.

There being no significant (5%) difference between attributes required by these roles the hypothesis was not supported.

7.6 Conclusions

The research found 29 Estimator and 36 QS attributes. Of these, relative to each others work, Estimators showed 9 (approx 31.0%) attributes that appeared to be exclusive to them and QSs 21 (approx 58.3%). The remaining 20 (approx 69.0%) Estimator attributes were shared with QSs and the remaining 15 (approx 41.7%) QS attributes were shared with Estimators. There were other attributes on the 'individual' list that had partial comparisons where these were all-encompassing, e.g. *being involved in project design stage through to final commissioning* was a QS competency that had a partial comparison to Estimators' *working on design and build projects.*

In testing the hypothesis it was demonstrated that employers were not expecting QSs to have a greater number of job than they were Estimators and added to the information from Chapter 6 that there may be little difference between the groups in the regard in which they were held by their employers.

Verification of the work was facilitated by the statistical test on the hypothesis and checks by the supervisor, prior to it being made available for scrutiny.

A major benefit deriving from this study was that the development of a comprehensive list of attributes was enhanced for both groups. There were also early indications of overlaps in their task knowledge and of exclusivity, indicating a similar knowledge base but a distinct job specification.

Chapter 8 - Estimator-QS Educational Availability Comparison

8.1 Introduction

The information emerging from Chapters 6 and 7 was of an analogous knowledge requirement and employers' remunerative recognition of the estimating role when compared to quantity surveying, which could be indicative of a possible worthiness for professional acceptance. However, three defining criteria for a profession, found in Chapter 3, were the possession of specific knowledge, skill and technique. Therefore, it would seem that any justification for estimating becoming an accepted profession would, at the very least, require an educational programme designed specifically for them. As with Chapters 6 and 7, QSs were utilised in this comparison as a benchmark to which Estimators would need to aspire in order that a case for professional acceptance could be made.

8.2 Research Aims

The intention was to research Estimator education and training. There were three aims, all based on Estimator-QS comparisons, which were to:

1) Research and compare specific Estimator-QS education provided by HE, PBs and training organisations, at formal and professional levels in the UK (results to be found at 8.5.1, below)
2) Compare the extent of Estimator-QS education expected by employers (results to be found at 8.5.2, below)
3) Compare the level of importance employers attached to Estimators' and QSs' work experience as it was considered that the effectiveness of education within a work environment could be greatly enhanced if coupled with work experience (results to be found at 8.5.2, below)

At 1), in the perceived event that specific ETPs could not be found for Estimators, existing course structures designed for other CI roles would be researched. This would seek to discover the availability of estimating-related modules within those existing course structures. In the event that such modules were found information would be sought on:

- The levels at which those modules were set

- Their value in the form of credits, or other means of measuring achievement
- The qualifications that ensued

This would highlight any areas of weakness that may form a barrier to the progress of estimating acquiring a professional standing

8.3 Research Method

The method adopted was that used in Chapters 6 and 7, the revised DRS proposed by Blaikie. Using this strategy allows:

- Theories to be tested
- Data to be collected
- Theories to be constructed and hypotheses developed
- Hypotheses to be tested by matching them with the data
- Qualitative data to be tested

The research had the same principal aims but, as in Chapter 7, the data collected was of a qualitative nature but still proposed theories, developed hypotheses and tested their validation with the data. This meant that its advantages and disadvantages also applied here. The information discovered in this study would add to the knowledge on the regard paid to Estimators by the UK CI.

Selecting this revised DRS method was regarded as apposite for this specific study. The methodology adopted to justify this method is described below.

8.4 Methodology

8.4.1 Design

The revised DRS, described above, was carried out using information on ETPs found on the internet which showed the education and training availability for Estimators and QSs. The disadvantages of the revised DRS method were addressed in the same way as that described in Chapter 6 with the exception of:

Reliability and Validity

- Validity of the data was helped by selecting data on ETPs that contained all the information required to perform the tests

- Reliability of the data collected by the researcher, and its verification, was helped by the supervisor checking the transfer of this data from the ETPs found to the Estimating/Tendering Module Content Tables from HE shown in detail in Appendix 3
- Establishing comparisons between the two groups on employers' expectations of formal qualifications was measured by a Mann-Whitney U test. This provided the objectivity of an inferential analysis of the data-set and aided verification
- Establishing comparisons between the two groups on employers' expectations of professional qualifications was measured by a Chi-squared test thus providing an objective inferential analysis of the data-set and helped with verifying the study
- Establishing comparisons between the two groups on employers' expectations of role experience was measured by a Chi-squared test and a Mann-Whitney U test which facilitated verification and provided an objective inferential analysis of the data-set

8.4.2 Sample

As a means of discovering information on ETP availability for Estimators and QSs it seemed that the most likely source of information on all appropriate courses and subjects being offered at UK Universities and Colleges of Higher Education (HE) was the Universities and Colleges Admissions Service (UCAS) which, according to its website (2008) was the organisation responsible for managing applications to HE courses in the UK. In addition the search also concentrated on two PBs which covered professional training and the Construction Industry Training Board (CITB) which appeared to be the main body responsible for training within the UK CI. In addition, sample searches were also be carried out of less likely sources, in courses such as Building Surveying, Facilities Management etc. Further, the internet was explored independently in the event that UCAS had not covered all Universities and Colleges. In total 28 Universities and colleges were sourced across the all four countries in UK and 619 courses were sampled.

8.4.3 Materials

Given the possibility that there may not be complete estimating courses available, a guideline table was produced showing:

- Modules covering estimating and tendering
- Modules where estimating and/or tendering were included with another subject
- Unspecified modules that may possibly contain relevant content

On this basis the table was set out showing:

- The level at which the module was taught
- Sources
- Module title
- Qualification within which the module was set
- The number of credits or other forms of assessment for each module

Each possible module found was tabulated, including as much information that was on offer at each website. These tables can be found at Estimating/Tendering Module Content Tables from HE in Appendix 3.

Bar charts were also produced in order that the information from the tables could be given more clarity. These charts would offer additional breakdowns so that each level of qualification, e.g. BSc (Hons.), BSc, HND etc. were also distinguished. The Charts can be found at Estimating/Tendering Module Charts Appendix 3.

From the job advertisement survey used in Chapters 6 & 7, information was also retrieved on qualification requirements that could be useful to this study as an indicator of employers' expectations of job applicants' educational achievements. This was extracted and categorised in tables, enabling a comparison to be made between the groups on the level of formal and professional achievement and experience expected of them.

8.4.4 Procedure

Internet searches were carried out on the Samples shown above and data on education availability for Estimators and QSs extracted and recorded in the tables. Where it was felt that a website could not provide sufficient information to fulfil the requirements

then those establishments were contacted by e-mail or telephone with requests for additional data. The information gathered enabled three hypotheses to be formulated, which looked at formal and professional qualification requirements and experience sought. These were:

8.4.4.1 Hypothesis 1

H_1 QSs, belonging to a recognised and accepted profession, are required to hold better formal qualifications than those required of Estimators, who are not recognised as belonging to a profession

H_0 QSs, belonging to a recognised and accepted profession, are not required to hold better formal qualifications than those required of Estimators, who are not recognised as belonging to a profession

The processes undertaken in Chapters 6 and 7 to determine the most suitable statistical test were again applied using SPSS. As this data could be ranked it was categorised as Ordinal, requiring a Mann-Whitney U test. With a prediction as to direction, this was designated as a single-tailed hypothesis.

Hypothesis 2

H_1QSs, belonging to a recognised and accepted profession, are required to hold better professional qualifications than those required of Estimators, who are not recognised as belonging to a profession

H_0 QSs, belonging to a recognised and accepted profession, are not required to hold better professional qualifications than those required of Estimators, who are not recognised as belonging to a profession

This data was treated as Nominal and the tests were to be carried out with SPSS, using a Chi-squared test. With a prediction as to direction, this was designated as a single-tailed hypothesis.

Hypothesis 3

H_1 There will be a difference between QSs and Estimators in the amount of experience being sought by prospective employers

H_0 There will be no difference between QSs and Estimators in the amount of experience being sought by prospective employers

Data for this exercise was divided into Relative- and Amount of- Experience. Relative Experience was classified as Nominal which, as with Hypotheses 1 and 2, involves using the Chi-squared test and SPSS software. Amount of Experience was classified as Ordinal data as it could be ranked and therefore tested using a Mann-Whitney U test. As there was no prediction as to the direction they were both designated as two-tailed hypotheses.

8.5 Results

8.5.1 Education Availability Survey

Information from PBs and the CITB was contained within their websites and a thorough search failed to reveal an organisation within the UK that appeared to recognise Estimators as a specific group. Further website searches and in-depth e-mail correspondence with the CITB also failed to unearth any specific qualification recognition.

For HE the majority of the detail came from accessing institutions via the UCAS website. This was clearly laid out and well categorised so that all courses related to Building, Construction, Architecture, Engineering etc could easily be segregated and was such that there was often an overlap between subjects so that, for example, a course on Architecture and Construction would be listed in both categories, making it reasonable to conclude that possible courses or modules were not missed.

The undergraduate Degree/HND/HNC courses being offered at UK Universities and HE Colleges disclosed by UCAS listed a total of 582 courses related to Building,

covering all areas of the CI. Of those, 49 [2] were specifically designed for QSs either as pure Quantity Surveying or as mixed degrees of, for example, 'Construction and Quantity Surveying' and 'Quantity Surveying and Commercial Management'. There were three courses, two at Aston University and one at Dudley College, which were found independently and not shown under the UCAS listings. Similar qualifications for Estimators did not appear to be specifically offered at any University, either in a pure or a mixed form, at this time, and sample searches of 29 courses under unlikely headings such as Architectural Engineering. Building Control, Building Design Engineering and five other subjects failed to elicit any estimating/tendering modules

'Core Competency' modules relating to Estimating, Tendering, Construction Measurement etc. incorporated into many of the courses are shown in Appendix 3 Estimator Core Competency Modules Tables 1-11 and Charts 1-13. There was a confusing array of different module types, ranging from full modules to 12-credit part-modules, some of which offered little clarity of their value. Confusion as to the value of qualification levels was exacerbated by the National Qualifications Framework website (2004), which said that the qualifications framework did not specify minimum levels of learning by using units of credit. Not all institutions, it seemed, used the credit system and there was no national structure found to be in place for such use. The website continued that it was for the providers of the HE programmes to decide upon the use of a credit structure or otherwise. There was no mention of how employers were expected to interpret these credit structures.
A breakdown of the results is given below and, beneath those, two condensed charts of the main estimating module availability and levels on offer, see Charts 3 and 4, below the results breakdown:

Degrees

- QSs had 49 undergraduate degree courses available, either distinctively or with another subject
- Estimators were not provided for specifically in 2004[3]

[2] Updated this figure was 38 courses from year beginning September 2011 and 44 courses from year beginning September 2012
[3] This position remained the same from year beginning September 2011 and September 2012

Estimator-Specific Modules

- 21 Estimating/Tendering modules were on offer at undergraduate/higher national level
- 14 Estimating/Tendering part-modules were on offer at undergraduate/higher national level
- 4 Estimating/Tendering modules were on offer at Foundation degree level
- The CITB offered some core estimating content with its BTEC National Certificate in Construction and further modules in its NVQs
- An Estimating/Tendering module was included by the CIOB (2003) in its MCIOB qualification but with just 15 credits from a total of 360
- It was not clear whether the RICS part-module, entitled "Measuring and Costing Construction Works", included estimating in its MRICS qualification and the RICS were unable to expand on the information provided

Chart 3

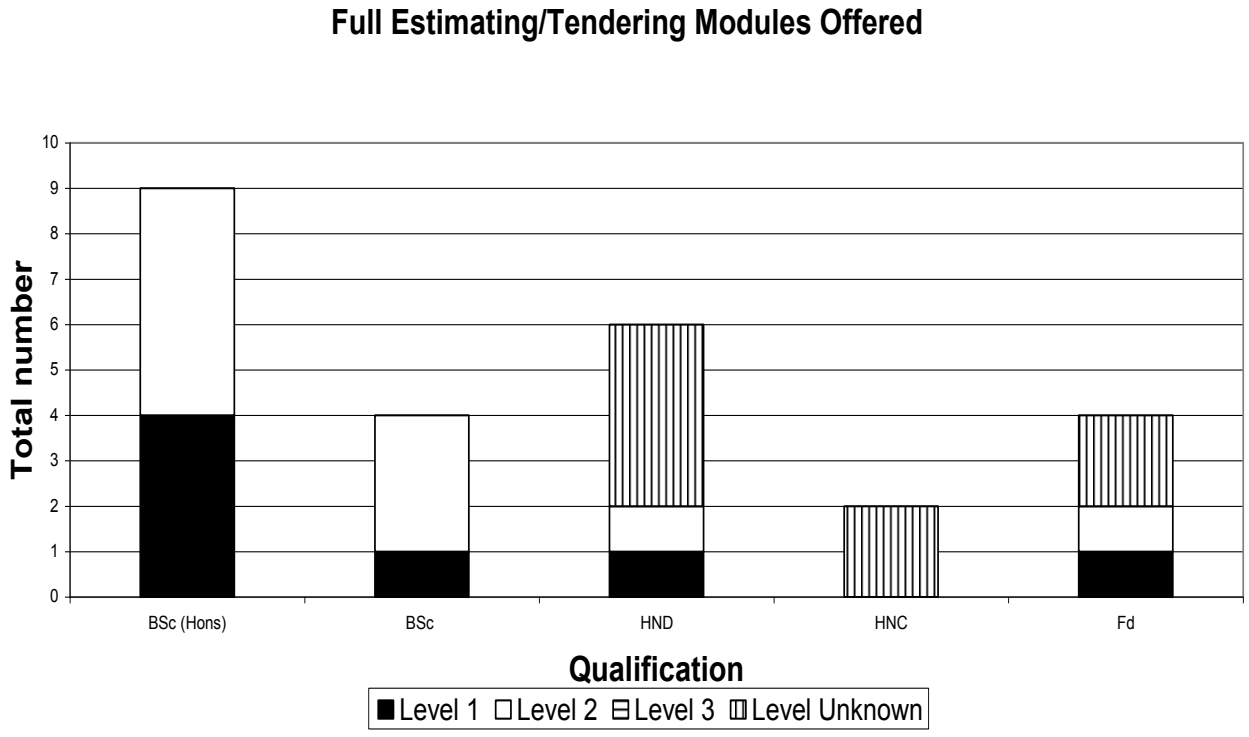
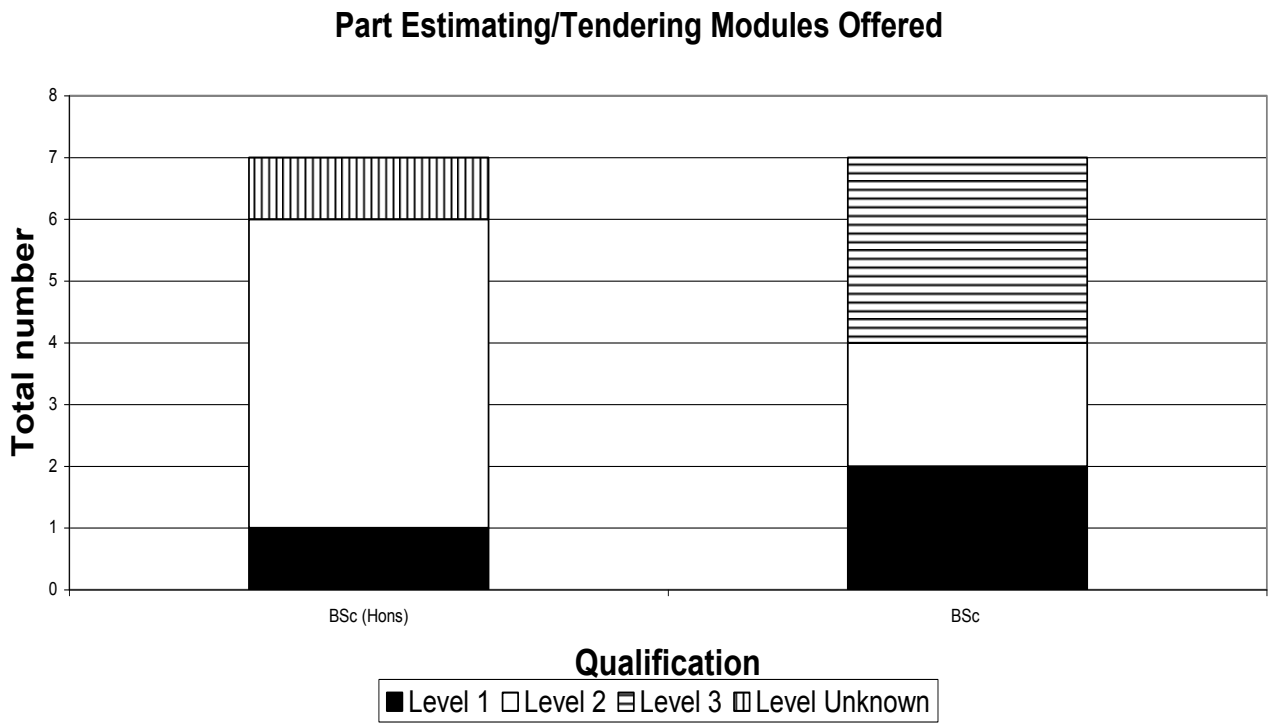


Chart 4



In the charts above, where requests for additional data were made but failed to extract sufficient information, these have been separated from the remainder under an "unknown level" title.

8.5.2 Employers' Qualification Requirements

Hypothesis 1

Information collected from the advertisement survey for qualifications is shown in Appendix 2 Advert Details.

The number of advertisements requiring qualified staff was very low. Because of this there was no attempt made to test the hypothesis by dividing the positions into:

- Trainee/Assistant
- Project
- Senior
- Head

Even when the information was grouped without any divisions the figures were too low to be tested statistically with the Mann-Whitney U test. Therefore the information obtained from the advertisements is shown in Table 52, below, in a descriptive form only:

Table 52 Formal Qualification Requirements (Overall)

Comparison	Non Specified		Relevant		HNC		HND		Degree		Total	
	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est
Formal Qualifications	35	38	5	3	1	2	2	2	11	9	54	54

These descriptive statistics do not have the overall thoroughness of a Chi-squared test but they do show a low requirement by employers for clearly defined formal qualifications. In the case of QSs almost 65% did not specify any type of formal qualification and, in the case of Estimators, this was slightly higher at just over 70%. Where qualifications were asked for and specified (HNC, HND, Degree) they were for almost 26% of QSs' and over 24% of Estimators' job offers. The figures, at face value, indicate a significance difference of almost 8% which would substantiate the hypotheses albeit without the benefit of a statistical test.

The above information, broken down into specific job levels, is shown in Table 53, below, and is to indicate the levels at which formal qualifications are needed and those at which experience is needed. The "None Specified" headed column is for advertisements that gave no indication of either qualifications or experience required:

Table 53 Formal Qualification Requirements (Level Breakdown)

Job Level	None Specified		Relevant		HNC		HND		Degree		Total	
	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est
Trainee /Assistant	4	6	1	1	1	2	1	2	9	5	16	16
Project	13	13	4	1	0	0	0	0	1	4	18	18
Senior	16	17	0	1	0	0	1	0	1	0	18	18
Head	2	2	0	0	0	0	0	0	0	0	2	2

This table demonstrates that the majority requirement for qualifications is for staff at an early stage. Trainee/Assistant QSs needed specific qualifications for almost 69% of the posts available and Estimators over 56%. This tailed off at the next level, Project, where it was less than 6% of QSs and over 22% of Estimators. From the table it can be seen that the higher the level the more demand there is for experience and the less demand there is for qualifications.

Hypothesis 2

As with Hypothesis 1, and for the same reasons, a statistical calculation could not be performed as the "minimum expected cell frequency" was violated. Again the information obtained from the advertisements is shown in Table 54, below, in a descriptive form only:

Table 54 Professional Qualification Requirements (Overall)

Comparison	None Specified		Relevant		CIOB		MICE		MRICS		Total	
	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est	QS	Est
Formal Qualifications	45	50	0	1	2	1	0	2	7	0	54	54

The requirement for professional qualifications was not strong. Even for QSs this was less than 17% and for Estimators was lower at less than 8% even with the "Relevant" qualification included. From this table it is clear that with so few requests for specific qualifications there would be little point in providing a breakdown into the job levels that was done with Hypothesis 1. Again, the majority of advertisements were none-specific and though the return was small, it could be argued that QSs were more often required to hold professional qualifications just by "eyeballing" the figures; on that basis the hypothesis would be supported.

Hypothesis 3

This test was divided into two parts:

1) Relevant experience required by employers
2) Amount of experience required by employers

1) Relevant Experience

There was sufficient data on relevant experience required by employers as it can be seen from the advertisement information that this was sought far more often than qualifications. The Chi-squared test result is shown in Table 55, below:

Table 55 Relevant Experience Comparison (Overall)

Comparison	Relevant Experience
Value	1.725
df	2
p	.422
None Specified QS	20
None Specified Est.	14
Unstipulated QS	10
Unstipulated Est.	10
Stipulated QS	24
Stipulated Est.	30

The implications from the above table, with the p value being based on a two-tailed hypothesis, left the value unchanged. Therefore, with $p>.05$, the results were not significant and that the hypothesis could not be supported.

2) Amount of Experience

Testing the amount of experience required by employers brought the same difficulties with a mass of "None Specified" in that the figures were too low. Therefore a Mann-Whitney U test could not be undertaken. Again the information obtained from the advertisements is shown in Table 56, below, in a descriptive form only:

Table 56 Amount of Experience Comparison (Overall)

Comparison	Unspecified	6 mths.	1 yr.	18 mths.	2 yrs.	3 yrs.	3-5 yrs.	5-7 yrs.	7+ yrs.	Total
Amount of Experience QS	39	0	0	0	6	0	2	6	1	54
Amount of Experience Est.	43	2	1	1	1	1	2	2	1	54

What was relatively clear from the table was that the majority of advertisements did not specify any experience measured in years. This did not necessarily mean that that experience was not required, only that the advertisements were not specific. Results on unspecified experience, although not statistically measured, indicated that the demand for experience increased for Estimator positions by a significance level greater than 9% (72.2% Est: 79.6% QS), which suggested that the hypothesis could not be supported but as experience is not as quantifiable as qualifications a clear-cut result, without a statistical measure, could not be demonstrated.

8.6 Conclusions

There was shown to be a gulf between the groups in this study. QSs seemed to be well provided for with access to education at both formal and professional levels and had the opportunity to enter their chosen sphere with confidence in their education and training. Estimators, on the other hand, had no such prospects. From Chapter 7, the study on attributes revealed that both groups required similar knowledge and yet only QSs had available opportunities within a set course structure. Much of the subject matter that Estimators required could not be accessed as that would involve dividing their time between several different courses and Universities/Colleges in order to do so. Even if that were possible there had to be doubt that they could tailor this to suit their own needs, a seemingly impractical task. In addition, even their core subject of estimating and tendering appeared to have limited provision, with just 21 full modules and 14 part modules at degree level and a meagre, indeterminate set of modules

offered by professional institutions that seemed to be on offer more to provide an insight into estimating for other courses than as an aid for Estimators.

With regard to employers' requirements for taking on qualified staff the limited testing available could not statistically demonstrate that this leaned towards QSs. However, looking at the data in a "descriptive" way showed support for the first two hypotheses, that of an employer expectation of better qualifications from QSs. As the only group with any job-specific formal and professional qualification opportunities this was completely understandable. It also further demonstrated that opportunity and availability for education and training was heavily weighted towards QSs.

For both roles, employers seemed to place a greater reliance on experience than qualifications. This would be relevant, had it applied solely to estimating positions, as the opportunities for educational achievement were shown to be far more limited and indeed the third hypothesis did suggest that more dependence was placed on the amount of experience required when advertising estimating positions.

The survey for which the data was collected highlighted a 'side issue', where it was found that gathering the data proved to be far more difficult with advertisements for trainee/assistants in both fields than it was with advertisements for project or senior positions. While it was logical that there would be many more staff required at the higher levels than at trainee levels, it became difficult to find any further advertisements than the 16 of each that were used in the trainee category even though a time-consuming effort was made to balance the number with that of project and senior roles (18 of each at each level). This was despite the fact that there were 305 Estimator and 1,526 QS positions advertised (total 1,831), making a trainee figure of less than 2% of the total. With regard to this lack of desire for qualified staff and for employing trainees this particular study did not show the UK CI employers in a good light.

A further issue highlighted by the data was that of the CITB's provision of Non-Vocational Qualifications (NVQs) which, from the advertisements found, were not included as a requirement from any of the companies looking for staff. This left a question mark over why a CI training body was concentrating energy and finances on

qualifications that the CI did not seem to recognise as relevant. As these investigations develop, the industry's perception of NVQs will become clearer.

Chapter 9 - Delphi Study

9.1 Introduction

Chapter 7 provided the basis for a list of job competencies and this list needed to be underpinned and developed, as well as establishing whether or not there was any correlation between the Estimating and QS groups. At this point in the thesis no firm evidence existed about the core attributes of these roles and, therefore, there was a necessity to ensure that the information obtained from literature, internet sources and job advertisements was bolstered with data that was as up-to-date as possible and with a closer attachment to the workplace.

9.2 Research Aims

The information gleaned from Chapter 7 required substantiation from other reliable sources that would help to test its validity and reliability. Therefore, three aims were created, these being:

1) To enhance and agree the list of core competencies and therefore develop the fourth objective of producing a TNA and a BoK for Estimators in Chapter 12 (results to be found at 9.5, below)
2) To use the list of core competencies to carry out an Estimator-QS comparison as a final confirmation of whether or not Estimators were required to hold similar KSAs to QSs and therefore had a valid claim for professional recognition (results to be found at 9.5, below)
3) That in the event that Estimators were shown to require a similar knowledge base then to use the same information and Estimator-QS comparison to show whether or not their knowledge base, although found to be similar, was sufficiently distinct to justify its classification as a separate role (results to be found at 9.5, below)

9.3 Research Method

The Delphi technique was the chosen method for this study. The principal aim of this technique is to arrive at a consensus of professional opinion on any given topic. This technique involved repeated iterations of a questionnaire, sent to experts in the field being studied, until a core set of statements are consensually agreed on. It is particularly useful if decisions have to be made where there is too little or too much

information or where there is contradictory evidence (Hicks 2009). In this case, with a need to collect job attribute requirements and carry out further Estimator-QS comparisons, it was used because there was too little information available from other researched sources. However, Mullen (2003), in identifying 23 Delphi methods, said that there was no true Delphi technique but that each study needed to be refined to suit its specific purpose. It is possible, though, to base an approach on commonly recognised characteristics and, quoting Beretta (1996), Hennessy and Hicks (2003) identified a number of these as:

- Using a panel of experts
- Eliciting opinions, in writing, using questionnaires, via a number of iterations until consensus is achieved
- Guaranteeing anonymity to respondents at all times

These techniques are relevant to this study in establishing the role attributes of two groups, Estimators and QSs. The technique has also been used extensively in social science and health literature - for example, Hennessy and Hicks (2003) identified for the World Health Organisation (WHO) the ideal attributes of Chief Nurses within Europe. The advantages of the Delphi method are:

1. Encourages unbiased answers free from peer pressure and top-down pressure
2. Allows well informed but less dominant, more inhibited people to express opinions
3. Using postal distribution means:
    - Uncontamination from interviewer pressure
    - Allowing collection of a large quantity of data from a wide range of experts
    - Ensures content validity through tapping into a range of expert opinions
4. Offers a highly flexible technique that can be used on a range of professional disciplines

(Hicks 2009)

5. Provides cost effective method as it uses postal questionnaires
6. Maximises quality of data by using qualified experts

(Hennessy and Hicks 2003)

As the intention was to discern data on job attribute requirements these advantages make the method ideal for this study.

There are disadvantages that have been taken into account and these are shown in three categories as follows:

4. Sampling:
    - No recommended inclusion criteria for selection of experts
    - Difficult to associate the size of the sample with genuine population size
5. Reliability and Validity:
    - Quantitative methods will require measures of the characteristics to be devised
    - Characteristics distribution requires comparisons with the population within which the study is conducted
    - If testing Variables, these can only be realised when characteristics have been discovered

(Blaikie 2007)

6. Experimenter Bias Effects where the researcher can influence results by:
    - Deciding the point at which consensus is reached
    - Excluding outlying views which may eliminate valuable perspectives
    - Classification of initial responses under broader headings may involve arbitrary assumptions and decisions
    - Categories may reflect researchers personal agenda

(Hicks 2009)

Irrespective of these points this specific method of using the Delphi technique was considered to be the most appropriate instrument for use in this study. However, it necessitated the selection of a sound and justifiable methodology.

9.4 Methodology

9.4.1 Design

A Delphi survey, described above, was sent to considered experts in the field of estimating and quantity surveying. The Delphi method disadvantages, described above, were addressed in the current study by the following means:

2. Sampling

The Delphi method assumes expertise in a given field and decisions on panel members can be agreed between the research stakeholders (Hennessy and Hicks, *op. cit.*). In this case the decision on who could be classed as experts was that they should hold either Senior or Head positions in their companies. This indicated that they were experienced, well regarded, responsible and, therefore, capable of providing the quality of information being sought as well as making the right decisions with regard to its importance. Companies were selected randomly and the two groups divided equally into contractor and consultant sections. By using these selection methods sources of error in the choice of panel members was eliminated.

1. Sample sizes for the panel of experts were noted by Mullen, *op. cit.,* who quoted several authors recommending optimum panel sizes varying from 7-12 and 300-500. From personal experience of surveys carried out in the CI it was decided to involve as many people as it was viable to contact, financially and practically, and aim to achieve at least the minimum requirement
2. Reliability and Validity
    - Content validity was addressed by using a postal distribution and panel members who were experts, in senior positions in their fields
    - In Round 1, reliability of establishing main categories was helped by two people, supervisor and researcher both familiar with the subject, identifying these categories independently and obtaining agreement on them. In Round 2, reliability of establishing agreement between the two groups was measured using a Kendall test

3. Experimenter Bias Effects
    - Distilling the initial responses into themes by using two independent researchers to categorise the data
    - Using objective tests of inferential statistics to establish whether or not agreement has been reached; this excluded researcher interpretation of responses and thus reduced bias
    - No outlying views were excluded

9.4.2 Sample

Members were chosen from:

- *Employers* – Chief/Regional/Senior, QSs and Estimators
- *Educators* –Senior personnel responsible for the provision of QS courses and Estimating/Tendering modules
- *Professional bodies* (PBs)– Senior personnel whose responsibility it was to set up examination, training and ongoing professional development for QSs and possibly Estimators
- *Public Bodies*- Senior personnel responsible for training and examination of QSs and Estimators

Following these guidelines, it was decided that 100 people would be targeted for each role, as follows:

Contracting

1. The largest contracting companies, on the basis that these were more likely to employ the most expert and professional people. This list was compiled using information from a list in Building Magazine (2004) of the top 100 contractors and from the CIOB website (2004) based on the ability of companies on their database who were capable of undertaking projects of general construction or civil engineering in excess of £10m individually based on the DETR classification referred to in Chapter 5 (p.52).
2. PBs
3. Universities who have courses or modules for QSs and Estimators.

Consulting

1. A list compiled from information provided on the RICS website (2004) which offered details on a random basis of approved consultants operating as QSs, Construction Cost Surveyors and those providing Engineering Cost Surveyors. It was felt that a RICS approval would offer the greatest likelihood of finding experts within these specific fields as they are considered to be the largest professional body representing the UK Cost Consultancies. In the QS section consultants were chosen randomly from a total of 585 names available, to provide the required information on the work of a consultant QS; however, seeking consultants for estimating proved more problematic. There were 318 consultants on the list of Construction Cost Surveyors and those who were not also on the QS list were contacted directly to ascertain whether they employed Estimators to undertake this work. The list of Engineering Cost Services had 17 consultancies registered. Only three in total from these two sections were able to confirm that they used Estimators and therefore, with no other clear avenues available for this information it was decided that, along with the QS request, each of the 100 consultants would also be asked to provide information on Estimators working within the consultancy field, if possible. This increased the requests to 103 for this discipline but with the likelihood of a considerably lower response than for the other three
2. Other PBs were also asked for information on consulting Estimators as well as QSs, without knowing if they existed within their organisations
3. Local Authorities as in 2 above
4. Universities as in 2 above

9.4.3 Materials

Questionnaires were sent which explained the purpose of the study and the Delphi technique that was being used. Participants were requested to list the skills, attributes and qualities that they considered were required of their roles. It was also explained that the information derived from the survey could ultimately inform training and education and help to improve the quality of the work in these roles and, therefore, provide widespread benefits for the industry as a whole. A covering letter from the researcher's supervisor gave details of the researcher's role and experience in the CI and reasons for carrying out the study.

Once the attributes supplied by the questionnaires, in Round 1, had been placed into categories, by the means described under Procedure, below, they were then set into three-page questionnaires for each role requesting that the respondents provide a mark along an unmarked 100mm Visual Analogue Scale (VAS) indicating how important they considered each main attribute to be. The questionnaires contained examples of individual attributes that had been allocated to each main category alongside the VASs which ensured that the respondents ranked in a consistent way. The 100mm VAS is displayed below:

Visual Analogue Scale

0 = not at all important 10 = extremely important

Hicks, *op. cit,* provided information on this method in discussing measurements of responses using Attitude Scales. The VASs were unmarked at the poles, so that the respondents could place their marks freely, without guidelines which would influence their marking positions. The distance between the marks and the left hand pole was measured once the sheets were returned and thus constituted the data; therefore the VASs were carefully set at exactly 100mm on the pages sent out. This questionnaire was used in the second iteration.

9.4.4 Procedure

For the purpose of this research, the multi-pass process has been titled Round 1 and Round 2.

9.4.4.1 Identification of Estimator-QS Attributes Round 1

Once the identification of experts had been made then a letter was sent to each, inviting them to identify, in free-response form, as many attributes as possible that they considered were required in order for each discipline to perform its tasks. The letters were sent out as attachments to e-mails and a time period of three weeks requested for responses.

On receipt of the information requested a thematic analysis was performed independently by supervisor and researcher in order to obtain consensus on main attribute categories. This analysis used a conventional protocol designed by Attride-Stirling (2001) which provides for a thematic network composed of three themes, as follows:

1. Basic themes
2. Organising themes
3. Global themes

This protocol was followed in performing the analysis. The responses produced 270 attributes named by Estimators and 203 by QSs. With the supervisor and researcher being familiar with the names and nature of the data, these attributes were categorised into themes. To reduce researcher bias this was done independently and the themes and content compared on completion to establish the degree of concurrence. The two analyses showed differences in that, with Estimators, one had 17 main categories and the other 18 and, with QSs, one had 18 and the other 19. The attribute allocation in the analyses showed agreement on 221 (81.85%) Estimator and 167 (82.27%) QS attribute positions within the selected main categories. The main themes chosen for use in Round 2 composed 18 Estimator and 19 QS themes, the higher of the two analyses. The reason for this was that one theme, Pre- and Post- contract financial and construction advice to client/employer, was elected to be separated into two (Pre- and Post) themes. Examples of main category headings decided on were:

- Post- Contract Financial and Construction Advice to Client/Employer
- Cost Estimating Skills
- Thorough Knowledge of Construction
- Knowledge of Contracts and Contract Law
- Ability to Measure Work and Prepare BQs

While the number of times each individual attribute had been mentioned was noted in the analyses and given an initial ranking to the main categories, there was no hierarchy attached to these categories when being listed in preparation for the questionnaire in Round 2.

9.4.4.2 Identification of Estimator-QS Attributes Round 2

The main attribute categories from Round 1 were randomly listed in the questionnaire containing the VASs. The questionnaires for each group are shown in Appendix 4, Delphi Study Round 2 Questionnaire together with the complete list of main categories and individual attributes found. Instructions were issued to the recipients to ask that they place a mark at any point along each line indicating their considered level of importance to each category as it related to their particular discipline. To avoid the possibility of distortion of the VAS lines if the sheets were sent electronically, all were sent by post. This ensured that each respondent had exactly the same lines of measurement on which to work.

The results of the VAS scales were statistically checked by:

- Measuring the distance between the left hand pole and the mark made on the VAS for each attribute by each respondent; this established the degree of importance attached to the attribute
- Using the Kendall coefficient of concordance test for each group which enabled the information to be used to investigate the degree of agreement between each group on their required attributes
- Using a Spearman rank order correlation coefficient test for a comparison between the groups. This comparison would confirm whether or not these two groups were similar

There was a possibility that Estimators and QSs, if having very similar knowledge bases, could also need an equal knowledge requirement to enable them to perform their work. If this was the case then it could be argued that their work was the same and that an Estimator could be a QS and vice versa. Therefore, the Spearman test would confirm whether or not there was a positive, negative or no association between the groups. Hicks, *op. cit.,* explained the use of this test as being for situations where the degree of association between two sets of scores was to be compared.

9.5 Results

9.5.1 Round 1

With an initial response of four returns, prompts, additions to the list and a deadline extension increased this to 27 people which, from 400 requests, was low but was considered to be sufficient for three of the four categories. The numbers are shown below as:

- Seven consulting QSs
- Eight contractors' QSs
- One consulting Estimator
- Eleven contractors' Estimators

The "basic themes" of 270 Estimator and 203 QS attributes reduced to 158 once these had been placed in "organised themes. These were set into 18 Estimator and 19 QS main categories which are shown below.

QS Categories

1. Good Personal Qualities
2. Good Communicational/Teamwork Skills
3. Intelligence and Cognitive Ability/Style
4. Cost Estimating Skills
5. Relevant Experience
6. Management Skills
7. Good Formal Education
8. Professional Training Initial and Ongoing
9. Thorough Knowledge of Construction
10. Knowledge of Contracts and Contract Law
11. Ability to Prepare, Select and Appraise Tenders
12. Ability to Measure Work and Prepare BQs
13. Good Negotiating Skills
14. Able to Provide Pre Contract Finance and Construction Advice to Client/Employer
15. Able to Provide Post Contract Finance and Construction Advice to Client/Employer

16. Commercial Business Acumen

17. IT Skills

18. Conflict Management

19. Risk Management

Estimator Categories

To avoid duplication Estimator categories matched the categories for QSs with the exception of item 18 Conflict Management which was not mentioned in Estimator responses.

9.5.2 Round 2

Kendall test

Of the 27 enquiries sent out the results from the returns of the VAS questionnaires produced a response level of 22. The marks on the VASs, when tested with Kendall tests showed that it was clear that QSs working for consultants carried out similar work categories to those working for contractors, as was also the case with Estimators, and therefore the consultant and contracting groups were able to be combined for each discipline to provide overall analyses. These test results are shown below with QSs detailed in Tables 57-59. Data displayed to 2 decimal places:

Table 57 Kendall Coefficient of Concordance Test (QSs Overall)

Statistical Probability Table of Critical Values			
s	W	x^2	df
32066.00	0.33	77.89	18

From table, p<.0005 for a single tailed test therefore the level of agreement on the core competencies is significant which means there is no significant diversity on QSs views on their core competencies

Table 58 Kendall Coefficient of Concordance Test (Consultant QSs)

Statistical Probability Table of Critical Values			
s	W	x^2	df
20034.50	0.43	70.30	18

From table, p<.0005 for a single tailed test therefore the level of agreement on the core competencies is significant which means there is no significant diversity on QSs views on their core competencies

Table 59 Kendall Coefficient of Concordance Test (Contractors' QSs)

Statistical Probability Table of Critical Values			
s	W	x^2	df
2967.50	0.33	23.43	18

From table, p>.05 for a single tailed test therefore the level of agreement on the core competencies is not significant which means there is a significant diversity on Contractors' QSs views on their core competencies

Whereas with contractors' QSs there was a significant diversity, this should be kept in context in that the number of respondents was, at four, less than half of those for consultants and therefore offered more likelihood of distortion. In addition the result was only marginally short of recording no significant diversity.

Estimators' test results are given below in Tables 60-61:

Table 60 - Kendall Coefficient of Concordance Test (Estimators Overall)

Statistical Probability Table of Critical Values			
s	W	x^2	df
17463.78	0.44	68.08	17

From table, p<.0005 for a single tailed test therefore the level of agreement on the core competencies is significant which means there is no significant diversity of Estimators views on their core competencies

Table 61 Kendall Coefficient of Concordance Test (Contractors' Estimators)

Statistical Probability Table of Critical Values			
s	W	x^2	df
10398.28	0.44	52.12	17

From table, p<.0005 for a single tailed test therefore the level of agreement on the core competencies is significant which means there is no significant diversity of Estimators views on their core competencies

A response from just two consultant Estimators meant that there was insufficient data to perform a Kendall test on this group.

Spearman Test

It could be argued that the section for contractors QSs should have been returned to the respondents for a third round as they had failed to agree on their rankings levels. However, consultant Estimators had not provided responses in sufficient numbers for a test to be carried out on them, so, as the number and type of competencies had not varied across the disciplines within each group and had shown just one additional competency in the QS group, it seemed that the most sensible approach was to use the "overall" comparison for each group rather than to look for additional comparisons between separate sections. Therefore, the Spearman test compared the two groups in their 'overall' form in order to assess whether there was agreement between them on how they rated the level of importance of each competency. To provide a balanced test the additional "QS only" competency of Conflict Management (item 18) was excluded. These results are shown in Table 62, below:

Table 62 Spearman Rank Correlation Test on Estimator-QS Comparison

Main Category Headings	(Est)	(QS)
	Rank	Rank
Cost Estimating Skills	1	13
Ability to Prepare Select & Appraise Tenders	2	7
Intelligence & Cognitive Ability/Style	3	4
Good Personal Qualities	4	1
Good Communicational/Teamwork Skills	5	2
Thorough Knowledge of Construction	6	12
IT Skills	7	9.5
Ability to Measure Work & Prepare BQs	8	6
Relevant Experience	9	16
Risk Management	10	9.5
Knowledge of Contracts & Contract Law	11	14
Good Negotiating Skills	12	11
Able to Provide Pre Contract Financial & Construction Advice to Client/Employer	13	5
Good Formal Education	14	18
Professional Training Initial & Ongoing	15	15
Management Skills	16	17
Commercial Business Acumen	17	8
Able to Provide Post Contract Financial & Construction Advice to Client/Employer	18	3
correlation coefficient	$r_{s=+}$	0.30

From table, p>.05 for a single tailed test therefore the level of agreement on the core competencies is not significant which means that there is a significant diversity of QS/Estimators views on their core competencies

The Spearman test, in displaying a significant diversity in the level of importance placed on the same work categories, showed that each group had a separate role.

An added benefit from these tests was that lists were provided showing the work categories, for both roles, in order of importance. These are shown in Tables 63-64, below:

Table 63 QS Attribute Ranking

QS Attributes in Ranked Order	Score	Rank No
Good Personal Qualities	67.00	**1**
Good Communicational/Teamwork Skills	75.50	**2**
Able to Provide Post Contract Financial & Construction Advice to Client/Employer	81.00	**3**
Intelligence & Cognitive Abililty/Style	96.00	**4**
Able to Provide Pre Contract Financial & Construction Advice to Client/Employer	102.50	**5**
Ability to Measure Work & Prepare BQs	104.50	**6**
Ability to Prepare Select & Appraise Tenders	105.50	**7**
Commercial Business Acumen	120.50	**8**
IT Skills	120.50	**9**
Risk Management	122.00	**10**
Good Negotiating Skills	124.50	**11**
Thorough Knowledge of Construction	129.00	**12**
Cost Estimating Skills	132.50	**13**
Knowledge of Contracts & Contract Law	152.50	**14**
Conflict Management	152.50	**15**
Professional Training Initial & Ongoing	174.50	**16**
Relevant Experience	191.00	**17**
Management Skills	207.50	**18**
Good Formal Education	211.00	**19**

Table 64 Estimator Attribute Ranking

Estimator Attributes in Ranked Order	Score	Rank No
Cost Estimating Skills	19.50	**1**
Ability to Prepare Select & Appraise Tenders	44.50	**2**
Intelligence & Cognitive Abililty/Style	49.00	**3**
Good Personal Qualities	58.00	**4**
Good Communicational/Teamwork Skills	63.50	**5**
Thorough Knowledge of Construction	67.50	**6**
IT Skills	74.50	**7**
Ability to Measure Work & Prepare BQs	75.00	**8**
Relevant Experience	79.50	**9**
Risk Management	86.50	**10**
Knowledge of Contracts & Contract Law	94.00	**11**
Good Negotiating Skills	97.50	**12**
Able to Provide Pre Contract Financial & Construction Advice to Client/Employer	109.50	**13**
Good Formal Education	111.50	**14**
Professional Training Initial & Ongoing	118.00	**15**
Management Skills	119.00	**16**
Commercial Business Acumen	122.50	**17**
Able to Provide Post Contract Financial & Construction Advice to Client/Employer	142.50	**18**

9.6 Conclusions

This study made a significant contribution to the development of a TNA and BoK, demonstrating a great deal of similarity between QSs and Estimators on what constituted essential/necessary competencies. A defined list produced 19 QS and 18 Estimator main competencies, with all Estimator competencies mirroring those of QSs. Of equal importance to the CI is that this list offered information to all those involved in education and training provision that estimating was not simply about calculating the project price, it was now involved in all but one aspect of the total QS role. On that basis, the author recommends that the industry looks at what it could be doing to support their work, comparing it with what it already does for QSs and taking steps to rectify the inequality.

It was also verified with the Kendall tests that, overall (consultants and contractors combined), the Estimators and QSs contributing to the knowledge base were

significantly in agreement regarding the level of importance that they placed upon the selected main category headings in each discipline. The addition of Spearman tests provided confirmation that they were distinct groups with diverse needs on the level of importance that each attached to its work categories even though there was a broad and equal knowledge requirement for each category.

The ranking lists produced additional information that was, on the face of it, surprising for both groups. The level of importance attached to education and training was shown to be very low, even more so for QSs than Estimators. Extracted from Tables 63 & 64, above, the positions were that:

Estimators placed:

- Formal education at 14th of 18 places
- Professional training at 15th of 18 places

QSs placed:

- Formal education at 19th of 19 places
- Professional training at 16th of 19 places

Perversely QSs, privileged with access to exclusive formal and professional education and training programmes, in ranking them in even lower positions than did Estimators, showed the least regard for these benefits.

When these low rankings emerged, all of the respondents were asked why they thought they had arrived at this conclusion. Unfortunately all declined to answer. This was the second study that had shown education occupying a surprisingly low position, by employees in this Chapter and employers in Chapter 8. A thorough education and training package was being offered to QSs and the response from employees and employers alike appeared to be lukewarm. Was the industry, therefore, saying training wasn't required or that it had little confidence in what was being provided? The CI has to operate in a sector where the majority of the work is of a one-off nature and, as such, carries a high financial risk. In general, contractors base their tenders on low profit margins, and this, combined with the high risk, has given the UK CI an historical reputation for company failure. As such, its apparently low regard

for education was difficult to comprehend. From this author's experience, in employing construction staff and in discussions with other employers, one reason for this could be that there was concern about the level of ability of students entering the industry either from schools or Universities/Colleges. A second, and contrary, explanation could be that there was a general consensus that the status quo was adequate for the industry's needs. QSs had gained professional recognition through their own efforts; Estimators had not enjoyed the same level of professional recognition. The authors impression gained from this research had been that Estimators were not typical of "*a 50 year old man in a grey suit who is anything but dynamic and go-getting*" (p.38), as Delargy, *op. cit*., asserted. Many of the Estimators interviewed expressed a desire for specific Estimator ETPs but, to date, this does not appear to have been achieved.

Chapter 10 - Ethnographical Research

10.1 Introduction

Work on professions, in Chapters 3 and 4 showed that it was possible for Estimators to be able to satisfy sufficient professional criteria to enable them to substantiate a position of professional status. Chapters 4, 6 and 8 helped to assemble a list of Estimator job attributes but, in order to ensure its thoroughness, all feasible avenues needed to be explored that would either confirm the list as complete or enhance it by unearthing further job requisites. Researching estimating work practices by observing Estimators in their working environments would be a different approach to the methods of discovering attributes used so far in this research.

Ethnographical approach to the assessment of Estimators skills

The large proportion of this research had been carried out using statistical methodologies and the justification for this was that it had been dealing with hard facts such as salary comparisons, study modules, qualifications and KSAs. All of these attributes are essential elements but where, so far, there had been a list that included mental capabilities such as being analytical, logical and numeric, there should also be a place for 'thinking time', helping produce more creativity, innovation and opening up individuals to use their instincts and other social skills. Whilst it was necessary to be accomplished at producing an accurate estimate, which in black and white terms fulfilled all the necessary criteria, it was also essential to take account of local, national and international conditions that may affect the outcome of the tender. In failing to do so there may well be consequences for the financial result of any engineering or construction project. Such failures could occur that might be avoided if account had been taken of known problem areas where the contractors and contractors' Estimators could have drawn on the experience of:

a) Previous projects of a similar type
b) Relatively new and therefore untried contract types e.g. PFI
c) Special interest projects that attract opposition from activist groups
d) Historically problematic local conditions

That kind of knowledge does not require precision or numeric skills but a need to research work done on previous projects of a specific type or in a specific area and also by reading, listening, communicating. In being able to highlight the possibility of

major problems the contractor is given an opportunity to make a financial allowance to cover them at the tender stage. If, in doing so, the contractor fails to win the tender then that has to be a preferable outcome than having to overcome difficulties incurred by contractors on projects such as those described below:

- Multiplex, in building Wembley Stadium, complained of rising costs and a bitter legal dispute with their steelwork contractor as being a major contributory cause of a multi-million pound deficit on the project (The Times 2005). The Buildingtalk website (2006) said that these losses were likely to be around £45m on a £352m contract sum. This figure was agreed with by the project client, with information put onto their website (Wembley Stadium 2006). This loss was later revised to £100m by The New Civil Engineer (NCE) website (2007). Such a loss would raise questions regarding:
    1. Scrutiny of the steelwork contractor's tender before being included in the estimate
    2. Detailed knowledge of the steelwork contractor by Multiplex
    3. Detailed knowledge of Multiplex by the steelwork contractor
    4. The consideration given to likely or possible price rises over the contract period, to protect Multiplex's fixed price tender responsibilities

- John Laing plc reportedly lost £30m on the Millennium Stadium, Cardiff, blaming the loss on the complexity of the construction. A financial reporting website, InterNet Bankruptcy Library (IBL) (2006), considered that the cause for part of this failure was Laing's undertaking the work on a fixed price basis. They added that this stadium project, and other fixed price contracts undertaken by Laing's construction division, had caused a loss of £195.7m over the 3 year period to 2001, forcing the company into a rights issue with its shareholders in order to alleviate a nett £130m debt. This led to the resignation of their plc executive chairman and finally the sale of the construction division for a symbolic £1. Tom Broughton of Building Magazine, quoted on the BBC website (2006), thought that large "landmark" contracts were difficult to build and the problems arising from those difficulties caused spiralling costs.

Again it was a fixed price contract and complicated designs, as with Wembley Stadium, that had seemingly caused Estimators so many problems that they spectacularly failed to get the prices right

- Jarvis plc incurred a loss of £5m in its Accommodation Services division, which it blamed on 'cost overruns' on projects which it had previously projected profits of £5m, according to BBC News (2006). The difference on those projects for Jarvis was not, therefore, £5m but £10m; it being the loss plus the projected profit. Anecdotal evidence suggested that Jarvis had also obtained several PFI contracts at prices that other companies competing for the work considered to be unviable, and it seemed that this was particularly so on a number of school developments.

  The failure of a single project happens to all companies but several projects of a similar nature, and within a short time period, did imply failings within the estimating teams as well as management.

- Further anecdotal evidence and personal experience, from the 1970's, showed that civil engineering and construction companies would either avoid tendering or would add large additional sums to tenders if projects were in areas of strong union unrest or which they felt may be targeted by activist groups with special interests in particular fields. In recent times the Animal Rights Liberation Front (ALF) caused the withdrawal, in 2004, of main contractor, Montpellier, from an £18m animal research laboratory project at Oxford University. Part of the ALF campaign was designed to drive down Montpellier's share price by targeting the company's shareholders (Thisis money website 2006). The ALF, later, increased pressure on the staff at the University, when another, unnamed, contractor had taken over the work (Guardian Unlimited 2006).

  It was the responsibility of their Estimators, as well as Montpellier's management, to have foreseen those problems arising before they embarked on a contract of this type. This is particularly so as staff and many companies

> associated with Huntingdon Life Sciences (HLS), who were to operate the laboratory, had been targeted by the ALF for several years, due to HLSs work on animal testing. In a Guardian news article, seven members of the ALF were convicted for these activities in 2008 and were said to have been carrying out such attacks over a six-year period, according to the website of guardian.co.uk (2009). This meant that such activity was happening two years before Montpellier became involved in this project and, as such, a minimal amount of research would have highlighted the problem.

Not long after writing of the difficulties that these four companies had faced, and John Laing's loss of independence, there was news of major effects on two of the other companies mentioned above, with:

1. Multiplex losing its independence to Brookfield Asset Management Inc. (BAM) in December 2007, BAM (2010)
2. Jarvis plc (2010) ceasing to trade, due to financial problems, in 2010

These were major CI companies who, no doubt, employed many talented individuals. It was not that their collapse could be blamed entirely on poor estimating, as there would undoubtedly be other management failures too. What was unarguable was that providing ETPs for a group of employees totally enmeshed in the industry's financial health could only improve its fortunes and would certainly have given each of these three companies, and many more, a better chance of survival.

With most projects it would never be just an estimate error that would be the single cause for a financial loss. Other causes, such as, bad management, poorly considered tender margins, liquidated damages, over-eagerness to win prestigious contracts and, as has been seen above, insufficient attention paid to local and client problems, can also contribute. Many of these grounds, though, can be alleviated with thoroughly educated, trained and experienced Estimators, who should provide their management teams with sound, confidently expressed arguments about the estimate costs and project risks that have been identified during the tender period. They ought then to be able to offer the necessary guidance to those setting the tender margins and those planning and organising the work, and to be listened to with respect and confidence in their assessments.

The examples above were by no means the only problem projects during recent years but they did emphasise the need for Estimators to be able, as far as possible, to look at the "bigger picture" surrounding each project, assess the complexities in relation to timescales and forecasting financial situations, when considering their nett estimates. Therefore, interaction with other members of staff, friends, acquaintances and a general 'living of life' could all help to provide clues and offer insights that could inform Estimators of the direction in which the economy was moving, both in the UK and the rest of the world. In addition, particularly with the Millennium Stadium, knowledge of previous contracts of a similar nature, particularly those having a retractable roof, could have enlightened them sufficiently to have made adequate provision for convoluted designs and construction intricacies. Estimators need to look beyond the costs of resources, labour outputs and construction knowledge and to develop a 'feel' for how they consider each project would perform, consider personalities of the likely staff and consultants involved, study labour relations in the area, be aware of project sensitivity and take account of the rigidity or flexibility of crucial client representatives such as QSs, Architects and Engineers. For Estimators to be aware and elucidate these types of attributes in answering questionnaires is not always certain. Therefore a completely different method was found that could draw these attributes out. Hammersley and Atkinson (1983) had a view on this, in that empirical research should meld with social theory. Therefore, in order to develop a more rounded list of attributes required, and possibly adding new attributes, then the study has followed this advice and used an interpretive, anthropological method, ethnography. Hammersley and Atkinson described this as an understanding of peoples' perspectives and the observation of their everyday life activities, and Fetterman (1998) considered it as being an ambitious trip through the intricacies of social interaction. An older but possibly more simplified description from Malinowski (1922) was of a method for grasping life from the point of view of the native. Ethnography was adapted here to meet the requirements of the study of Estimators as a specific working group and comments from Francis Bacon (1620) taken from the Constitution Society website (2006) of life almost 400 years ago are still appropriate today. An apposite part of what he wrote was as follows:

> *"…The more ancient of the Greeks (whose writings are lost) took up a position between the presumption of pronouncing on everything and the despair of comprehending anything: and though frequently and*

bitterly complaining of the difficulty of inquiry and the obscurity of things, and like impatient horses champing at the bit, they did not the less follow up their object and engage with nature, thinking (it seems) that this very question - viz., whether or not anything can be known - was to be settled not by arguing, but by trying. And yet they too, trusting entirely to the force of their understanding, applied no rule, but made everything turn upon hard thinking and perpetual working and exercise of the mind".

There are many studies of this nature that look at the whole socialisation processes of work/life situations but it was felt that, for this purpose, the focus would be restricted to studying the tasks necessary to be carried out in order to achieve the estimate cost, observed in everyday situations and surroundings, as a means of complimenting the statistical formality of the previous studies in this thesis. Personal feelings and desires were noted but recorded only where these concerned and affected work related issues. While interaction between colleagues on politics, football, television etc., were all considered necessary in developing work relationships and a good working environment, they were also social skills rather than practical skills. The concentration of this thesis, being on the practical KSAs needed for an occupation to obtain a specific education and a professional status, was, therefore, on social interaction, viewed as a means of collecting information on 'external problems' that may affect current and future projects.

10.2 Research Aims

To gather information on Estimator attributes by spending as much time as possible within the working environment of the estimating sections of civil engineering and building companies. Studying Estimators in their workplaces was to be a two-pronged method of obtaining information, by noting the techniques undertaken and tasks performed, and observing work related actions that occurred from social activities. The information gained could then be compared to the list of attributes already compiled, and any items found, that had not previously been uncovered, could then aid the development of that list compiled to achieve Objective 4, a development of a TNA and BoK in Chapter 12 (results to be found at 10.5, below).

10.3 Research Method

The priority of this specific study was to discover Estimator attributes by a different method than those used so far, with the expectation that this would unearth attributes not yet discovered. Using an ethnographical method was the chosen course. There are variations of these methods and the choice to be made depends on its appropriateness for the way in which the data is to be collected. There are three 'key' methods Murchison (2010) said, these being:

1. Participant-observation
2. Interviews
3. Maps and charts

These methods, Murchison added, can be used and adapted in different ways to suit the research purpose. The participant-observation method was chosen for this study as Murchison said that the technique offered a unique way of gaining access to information that was hard to obtain using other methods. The method was given additional explanation by Adler and Adler writing in Denzin and Lincoln (eds.) (1998) who wrote of work from Gold (1958) that said there were four approaches to this method, which were:

1. The complete participant- records observations of activities and is totally immersed in those activities
2. The participant as observer - observes while participating in the activities
3. The observer as participant – observing subjects for brief spells whilst conducting interviews
4. The complete observer - observers fundamentally removed from their settings

Additional approaches have since been added by Adler and Adler (1987), based on members of society, these being:

5. The complete-member-researcher – where researchers observe activities where they are already part of the group being observed or where they become converted into joining the group during the observation
6. The active-member-researcher – where researchers become involved in the activities being observed
7. The peripheral-member-researcher – obtaining an "insider's" view in order to form accurate evaluations

Adler and Adler (1998), *op. cit.,* said that observational research would include a combination of these seven approaches. The approach chosen used a combined role of

being a complete observer, item 4, with knowledge of the activities being observed, participating in discourse but not in the activities which would be that of a peripheral researcher, item 7.

The uniqueness that Murchison, above, wrote of was expected to draw out data that had not been found using other methods. His guidelines for carrying out this type of research were:

- That the researchers' gain experience in observation techniques and in the activity in which those to be observed are engaged
- The right situations and locations should be identified
- Spending as much time as possible in one place so that the maximum number of people and activities can be observed

This, he said, helped to create an "*analytical picture*" (p.42) of the area being observed

These techniques are relevant to this study in the establishment of Estimator attributes. The same techniques, used previously have collectively derived similar information. Two such studies described by Schwartzmen (1993), were:

1. A study that was undertaken in a petrochemical company that viewed the extent of teamwork within the organisation
2. A study that she had carried out called "Culture as Formal and Informal Organization" which had gathered views on all characteristics of a corporate experience, discovering what people thought of the structure of the organisation, language used, technology incorporated and also the tangible work

The combination of Schwartzmen's works fulfilled the criteria for collecting a wide-ranging set of data on tangible and non-tangible job attributes.

The advantages of using this method are:

1. Having experience in the field in which the observations are being recorded helps the researcher to understand the protocols, cultures, personal emotions and social interactions of those being observed

2. Offers the advantage of the researcher being in a unique position of observing workplace activities as they occur, which provides insights into the data being sought

(Murchison)

3. Having an "insider's" knowledge aids the accuracy of appraisals
4. Gaining acceptance as an "insider" allows the observer to pass freely through the area of activities in order to extend the data being observed

(Adler and Adler, 1998)

As the intention is to discern data on job attribute requirements these advantages make the method ideal for this study.

There are disadvantages to this method and these are shown below:

1. Sampling
    - Observations can be time consuming
    - Researchers need to ensure that the activities being observed are timed correctly and not waste time being present when there is little to observe

(Murchison)

- Experimenter Bias Effects:
    - Having an observational role does not allow the researcher to integrate into the activities and obtain a "hands-on" knowledge

(Adler and Adler, 1998)

- Researchers may become so involved in the proceedings that they fail to take note of the "bigger picture" or perform objective analyses of the events being observed
- Difficult to have access to a full cycle of events which may be vital to the observations
- Lack of detailed knowledge of the proceedings being observed
- Missing events due to unforeseen circumstances such as illness may mean that vital observations are missed
- Difficulty in maintaining concentration over extended periods of observation

(Murchison)

- Making presuppositions of the methods being used
- Developing views on subjects' and their capabilities, based on their personal characteristics
- Accepting anecdotal evidence of data
- Seeking evidence to support the researchers' theories rather than aiming for exhaustive data collection, which may cloud the observers' judgements of unusual or unanticipated practices

(Bryman 2001)

This specific method of using the participation-observation technique was, therefore, linked with a methodology deemed to be suitable for its purpose.

10.4 Methodology

10.4.1 Design

The participation-observation ethnographic technique, described above, was used for studies of Estimators in four separate companies.

The disadvantages of using this method were addressed by the following means

1. Sampling:
    - Finding sufficient time and finance to observe the activities within estimating departments was addressed by confining the study to four companies with a total of two weeks spent with each
    - Developing a rapport with the Estimators involved so that the researcher's presence could be arranged to fit with the work activities
2. Experimenter Bias Effects:
    - The researcher had several years of "hands-on" experience of the role that was being observed. In addition, because of perceived company sensitivity in allowing an unknown individual to roam freely, which would have limited the observations, these companies were not chosen at random. Of the four companies involved two were personally-known to the researcher and two peer-introduced. Thus the content

validity was addressed by the researcher being experience in the field being observed and able to fully understand, interpret and analyse the work practices being undertaken

- External validity was ensured by observing only those subjects directly involved in carrying out the work and directly involved in communication with other parties who had an interest in the work
- Using data that had been categorised in the Delphi study and, therefore, had guidelines with which to work when allocating new attributes
- No outlying views were excluded
- With the researcher having a personal interest in discovering new methods there was no exclusion due to presupposition or support of theories
- Anecdotally gathered evidence was avoided with telephone gathered information by ensuring that it was retrieved from the subject being observed
- Being objective when observing work practices

Reliability in achieving consistent and exhaustive data collection was ensured by:

- Proceedings involving estimate production, negotiations, planning etc. are slow moving activities that can take weeks to complete. As such, an intense involvement in observing the activities, leading to loss of concentration, was not an issue
- Contacting Estimators by phone or e-mail to collect the results of tender submissions when there was a time-lag between tender submissions and announcement of results
- Researcher's general CI and QS/Estimator-specific experience
- Missing events through illness would be impossible to guard against but the studies were timed to avoid the researcher's busiest work schedules and holidays and, therefore, ensure presence at the appropriate times. There were no incidents of illnesses

- As many Estimator work activities are time-consuming this was addressed by confining fieldwork to short visits timed to coincide with work activities

10.4.2 Sample

The companies involved consisted of:

1. General construction with a turnover of £3.5m – Estimators were observed on contracts valued from £150,000-£600,000. Staff involved were:
    - 1 Estimator
    - 1 Contracts Manager
    - 1 Managing Director
    - 1 Client's Representative
    - 1 QS
2. General construction and civil engineering with a turnover of £580m – Estimators were observed on contracts valued from £4.5m-£5.2m. Staff involved were:
    - 1 Senior Estimator
    - 3 Estimators
    - 1 Assistant Estimator
    - 1 Senior Contracts Manager
    - 1 Managing Director
    - 1 QS
    - 1 PQS
    - 1 Architect
3. General construction and civil engineering with a turnover of £700m – Estimators were observed on a 115 dwelling housing association contract of undisclosed value. Staff involved were:
    - 1 Regional Procurement Manager
    - 3 Project Estimators
    - 1 Senior Contracts Manager
    - 1 Managing Director

4. General construction and civil engineering with a turnover of £100m - Estimators were observed on a Frameworks contract valued at £2.4m for a housing association. Staff involved were:
    - 1 Regional Estimator
    - 1 Senior Estimator
    - 1 Project Estimator
    - 1 Trainee Estimator
    - 1 Managing Director

The tenders covered civil engineering works as well as general construction which provided a broad scope for this study in both contract type and size.

10.4.3 Materials

As many Estimators' activities are time-consuming it was decided that the observations could be interspersed, if necessary, with the help of a list of questions that may enhance the collection of attribute data, used at times when activity was slow. Also, it was considered that having such a list could be helpful as an aid to "what to look for" during the observation periods. Guidelines to facilitate this list came from Hammersley and Atkinson, *op. cit.,* who had said that the problems being studied needed to be converted into a set of questions to which a theoretical answer could be specified. These comments being noted, the questions were prepared covering working within an organisation, IT and the range of work oriented skills that had been discovered from the Delphi Study. These were intended to be put to Estimators on an informal basis rather than as structured interviews and are shown below:

Teamwork within the group

How important is teamwork?

Is information shared?

Is there communication?

What is the reaction if one member wins a tender?

Is there a desire to win work or finish a close second because of the extra work and responsibility that winning brings?
Is there an integration of work on individual projects?
Is historical data stored for re-use?

Teamwork within the organisation

How important is teamwork?
Is information shared with other disciplines?
Is there communication?
Is there a feeling of subordination with other groups?

Teamwork within individual project tender organisations

How important is teamwork?
Is information shared with other disciplines?
Is there communication?
Is there a feeling of subordination with other groups?
Are comparisons made between priced items and actual item costs?

10.4.4 Procedure

As the procedure for each study was the same, these have been combined as follows:

1. Arrangements were made with each of the four companies, in turn, to visit at times when tenders invitations were due to arrive
2. Preliminary visits were made to each company for the researcher to make acquaintance with their estimating teams where each team was given an explanation of the researcher's purpose and of how the observations would be conducted ie. with silent observations, asking questions from the prepared list and off-the-cuff and making conversation on a social and work level
3. A total of two weeks was spent at each organisation's offices, in periods ranging from half to three days, spread over the tender periods allocated for each exercise. During the tender processes arrangements were made each day between the researcher and the Estimators involved regarding useful times to visit, times when there was little

likelihood of activity worth recording and times when results could be obtained by phone

4. The set questions were used informally, sometimes being answered by observation and sometimes by direct questioning
5. All work related activities were recorded for implementation into the list that had evolved at the Delphi study stage
6. Attributes found from the observations were collated and then compared to those already collected and any new items separated
7. A thematic analysis was performed on the new attributes, mirroring that of the Delphi study
8. The new attributes were placed in the main competency group headings using the guidelines from the Delphi study and the work readied for transfer to the Estimator Skills Questionnaire and TNA

10.5 Results

The observations produced a total of 97 attributes. An additional main competency, Programming and Planning, was also discovered during the study. This was not a specific competency gained from social interaction but was an important addition that had not been detected from the previous studies, and increased main category list to 19 items. Programming and Planning had been found in the estimating department of the largest of the four companies involved in this research. Information on their study, which can be found in Company 3 of Appendix 5, showed a divergence from the traditional processes carried out within other CI companies studied. With this company all the work was done by specialist sub-contractors, who supplied all the resources necessary to complete their section of the construction process. This meant that the main contractor's Estimators were not involved in the itemised pricing process but spent more time in the preparation, selection and appraisal of sub-contract tenders and the added involvement of preparing programmes and contract planning procedures. Their Estimators pointed out, however, that itemised pricing was still done when specialist sub-contractors failed to return their tenders in time to meet the tender deadlines. Because of this, they said, it was still essential that their Estimators were to be fully conversant with basic estimating procedures.

Of the 97 attributes 33 had not been found from the previous studies. These were transferred to the Estimator Skills Questionnaire Chapter 11 along with the additional main category Programming and Planning. Appendix 5, Ethnographical Information, shows the detailed notes of the observations made during the time spent at each company and the list of new attributes found.

10.6 Conclusions

Spending time within the Estimators' working environments produced an added number of attributes. Some were gained from social skills in and out of the workplace while the Estimators were talking, reading, listening and watching. A further main category process emerged, together with 33 additional individual attributes, which enhanced the TNA and BoK. There was also a discovery of further evidence of a changing Estimator role with one company's work method being that all of their trade operations were outsourced to specialist contractors. This changed their estimating methods into having a total involvement in the preparation, selection and appraisal of tenders from sub-contractors, programming and planning the construction phase and increased interaction with management. There had been no indication from this research that the procedure was prevalent in other CI companies but as it had been detected in a large UK company it may be that estimating techniques are changing with other companies too. While this would not change the attribute list for the TNA or the BoK it may, once any TNAs were implemented, mean that a greater education and training emphasis might be placed differently to that suggested by the Delphi study where information on tender preparation and appraisal was ranked 11 of 18 main competencies and programming and planning techniques were not mentioned.

Chapter 11 - Estimator Skills Questionnaire

11.1 Introduction

The information collected on Estimator attributes from the studies covered by Chapters 5, 7, 9 and 10 was supplemented by additional research in order to unearth as many attributes and as much information, on Estimators, as possible. It could add to the development of the TNA/BoK and, thus, provide a comprehensive document that could be relied upon for use in Estimator ETPs.

11.2 Research Aims

As a final aim, designed to aid the development of the TNA, the intentions were:

a) To collate the knowledge gained from Chapters 5, 7, 9 and10 on Estimator attributes for transfer to the TNA and also to present it to organisations in the CI for their opinions on its usefulness to the Estimator role (results to be found at 11.5, below)
b) To determine the degree of capability and knowledge of those attributes, by Estimators in the organisations contacted, which would help to provide 'indicators' within the TNA of areas of weakness that could then be addressed in training programmes (results to be found at 11.5, below)
c) To draw out any further Estimator attributes that could enhance the TNA (results to be found at 11.5, below)

11.3 Research Method

The revised IRS that was described by Blaikie and used in Chapters 3, 4 and 5 was adopted for this study as a means of helping to add to the information on what Estimators do, what their perceptions of their roles are and what regard is shown to them by their employers. As such, the same advantages and disadvantages that were shown in Chapter 3 were considered.

As with Chapters 3, 4 and 5 this method was considered suitable for this study and, therefore, used a suitable methodology to justify its use.

11.4 Methodology

11.4.1 Design

To extend and consolidate the information on Estimators the revised IRS method, described in Chapter 3, here used structured interviews as a means of collecting data. The design strategy mirrored that used in the Pilot Estimator Interviews, Chapter 5, albeit that the information available for the development of the structured questionnaire was more extensive and structured given that it was base on the knowledge obtained throughout the course of this research.

The disadvantages revised IRS method, described in Chapter 3, and flawed nature of standardised questionnaires, described in Materials, see 11.4.3, below, were addressed in this study by the following means:

1. Sampling
    - Guidance when deciding on the selection of questions from the data-base used the researcher's familiarity with the work carried out by Estimators in the CI
    - Information had been gathered from pilot interviews, job attribute research, a Delphi study and ethnographical studies that bolstered the knowledge available to structure an extensive questionnaire
2. Experimenter Bias Effects
    - Using the standardised questionnaire meant that all interviews were performed under the same conditions
    - The researcher was familiar with the work carried out by Estimators and therefore understood what questions to ask and which characteristics to look for.
    - Reliability of establishing information on "what" questions was helped by the researcher preparing a standardised questionnaire that was checked and approved by the supervisor. This also aided verification
    - Collection of external data, attributes obtained by observation and listening, were all done by the same researcher with the bias

therefore being controlled by using a checklist of attributes agreed between supervisor and researcher

- The use of a questionnaire during the interviews meant that the views recorded were those of the interviewees and not the researcher. The possibility of interviewer bias was kept to a minimum by the interviews following the prescribed format of the questionnaire in each case. This reduced the opportunities for influencing or guiding the respondents

11.4.2 Sample

Having chosen an interview method using structured questionnaires to obtain the desired information, methods of survey sampling were followed as described in Chapter 5. From this, the recipients were selected by following the process that was used in the Delphi Study, but with the "top contractors list" updated to include contractors listed in a special feature (Building 2006). This was based on the selection of a list of Estimators in senior positions, from companies of medium to large size, ranged across civil engineering, general construction and the housebuilding sectors with companies chosen randomly from those lists ie stratified sampling. It was not felt necessary to ensure an equal number of Estimators from each group section, or size, as the intention was to extract as much information as possible, from whatever source. The researcher and supervisor agreed that a minimum of ten interviews should be carried out and, so, 45 invitations were sent to an equal spread of civil engineering, general construction and housebuilding companies, plus six companies with whom the researcher had personal contacts.

11.4.3 Materials

A questionnaire was developed with the main attribute headings, taken from the Estimator attribute rankings in the Delphi study, Chapter 9, being used as a base for its formal structure. Allowance was created within it to accommodate any further competencies that may have been unearthed during its use, and questions incorporated to determine considered ability levels. To this end, literature was researched to determine the most effective way of producing a questionnaire that would best serve the desired purpose. The final document can be seen in Appendix 6.

Questionnaire Design

Appendix 1, Research Strategies, provides more detailed explanations related to surveys and questionnaire designs and a summary of that, including the Appendix item references, is shown below:

- Conducting surveys was looked at, as before, with consideration given to methods described under item 1.3
- On the construction of a schedule or questionnaire Parten (1965) and Oppenheim (1992) offered many points that require consideration. These are listed under item 1.8
- Parten also explained the processes to follow in deciding upon which questions to include, and there are nine points described under item 1.9
- For methods to obtain information on what respondents think about particular issues or subjects, the opinions of Parten and Oppenheim were again viewed and these can be seen in item 1.10
- Oppenheim also offered a five point check list for constructing the questionnaire and this is again detailed in item 1.10
- Explanations on the types of questionnaires that can be used were set out by Oppenheim and are described under item 1.11
- Adding to Parten's methods of approach to the survey, Oppenheim considered additional ways and these are included in item 1.12

Greater emphasis on the initial response to an invitation, mentioned by Oppenheim, came from Alreck and Settle (1995), who claimed that research experience consistently showed that decisions on whether or not to co-operate with a survey were made within the first few seconds following an invitation. This, they added, was regardless of the method of invitation used, whether by post, telephone or in person. They therefore stressed the importance of the composition and delivery of the introduction, adding that if properly presented the reliability and validity of the study would be enhanced.

By necessity the Delphi study had been undertaken as a postal survey and the responses, albeit satisfying the requirements demanded of it, had been disappointing. However, for this survey, it was felt that the most effective method would be to

structure a series of personal interviews. It had been pointed out by Oppenheim that this method would be time consuming and costly but had the advantage of having a high rate of return. Therefore, provided that a well balanced set of interviewees was chosen, it was felt that this could provide the most satisfactory solution.

Having elected to carry out personal interviews using a purpose built questionnaire then information specific to this method was found from Fowler (1990) who described it as a conversation with a rationale. He did, though, point out the sources of error and these were used as a guideline in guarding against them:

1. Sample surveys are subject to sampling errors which occur when:
    - Some types of people are excluded from the sampling frame
    - The chance that by some probability the sample does not reflect the population from which it is drawn
    - When some people in the survey do not provide answers to all of the questions.
2. Questionnaire wording may have a bearing on the accuracy of the answers when:
    - They are misunderstood
    - Require information that the respondents cannot provide
    - There is an unwillingness to give accurate answers
3. Interviewer attitude can influence the amount and type of errors by:
    - The questions are being put to the interviewee incorrectly
    - There is a bias in the relationship between the two people
    - If the questions are recorded inaccurately
4. Data analysis can be influenced by errors during the process of entering the information when:
    - The judgement used in inputting the information is faulty
    - If data is entered incorrectly

Fowler argued that standardising surveys was a vital part of a measurement process with the intention being that each respondent could be offered the same questions and, also, that their answers could be regulated too. It was said that this aided the correct interpretation of those answers and ensured that any differences in them would reflect differences in the respondents rather than in the inquiring procedure. He considered

that there was a specific place for using this method, and he provided guidelines, as follows:

- It was inappropriate when the research was at an exploratory stage and the researcher discovering which questions to ask
- It was only once the questions had been defined that a standardised questionnaire could ask for answers
- It was important that the researchers assured themselves that the questions provided were both appropriate and comprehensive
- There was no necessity for a rigid set of questions as there could be some latitude in the structuring of the questionnaire
- Having a set format, which would define specific areas, could provide the flexibility of allowing the respondents to expand upon the set questions and offer additional explanations and detail about which the interviewer required information. This would mean that the researcher would not be looking at the interviews as measurement but as an information gathering exercise.

The form design gave consideration to all relevant information provided by the above authors. It also appeared to fit well with Fowler's description of its purpose, and was thought to be the best method of gaining more information on the categories of job competencies derived from the attribute base. Sixteen of the eighteen attributes from the Delphi study were incorporated into the form, omitting Good Personal Qualities and Relevant Experience which were not considered to be necessary for a training programme. It was decided that these attributes should be set out in the form of a check list based on advice from Parten, *op. cit.,* who said that where an issue was not sufficiently clear cut that it could be answered dichotomously then the interviewer could offer the interviewee a choice of differing opinions from which to choose an answer, thereby providing a totally comprehensive list from which to choose. This allowed information which could not be expanded by asking questions that could be answered dichotomously, but needed the respondents to be offered multi-choice questions, with an opportunity of adding their own work or knowledge to that already obtained. The main- and sub-headings did not strictly adhere to the Delphi study's ranking format but were re-configured into a sequence providing a more natural and logical flow of subject matter.

In addition to including attributes found from the previous studies it was felt that it would also be useful to request interviewees to offer their views on future estimating training and education. As with the other questions, these were designed in a structured format with multi choice tick boxes and an opportunity to add further ideas to those selected. This section contained defined answers or the opportunity for additional answers, so that each respondent could either agree or choose an alternative.

The construction design proposed by Parten, above, was to ensure that the form was brief to avoid possible rejection from recipients and to minimise disruption to their working days. As the form was controlled by the interviewer, its appearance was not necessarily as important as one where the questionnaire was to be posted but, nonetheless, it was felt that sitting alongside the respondent and showing them the questions as they arose helped with the interaction between the two parties and, therefore, designing the form with a professional appearance, as if it was to be sent by post, was judged to be useful.

11.4.4 Procedure

Before the interviews were arranged a preliminary trial was carried out with an Estimator colleague and although the questions were comprehensive the form was completed within a 15 minute period. This anticipated time period was incorporated into the letter of introduction.

With the essence being to derive as much additional information as possible, it was decided to try to carry out the interviews in a relaxed and informal manner, thereby hopefully encouraging the respondents to expand on their work, beyond the questionnaire structure. The personally known contacts were invited by telephone and other requests were sent either by e-mail or post, with a stamped addressed envelope for the return of those posted and a covering letter designed to, hopefully, capture their interest. The response from the personal contacts was excellent, with all six offering their help, but the remaining 45 invitations initiated a response of only one. Polite reminders elicited one more response and with a list of just eight a further 20 invitations were despatched, which produced five more acceptances and brought the total to 13.

To aid the question flow there were 15 main attribute headings used with 'ability to prepare select and appraise tenders' and 'ability to measure work and prepare BQs' placed under the 'cost estimating skills' heading and 'knowledge of contracts and contract law' sub-divided into separate headings.
Answers to questions during the interview and additional views put forward by interviewees were recorded at that time. The information obtained was analysed by the researcher and the results of the analyses checked by the supervisor. The information found, together with all new attributes and new main attribute categories, was prepared for transfer to the TNA/BoK, Chapter 12

11.5 Results

These are provided in percentage form below. The Delphi attribute rankings are shown in brackets where this is relevant.

1. Company Types

The information obtained from the questionnaires was shown to be spread over the complete spectrum of the CI and although not all companies worked exclusively in any particular sector there was a good coverage on all as can be seen below:

- Building 23.1%
- Civil Engineering 23.1%
- Building and Civil Engineering 7.7%
- Housebuilding 7.7%
- Building and Housebuilding 38.5%

2. Estimator Interviewee Job Descriptions

The Estimators interviewed held either Senior or Head positions.

- Senior Estimators 53.85%
- Chief Estimators 46.15%

3. Formal Education (14)

Most of the interviewees (84.7%) had obtained formal qualifications beyond secondary school level. The breakdown of qualifications obtained was as follows;

- 7.7% had reached GCE (now GCSE) standards

- 7.7% had reached A level standards
- 30.8% HNC
- 7.7% HND
- 46.2% Bachelors degree

4. Professional Education (15)

61.5% of the interviewees had gained a professional qualification, albeit not Estimator specific. Their qualification breakdown is as follows:

- 38.5% did not have a professional qualification
- 38.5% MCIOB
- 15.4% MRICS
- 7.6% IOBS (Institute of Building Surveyors, which is no longer in existence)

5. Cost Estimating Skills and Tender Appraisal (1 & 2)

Competitive Tenders

Eight different categories of competitive tenders were established, seven of which had been experienced by more than 50% of interviewees. The most commonly used were Plan and Specification, BQ and Drawings and Design and Build. A ninth category, Fee Contracts, was included on the questionnaire but none of the participants had been required to produce an estimate in this type. The tender types and percentage of Estimators that have carried out each form are listed below:

- Specification only 61.5%
- Plan and specification 100%
- Plan and quantified specification 69.2%
- BQ and drawings 92.3%
- Design and build 92.3%
- PFI 53.8%
- Frameworks 61.5%
- Target contracts 15.4%

Negotiated Tenders

Ten different categories of negotiated tenders were established, eight of which had been undertaken by more than 45% of the interviewees. The most commonly used

methods were Plan and Specification and Design and Build. As above, Fee Contracts were included in the questionnaire but not experienced by any of the participants. The tender types and percentage of Estimators that have carried out each form are listed below:

- Specification only 46.2%
- Plan and specification 92.3%
- Plan and quantified specification 53.8%
- BQ and drawings 53.8%
- Design and build 92.3%
- PFI 30.8%
- Partnering 61.5%
- Speculative housing 46.2% (This item is included as the work is carried out "in house" directly for the employer rather than as a competitive tender).
- Frameworks 46.2%
- Target contracts 15.4%

Estimating Process

The majority of estimating was still carried out by pricing a complete breakdown of trades (directly employed and "labour only" or using directly employed operatives only) and adding in assessed tender sums from specialist contractors. The process of using tenders from labour and materials contractors and specialists was being employed by 30.8% of Estimators. The processes that are employed to produce an estimate and the percentage of estimates produced by each process, with some companies carrying out more than one, were as follows:

- Directly employed trade, "Labour only" and Specialists 61.5%
- Directly employed trade and Specialists 15.4%
- Labour only and Specialists 7.7%
- Labour and materials contractors and Specialists 30.8%*

*Labour and materials contractors have been distinguished from Specialist contractors for a specific reason, explained in the *estimating methods* below.

Estimating Methods

Most estimators operated in the "traditional" way and therefore, where companies were solely using sub-contractors to carry out all their work the estimate breakdown was used as a cost check on tenders submitted by traditional trades contractors*. The methods that Estimators employed to complete the estimating processes shown above with some companies utilising more than one method, are listed below.

- Pricing Trades, Resources and Inserting Chosen Specialists 76.9%
- Pricing Trades as Check on Labour and Materials Contractors and Inserting Chosen Specialists 46.2%
- Inserting Labour and Materials Contractors and Chosen Specialists Only 30.8%
- Pricing Materials, Inserting Contractors Labour Costs and Specialist's 7.7%

*Traditional trades' contractors are, for example, Brickwork, Carpentry, Labouring and Groundworks who were previously either directly employed as tradesmen or employed as labour only sub-contractors offering their services supplying labour and materials in much the same way as would a specialist contractor carrying out electrical, mechanical work etc.

6. Ability to Measure Work and Prepare BQs (8)

Measurement

Where BQs were not provided as part of the tender documents, 100% of Estimators had experience of taking off quantities, mostly by hand, i.e. using a scale rule to obtain measurements. Alternative means were found to be a digitiser, an electronic measurement device that collects and collates measurements under the hand held control of the Estimator, and apparently a Planimeter, which is also a hand held instrument used for measuring areas. Estimators were also sending out their drawings for the quantities to be taken off by an external source, usually by a QS. The breakdown is shown below:

Taking off quantities was done;

- By hand 92.3%
- Using a digitiser 46.2%
- Using a Planimeter 7.7%

- Using an external source (QS) 15.4%

BQ Preparation

Once the quantities had been taken off, Estimators engaged in BQ preparation in a variety of ways. The majority using a PC either by entering the information manually or by having the digitiser produce the BQ as part of the take off process. Some were still preparing BQs by hand and some sending out to an external source to prepare them. See below for breakdown:

- By hand 23.1%
- By digitiser onto PC 23.1%
- By hand onto a PC 84.6%
- By being done by an external source (QSs) 30.8%

Estimator Training

All Estimators received some of their training "on the job" and a minority had further training either at a University/College or with a professional body. Broken down the figures were as follows:

- University/College 30.8%
- Professional Institutions 15.4%
- "On the Job" 100%

Preparation, Selection and Appraisal of Tenders

All Estimators interviewed were required to send out drawings and appraise tender returns and almost all were involved in selecting tender lists. The breakdown is shown below:

- Select tender lists 84.62%
- Send out drawings and documents 100%
- Appraise tender returns 100%

7. Pre-Contract Information and Advice (13)

Information for Client/Employer

Estimators' work extended beyond producing cost estimates and the majority were preparing Cost Analyses, Budgets, Cost Plans, Cash Flow Forecasts, and

Development Appraisals etc., at both pre- and post- contract stages. The list and breakdown of each is shown below:

- Cost Analyses 76.9%
- Life Cycle Costing 30.8%
- Cash Flow Forecasts 61.5%
- Budgets 84.6%
- Cost Plans 84.6%
- Development Appraisals 46.2%
- Feasibility Studies 30.8%
- Value Engineering 23.1%
- Value Creation 15.4%
- Programming 61.5%
- Planning 23.1%

8. Post-Contract Information and Advice (18)

Particularly with the development of the NEC Contract, costs of additional works were required to be agreed prior to their inception. As an area of estimating expertise, Estimators were sometimes expected to provide this information either for their project QS or for direct negotiation with the client's representative. Most were also collating information from actual site conditions for comparisons with original estimate costs and for future use. The percentage of Estimators undertaking this work was:

- Pricing additional works during the construction phase 46.2%
- Retrieving and analysing information and data for future use 84.6%

9. Negotiating Skills (12)

Pre-Contract

At the pre-contract stage Estimators were expected to use negotiating skills in discussions with clients' consultants. The percentages of Estimators found to be utilising these skills were as follows:

- Design and Build 84.6%
- PFI 38.5%
- Partnering 53.8%

- Frameworks 53.8%
- Integrated Teams 23.1%
- Target Contracts 15.4%

Post-Contract

At the post-contract stage some Estimators are required to negotiate prices with both materials suppliers and sub-contractors with the percentages as follows:

- Materials suppliers 15.4%
- Sub-contractors 53.8%

10. Knowledge of Construction (6)

Estimators obtained their knowledge of construction from three sources:

- University/College 84.6%
- PBs 53.8%
- "On the Job" 100%

11. IT Skills (7)

Estimate Preparation

Computers are being used to carry out estimates with 90% of Estimators using spreadsheets in some form and only 15.4% now carrying out the estimating task by hand. The breakdown was:

- By Hand 15.4%
- By Spreadsheet 92.3%
- By CAE software 46.2%

Use of Spreadsheets

When using spreadsheets for estimating, 30% of Estimators used it for applying addition and multiplication calculations only, a greater number extended it to automatic total updates linked to base information, and others developed the spreadsheet to perform in a similar way to CAE software. 10% did not utilise spreadsheets for this function at all. The breakdown is given below:

- Additions and multiplications only 23.1%
- Additions, multiplications and automatic total adjustments 38.5%

- Developed to near CAE level 30.8%
- None 7.7%

Knowledge of Spreadsheets

Estimators considered that their skill levels on operating spreadsheets were:

- None 7.7%
- Reasonable 69.2%
- Good 23.1%

Use of Historical Cost Data

Most Estimators retained and re-used data from previous estimates as below:

- Data from estimates stored 100%
- Stored data recovered for use in other estimates 92.3%

Electronic Document Transfer

Almost all Estimators interviewed had the ability to handle the complete range of document transfer electronically, as can be seen below:

- Specifications sent and received 100%
- Drawings sent and received 92.3%
- BQs sent and received 84.6%

Use of Microsoft Word Software

In general Estimators were expected to use Word although less than 10% had found this to be unnecessary and had no skills in its use. Their considered ability levels can be seen as follows:

- None 7.7%
- Reasonable 76.9%
- Good 15.4%

12. Knowledge of Contracts (11)

This was a 'combined' question that elicited information on the types of contracts that Estimators' experienced and the knowledge level that they felt was needed. Three contract types emerged of which they had knowledge and there were varied opinions

on the level of knowledge required on all forms. The majority of Estimators considered it necessary to have a working knowledge rather than knowledge of pre-tender clauses only. Having no knowledge was not considered an option but neither was it thought that a thorough knowledge was required. See breakdowns below:

Forms of Contract

- NEC 38.46%
- JCT 92.31%
- ICE 46.15%

Contract Knowledge Level

- No knowledge 0%
- Pre-tender clauses only 15.4%
- Working knowledge 84.6%
- Thorough knowledge 0%

13. Knowledge of Contract Law (11)

This was divided into a list of specific regulations that Estimators felt were useful to understand for the work their companies carried and out the knowledge level that was considered to be required.

Specific Regulations

There were ten sets of specific regulations that were considered required knowledge, two of which, Construction, Design and Management (CDM) and Housing Regulations were mentioned by every Estimator. The list is shown below:

- Building 46.15%
- Disability 15.38%
- Housing Corporation Design 15.38%
- Waste Management 23.08%
- CDM 100.00%
- Housing 100.00%
- National House Building Council (NHBC) 46.15%
- Speculative Housing 46.15%

- Building Research Establishment Environmental Assessment Method (BREEAM) 15.38%
- Streetworks Act 23.08%

Regulation Knowledge Level

As with Knowledge of Contracts above, it was thought by all that some knowledge was required but this was fairly evenly balanced between pre-tender and a working knowledge. Again, having no knowledge was not considered to be an option but neither was it felt that it should necessarily be thorough. The breakdown was:

- No knowledge 0%
- Pre-tender clauses only 53.8%
- Working knowledge 46.2%
- Thorough knowledge 0%

14. Communicational/Teamwork Skills (5)

The information available from estimates was communicated to QSs, Buyers, Site Managers and Office Management. The majority of this work took the form of costs and resources information with report writing being done to a lesser extent but most Estimators were expected to be able to provide it. Its distribution is as follows:

Users of Pricing Information

- QS 100%
- Buyer 92.3%
- Site Management 76.9%
- Office Management 76.9%

Users of Resource Information

- QS 76.9%
- Buyer 76.9%
- Site Management 76.9%
- Office Management 61.5%

Users of Reports

- QS 53.8%
- Buyer 38.5%
- Site Management 38.5%
- Office Management 61.5%

Working in Teams

All Estimators were expected to be capable of working on their own initiative but also, in the majority of cases, they were expected to be able to work within teams in order to complete the estimate, see as follows:

- Working as individuals 100%
- Working within teams 76.9%

15. Intelligence & Cognitive Ability/Style (3)

Innovation

Advantages could be gained for their companies by Estimators becoming innovative with construction methods and materials and almost all felt it necessary to maintain an awareness of new methods and products and gave consideration to methods of construction although this did not extend into design improvement for materials or plant; see as follows:

- Awareness of New Methods 92.31%
- Awareness of New Materials or Plant 92.31%
- Think About Improvements in Construction Methods 61.54%
- Think About Improvements in the Design of Materials and/or Plant 0.00%

16. Risk Management (10)

A necessary part of the estimating process was shown to be the need to assess the likelihood of risks so that costs could be allowed against each and also, if required, solutions for risk reduction or elimination offered. A high percentage of Estimators implemented this practice with consideration given to the following categories:

- Contractual risks 92.3%
- Financial risks 100%
- Personal risks 84.6%

- Provide solutions 76.9%

17. Commercial Business Acumen (17)

The estimating process also required considerations that may affect the business of the Estimators' companies. The list of items that needed consideration and the percentage of Estimators giving credence to each of these were as follows:

- Company profitability 100%
- Client satisfaction 76.9%
- Environmental issues 84.6%
- Resource issues 92.3%
- Project sensitivity 92.3%

18. Management Skills (16)

Most Estimators in senior positions were required to manage other people but not all were given training to prepare them for this task; see below for details:

- Required to manage individuals 84.6%
- Required to manage teams 69.2%
- Given management training 69.2%

19. Future Education and Training

These being open ended questions, participants were able to choose more than one option if they wished.

Future Formal Education

A large majority (76.9%) of Estimators expressed a desire to see a specific University course for Estimators and felt that it should be based on a "sandwich degree" and therefore, being mixed equally with work experience, it was felt that this would help to produce a more rounded Estimators' formal education of practical as well as theoretical understanding. Everyone wanted to see the introduction of a specific formal education in some form. Significantly, no one regarded a formal education as unnecessary. The list of proposals was as follows:

- Foundation degree 0%
- Bachelors degree (Full Time)23.1%

- Masters degree 0%
- Bachelors degree (Sandwich) 76.9%
- HNC 7.7%
- Not necessary 0%

Future Professional Education

The preferred organisation (61.5%) was for the CIOB to provide an Estimating course and qualification but there was also support for the RICS, the ICE and to the possibility of either a new Estimator specific institute or a University/Employer joint venture, although an NVQ from the CITB drew no support whatsoever. As with Formal Education, the desire for its inception was unanimous and the lack of such a provision was not considered an option. The list of possibilities ranged as follows:

- RICS 38.5%
- CIOB 61.5%
- ICE 15.4%
- New Estimating Institute 23.1%
- University/Employer joint venture 15.4%
- NVQ from CITB 0%
- Not necessary 0%

Future Ongoing Training

There was strong support for training being provided from two sources, PBs and employers, particularly towards PBs and also a relatively strong inclination for a University/Employer joint venture but again, no support for the CITB. Anecdotally, ongoing training appeared to be perceived as a nuisance but all interviewees favoured its introduction although, again, with no enthusiasm for this being carried out by the CITB, in any form. The complete list is as follows:

- With PBs 69.2%
- With employers 61.5%
- University/Employer joint venture 30.8%
- CITB/Employer joint venture 0%
- CITB 0%
- Not necessary 0%

20. Additional Attributes

The interview questionnaires were designed to allow for additional information on each attribute included and where this was provided it has been shown above. However, during the course of the interviews, two major additional attributes were confirmed that had only been gleaned from one company in the early pilot interviews and one company in the ethnographical study. These may have held more significance had they been shown to have a more widespread use but the studies that had produced the overwhelming majority of the attribute list had all failed to disclose any use at all. Discovering that more than 60% of the Estimators interviewed with this questionnaire were carrying out programming gave this sufficient weight to be included as a further main attribute. These items have been included in Information for client/employer, item 7, above. The percentages of use were as follows:

- Programming 61.5%
- Planning 23.1%

It should be noted that 7.7% of the Estimators providing this service had been freed completely from pricing individual trade rates.

The Estimators carrying out this work supplied detailed work content, which will be included in the TNA that follows.

21. Participating Company Size

Of the 13 companies that took part in the survey all were producing turnovers in excess of £1m and the majority in excess of £10m. See breakdown below:
Turnover £1-10m 23.08%
Turnover in excess of £10m 76.92%

11.6 Conclusions

The survey was intended to enhance the collection of attributes and form a link to the production of a TNA. This was achieved but in its development it became clear that there were areas of weakness in Estimator skill levels. It has been shown that the estimating process extended far beyond the calculation of project costs and seemed to have placed additional demands on Estimators that they had not all been trained to

undertake. With such a diverse range of project procurement methods, and with some companies preferring to prepare estimates by hand, there were doubtless going to be many occasions when, in changing companies, Estimators would lack the computer skills needed by companies using CAE software or spreadsheets, and negotiating skills or pre-contract costing skills required by companies carrying out D and B, Partnering or PFI contracts. This would not only limit their ability to perform efficiently but also the ability of their employers to provide the services expected of them, until the necessary skills have been developed and matured. A rounded training programme would aid both the employer and the employee in such situations.

The Estimators interviewed were all of senior level or above and, in the majority of cases, had gained qualifications from Colleges, Universities or PBs. However, only 15.4% said that they had received any training or education in pricing estimates from their PBs and similarly only 30.8% from Colleges or Universities. In the main, experience and knowledge had been accrued at the workplace.

On future education and training, a strong desire and support was shown by Estimators for a specific ETP provision, both at a formal and professional level. This would necessitate employers, Universities and existing PBs playing a much more prominent role in Estimator development, particularly in the creation of courses and training schemes designed to meet their needs and the needs of the companies employing them. When told that the purpose of the interviews was to provide information to aid the production of training and educational programmes, a common remark from those being interviewed was, “it’s about time”, which was a clear indication that they realised and needed the value that could be gained from such schemes. Estimators also talked informally about the difficulties being experienced in recruitment, both in quality and in numbers, and many expressed a view that specific University courses would enhance the possibilities of employing Estimators of better educational standards and skill levels as well as increasing their numbers.

As the final study on the accumulation of attributes, a widespread list was produced to aid the development of a TNA for Estimators. However, as the thesis grew so also did awareness that Estimators’ requirement for a broad knowledge and skill base was being met in a haphazard manner. While QSs were offered the opportunity of a

comprehensive education and training, which displayed confidence in their abilities, both to the QS and the employer, and allowed them to enter employment in any company without there being concerns on varying demands, the same can not be said for Estimators. With a need for them to be able to work with accuracy and to demanding deadlines, then their capabilities have to be high in order for this to be successful. From personal experience there have been a number of QSs who have undertaken estimating work and have then refused further similar work. This they said was due to a dislike of the extreme pressure that they were placed under during the tender period, specifically with time deadlines and the effort required obtaining sub-contract prices in time. They also added that questions from contractors on their individual pricing decisions made them feel that their work was under constant scrutiny. That is an example of what working under pressure means and it demonstrates that the estimating role requires not only a high level of KSAs but also great resilience in carrying out tasks with precision under pressures that many other roles do not experience.

Chapter 12 - Estimator Training Needs Analysis

12.1 Introduction

The research in this thesis has demonstrated:

- A changing and expanding Estimator role which, to date, had not been fully defined
- A limited availability of appropriate education

The development of an Estimator TNA could help to address this by identifying where skill deficiencies and training needs lie within the Estimator workforce and was, therefore, a natural progression. By reviewing 21st century literature and summarising and synthesising the preceding studies a structured list of required and desirable attributes could be compiled, from which specific training and education programmes could be developed.

A TNA was defined as analysing identified job requirements in a way that would enable them to be addressed by the best possible means (Williamson 1993). He also said that not all needs could necessarily be answered by the provision of training, and that in identifying needs it was important to ensure that they could be met by a training solution. In this regard, intrinsic ability, personality and intelligence, which may often be essential job requirements, would not be considered to be attributes that can be taught and thus would not be expected to be listed as training needs. Taylor and Furnham (2011) described TNAs as a means of discovering the needs of organisations and the abilities of individuals in present and future situations. In a collective way, they said, such an analysis would identify development needs in KSAs and that using TNAs identified requirements that enabled individuals and organisations to become more efficient. A description of pertinence to this study came from Accelerating Performance (2011) in that TNAs were suitable for organisational or role changes where they could identify competency and behavioural requirements. Entrepreneur (2011) added that they were used to overcome or limit the shortcomings of individuals or organisations by the identification of means of training or development. Mitchell (2011), while agreeing with the authors above, added that questions needed to be crafted with care preferably using two or three people to

design the questions that would obtain the necessary information. This was expanded on by Hicks and Hennessy (1996) in giving consideration to the application of psychometric principles when developing training needs questionnaires.

Advantages given for the use of an effective TNA are:

- Being in possession of the right knowledge, skills and behaviour aids the ability of organisations to achieve targets and deliver an acceptable service
- Enables staff to develop and achieve goals
- Increases job satisfaction
- Helps to retain staff
- Tailors training to more cost effective needs identification
- Establishes areas of needs that require development
- Identifies requirements of individuals, teams and organisations
- Identifies areas of development to accommodate future changes

(Taylor and Furnham, 2011)

- Investing in an analysis ensured a greater return on an investment
- Determined key performance and business needs
- Identified knowledge and performance gaps not clearly evident

(Accelerating Performance 2011)

- Resources target identified priorities
- Enhances performance
- Enhances progress towards "Investors in People" as a TNA is one of that organisation's key standards

(Entrepreneur, 2011)

Disadvantages are said to be:

- Team appraisals need to be conducted before needs can be identified
- Learning outcomes need to be clear and measurable

(Taylor and Furnham, 2011)

- Time and energy required to plan and analyse the results
- Results need to be coordinated between managers in order that the plan is reflective of the company rather than just one area
- Requires total involvement of individuals involved

- Managers of the process require training

(Entrepreneur, 2011)

- Gathering information for the TNA is a process that requires specific skills

(Mitchell, 2011)

The decision to include an Estimator TNA in this thesis was made because, as far as could be established, in the UK CI no Estimator-specific document had been produced. Similarly, a TNA for any specific profession was not discovered although the probability was that if these were done then they would have been prepared for individual organisations and, therefore, being privately financed would mean that they were unlikely to be in the public domain. Furthermore, they would be likely to be situation-specific and, therefore, limited to individual organisations rather than offering widespread information. The Estimator BoK, also, does not appear to have been produced before and, again, there is little evidence of such a document existing within the major UK CI professions. Extensive searches found that a BoK existed for Project Management, produced by the Association of Project Management (APM) (2010). The only other such document found was from the Project Management Institute UK Chapter (PMI) (2011), an organisation based in the USA with a UK branch. Searches of all main PBs representing Architecture, Building, Engineering (Civil, Structural, Electrical and Mechanical), Surveying (all branches under the umbrella of the RICS) and Health and Safety failed to unearth a BoK for their organisations. One PB, the ICE was marketing a BoK by McCuen et al (2011) but this was written for the American Society of Civil Engineers (ASCE). This Estimator TNA/BoK, therefore, offered the significant advancement of documented knowledge on which to base the development of an Estimator PB. In addition it would have the secondary pay-off of informing customised training packages within the industry. Moreover, the highlighting of discrete skills made it conceivable for Estimators to justify a claim for professional status.

12.2 Research Aims

The proposal was to develop a customised Estimator TNA prototype from a review of updated literature on the estimating practice and a list of job requisites that had been identified from a number of different areas of research in this thesis. This was the

culmination of the fourth main objective and established the KSA requirements that could also be used as a BoK for estimating. As it appeared to be the first time that such information had ever been produced in the UK, for Estimators, then there would be the added benefit of enabling specific attention to be concentrated upon these skills within future Estimator education and training programmes (the completed TNA to be found at 12.5, specifically at Tables 66-73, below):

12.3 Research Method

The revised IRS that was described by Blaikie and used in Chapters 3, 4, 5 and 11 was adopted for this study as a means of collating, analysing and classifying information on Estimator attribute requirements from the appropriate studies in this thesis. These techniques are relevant to this study in establishing an Estimator TNA which incorporates an Estimator BoK. The technique has also been used in CI literature - for example, The National Heritage Training Group (NHGT) (2008) produced a skills needs analysis to aid the revival of traditional building craft skills.

The methodology, shown below, was used to combine with this research method.

12.4 Methodology

12.4.1 Design

To collate, analyse and classify the information on Estimator attributes the revised IRS method, described in Chapter 3, used a triangulation of techniques to provide the necessary data.

The revised IRS disadvantages, described in Chapter 3, together with the disadvantages relating to the data collection methods and the TNA preparation were addressed in this study by the following means:

1. Reliability and Validity
    - Reliability of information on "what" questions necessary for entering into the TNA had been established in the previous studies eg. The collection of job attributes in Chapter 7 by using random sampling methods and the supervisor independently checking the data

- Data input into the TNA, taken from the PBs and literature reviews, Pilot Estimator Interviews (Chapter 5), Estimator/QS Job Attribute Comparison (Chapter 7), Delphi Study (Chapter 9), Ethnographic Study (Chapter 10), and Estimator Skills Questionnaire (Chapter 11), was independently entered by the supervisor and researcher and then correlated
- Content validity was enhanced by ensuring that the comprehensive range of data included in the TNA represented the purpose for which the study was intended, was contributed to by the many experts in the field of estimating, judged by the researcher and independently corroborated by the supervisor
- Construct validity was addressed by ensuring that the TNA fulfilled the purpose for which it was intended by including main category data that was relevant and classifying it in a format that had been developed and organised, by the use of experts, in the Delphi study
- Face validity was aided by the completed TNA having the appearance of containing the information intended, arranged and developed logically and meeting its objective
- Any shortcomings of a psychometric nature in the data collection methods were minimised by the variety of collection sources and triangulation of techniques

12.4.2 Sources of information used to develop job attributes

Literature on estimating, published since the studies in this thesis were carried out, was researched in order to find any further attribute requirements that may have emerged with the increased use of new industry procurement methods. This found an additional 9 sources from published authors.

Estimator job attributes were found from 178 individuals/organisations who took part in previous studies in this research, these being:

- PBs and literature reviews – 12 individuals/organisations
- Pilot Estimator Interviews (Chapter 5) – 6 individuals

- Estimator/QS Job Attribute Comparison (Chapter 7) – 108 individuals/organisations
- Delphi Study (Chapter 9) – 27 individuals
- Ethnographic Study (Chapter 10) – 12 individuals
- Estimator Skills Questionnaire (Chapter 11) – 13 individuals

12.4.3 Materials

A customised TNA instrument was developed from information derived from the sources shown above. The sets of data emerging from this information were collated to yield an occupational profile of Estimators. This profile, in conjunction with the performance levels on the tasks that comprised it, should provide a measure of training needs within the sample. In customising a format with which to record the information on training needs guidance was obtained from published literature on TNA development which showed the considerations and decisions that had been made in order to produce the TNA, shown below:

Goldstein (1993) says that the analysis was of the job that employers required to be performed for the benefit of the organisation and explained these procedures as:

1. 'Job Description', which specified the obligations and special conditions needed to perform the function
2. 'Task Specification', which described the KSAs that would be essential in the individual in order for them to perform their obligations successfully. This needed to be a complete list of tasks that afforded information on "what", "how", "when" and "why" the work was done. In addition it may also be necessary to sub-divide the tasks into levels of importance and frequency of performance. In developing these KSAs there would be a need to establish which of these were:
    - Essential to the job performance
    - Expected of the person prior to employment
    - Required to be taught in "off the job" training

Having developed a Task Specification, Goldstein proposed that the tasks within this specification be organised into what he called Task Clusters, these being a list of headline tasks into which individual tasks were collected. Once these had been

determined, the preferred procedure was to use a group of experts to independently sort individual elements into the group headings. There was, he said, a need to obtain consensus on this and that it may be necessary to refer back to the experts and re-work the results until a consensus had been achieved.

A definition of KSAs was offered by Prien (1977) (cited in Goldstein, 1993 p.62) who offered these categorisations below:

a) *"Knowledge is the foundation on which abilities and skills are built. Knowledge refers to an organised body of knowledge, usually of a factual or procedural nature, which, if applied, makes adequate job performance possible. It should be noted that possession of knowledge does not ensure that it will be used.*"
b) "*Skill refers to the capability to perform job operations with ease and precision. Most often skills refer to psychomotor-type activities. The specification of a skill usually implies a performance standard that is usually (sic) required for effective job operations*."
c) "*Ability usually refers to cognitive capabilities necessary to perform a job function. Most often abilities require the application of some knowledge base*."

Examples of these definitions offered by Goldstein were:

a) Knowledge
    - Having a good understanding of subjects e.g. law, building and engineering construction etc
    - Knowing what was required to carry out tasks
b) Skill
    - Copying information accurately
    - Writing legibly
    - Dexterity
    - Practised ability
    - Expertise
c) Ability
    - Being able to recognise peoples strengths and weaknesses
    - Organisational expertise

- Communicational capability
- The recognition of useful information produced by others
- Dispute resolution

In an effort to simplify the distinction, Goldstein gave an example of hitting a golf ball as that of there being a difference between having knowledge of how to hit it and the ability to achieve it. He also said that there were times when it was difficult to decide what should be knowledge, skill or ability and that in these situations it was important to ensure that each item appeared in at least one form. Freidson (2001) offered some help on a distinction between knowledge and skill by saying that skill was the capacity to use knowledge in order to complete tasks and that it could be a natural gift or entrenched in experience, although could not necessarily be taught.

The next step, Goldstein said, was the necessity of knowing which the important tasks were and which were frequently used. He also included determining which KSAs were important and which were difficult to learn. Wills (1993) said that an individual's developments had to be met whilst also meeting the skills requirements of the organisation. An extra dimension was added by Williamson (1993) who emphasised the necessity to separate needs into those requiring training and those requiring education. He described the complete learning process as that of a pyramid, in which the base was formed from life experiences onto which was added education and finally training at the top. Choosing the correct method for arriving at each training need, he suggested, would be critical to the TNA process.

The purpose of the design was to produce an all-encompassing list of Estimator KSAs that ensured that the recorded attributes were transferable across the industry, using detail from the literature reviewed above. Setting out the TNA in this way offered information that could be used for education and training provision in a general and/or specific manner. In doing so it provided a format that would classify attributes that:

- Need to be looked for when selecting individuals for a specific job
- Require a formal and/or professional education
- Can be attained with training by the employer either "in house" or via an external course.
- Can be developed with experience

Whilst due attention was paid to Goldstein on the designation of KSA importance levels, gathering information on frequent use and task learning difficulty were not included as it was considered impractical to obtain that type of information with an attribute list of over 150 items and with a wide variety of estimating methods having been shown to be used across an industry of around 183,000 companies according to The Department of Trade and Industry (Dti) (2006) figures for the third quarter period of 2005. As an alternative each task was allocated a cell in the TNA for the sources of information that had disclosed the task. In each of these cells was placed the number of companies/main sources that revealed the task, expressed as a percentage of the companies involved in each study. As each of the studies had been small in comparison to the size of the industry it was unlikely that this information would be definitive but it should, nonetheless, be useful as an aid to placing an educational emphasis in a particular area for educators and trainers.

Therefore, from the literature and the decision made on task usage a format was developed displaying all of the relevant requirements in a 13 column structure. It is described alongside each column number, below:

1. Item number for each sub-attribute identified
2. Main and sub-attribute categories/BoK (from Delphi and Training Needs Questionnaire (TNQ))
3. Source from where attributes discovered (eg. Pilot interviews, Delphi etc.)
4. Knowledge required for specific attributes
5. Skill required for specific attributes
6. Ability required for specific attributes
7. Essential to job performance
8. Expected prior to employment (separated into trainee, assistant and estimator categories)
9. Requiring education
10. Requiring “on-the-job” training
11. Requiring “off-the-job” training
12. Times mentioned in percentage terms (a number in these columns indicates the number of organisations/individuals that took part in each of the studies)
13. Importance ranking for each main heading (taken from the Delphi study and Training Needs Questionnaire)

12.4.4 Procedure

A literature review was carried out of 21st century publications to discover attributes that may have emerged since the studies in this research were prepared. These were collated and tabulated by the researcher prior to transfer and allocation to their allotted section in the TNA. The supervisor checked the transfer from table to TNA, KSA selection and percentage calculation of 'times mentioned', as with the other attributes. Consensus was achieved between supervisor and researcher on the positioning of attributes into their main categories.

In analysing the information relating to job attributes account was taken of Williamson, *op. cit.,* who said that not all needs could be met by training. Therefore, the Estimator attributes developed during this research were carefully screened and categorised in order that an effective solution could be produced. This was done independently by the supervisor and researcher, and then correlated. The procedure was as follows:

1. Selecting group headings for the attributes:
2. Selecting importance levels for group headings
3. Selecting individual attributes for each main group
4. Assessing the education/training requirement for each attribute
5. Calculating and recording the number of times each attribute had bee mentioned in the studies fro which data had been collected
6. Entering the importance ranking for each main group of attributes

The Delphi study had provided the information on group headings and their importance rankings and this was considered to be the most feasible method of satisfying Goldstein's principles. Additional main categories, discovered during the ethnographical study and the TNQ, were then placed at the end of the list of importance rankings, on the basis that as they weren't mentioned in the Delphi study their use was not considered to be as regular or widespread as the categories that were.

A list of 18 main attribute group headings were then placed in the form in their rank order and sub-attributes assembled under each, together with information on the source. The ethnographical study presented additional individual attributes and the

TNQ expanded on the work with information on further tasks and by confirming an additional main group, Programming and Planning, which brought the total number of groups to 19. Decisions were then made on whether each attribute required:

- Knowledge
- Skill
- Ability
- Was necessary for job performance
- Was needed prior to employment
- Education
- Training

These decisions, demonstrating the selection methods for each column within these headings, are explained by two examples, below. Items a-j being measured dichotomously, marked with a ✓ for yes and left blank for no:

1. ***Cost Estimating Skills (rank 1, item 3, assess site conditions).***
    a. *Does it require knowledge?* Yes, of the methods of operation required to carry out the project and of how different conditions can affect construction operations e.g. limited working space, adjacent buildings, ground conditions, overhead cables, storage space
    b. *Does it require skill?* As Goldstein said, it is sometimes difficult to distinguish between skill and ability and the group heading uses "skills" in its title but the use of the word is intended as an 'all encompassing' expression to describe KSAs. If taken literally, as Goldstein's explanation, then probably not on the basis that there would be no dexterity needed to carry this out. This was decided as a no
    c. *Does it require ability?* Yes, to make an assessment on whether or not these conditions may impact on the construction process and decide upon what would need to be done to overcome the problems
    d. *Is it essential to job performance?* Yes, otherwise there would be no cost provision made
    e. *Would it be expected of Trainees?* No, but acquiring the knowledge and ability necessary during training should be expected

f. *Would it be expected of Assistants?* Probably not, but they would be expected to be developing an understanding at this stage
g. *Would it be expected of Project Estimators?* Yes, they would be required to make such assessments to enable them to produce accurate financial costing of the work necessary to overcome site condition problems
h. *Does it require education?* Yes, at the very least in providing knowledge of construction methods, techniques and process sequences etc. and of the resources necessary to enable the work to be assembled
i. *Does it require "on-the-job" training?* Yes, observing work being carried out is essential to developing an understanding of the problems that can occur that may hamper this process and discovering what techniques are used in varying situations and conditions to overcome difficulties
j. *Does it require "off-the-job" training?* Not necessarily. This could be provided, if required, but sufficient experience ought to be gained from education under 'on-site' conditions
k. *How often was this mentioned?* Observations during the ethnographical study showed Estimators visiting sites, pre-contract, and making assessments of conditions. All companies involved were seen to do this and therefore it was rated under the Ethnographical Study column as 100%. The Delphi study had a collective item of Cost Estimating Skills, but not specifically assessing site conditions, this showed ten of thirteen companies (76.92%) mentioning the work No other study produced this information and the remaining columns are therefore blank
l. *Where is the Importance ranking?* There is no importance ranking provided for individual items, just main heading items. The main Cost Estimating Skills heading is shown ranked **1**. Some knowledge of the individual item's importance can be gleaned from within the "times mentioned" section

2. IT Skills (rank 7, item 12, use computer aided estimating software)

a. *Does it require knowledge?* Yes, it is necessary in order to produce an accurate estimate and, how to use a computer, and how to operate CAE software programmes

b. *Does it require skill?* Yes, in computer operation, setting out the work in a manner that can be understood by others, using a keyboard etc.

c. *Does it require ability?* Yes, all the abilities needed in producing an estimate plus being able to organise the work under whatever controls may be imposed by the software etc

d. *Is it essential to job performance?* Not necessarily. Estimates can always be produced by hand, without any aid from a computer, but it is likely that, increasingly, employers will be using computers for this work and will therefore be expecting their Estimators to have experience in this field. To this end it may eventually become a necessity

e. *Would it be expected of Trainees?* No, but acquiring the knowledge and ability necessary during training should be expected by all employers who use CAE.

f. *Would it be expected of Assistants?* Probably not, but they would be expected to be developing an understanding at this stage, with all employers who use CAE.

g. *Would it be expected of Project Estimators?* Not necessarily, but all employers will expect their Estimators to use CAE, if this is their method of working. It would be unlikely that they would make exceptions for individuals as this would impair the operational methods that would have been adopted with computerisation

h. *Does it require education?* Yes, in providing the KSAs necessary to operate CAE software

i. *Does it require "on-the-job" training?* Yes, in providing the KSAs necessary to operate CAE software and its implementation and adaptation to specific employers' requirements

j. *Does it require "off-the-job" training?* Yes, if a specific CAE package from software suppliers is being used then it is likely that the suppliers

will provide training on its use, which might well be at their premises where all the necessary facilities will be in place

k. *How often was this mentioned?* Ads/PBs/Literature showed one mention from eleven sources (9.09%), the Pilot study had five of six interviewees using CAE in some form (83.3%), of the thirteen companies interviewed for the TNQ, six used CAE (46.15%), the Ethnography study saw two of four companies using it (50%), and the Delphi study had five of thirteen companies mention IT, although not specifically CAE (38.46%)

l. *Where is the Importance ranking?* See Cost Estimating Skills above

Each individual item and group heading was assessed in the same manner as the examples above. However, positive assessments should not necessarily be deemed definitive because, to repeat Goldstein on KSAs, it can sometimes be difficult to decide. The most important issue was that the list of tasks should be as comprehensive as possible and then any changes in emphasis, if thought necessary, could be decided upon by the individuals or organisations using the analysis.

A ✓ was displayed in the corresponding cell of each sub-attribute where a requirement was considered appropriate and, on completion, consensus was obtained between researcher and supervisor. Percentage calculations of the times each attribute was mentioned, in each study, were presented in the appropriate cells. The importance ranking for each main heading was entered.

A column in the table, indicating the percentage of times mentioned also had a percentage value set into the main group headings as, in these cases, the information from different studies gave the main heading as an individual attribute, sometimes without further breakdown, and this was therefore the only possible place for a percentage indication from that source. The percentages shown in these positions were set in ‘bold’ alongside their group headings.

Some individual items were highlighted within headings, ‘Intelligence’ (ranked 3) and ‘Communication’ (ranked 5) because these were attributes offered by QSs rather than Estimators. The decision to include them was made on the basis that being personal

and social qualities rather than specific functional attributes it was considered that they could enhance the analysis as professional qualities that Estimators could aim to attain. It was also mentioned by Williamson, above, that not all needs could necessarily be answered by training, stressing that natural ability, personality and intelligence were often essential job requirements but not attributes which could be taught. The inclusion of these natural and personal items was, therefore, done to provide additional informational benefits for employers when looking for the best quality and the most suitable candidates to perform specific roles

12.5 Results

Information on Estimator attributes and CI procurement methods with which Estimators would be expected to work were discovered and are shown in Table 65, below, together with the applicable author references.

Table 65 Estimator Attributes from Updated Literature

Estimator Attributes from Updated Literature		
Main Category	**Attribute**	**Author**
Cost Estimating Skills	Analyse Data	Buchan, et al, (2003)
	Price by Unit of Occupancy	Brook (2008)
	Price by Superficial Area	Brook (2008)
	Price by Elemantal Cost	Brook (2008)
	Price by Volume	Brook (2008)
	Operational Estimating	Brook (2008), Ashworth and Willis (2008)
	Calculate Unit Rates	Ashworth and Willis (2008)
	Collate Cost Information	Brook (2008), Akintoye and Fitzgerald (2000)
	Prepare Cost Estimate	Brook (2008), Buchan, et al, (2003), Akintoye and Fitzgerald (2000)
	Develop Database	Brook (2008), Buchan, et al, (2003), Akintoye and Fitzgerald (2000)
	Rebase Cost Data	Brook (2008)
	Logistical Planning	Brook (2008)
	Analyse Health and Safety Issues	Buchan, et al, (2003)
	Calculate Net Unit Rates	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Calculate All-In Labour Rate	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Calculate All-In Plant Rate	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Obtain Quotations for Plant, Materials and Sub-Contractors	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Insert PC and Provisional Sums	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Calculate Preliminaries and Overheads	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Check Calculations	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Range Estimating	Akintoye and Fitzgerald (2000)
	Parametric Estimating	Akintoye and Fitzgerald (2000)
Ability to Prepare, Select and Appraise Tenders	Send Information to Sub-Contractors	Buchan, et al, (2003)
	Tender Adjudication	Ashworth and Willis (2008)
Intelligence, Cognitive Ability/Style	Numeracy	Buchan, et al, (2003)
Good Communication/Teamwork Skills	Information Transfer	Brook (2008), Akintoye and Fitzgerald (2000)
	Visit Consultants	Brook (2008)
	Intuition	Akintoye and Fitzgerald (2000)
IT Skills	IT	Ashworth and Willis (2008)
	Electronic Communication	Ashworth and Willis (2008)
	CAE	Buchan, et al, (2003), Akintoye and Fitzgrald (2000)
	Spreadsheets	Buchan, et al, (2003)
	Word Processing	Buchan, et al, (2003)
Ability to Measure Work and Prepare BQs	Prepare BQ	Brook (2008)
	Measure Approximate Quantities	Brook (2008)
Risk Management	Risk Management	Brook (2008)
	Monte Carlo Simulation	Brook (2008)
	Risk Analyses	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
Knowledge of Contracts and Contract Law	Partnering	Brook (2008), Ashworth and Willis (2008)
	D & B	Brook (2008)
	Management Contracts	Brook (2008)
	Construction Management Contracts	Brook (2008)
	PFI	Brook (2008)
	Prime Contracts	Brook (2008)
	Lump Sum Contracts	Brook (2008)
	Fixed/Firm Price Contracts	Brook (2008)
	Measured Contracts	Brook (2008)
	Cost Reimbursement Contracts	Brook (2008)
	JCT Contruction Management Agreement Contracts	Brook (2008)
Good Negotiating Skills	Post-Tender Negotiation	Brook (2008)
	Contract Negotiations if Tender Successful	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
Able to Provide Pre Contract Financial and Construction Advice to Client/Employer		
	Design to Cost	Brook (2008)
	Determine Best-Value	Brook (2008), CIOB (2009), Ashworth and Willis (2008)
	Target Cost Plans	Brook (2008)
	Final Tender Reviews	Brook (2008), Ashworth and Willis (2008)
	Tender Analyses	Brook (2008)
	Bidding Strategies	Brook (2008), Ashworth and Willis (2008)
	Cash Flow Forecasts	Buchan, et al, (2003)
	Benchmarking	Brook (2008), CIOB (2009), Ashworth and Willis (2008)
	Settlement meetings	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Prepare Summaries	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
Able to Provide Post Contract Financial and Construction Advice to Client/Employer		
	Prepare Estimators Reports	Ashworth and Willis (2008)
	Involvement if On-Line Auctions	Brook (2008)
	Involvement in Reverse Auctions	Brook (2008)
	Prepare Reports	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)
	Transfer of estimate information to site and management teams	CIOB (2009), Holdroyd (2002), Harris, et al, (2006), (Brook (2008)

Information from the previous studies was shown in the Results section of each study.

12.6 TNA Instrument

The completed TNA covered 19 main Estimator job requirement categories and identified each one by the means and priorities of training. These categories were broken down into sub-categories and both the main- and sub-categories offered clear guidelines for training providers to help them distinguish category:

- Importance levels
- Essential to job performance
- KSAs expected prior to employment for all Estimator grades
- Requiring training on- and off-the-job
- Requiring education

These main group headings (in rank order) and individual attributes selected for each, together with the required information, are displayed on the form in Tables 66-73, below. The main category headings together with their individual attributes can also be used as a tabulated “Estimator body of knowledge”:

Table 66 Estimator Training Needs Analysis (p.1)

Key to Abbreviations: Delphi-Delphi Study: **Ads**-Job Advertisements & Estimator Formal Education Study: **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study: **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Training Needs Analysis (page 1)
Summary of Tasks from Individual Studies

Item	Categories	Source	Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment: Trainee	Expected Prior to Employment: Assistant	Expected Prior to Employment: Estimator	Requiring Education	Requiring Training: On the Job	Requiring Training: Off the Job	Mentioned %: Ads/PBs/Lit (19)	Mentioned %: Delphi (12)	Mentioned %: Pilot (6)	Mentioned %: TNQ (13)	Mentioned %: Ethnography (4)	Importance Ranking Delphi/TNQ
	Cost Estimating Skills	Delphi	✓	✓	✓	✓			✓	✓	✓			**76.92**				1
1	Analyse Health and Safety Issues	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓	✓	5.26					
2	Analyse Individual Rates	Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓			76.92		100.00		
3	Analyse Information and Data	Ads/PBs/Lit/Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓		5.26	76.92		100.00		
4	Assess Site Conditions for;	Eth	✓		✓	✓			✓	✓	✓						100.00	
	Access, Storage and Accommodation, Logistics, Working Space, Ground Conditions, Security and Protection, Impact on Surrounding Area																	
5	Awareness of New/Alternative Materials	TNQ/Eth	✓		✓	✓			✓		✓					92.31	25.00	
6	Awareness of New/Alternative Plant	TNQ/Eth	✓		✓	✓			✓		✓					92.31	25.00	
7	Awareness of New/Alternative Working Methods	TNQ/Eth	✓		✓	✓			✓		✓					92.31	25.00	
8	Awareness of Changes in Costs	Ads/PBs/Lit/TNQ/Eth	✓		✓	✓			✓		✓		5.26			100.00	25.00	
9	Awareness of Changes in Exchange Rates	Ads/PBs/Lit	✓		✓					✓	✓	✓	5.26					
10	Awareness of Changes in Regulations	Delphi/TNQ/Eth	✓		✓	✓			✓		✓			8.33		69.23	25.00	
11	Build Up All-In Labour Rates	Ads/PBs/Lit/Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓		21.05	75.00		100.00	100.00	
12	Build Up All-In Plant Rates	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓		21.05					
13	Build Up Individual Rates	Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓			75.00		75.00	100.00	
14	Calculate Manually	Delphi/Eth	✓	✓	✓	✓			✓	✓				75.00			50.00	
15	Check Calculations	Ads/PBs/Lit	✓	✓	✓	✓	✓	✓	✓	✓	✓		21.05					
16	Check for Omissions and Errors	Eth	✓	✓	✓	✓			✓	✓	✓						50.00	
17	Collate and Calculate Information and Data	Ads/PBs/Lit/Delphi/TNQ/Eth	✓		✓	✓			✓	✓	✓		47.37	16.67		100.00	50.00	
18	Cost Preliminaries	Ads/PBs/Lit/Delphi/TNQ//Eth	✓	✓	✓	✓			✓	✓	✓		36.84	75.00		100.00	100.00	
19	Create "What If" Scenarios	Eth	✓	✓	✓					✓	✓						25.00	
20	Decide on Preliminaries	Ads/Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓		25.00	75.00		100.00	100.00	
21	Design Temporary Works	Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓			16.67		100.00		
22	Estimate Preparation	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓	✓	42.11					
23	Insert PC and Provisional Sums	Ads/PBs/Lit	✓			✓		✓	✓	✓	✓		21.05					
24	Knowledge of Construction Costs	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓		21.05					
25	Logistics	AdsPBs/Lit/Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓		5.26	8.33		100.00		
26	Making Decision to Tender	Ads/PBs/Lit	✓		✓	✓			✓		✓		26.32					
27	Obtain Quotations for Materials and Plant	Ads/PBs/Lit	✓	✓	✓	✓		✓	✓		✓		26.32					
28	Operational Estimating	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	10.53					
29	Parametric Estimating Technique	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
30	Price Temporary Works	Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓			75.00		100.00		
31	Programming Estimate	Ads/PBs/Lit	✓	✓	✓	✓			✓		✓		26.32					
32	Prepare Complete Estimate by Hand	TNQ/Eth	✓	✓	✓	✓			✓	✓	✓					15.38	50.00	
33	Prepare Complete Estimate by Spreadsheet	TNQ	✓	✓	✓					✓	✓	✓				92.31		
34	Prepare Complete Estimate by using CAE Software	TNQ/Eth	✓	✓	✓					✓	✓	✓				46.15	50.00	
35	Produce Resource Lists	TNQ/Eth	✓		✓				✓		✓	✓				73.08	100.00	
36	Price by Elemental Cost	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
37	Price by Superficial Area	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
38	Price by Unit of Occupancy	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
39	Price by Volume	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
40	Price Estimate for Direct Labour/Resources and Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					76.92		
41	Price Estimate for Direct Labour, Labour Only & Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					61.54		
42	Price Estimate for Labour/Resources (as Check) and Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					46.15		
43	Price Estimate for Labour Only/Resources and Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					7.69		
44	Price Estimate by entering Labour, Materials, Contractors and Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					30.77		
45	Price Materials, Inserting Contractors Labour and Specialists	TNQ	✓	✓	✓	✓			✓	✓	✓					7.69		
46	Produce and Maintain Resource Database	Eth	✓	✓	✓	✓			✓	✓	✓	✓					75.00	
47	Project Assessment	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓		26.32					
48	Range Estimating Technique	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	5.26					
49	Rearrange Estimate Information to Suit Project Requirements	Eth	✓		✓	✓			✓		✓						50.00	
50	Rebase Cost Data	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓	✓	5.26					
51	Retrieve and Use Information and Data	Ads/PBs/Lit/Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓		15.79	16.67		92.31	50.00	

Table 67 Estimator Training Needs Analysis (p.2)

Key to Abbreviations: Delphi-Delphi Study; **Ads**-Job Advertisements & Estimator Formal Education Study; **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study; **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Item	Categories	Source	Training Needs Analysis (page 2) Summary of Tasks from Individual Studies																	Importance Ranking
			Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment			Requiring Education	Requiring Training		Mentioned %							
							Trainee	Assistant	Estimator		On the Job	Off the Job	Ads/PBs/ Lit	Delphi (12)	Pilot (6)	TNQ (13)	Ethnography (4)	Delphi/TNQ
	Ability to Prepare Select and Appraise Tenders	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		**76.92**		**48.08**	**100.00**	**2**
1	Analyse Information and Data	Ads/PBs/Lit/Delphi/Eth	✓	✓	✓	✓			✓	✓	✓	✓	5.26	75.00			100.00	
2	Analyse Returned Tender Information	Ads/PBs/Lit/Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓	✓	10.53	75.00		100.00	100.00	
3	Bidding Strategies	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓	✓	10.53					
4	Collate Information and Data	Delphi/TNQ/Eth	✓		✓	✓			✓	✓	✓	✓		75.00		100.00	100.00	
5	Decide between Direct and Sub-Contract Labour	Eth	✓		✓						✓						50.00	
6	Make Price Adjustments	Eth	✓		✓	✓		✓	✓		✓						50.00	
7	Prepare Summaries	Ads/PBs/Lit	✓	✓	✓	✓			✓		✓	✓	21.05					
8	Produce Resource Schedules	Eth	✓	✓	✓				✓	✓	✓						75.00	
9	Report Verbally or in Writing on QS Pricing Information, Buyer Materials Information, Management Information on Pricing Decisions and the Possible Consequences, Tender Information	Ads/Delphi/TNQ/Eth	✓	✓	✓					✓	✓	✓	25.00					
10	Select the Most Suitable Company to Carry Out the Work	TNQ/Eth	✓	✓	✓	✓			✓		✓					84.62	100.00	
11	Select the Right Companies for the Right Projects to Enable Projects to be Priced	Ads/PBs/Lit/TNQ/Eth	✓	✓	✓	✓			✓		✓		26.32			84.62	100.00	
12	Send Out Drawings and Documents	TNQ/Eth	✓	✓	✓	✓		✓	✓		✓					100.00	100.00	
13	Settlement Meetings	Ads/PBs/Lit	✓	✓	✓	✓			✓		✓	✓	21.05					
	Intelligence and Cognitive Ability/Style	Delphi	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		**46.15**				**3**
1	Analytical	Ads/Delphi		✓	✓	✓			✓		✓		8.33	50.00				
2	Bright	Delphi (QS)			✓	✓	✓	✓	✓									
3	Clever	Delphi (QS)			✓	✓	✓	✓	✓									
4	Coherent	Delphi (QS)			✓	✓	✓	✓	✓	✓								
5	Grammatical	Delphi (QS)	✓	✓	✓	✓	✓	✓	✓	✓								
6	Good Memory	Delphi (QS)		✓	✓	✓	✓	✓	✓									
7	Intuitive	Ads/PBs/Lit	✓	✓	✓								5.26					
8	Logical	Delphi (QS)			✓	✓	✓	✓	✓	✓	✓	✓						
9	Numerate	Ads/PBs/Lit/Delphi		✓	✓	✓	✓	✓	✓				15.79	46.15				
10	Rational	Delphi (QS)			✓	✓	✓	✓	✓									
11	Sharp	Delphi (QS)			✓	✓	✓	✓	✓									
12	Solves Problems	Delphi	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		7.69				
	Good Personal Qualities	Delphi	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		**83.33**				**4**
1	Accountability	Delphi			✓	✓			✓									
2	Assertiveness	Delphi/Eth			✓							✓		7.69			25.00	
3	Clarity of Thought	Delphi			✓	✓			✓			✓		7.69				
4	External Awareness	Delphi			✓				✓		✓	✓		30.77				
5	Good Judgement	Delphi	✓	✓	✓				✓	✓	✓	✓		7.69				
6	Hold Current Driving Licence	Ads/Eth	✓	✓	✓			✓	✓	✓		✓	5.26				100.00	
7	Initiative	Delphi/TNQ/Eth			✓	✓	✓	✓	✓					7.69		100.00	100.00	
8	Integrity	Delphi			✓	✓	✓	✓	✓	✓	✓	✓		50.00				
9	Interested	Delphi			✓	✓	✓	✓	✓					16.67				
10	Interpret Information	Delphi			✓	✓			✓	✓	✓	✓		7.69				
11	Inventive/Innovative	Delphi/TNQ			✓	✓	✓	✓	✓	✓	✓			15.38		61.54		
12	Legible	Delphi			✓	✓	✓	✓	✓					7.69				
13	Logical	Ads			✓	✓	✓	✓	✓				5.26					
14	Methodical	Ads/Delphi			✓	✓	✓	✓	✓	✓	✓		5.26	7.69				
15	Precision	Delphi		✓	✓			✓	✓	✓	✓	✓		15.38				
16	Self Confidence	Delphi			✓					✓	✓	✓		7.69				
17	Vision	Delphi			✓		✓	✓	✓	✓	✓			7.69				
18	Work to Deadlines	Delphi			✓	✓	✓	✓	✓	✓	✓	✓		7.69				
19	Work Under Pressure	Delphi/Eth			✓	✓		✓	✓	✓	✓	✓		15.38			40.00	
20	Work on Own Initiative	Ads/PBs/Lit/TNQ/Eth			✓	✓		✓	✓		✓	✓	10.53			100.00	100.00	

Table 68 Estimator Training Needs Analysis (p.3)

Key to Abbreviations: **Delphi**-Delphi Study; **Ads**-Job Advertisements & Estimator Formal Education Study; **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study; **Pilot**-Pilot Interviews; **PBs/Lit**-Literature Reviews			Training Needs Analysis (page 3)																	
			Summary of Tasks from Individual Studies																	
Item	Categories	Source	Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment			Requiring Education	Requiring Training		Mentioned %						Importance Ranking
							Trainee	Assistant	Estimator		On the Job	Off the Job	Ads/PBs/ Lit (19)	Delphi (12)	Pilot (6)	TNQ (13)	Ethnography (4)	Delphi/TNQ
	Good Communication/Teamwork Skills	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		**76.92**				**5**
1	Agree Basic Labour Rates with Senior Managers	Eth	✓	✓	✓	✓					✓	✓					75.00	
2	Collaborate with Architects, QSs, Buyers, Managers, Clients	Eth	✓	✓	✓	✓					✓	✓					25.00	
3	Communicates at All Levels	Ads/PBs/Lit/Eth			✓	✓			✓		✓	✓	26.32				60.00	
4	Co-ordinate with Clients	Ads/PBs/Lit		✓	✓				✓		✓	✓	15.79					
5	Co-ordinate with Site Staff	Ads/PBs/Lit		✓	✓				✓		✓	✓	15.79					
6	Co-ordinate with Management	Ads/PBs/Lit		✓	✓				✓		✓	✓	15.79					
7	Co-ordinate with Sub-Contractors	Ads/PBs/Lit		✓	✓				✓		✓	✓	15.79					
8	Discuss Design Briefs with Architects	Eth	✓	✓	✓						✓	✓					25.00	
9	Hold Discussions with Sub-Contractors	Eth	✓	✓	✓						✓	✓					100.00	
10	Hold Discussions with Suppliers	Eth	✓	✓	✓						✓	✓					25.00	
11	Hold High Level Project and Financial Discussions with Senior Managers on; Risks, Profit Levels, Labour Rates, Labour Requirements/Availability and Impact on Timing, Contract Conditions, Design Details, Project and Pricing Methodologies, Methods of Tender Presentation, Importation Costs and Implications, Local Labour Availability	Eth	✓	✓	✓	✓				✓	✓	✓					100.00	
12	Integrates	Delphi (QS)			✓	✓			✓			✓						
13	Offers Help to Others	Delphi (QS)			✓	✓			✓			✓						
14	Organise Team Structures	Eth	✓	✓	✓						✓	✓					25.00	
15	Represent Company at Client Meetings	Eth	✓	✓	✓						✓	✓					25.00	
16	Shares Ideas	Delphi (QS)			✓	✓			✓			✓						
17	Shares Knowledge	Ads/PBs/Lit/Eth	✓		✓	✓			✓			✓	21.05				25.00	
18	Social Skills	Delphi	✓	✓	✓					✓	✓	✓		7.69				
19	Team Presentational Skills	Delphi	✓	✓	✓					✓	✓	✓		7.69				
20	Working within a Team to Prepare Estimates	Ads/PBs/Lit/TNQ/Eth	✓	✓	✓	✓			✓		✓	✓	15.79			76.92	50.00	
21	Work with Consultants on Financial Matters	Eth	✓	✓	✓						✓	✓					25.00	
9	**Thorough Knowledge of Construction**	Delphi/Pilot/TNQ	✓	✓	✓	✓		✓	✓	✓	✓	✓		**76.92**	**100.00**	**100.00**		**6**
1	***Building Works***																	
	Foundations to Roof Structures of;																	
	Houses, Flats, Offices, Public Buildings,																	
	Sports Stadia, Leisure Facilities etc																	
2	***Engineering Works such as;***																	
	Roads, Bridges, Power Stations,																	
	Oil Installations, Rail Infrastructure etc																	
3	***General Building and Engineering Items;***																	
	Knowledge of Plant and Equipment,																	
	Temporary Works, Preliminaries, Design,																	
	External Works, Sewers,																	
	Gas, Water and Electrical Installations,																	
4	Construction Process/Sequence etc	Ads/PBs/Lit	✓	✓	✓	✓			✓	✓	✓	✓	21.05					
5	Keep Up to Date with Current Construction Methods	Eth	✓		✓	✓			✓								50.00	

Table 69 Estimator Training Needs Analysis (p.4)

Key to Abbreviations: Delphi-Delphi Study; **Ads**-Job Advertisements & Estimator Formal Education Study; **TNQ**-Training Needs Questionnaire; **Eth**-Ethnographical Study; **Pilot**-Pilot Interviews; **PBs/Lit**-Literature Reviews			**Training Needs Analysis (page 4)**															
			Summary of Tasks from Individual Studies															
Item	**Categories**	**Source**				**Essential to Job Performance**	**Expected Prior to Employment**			**Requiring Education**	**Requiring Training**		**Mentioned %**					**Importance Ranking**
			Knowledge	**Skill**	**Ability**		**Trainee**	**Assistant**	**Estimator**		**On the Job**	**Off the Job**	**Ads/PBs/ Lit**	**Delphi (12)**	**Pilot (6)**	**TNQ (13)**	**Ethnography (4)**	**Delphi/TNQ**
	IT Skills	Ads/PBs/Lit/Delphi	✓	✓	✓					✓	✓	✓	**21.05**	**38.46**				**7**
1	Analyse Information and Data	Delphi/TNQ	✓	✓	✓					✓	✓			16.67		100.00		
2	Collate Information and Data	Delphi/TNQ	✓		✓					✓	✓			16.67		100.00		
3	Copy Information onto Disc/Memory Stick/CD	Eth	✓		✓					✓	✓	✓					25.00	
4	Input Data sent Electronically into CAE Package	Eth	✓	✓	✓					✓	✓	✓					25.00	
5	Retrieve Information and Data	Delphi/TNQ	✓	✓	✓					✓	✓			16.67		100.00		
6	Transfer Information Electronically	Pilot/TNQ/Eth	✓	✓	✓					✓	✓	✓			66.67	92.31	50.00	
7	Use Computer Aided Design Software (CAD)	Ads	✓	✓	✓					✓	✓	✓	5.26					
8	Use Computer Aided Estimating Software (CAE)	Ads/PBs/Lit/Pilot/TNQ/Eth	✓	✓	✓					✓	✓	✓	31.58		83.33	46.15	50.00	
9	Use Computer Software	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	26.32					
10	Use Digitised Take Off and Billing Software,	TNQ	✓	✓	✓					✓	✓	✓				34.62		
11	Use E-Mail	Ads/PBs/Lit/Pilot/TNQ/Eth	✓	✓	✓					✓	✓	✓	5.26		83.33	100.00	50.00	
12	Use Internet	Pilot	✓		✓					✓	✓	✓			83.33			
13	Use Plotter for Printing A1 Drawings	Eth	✓		✓						✓	✓					50.00	
14	Use Power Point	Pilot	✓	✓	✓					✓	✓	✓			33.33			
15	Use Printer for Printing Information from PC	Eth	✓		✓						✓	✓					50.00	
16	Use Programming Software	Pilot	✓	✓	✓					✓	✓	✓			33.33			
17	Use Project Management Software	Pilot	✓	✓	✓					✓	✓	✓			50.00			
18	Use Spreadsheet Software	Ads/PBs/Lit/Pilot/TNQ	✓	✓	✓					✓	✓	✓	5.26		100.00	92.31		
19	Use Spreadsheet Software for Additions and Multiplications	TNQ	✓	✓	✓					✓	✓	✓				23.08		
20	Use Spreadsheet Software with Formulae for Total Adjustments	TNQ	✓	✓	✓					✓	✓	✓				38.46		
21	Use Spreadsheet Software with near CAE Level Formulae	TNQ	✓	✓	✓					✓	✓	✓				30.77		
22	Use Valuation Software	Pilot	✓	✓	✓					✓	✓	✓			16.67			
23	Use Word Software	Ads/PBs/Lit/Pilot/TNQ	✓	✓	✓					✓	✓	✓	5.26		83.33	76.92		
24	Use Word Software to a Good Level	TNQ	✓	✓	✓					✓	✓	✓				15.38		
25	Send and Receive BQs Electronically	Pilot/TNQ/Eth	✓		✓					✓	✓	✓			16.67	84.62	50.00	
26	Send and Receive Drawings Electronically	Pilot/TNQ/Eth	✓		✓					✓	✓	✓			16.67	92.31	50.00	
27	Send and Receive Specifications Electronically	Pilot/TNQ/Eth	✓		✓					✓	✓	✓			16.67	100.00	50.00	
	Ability to Measure Work and Prepare BQs	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		**53.85**				**8**
1	Knowledge of Standard Method of Measurement	Delphi	✓	✓	✓				✓	✓	✓	✓		7.69				
2	Mapping Skills	Delphi	✓	✓	✓						✓			8.33				
3	Prepare BQ either as a Standard Method of Measurement/ Builders Quantities or Other Specified Form by Hand	Ads/PBs/Lit/Delphi/Eth	✓	✓	✓	✓			✓	✓	✓		21.05	23.08			50.00	
4	Prepare BQ either as a Standard Method of Measurement/ Builders Quantities or Other Specified Form onto PC	TNQ/Eth	✓	✓	✓				✓	✓	✓					84.62	50.00	
5	Prepare BQ either as a Standard Method of Measurement/ Builders Quantities or Other Specified Form using a Digitiser	TNQ	✓	✓	✓					✓	✓					23.08		
6	Read Understand and Interpret Architectural/Engineering Drawings and Specifications	Ads/Delphi	✓	✓	✓	✓			✓	✓	✓		5.26	7.69				
7	Site Measurement	Eth	✓	✓	✓				✓	✓	✓						25.00	
8	Take Off Approximate Quantities of Measurement/Builders Quantities or Other Specified Form	Ads/PBs/Lit	✓	✓	✓			✓	✓	✓	✓	✓	5.26					
9	Take Off the Quantities either as a Standard Method of Measurement/ Builders Quantities or Other Specified Form	Ads/PBs/Lit/Delphi/TNQ/Eth	✓	✓	✓	✓			✓	✓	✓		21.05	50.00		92.31	75.00	
10	Take Off the Quantities using a Planimeter	TNQ	✓	✓	✓				✓	✓						46.15		
	Relevant Experience	Delphi/Pilot/Ads	✓	✓	✓	✓		✓	✓	✓	✓	✓	**55.56**	**30.77**	**83.33**			**9**

Table 70 Estimator Training Needs Analysis (p.5)

Key to Abbreviations: Delphi-Delphi Study: **Ads**-Job Advertisements & Estimator Formal Education Study: **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study: **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Item	Categories	Source	Training Needs Analysis (page 5) Summary of Tasks from Individual Studies											Mentioned %				Importance Ranking
			Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment Trainee	Assistant	Estimator	Requiring Education	Requiring Training On the Job	Off the Job	Ads/PBs/ Lit (19)	Delphi (12)	Pilot (6)	TNQ (13)	Ethnography (4)	Delphi/TNQ
	Risk Management	Ads/PBs/Lit/Delphi	✓	✓	✓	✓			✓	✓	✓	✓	**10.53**	**23.08**				**10**
1	Analyse Risks	Ads/PBs/Lit/Delphi	✓	✓	✓	✓			✓	✓	✓	✓	21.05	7.69				
2	Assess Contractual Risks	TNQ/Eth	✓	✓	✓	✓			✓	✓	✓	✓				92.31	100.00	
3	Assess Financial Risks	TNQ/Eth	✓	✓	✓	✓			✓	✓	✓	✓				100.00	100.00	
4	Assess Personal Risks	TNQ/Eth	✓	✓	✓	✓			✓	✓	✓	✓				84.62	100.00	
5	Identify Risks	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		23.08				
6	Monte Carlo Simulation Technique	Ads/PBs/Lit	✓	✓	✓					✓		✓	5.26					
7	Provide Information on Project Risks	Eth	✓	✓	✓	✓					✓	✓					50.00	
8	Provide Solutions for Minimising Risks	TNQ	✓	✓	✓						✓	✓				76.92		
	Knowledge of Contracts and Contract Law	Delphi	✓		✓	✓			✓	✓	✓	✓		**30.77**		**100.00**		**11**
1	BQ and Drawings	TNQ/Eth	✓		✓	✓			✓	✓	✓	✓				73.08	20.00	
2	Building Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				23.08		
3	Building Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				23.08		
4	BREEAM Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				7.69		
5	BREEAM Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		
6	Competitive Tendering	Eth	✓	✓	✓												80.00	
7	Construction, Design & Management Regulations (CDM)	TNQ	✓		✓	✓			✓	✓	✓	✓				100.00		
8	CDM Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓	✓			✓	✓	✓	✓				53.85		
9	CDM Regulations Working Knowledge	TNQ	✓		✓				✓	✓	✓	✓				46.15		
10	Construction Management Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	10.53					
11	Cost Reimbursement Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
12	Design and Build Contracts	Ads/PBs/Lit/TNQ/Eth	✓		✓	✓			✓	✓	✓	✓	15.79			92.31	20.00	
13	Disability Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				7.69		
14	Disability Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		
15	Fee Contracts	TNQ	✓		✓					✓	✓	✓				0.00		
16	Fixed/Firm Price Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
17	Framework Contracts	TNQ	✓		✓					✓	✓	✓				53.85		
18	General Contractual Knowledge "Pre-Tender Clauses" Only	TNQ	✓		✓	✓			✓	✓	✓	✓				15.38		
19	General Contractual Working Knowledge	TNQ	✓		✓				✓	✓	✓	✓				84.62		
20	Housing Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				30.77		
21	Housing Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				38.46		
22	Housing Regulations Thorough Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		
23	Housing Corporation Design Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				7.69		
24	Housing Corporation Design Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		
25	ICE Forms of Contract	TNQ	✓		✓	✓			✓	✓	✓					46.15		
26	Joint ContractsTribunal Forms of Contract	TNQ	✓		✓	✓			✓	✓	✓	✓				92.31		
27	Joint ContractsTribunal Construction Management Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
28	Lump Sum Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
29	Management Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	10.53					
30	Measured Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
31	NHBC Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				23.08		
32	NHBC Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				15.38		
33	NHBC Regulations Thorough Knowledge	TNQ	✓		✓	✓				✓	✓	✓				7.69		
34	New Engineering and Construction Contracts	TNQ	✓		✓	✓			✓	✓	✓	✓				38.46		
35	Partnering Contracts	Ads/PBs/Lit/TNQ	✓		✓	✓			✓	✓	✓	✓	10.53			61.54		
36	Plan & Specification	TNQ/Eth	✓		✓	✓			✓	✓	✓	✓				96.15	40.00	
37	Plan & Quantified Specification	TNQ	✓		✓	✓			✓	✓	✓	✓				61.54		
38	Prime Contracts	Ads/PBs/Lit	✓		✓	✓			✓	✓	✓	✓	5.26					
39	Private Finance Initiatives	Ads/PBs/Lit/TNQ	✓		✓	✓			✓	✓	✓	✓	5.26			42.31		
40	Specification Only	TNQ/Eth	✓		✓	✓			✓	✓	✓	✓				53.85	20.00	
41	Speculative Housing	TNQ	✓		✓					✓	✓	✓				23.08		
42	Standard Housing Regulations	TNQ	✓		✓	✓			✓	✓	✓	✓				76.92		
43	Streetworks Act "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				15.38		
44	Streetworks Act Working Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		
45	Target	TNQ	✓		✓					✓	✓	✓				15.38		
46	Waste Management Regulations "Pre-Tender Clauses" Only	TNQ	✓		✓					✓	✓	✓				15.38		
47	Waste Management Regulations Working Knowledge	TNQ	✓		✓					✓	✓	✓				7.69		

Table 71 Estimator Training Needs Analysis (p.6)

Key to Abbreviations: Delphi-Delphi Study: **Ads**-Job Advertisements & Estimator Formal Education Study: **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study: **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Training Needs Analysis (page 6)
Summary of Tasks from Individual Studies

Item	Categories	Source	Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment: Trainee	Assistant	Estimator	Requiring Education	Requiring Training: On the Job	Off the Job	Mentioned %: Ads/PBs/Lit (19)	Delphi (12)	Pilot (6)	TNQ (13)	Ethnography (4)	Importance Ranking Delphi/TNQ
	Good Negotiating Skills	Delphi	✓	✓	✓					✓	✓	✓		**30.77**				**12**
1	Design and Build Contracts	TNQ	✓	✓	✓											84.62		
2	Negotiate Contracts	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓	31.58					
	Negotiate on;																	
3	Fee Contracts	TNQ	✓	✓	✓											0.00		
4	Framework Contracts	TNQ	✓	✓	✓											53.85		
5	Partnering Contracts	TNQ	✓	✓	✓											53.85		
6	PFI Contracts	TNQ	✓	✓	✓											38.46		
7	Target Contracts	TNQ	✓	✓	✓											15.38		
8	Negotiate with Consultants	Eth	✓	✓	✓						✓	✓					50.00	
9	Negotiate with Materials Suppliers	TNQ	✓	✓	✓						✓	✓				15.38		
10	Negotiate with Sub-Contractors	TNQ	✓	✓	✓						✓	✓				53.85		
11	Negotiating within a Team Framework	TNQ	✓	✓	✓						✓	✓				61.54		
12	Reach Agreements on Contractual Matters	TNQ/Eth	✓	✓	✓						✓	✓				61.54	35.00	
13	Reach Agreements on Financial Matters	TNQ/Eth	✓	✓	✓						✓	✓				92.31	35.00	
14	Reach Agreements on Personal Matters	TNQ	✓	✓	✓						✓	✓				61.54	25.00	
	Able to Provide Pre-Contract Financial																	**13**
	and Construction Advice to Client/Employer	Delphi/Ads/PBs/Lit	✓	✓	✓	✓				✓	✓	✓	15.79	**23.08**				
1	Advising on Preferred Procurement Routes	Delphi	✓	✓	✓	✓				✓	✓	✓		8.33				
2	Analyse Information and Data	Delphi	✓	✓	✓	✓			✓	✓	✓			46.15				
3	Benchmarking	Ads/PBs/Lit	✓	✓	✓					✓	✓	✓		15.79				
4	Budget Costing	Delphi/TNQ/Eth	✓	✓	✓					✓	✓	✓		16.67		84.62	25.00	
5	Cash Flow Forecasts	Ads/PBs/LitTNQ	✓	✓	✓					✓	✓	✓	5.26			61.54		
6	Collate Information and Data	Delphi/Eth	✓		✓	✓				✓	✓	✓		16.67				
7	Cost Analyses	Delphi/TNQ	✓	✓	✓	✓				✓	✓	✓		75.00		76.92		
8	Cost Control	Delphi	✓	✓	✓					✓	✓			7.69				
9	Cost Planning	Delphi/TNQ	✓	✓	✓					✓	✓	✓		23.08		84.62		
10	Design and Build Projects	Ads	✓	✓	✓					✓	✓	✓	8.33					
11	Design Cost Advice	Ads/PBs/Lit/Eth	✓	✓	✓					✓	✓	✓	5.26				25.00	
12	Development Appraisals	TNQ	✓	✓	✓					✓	✓	✓				46.15		
13	Feasibility Study	TNQ	✓	✓	✓					✓	✓	✓				30.77		
14	Financial Advice	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		23.08				
15	Investment Appraisal	Delphi	✓	✓	✓					✓	✓	✓		7.69				
16	Life Cycle Costing	TNQ	✓	✓	✓					✓	✓	✓				30.77		
17	Objective Selection of Procurement Strategies	Delphi	✓	✓	✓	✓				✓	✓	✓		7.69				
18	Planning	TNQ	✓	✓	✓					✓	✓	✓				23.08		
19	Produce Estimate and Tender Reports	Eth/Ads/PBs/Lit	✓	✓	✓	✓				✓	✓	✓	42.11				37.50	
20	Programming	Pilot/TNQ/Eth	✓	✓	✓					✓	✓	✓			50.00	61.54		
21	Provide Advice on Project Risks	Eth	✓	✓	✓	✓			✓	✓	✓	✓					25.00	
22	Providing Financial Reports	Delphi/Eth	✓	✓	✓					✓	✓	✓		25.00			25.00	
23	Retrieve Information and Data	Delphi	✓	✓	✓	✓				✓	✓	✓		16.67				
24	Strategic Decision Making	Ads/PBs/Lit	✓		✓					✓	✓	✓	5.26					
25	Value Creation	TNQ	✓	✓	✓					✓	✓	✓				15.38		
26	Value Engineering	TNQ	✓	✓	✓					✓	✓	✓				23.08		
27	Work in Integrated Teams	TNQ	✓		✓						✓	✓				23.08		
	Good Formal Education	Ads	✓	✓	✓		✓	✓	✓	✓			**70.37**	**33.33**				**14**
2	A Level	TNQ	✓	✓	✓		✓			✓						7.69		
3	Bachelors Degree	Ads/Pilot/TNQ	✓	✓	✓					✓			12.18		16.67	46.15		
1	GCSE	TNQ					✓			✓						7.69		
4	HNC	Ads/Pilot/TNQ	✓	✓	✓					✓			3.70		50.00	30.77		
5	HND	Ads/TNQ	✓	✓	✓					✓			3.70			7.69		
6	ONC	Pilot	✓	✓	✓					✓					50.00	0.00		
8	Relevant	Ads	✓	✓	✓					✓			5.56					
7	Specific Training	Delphi	✓	✓	✓					✓				7.69				

Table 72 Estimator Training Needs Analysis (p.7)

Item	Categories	Source	Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment: Trainee	Expected Prior to Employment: Assistant	Expected Prior to Employment: Estimator	Requiring Education	Requiring Training: On the Job	Requiring Training: Off the Job	Mentioned %: Ads/PBs/ Lit (12)	Mentioned %: Delphi (12)	Mentioned %: Pilot (6)	Mentioned %: TNQ (13)	Mentioned %: Ethnography (4)	Importance Ranking Delphi/TNQ
	Professional Training Initial and Ongoing	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		**53.85**				**15**
1	Continuous Professional Development	Delphi/TNQ	✓	✓	✓	✓			✓	✓	✓	✓		**53.85**		50.00		
2	Day Release and Evening Studies	Pilot	✓	✓	✓					✓	✓	✓			83.33			
3	Develop Innovations to Improve Technique and Ability	Delphi	✓	✓	✓	✓				✓	✓	✓		16.67				
4	Develop Solutions to Improve Technique and Ability	Delphi	✓	✓	✓	✓				✓	✓	✓		8.33				
5	In-House Training	Delphi/TNQ	✓	✓	✓						✓			50.00	100.00	61.54		
6	IOBS (Defunct)	TNQ	✓	✓	✓					✓	✓	✓				7.69		
7	MCIOB	Delphi/Pilot/TNQ	✓	✓	✓					✓	✓	✓		1.85	50.00	38.46		
8	MICE	Delphi	✓	✓	✓					✓	✓	✓		3.70				
9	MRICS	Pilot/TNQ	✓	✓	✓					✓	✓	✓			16.67	15.38		
10	On the Job (Office, Various Departments, Site)	Delphi/Pilot/TNQ	✓	✓	✓	✓			✓	✓	✓			7.69	83.33	100.00		
11	Personal Effort	Pilot	✓	✓	✓	✓			✓						100.00			
12	Relevant	Delphi	✓	✓	✓				✓	✓	✓	✓		1.85				
	Management Skills	Delphi	✓	✓	✓						✓	✓		**15.38**				**16**
1	Control Individuals, Companies or Organisations	TNQ	✓	✓	✓						✓	✓				69.23		
2	Control Materials/ other Resources	Delphi/TNQ	✓	✓	✓						✓	✓		16.67		23.08		
3	Integrate Other Roles into Project Team	Eth	✓	✓	✓						✓	✓					25.00	
4	Knowledge of Construction Management	Delphi	✓							✓	✓	✓		7.69				
5	Leadership	Delphi	✓	✓	✓						✓	✓		8.33				
6	Manage other Estimators	TNQ	✓	✓	✓						✓	✓				84.62		
7	Man Management	Ads/PBs/Lit	✓	✓	✓								15.79					
8	Organise Individuals, Companies or Organisations	Delphi/Eth	✓	✓	✓						✓	✓		16.67			25.00	
9	Organise Materials, Resources	Delphi	✓	✓	✓						✓			16.67				
10	Recruitment and Selection of Individuals/Contractors	Eth	✓	✓	✓						✓	✓					25.00	
11	Sound Knowledge of Employment Law	TNQ	✓	✓	✓					✓	✓	✓				76.92		
12	Supervise Individuals/ Companies/Organisations	Delphi/TNQ	✓	✓	✓						✓	✓		16.67		69.23		
13	Supervise Materials/other Resources	Delphi/TNQ	✓	✓	✓						✓			16.67		23.08		
	Commercial Business Acumen	Delphi/Ads/PBs/Lit	✓	✓	✓						✓	✓	**15.79**	**38.46**				**17**
1	Awareness of Labour Resource Problems	TNQ	✓			✓					✓					92.31		
2	Awareness of Project Sensitivity	TNQ	✓			✓					✓			33.33		92.31		
3	Business Management	Delphi	✓	✓	✓					✓	✓	✓						
4	Customer Care	Delphi	✓	✓	✓						✓	✓		8.33				
5	Environmental Awareness	Delphi/TNQ	✓		✓	✓					✓			33.33		84.62		
6	Knowledge of Clients Management Systems	Delphi	✓		✓						✓			7.69				
7	Provide Client Satisfaction	Delphi/TNQ	✓	✓	✓	✓					✓	✓		7.69		76.92		
8	Understand Business Acumen	Delphi	✓	✓	✓					✓	✓	✓		41.67				
9	Work for Profitability	Delphi/TNQ	✓	✓	✓	✓				✓	✓			7.69		100.00		

Key to Abbreviations: **Delphi**-Delphi Study: **Ads**-Job Advertisements & Estimator Formal Education Study: **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study: **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Training Needs Analysis (page 7) — Summary of Tasks from Individual Studies

Table 73 Estimator Training Needs Analysis (p.8)

Key to Abbreviations: Delphi-Delphi Study: **Ads**-Job Advertisements & Estimator Formal Education Study: **TNQ**-Training Needs Questionnaire: **Eth**-Ethnographical Study: **Pilot**-Pilot Interviews: **PBs/Lit**-Literature Reviews

Training Needs Analysis (page 8)
Summary of Tasks from Individual Studies

Item	Categories	Source	Knowledge	Skill	Ability	Essential to Job Performance	Expected Prior to Employment: Trainee	Assistant	Estimator	Requiring Education	Requiring Training: On the Job	Off the Job	Mentioned %: Ads/PBs/Lit (12)	Delphi (12)	Pilot (6)	TNQ (13)	Ethnography (4)	Importance Ranking Delphi/TNQ
	Able to Provide Post Contract Financial																	**18**
	and Construction Advice to Client/Employer	Delphi	✓	✓	✓	✓				✓	✓	✓		**16.67**				
1	Analyse Information and Data	Delphi/TNQ	✓	✓	✓	✓				✓	✓			23.08		84.62		
2	Collate Information and Data	Delphi/TNQ	✓		✓	✓				✓	✓			23.08		84.62		
3	Cost Control	Delphi	✓	✓	✓					✓	✓			7.69				
4	Financial Advice	Delphi	✓	✓	✓	✓			✓	✓	✓	✓		15.38				
5	Financial Information for QS	TNQ/Eth	✓	✓	✓				✓	✓	✓					100.00	50.00	
6	Involvement in Online Auctions	Ads/PBs/Lit	✓	✓	✓						✓			5.26				
7	Involvement in Reverse Auctions	Ads/PBs/Lit	✓	✓	✓						✓			5.26				
8	Price Additional Works	TNQ	✓	✓	✓					✓	✓					46.15		
9	Provide Price Information for Buyer	TNQ/Eth	✓	✓	✓				✓	✓	✓					92.31	100.00	
10	Provide Price Information for Office Management	TNQ	✓	✓	✓				✓	✓	✓					76.92		
11	Provide Price Information for Site Management	TNQ	✓	✓	✓				✓	✓	✓					76.92		
12	Provide Resource Information for Buyer	TNQ	✓	✓	✓				✓	✓	✓					76.92		
13	Provide Resource Information for QS	TNQ	✓	✓	✓				✓	✓	✓					76.92		
14	Provide Resource Information for Office Management	TNQ	✓	✓	✓				✓	✓	✓					61.54		
15	Provide Resource Information for Site Management	TNQ	✓	✓	✓				✓	✓	✓					76.92		
16	Reports for Buyer	TNQ	✓	✓	✓				✓	✓	✓	✓				38.46		
17	Reports for Office Management	TNQ	✓	✓	✓				✓	✓	✓	✓				61.54		
18	Reports for QS	TNQ	✓	✓	✓				✓	✓	✓	✓				53.85		
19	Reports for Site Management	TNQ	✓	✓	✓				✓	✓	✓	✓				38.46		
20	Retrieve Data	TNQ	✓	✓	✓	✓			✓	✓	✓					84.62		
21	Retrieve Information and Data	Delphi	✓	✓	✓	✓				✓	✓			23.08				
22	Sub-Contract Negotiations	TNQ	✓	✓	✓					✓	✓	✓				53.85		
23	Supplier Negotiations	TNQ	✓	✓	✓					✓	✓	✓				15.38		
24	Work in Integrated Teams	TNQ	✓		✓						✓	✓				23.08		
	Programming and Planning	Ads/PBs/Lit/Pilot	✓	✓	✓					✓	✓	✓	**10.53**	**50.00**		**61.54**		**19**
1	Analyse Activities to Determine Labour Group Size	TNQ	✓	✓	✓					✓	✓	✓				7.69		
2	Analyse Activities to Determine Production Rates	TNQ	✓	✓	✓					✓	✓	✓				7.69		
3	Compare Activity Progress with Initial Assessment	TNQ	✓	✓	✓					✓	✓	✓				7.69		
4	Consider the Alternative Methodologies to Efficiently Complete Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
5	Consider the Alternative Methodologies to Efficiently Complete Temporary Worl	TNQ	✓	✓	✓					✓	✓	✓				7.69		
6	Consider the Alternative Methodologies to Safely Complete Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
7	Consider the Alternative Methodologies to Safely Complete Temporary Works	TNQ	✓	✓	✓					✓	✓	✓				7.69		
8	Co-Ordinate Schedules to Produce Programmes	Eth	✓	✓	✓					✓	✓	✓					50.00	
9	Create Logical Links between Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
10	Create Resource Driven Links between Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
11	Determine Activities List	TNQ	✓	✓	✓					✓	✓	✓				7.69		
12	Determine Activity Calendar Periods	TNQ	✓	✓	✓					✓	✓	✓				7.69		
13	Determine Time Allowances Dictated by Project Schedule	TNQ	✓	✓	✓					✓	✓	✓				7.69		
14	Determine Time Schedule for Specialist Contractors	TNQ/Eth	✓	✓	✓						✓					7.69	50.00	
15	Develop the Chosen Methodology to Efficiently Complete Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
16	Develop the Chosen Methodology to Efficiently Complete Temporary Works	TNQ	✓	✓	✓					✓	✓	✓				7.69		
17	Develop the Chosen Methodology to Safely Complete Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
18	Develop the Chosen Methodology to Safely Complete Temporary Works	TNQ	✓	✓	✓					✓	✓	✓				7.69		
19	Identify the Critical Path Activities	TNQ	✓	✓	✓					✓	✓	✓				7.69		
20	Produce "Chainage Chart" to Identify Overlapping Activity/Location Clashes	TNQ	✓	✓	✓					✓	✓	✓				7.69		
21	Produce Resource Schedule for Buyers	TNQ/Eth	✓		✓					✓	✓	✓				7.69	50.00	
22	Produce Resource Schedule for Management	TNQ/Eth	✓		✓					✓	✓	✓				7.69	50.00	
23	Produce Resource Schedule Reflecting Programme Requirements	TNQ	✓	✓	✓					✓	✓	✓				7.69		
24	Reconcile Resource Schedule with Resources within the BQ	TNQ	✓	✓	✓					✓	✓	✓				7.69		
25	Record Activity Progress	TNQ	✓	✓	✓					✓	✓	✓				7.69		
26	Use Labour Resource Lists for Preparing Activity Time Schedules	Eth	✓	✓	✓					✓	✓	✓					50.00	

12.7 Conclusions

The eight-page TNA offers CI employers, Estimator managers and educators an extensively researched and potentially psychometrically robust analysis on which to initiate specific courses and programmes as a means of improving and developing Estimator KSAs. It could also be used to develop specialised training programmes in several formats. There are clear demarcations within the Tables for attributes to be extracted and developed into appropriate, tailored training schedules, with the outcome offering beneficial aids to finding flexibility in the way in which Estimators receive their education and training. The Delphi study's importance ranking should also prove to be of benefit when arranging subject emphasis, although, in this regard, a much larger study would enhance and solidify this work. Therefore, the CI could have confidence in the outcome, whether it was in developing professional qualifications, University degrees (full or part time), HNCs or "on-the-job" training. This confidence can be drawn from:

- Its reliability which has been helped by gaining consensus at every level of the process
- The use of published research literature on the subject whose advice has been used wherever it was appropriate
- Its comprehensive quality, having information on job attributes drawn from 187 individual sources
- The logical presentation which groups each need into a clearly defined structure

In categorising a list of Estimator attributes, the TNA also serves as an Estimator BoK. Although this is listed in a basic form, not being developed to the extent of the comprehensive APM document, it would be an extremely useful tool to aid the groundwork in the setting up of an Estimator specific PB or a specific estimating section within an existing PB. Information on every Estimator attribute found from this research is contained in the Categories column, arranged in levels of importance which show main attribute categories and sub-attributes required to fulfil the work of each main category. Anyone wishing to discover the KSAs that Estimators need in order to perform their role would find it here. To place this study in context the APM, formed in 1972, did not produce its first BoK until 1991, according to information

offered in an e-mail from Nicola Baggott, APMs Marketing Co-ordinator (2010). The Estimator BoK produced here has been completed prior to the inception of an Estimator-specific PB and appears to be the first time that this has been done in the UK CI.

However, it should be clarified that the TNA was intended to be an exploratory questionnaire to be tested with Estimators. This requires an additional study in order to provide a complete psychometric analysis. Considering the wide variety of delivery methods for estimating procedures, such a study would be more appropriate, and more financially affordable, if carried out by individual ETP providers.

Chapter 13 – Discussion

14.1 Findings

In seeking to find justification for the estimating role upgrading its position to a professional level this research found that:

- Definitions of a profession had expanded, adapted and modernised to meet the demands of a capitalist-driven society
- Estimators held many of the attributes that defined the modern professional
- There was a tendency for Estimators to move into the role from other spheres rather than begin their careers as Estimators. However, the majority held high level qualifications at both formal and professional levels, demonstrating that they were both able and ambitious
- Comparisons with QSs showed Estimators being held in equal regard in respect of salary and benefits offered by their employers and that the role required equal numbers and standards of KSAs. Despite this there had been no attempt by the CI to offer Estimators equality with QSs in professional training and formal educational opportunities
- Clients were found to be using a wide variety of contract procurement methods. Therefore, in adapting to these methods, the demands and availability of IT and to other industry needs, Estimators were shown to have changed and developed their KSAs in order to meet these demands.
- These changes, which involved alternate estimating techniques and the development of skills previously employed within the domain of QSs and Programme Planners, were documented in what was considered to be the first Estimator TNA/BoK ever produced for the UK CI

14.2 Discussion of findings

1. The first stage of this research was to discover definitions of professions by reviewing relevant literature. Making an assessment of whether Estimators' role requirements could qualify them for professional status was then done on the basis of the definitions found and a comparison with QSs. To achieve this, the studies in Chapters 3 and 4 used the revised IRS from Blaikie (2007) combined with a literature review as the means of collecting data. The IRS

was the chosen strategy from four research strategies available, Inductive (IRS), Deductive (DRS), Retroductive (RRS) and Abductive (ARS). This was because the study aimed to establish descriptions and produce generalisations whereas the other strategies had different intentions, these being:

- DRS - To construct theories, develop hypotheses and test them
- RRS – To discover underlying mechanisms in order to explain observed regularities and then construct hypothetical models of those regularities
- ARS – To describe and understand social life in terms of motives and understanding and to develop theories and test them iteratively

Refining this IRS into the revised strategy recommended by Blaikie, above, enabled the research to be focused specifically on what Estimators and QSs do. Blaikie said that the original strategy claimed to be able to produce generalisations that were universal which, he said was an untenable claim. The chosen method and methodology were published and current techniques and met the requirements of extracting and assessing data. A wide variety of definitions were found which had, historically, composed just three severely constrained groups whose work was limited to service to clients and the community. The limitations of these definitions were found to decrease over time and a more modern outlook removed the constraints and accepted that professional groups could work within capitalist organisations. This greatly expanded the number of professions both in the UK and world-wide. Information was also found on conditions under which new professions could evolve. These conditions occurred where social and economic conditions permitted. With this available information an assessment was able to be made of possible Estimator professional recognition by comparing Estimators with QSs based on their perceived attainment of defined professional attributes. This showed that there was such a possibility. At that point of the research the author moved on to discovering what Estimators do and whether their required KSAs would qualify them for professional recognition.

Limitations

- There were limitations in this area of the research and these lay in the researcher's personal assessment to make a judgment of Estimators' meeting professional criteria. While this was allowable within the method used and while the researcher gained consensus from two other experienced parties with almost 150 years of experience in the CI between all three, the assessment made would have had more validity had it been possible to have assembled a larger panel of judges from whom a consensus might have been obtained
- Limitations of sample size and data distribution could be improved by greater resources and numbers of researchers but literature was reviewed from 41 authors and adding 22 separate CI and governmental organisations provided a wide spread of sources of data

2. Discovering the job requirements and standards of Estimators, with a pilot study in Chapter 5, used the revised IRS from Blaikie, above, combined with semi-structured interviews as the means of collecting data. This strategy was selected from the four described for Chapters 3 and 4 because it was a data collecting study which did not require any further input in forming hypotheses or tests etc. The method and methodology used met the requirements of extracting data and gaining experience of preparing an interview questionnaire and carrying out personal interviews. The study disclosed a number of job attributes and also provided indications of the estimating role not appearing to be strongly marketed, with the majority of interviewees shown to have entered via other fields. All, though, had demonstrated a proven ability to learn and achieve standards with the majority holding professional qualifications albeit with a lukewarm attitude towards membership, whether continued or future. Most showed a keenness and capability towards IT, specifically CAE. However, overall, the information gained implied that Estimators showed proven ability but that there appeared to be systemic weaknesses within the CI from employers, educators and professions in failing to offer support tailored to their needs as the ETPs taken to gain their qualifications were not Estimator-specific.

Limitations

- A limitation with this study lay in the fact that it had been initially designed to obtain information on IT use rather than job attributes and was, also, designed as a pilot study. Its original purpose, however, did not preclude the interviews discovering useful information in addition to attribute information.
- Limitations of sample size and data distribution would be improved given that a larger survey would inevitably have offered more robust results but, as before, this was a resource issue. However, it was specifically designed as a pilot study and deliberately kept at a low sample. The source distribution was given adequate consideration with companies interviewed ranging in turnover from £900,000-£200m

3. A survey of job advertisements helped to broaden the scope of the research with an Estimator-QS comparison, in Chapter 6, which compared the remuneration and benefits offered by employers. This used a revised DRS from Blaikie, *op. cit.,* with techniques for collecting data and statistical tests for testing the data. A revised DRS was chosen as it was the most appropriate method for collecting data and formulating and testing hypotheses. The method, methodologies and statistical tests were used as they met the requirements of extracting and testing that data. They demonstrated that Estimators were able to command similar remuneration packages to those of QSs, suggesting that their work was equally valued and that, therefore, they were held in equal regard to a professional role with similar KSAs. Information used to make the comparison also uncovered further job attributes. From the point of view of sample size the survey was adequately covered.

Limitations

- The limitation was with the statistical tests which would not be regarded in natural science as providing a sound result as the data could not be collected under "laboratory conditions". The results were valid, based on the data collected, but there was no guarantee that data

collected at a different time and from different recipients would provide the same results. However, this condition would apply each time tests of this nature were carried out and, as this study was based on a snapshot survey, the results gave a clear outcome of the position 'at that time'

- Limitations of sample size and data distribution were considered to be minimal. Overall, the sample size was adequate with over 1,800 job advertisements available from recruitment websites in addition to advertisements placed in Building magazine and the Express and Star newspaper. However, the number of advertisements containing all of the required information was considerably less than the available sample. While the large sample size also helped to provide a good source distribution, in attempting to obtain an even sample spread across four job levels saturation point was reached on two of those levels, trainee and head positions, before the planned minimum sample size was reached.

4. By using information from the same survey in Chapter 6 and the same research method, the methodologies triangulated techniques to gather data from the survey and apply statistical tests on the information found. These met the needs of extracting and testing that data. This study, in Chapter 7, was a further comparison made with quantity surveying and statistically tested information on skills and core competencies. This determined a level of ability for Estimators equal to that of QSs and demonstrated an overlap in almost all key competencies deemed to be essential to both disciplines. In doing so, further evidence was gathered towards confirming Estimator parity with the QS role and additional job attributes were obtained.

Limitations

- Using information from the same survey as Chapter 6, even though the test methodologies were different, the same limitation applied
- Similarly, sample size and source distribution limitations were as Chapter 6

5. As the indications from Chapter 6 were that employers held Estimators and QSs in equal regard Chapter 8 sought to discover whether that regard extended into educational provision and the expectation of qualifications. This study introduced a survey on educational availability and extracted different information from the job advertisement survey. It also used the revised DRS method with methodologies that required triangulation techniques in collecting and statistically testing the data. Therefore, the reasons for selecting the revised DRS method were as Chapter 6, described at item 3, above. This Estimator-QS comparison viewed the availability of education and employers' qualification requirements and found that there was a considerable divergence in educational opportunities, with QSs having accessibility to an education that was tailored to their needs within the University system and a PB geared to providing specific QS training and CPD. Estimators on the other hand, had no specific education and training programme and were expected to find whatever formal courses were on offer within other occupational programmes. Professionally there were opportunities to join organisations that would afford them a qualification but again palpably little specific Estimator training or CPD. This disparity with QSs would possibly be understandable if the knowledge requirements and demands placed upon QSs were far greater which did not appear to be the case and, therefore, brought into question the regard held by employers and CI educators for Estimators. The demand for qualifications in job advertisements was low; both for Estimators and QSs and the statistical tests failed due to a low count on qualifications demanded although on face value there was a slightly greater demand for QSs to hold qualifications.

Limitations

- Limitations in this study occurred through an inability to statistically test the data due to low counts on qualifications asked for by employers. However, the survey on educational opportunities was comprehensive and covered the major sources of information from job advertisements. Increasing the survey sample would require extending the survey into other means of gleaning the required data, would be

time consuming, costly and require a considerable amount of co-operation from CI employers

- For the survey on education availability sample size limitations were minimal as the majority of applicable courses were discovered in the UK through its primary source, UCAS. In all 619 courses were sampled with a source distribution of 28 Universities and Colleges from all four countries in the UK, 2 courses at PBs and 1 course at a CI training body. Sample size and source distribution limitations for the statistical tests were as Chapter 6

6. The Delphi study in Chapter 9 helped to consolidate the work from previous Chapters in discovering additional job attributes. While it was a specific Delphi technique a triangulation of techniques was required to produce the results. The specific technique, methodologies and statistical tests were current works being used extract and test that data. Statistical tests on Estimator-QS comparisons confirmed that estimating required KSAs of a similar nature and standard to those of quantity surveying. These tests also demonstrated that whilst the intellectual standards and knowledge requirements of Estimators and QSs were similar their roles were distinct and, therefore, Estimators are not QSs and vice versa. Notably, though, both groups placed education and training in low ranked positions. However, none of the respondents were willing to explain why this was. The author had a concern with this as many other higher ranked attributes such as their estimating skills, knowledge of construction, IT skills and ability to prepare BQs could not have been developed without it. This study also highlighted a changing UK CI where the development of PFI, Partnering, D and B contracts and Integrated Teams etc were increasing the demand for Estimator input at a much earlier stage in the process and, consequently, developing and changing their roles. Information gained from the responses of some of the panel members showed Estimators carrying out work previously done by QSs. This knowledge gave weight to an argument that with this changing role the instigation of similar education and training structures found to be available for QSs, if made available to Estimators, would be beneficial to the CI.

Limitations

- The same limitations applied to the Delphi study as they did to the statistical tests in Chapter 6. As with that study, because the choice of experts and the time at which the responses were made the results may differ each time a Delphi study was carried out but they gave a clear outcome of the position 'at that time'.
- Limitations of sample size and data distribution were in the number of experts that could be surveyed by a single researcher and the response rates from those experts, which were low at 27 for Round 1 and 22 for Round 2, even though 403 surveys were sent out. While the number of responses achieved acceptable levels for carrying out statistical tests and the data sources ensured the most likely experts could be found, as with the other studies greater resources from a prominent research body would provide more robust results

7. The ethnographical study in Chapter 10 not only gathered job attributes but proved to be a useful exercise in observing techniques and attitudes of Estimators working for companies with different philosophies. It used the participant-observation technique together with a pre-prepared set of questions, to be used when and where it was considered necessary, to assemble the information on attributes. This technique was chosen in preference to one of the four strategies described by Blaikie, *op. cit.,* the revised ARS. While the revised ARS covered the requirements necessary for this study in discovering and describing concepts by observation, it was also used to develop and test theories. With a requirement for gathering information as in Chapter 5, for use in the TNA, there was no need for this to be extended into theorising and testing. As before, these met the conditions for extracting the necessary information. During these four studies, observing Estimators from different companies showed a notable difference in attitudes, dependant on individual company philosophies. However, their methods of approach to the work, their estimating techniques and the stress caused by limitations on tender time, were by no means unique. The studies also discovered an additional main category attribute, Programming and Planning

as well as further job attributes that could be appended to appropriate main categories. The overall finding was that unless a company was specialising in unique areas of the CI most Estimators, properly educated and trained, would find that they could adapt to the techniques and styles of most CI companies even though, as was found with these companies, their methods of operation were diverse.

Limitations

- There were limitations to this study in that, due to financial and time constraints the Estimators in each company could only be observed for limited time periods. This meant that even if a complete observation of a successful tender was made there were insufficient resources to enable this observation to continue through the contract period as well, which would have provided an insight into Estimator involvement with project and company management staff. However, this did not detract from observing Estimators carrying out their core activities.
- Limitations of sample size and data distribution were with the resources of finance and time. In total 26 people were observed over 4 separate companies whose turnovers ranged from £3.5m-£700m

8. The final study on the accumulation of attributes, the skills questionnaire in Chapter 11, was able to develop an extensive list that aided the production of the TNA. The revised IRS from Blaikie, above, was the method used and information was gathered by using a personal interview technique aided by a structured questionnaire. Reasons for using this strategy were as described for Chapters 3 and 4 at item 1, above. These techniques were helped by the experience gained from preparing a questionnaire and carrying out personal interviews in the pilot study, Chapter 5. From the interviews it was found that Estimators' KSAs were being acquired in a seemingly haphazard manner, which reinforced the findings from Chapter 8. Where, in comparison, QSs had been found to be very well provided for with education and training, allowing them to enter employment with appropriate qualifications as a demonstration of their abilities, Estimators had to gain their education and training wherever

they could find it. This study also discovered that Estimators in very senior positions wanted to be able to recruit thoroughly trained staff in sufficient numbers to meet the multi-faceted demands placed upon them and recognised the need for part of this training to be carried out by HE and PBs, in a format that would be tailored to the role. The Estimators interviewed all held senior positions across a broad base spectrum of the CI. Almost 50% had qualifications at degree level and over 60% held professional qualifications. The interviews found evidence of Estimators needing to develop their KSAs in two main ways:

- In meeting the needs of the rising number of client-driven procurement methods
- In adapting to varied methods of carrying out the estimating core process

Views obtained on future Estimator ETPs were strongly in favour of 4 year sandwich courses at Universities, an Estimator-specific professional qualification, with the CIOB being the preferred PB, and on-going training with the involvement of a PB and employers.

Limitations

- There were limitations with carrying out structured interviews. These were in ensuring that the questionnaires were restricted to a length that would not cause the interviewees concern about the amount of time being spent away from their work. In addition, there were concerns regarding personal bias by the interviewees. These were minimised by designing the questions to allow for a maximum amount of dichotomous answers and, where this was not possible, ensuring that the questions could be answered with short replies. The nature of the questionnaire was such that the majority of questions were work related. Also, the interviewees were informed that the information provided would be treated anonymously which it was felt would alleviate any concerns where the questions were of a personal nature.
- There were limitations due to the time-consuming and costly nature of

a personal interview strategy as, with companies spread hundreds of miles apart, there was a limit to the number of interviews that could be carried out. Limitations of sample size were in the interviews covering 13 separate company Estimators and the source distribution was limited, mainly, to the Midlands area. Nonetheless, interviews provided a comprehensive view of the estimating role in civil engineering, general construction and housebuilding, with companies whose turnovers ranged from £1m – in excess of £1b.

9. Estimator attributes gathered in Chapters 5, 7, 9, 10 and 11 provided a comprehensive list for the TNA in Chapter 12. It used the revised IRS from Blaikie, above, combined with a triangulation of techniques as the means of collecting data. Choosing this method was as with Chapters 3 and 4 at item 1, above. This TNA was carefully designed to include as much information as possible to aid education and training providers wishing to embark on developing ETPs for Estimators. The format used allowed for ease of use in accessing any required source of information that these providers might need. This included a Body of Knowledge, set under the Categories heading of the TNA, which would be an informative document for developing ETPs at either formal or professional levels.

Limitations

- The limitations of this TNA in its current form were that it was designed primarily as an explorative questionnaire for use by CI educators and trainers for testing with Estimators. This requires an additional study in order to provide a complete psychometric analysis. However it appeared to offer unique sets of information with the TNA and the BoK for the Estimator role as the researcher had been unable to find any other work that had produced this information in either format.
- Limitations in sample size and source distribution have been discussed, above, as data obtained for use in the TNA was all taken from studies in the thesis and an updated literature review

Verification of the research was addressed, as far as possible, by:

- Making the research up to and including the Delphi study available for scrutiny in an article for the Engineering, Construction and Architectural Management Journal (Appendix 7)
- Using statistical tests on hypotheses which were checked and approved by the researcher's supervisor
- Correlating thematic analyses and checking data collection by the researcher's supervisor and, in one case, an independent third party

Literature reviewed, describing the estimating role, documented it as dealing with the preparation of a nett construction cost. Harris, et al, (2006), the CIOB (2009) and Holdroyd (2002) had all listed role categories based on the work entailed in determining a nett estimate. Adding to this a survey of estimating practices by Akintoye and Fitgerald (2000), the CIOBs code of procedure, above, and work by Brook (2008) showed not only that this was the principal aim but that conventional estimating techniques were still the predominant method used to achieve it. However, contrary to that literature, this research, most particularly the Skills Questionnaire, found that the core estimating process was developing in order to adapt to contractors' changing contracting practices. In addition, while the main objective for Estimators continued to be that of determining the nett construction cost, in whatever form required by employers, their overall function was changing and adapting to clients' varied and developing procurement methods. In particular, PFI, D&B, Integrated Teams, Partnering etc. where contractors were involved throughout the project process. This research demonstrated that Estimators were providing pre-contract financial information that had hitherto been prepared by QSs. Included in the changing Estimator work practices were:

- Increased expectations of BQ production
- Techniques ranging from – traditional estimating methods of pricing labour, plant, materials and sub-contractors; to – estimating methods of preparing, selecting and appraising sub-contract tenders, pricing preliminaries
- Programming and planning the construction work
- Cost Analyses
- Life Cycle Costing

- Cash Flow Forecasts
- Budgets
- Cost Plans
- Development Appraisals
- Feasibility Studies
- Value Engineering
- Value Creation
- Contractual financial negotiations with clients and sub-contractors
- Post-contract costing of additional works

The conclusions to the findings of this research are that:

- The lack of regard shown to the estimating role in the UK by the CI in its disparate provision of education and training could be changed with the provision of Estimator ETPs
- Changing the way in which estimating was presented to possible student candidates by the CITB, providing quality and specific University courses and creating a professional role would enhance its profile, attract more able students and, consequently, decrease the financial risks that the industry faced with its tendering and construction cost procedures
- With Estimators acting as company representatives in design meetings and contract negotiations with clients and clients' representatives, upgrading the estimating role to a professional level would enhance the standing of Estimators and the construction and engineering companies that they represent in these transactions

Chapter 14 - Conclusions and Recommendations

14.1 Conclusions

The overall aim of the research was:

- To establish whether or not the estimating role in the UK CI justified eligibility for professional status

To realise this aim four objectives were set; which were:

1. To determine the general requirements for professional status and to assess the likelihood or otherwise of Estimators' abilities in meeting these requirements, which would be a pre-requisite to professional recognition
2. To determine the regard held by the UK construction industry for Estimators
3. To research education and training available to Estimators
4. To develop an Estimator Training Needs Analysis (TNA) and Body of Knowledge (BoK)

A summary of the main research findings is given below:

- Many Estimators enter the field from other areas of the CI
- Achieving professional recognition for Estimators was found to be a realistic aim
- Estimators were found to have parity with QSs on salaries and benefits provided, and the levels of KSAs required
- There was found to be a negative disparity with QSs on the provision of specific education and training
- The estimating role was found to be changing and developing in order to meet the requirements of different procurement methods, IT, particularly CAE, and differing methods of carrying out the project construction phase
- Estimator-specific courses at HE and PB levels were feasible and the estimating role was worthy of having such courses made available
- The estimating role was found to be held in higher regard in the US than in the UK (this study can be found in Appendix 8)
- The training needs for Estimators had been identified and tabulated
- Proposals for ETPs at University and professional levels have been made available, based on the TNA and the existing provisions at these levels for QSs. These can be found in Appendix 9.

Taken together, these findings show that the four objectives had been met.
The conclusions to these findings were that:

1. Estimating practices had changed and expanded over the last decade
2. The requirements, attributes and demands of the role could meet professional requirements
3. There were insufficient ETPs offered in the UK
4. The disregard for Estimator ETPs demonstrated the low regard in which they were held by the UK CI
5. Estimator specific University and PB courses would enhance their position, which would help in:
    - Changing in attitude of the CI in general and the CITB in particular
    - Attracting more and better students
    - Reducing the financial risks attached to civil engineering and construction contracts
    - Enhancing their standing in meetings with clients and clients' representatives as well as enhancing the standing of the companies they represent

14.1.1 Contribution to Knowledge

The research achieved all four objectives and established justification for the eligibility of professional status for the UK CI estimating role. The reasons for this justification were that the research had produced work that did not appear to have been covered before, which had, thus, updated information on "what Estimators do". This, therefore, had made a number of contributions to knowledge, shown below:

1. Demonstrated a changing, expanding and more demanding Estimator role
2. Produced evidence that Estimators had the necessary attributes to justify professional recognition
3. Developed an Estimator Training Needs Analysis
4. Provided an Estimator Body of Knowledge
5. Produced evidence that the KSA requirements of Estimators were equal to those of QSs
6. Produced evidence of ETPs being heavily weighted in favour of QSs compared to Estimators

7. Made available, in Appendix 9, a demonstration of the viability of an Estimator-specific education programme at University and professional levels

14.1.2 Research Limitations

Although the research achieved all of its aims and objectives there were limitations to the work carried out in the studies that were employed and these are described in Chapter 13, Discussion. However, the author is confident in the credibility, validity reliability and verification of the results.

14.2 Recommendations for the CI

With radical changes affecting the CI this could be the time for a fundamentally new approach to the way in which estimating is perceived and its trainees/practitioners prepared. This could be done in several ways:

An Appropriate Job Title

An estimate is variously described as being an approximate judgement, an opinion or the making of a rough calculation. However the role of an Estimator is expected to surpass that level and provide as accurate a measure of project cost as is possible. Therefore, in much the same way as Planning Supervisors have changed to being known as CDMCs, a more definitive title for their role, so a name change might be timely and appropriate for estimating, to better describe its function. With the changing nature of the job, and its increased scope, it seemed that a more apposite description of their work might be as cost evaluators and, as such, a title of Construction Cost Evaluator, Cost Evaluation Engineer or Cost Evaluation Surveyor could be more fitting for their modernised positions.

An Improved CI Structure

During the discussion with the CIC the lack of a co-ordinating body linking all sectors of the industry became apparent. Universities, training providers, organisations such as the CIC and PBs all appear to produce and/or operate courses relatively independently, even though it was noted that there were University courses accredited by PBs. A sole central body with the power and ability to synchronise the needs of the industry, thereby eliminating its fragmented nature, could provide a fulcrum for the CI and also the UK government.

The Development of a Professional Qualification

The US was shown to have implemented Estimator PBs without any Estimator-specific formal education at HE level. It would be an improvement on that system if CI related PBs in the UK, which were interested in developing an estimating qualification, could collaborate with Universities in the setting up and running of Estimator degree programmes. This would be as a forerunner to gaining an Estimator-specific professional qualification. In this way the transition from knowledge gained at Universities to that required at PB APC courses would be smoothed. This thesis offered PBs encouragement in this regard with the BoK and a proposed RICS APC course structure. The BoK would give any interested PB a basis for understanding the attribute needs of Estimators and the course proposal demonstrated that, with the RICS at least, a specific programme could be formulated from existing QS modules, thus easing the financial burden of developing a new course structure.

15.3 Recommendations for Future Research

The personal interviews carried out for the studies in Chapters 5 and 11 gave a strong indication that Estimators learned on-the-job although over 50% had obtained professional qualifications in other disciplines. This showed that there was willingness amongst Estimators to learn and develop their knowledge bases. The larger interview study in Chapter 11 disclosed a majority interest in seeing "sandwich" degree courses and in the CIOB providing Estimator-specific qualifications. This interest in formal and professional education contrasted strongly with the level of importance attached to it from the Delphi study, where both formal and professional education ranked very low down the importance ranking lists for both Estimators and QSs. In addition, there had been shown to be an almost total disregard by CI employers for the NVQs being made available to the CI, particularly those on offer from the CITB. Future research could include:

1. An expansion in size of the surveys, interviews and Estimator-QS comparisons, carried out by a large and well respected HE and/or CI organisation would refine the case made here
2. Appraising ways of helping students, given the high costs involved in obtaining a University education. This could include an in-depth investigation into the feasibility and acceptability, for both students and employers, of four

year “sandwich” courses as a way of overcoming the financial difficulties a University education may cause for many students

3. Interviewing PBs and CI organisations across the complete spectrum with an aim of establishing the viability of an overall co-ordinating body for all CI organisations. Such a body could:
    - Form a “bridge” between the UK government, professions, CI employers, HE, developers and training organisations
    - Provide direction merge and the interests of all parties in order to develop a much more co-operative and efficient industry.

    This research could include:
    - The identification of any constraints on its establishment
    - Calculation of the costs of its establishment
    - Identification of possible funding sources

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Appendices

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Appendix 1 Research Strategies

Throughout the thesis, various strategies have been employed in order to extract the maximum amount of information in the most effective and unbiased way. To this effect, literature has been searched for information from authors and is collated here for reference rather than being presented within each section.

1.1 Strategies

According to Robson (1994) there are three traditional strategies:

1.1.1 Experiment

This measures the effects of manipulating one variable on another

1.1.2 Survey

Undertaking a survey involves collecting information in standardised form from groups of people

1.1.3 Case Study

This covers the development of detailed knowledge of either a single case or a small number of related cases

1.2 Strategy Sub-Divisions

Apparently, however, these strategies do not have to be rigidly adhered to. It is possible that a 'hybrid strategy' can be developed whereby, for example, an experiment can be undertaken from data obtained from a survey. Using a combination of strategies is also possible if this can be found to be more effective. These strategies can then also be sub-divided into three classifications to determine the purpose of the enquiry being made. These sub-divisions are:

1.2.1 Exploratory

Used to find out; seek new insights; ask questions

1.2.2 Descriptive

Intended to portray profiles of persons, events and situations

1.2.3 Explanatory

Seeks explanations of situations or problems

1.3 Survey Methods

Robson, above, wrote on methods of carrying out surveys as follows:

1.3.1 Postal and other Self Administered Surveys

Advantages are:

- Often they are the easiest way of obtaining information from a large group
- They can be extremely efficient at obtaining data quickly and relatively inexpensively
- Their anonymity can encourage frankness

Disadvantages are:

- A low response rate
- Possible misunderstandings of the questions
- An inability to detect whether or not respondents take it seriously.

1.3.2 Interview Survey

Advantages include:

- The interviewer being able to clarify questions
- The presence of an interviewer can encourage participation and involvement
- It can be seen clearly whether or not the respondent is taking it seriously

The disadvantages with these are that:

- They open up the possibility of interviewer bias
- Data may be affected by the interaction of interviewer/interviewee
- The respondents may be less forthcoming due to a lack of anonymity

1.4 Sample Techniques

Robson (1994) wrote as follows on sample techniques:

1.4.1 Probability Samples

1.4.1.1 Simple Random

Involves selection at random from a list of e.g. companies

1.4.1.2 Systematic

*S*elects on the basis of deciding upon a starting point on the list and choosing every *n*th company

1.4.1.3 Stratified Random

Divides companies into groups where each shares a particular characteristic.

1.4.1.4 Cluster

Is for individual, e.g. companies, each having a range of characteristics which are therefore grouped into "clusters" where their characteristic range is shared.

1.4.1.5 Multi Stage

Extends the "cluster" method into selecting samples in stages i.e. taking samples from samples

1.4.2 Non-Probability Samples

1.4.2.1 Quota

Involves obtaining representatives of various elements of the companies and providing a quota in each category

1.4.2.2 Dimensional Extends the "quota" method by ensuring that at least one representative of every possible category is incorporated into the sampling procedure

1.4.2.3 Convenience Chooses the nearest and most convenient companies to act as respondents

1.4.2.4 Purposive

Involves researchers making their own judgement as to typicality or interest; in this way the specific needs of the researcher can be satisfied.

1.4.2.5 Snowball

Requires one or more companies to be identified and then the use of information obtained identifies others

Robson (1994) said that probability sampling made it possible to specify the probability that any company would be included. If it was not possible to do this, then the method to employ was non-probability, which is a common way when carrying out small scale surveys.

1.5 Validity

Robson (1994) explained the issues of validity as:

1.5.1 Internal Validity

Was *"concerned with the extent to which a study establishes that a factor or variable that has actually caused the effect that is found"* (p 46)

1.5.2 External Validity

Was "the degree to which findings can be generalised from the specific sample in the study to some target population" (p 46)

1.6 Statistical Test Selection Procedure

1.6.1 Designs

According to Hicks (1999) there are two research design types. Decide whether the design is of an Experimental or Correlational nature.

- If the decision is for an Experimental design a decision as to which of three types, needs to be made, these being same-, matched- or different-subject.
- Determine the number of conditions.

Hicks then explained the above points:

1.6.1.1 Experimental

The basis of experimental design is to alter one or more of the variables to see what difference it makes to the other. This method is known as "manipulation of variables". There are names given to these variables, the dependent (DV) and the independent (IV) variable. If a variable is manipulated this will be the IV and it will be the DV which will be affected by this manipulation.

1.6.1.2 Correlational.

In cases where two variables need to be tested for an association or a relationship between them rather than a difference, then this type of design is used. With this method one of the variables is not manipulated but a range of measures related to one of the variables is assessed against a range of measures on the other variable and compared for a relationship between the two. Therefore, as one of the variables will not be manipulated this variable will not be considered as an IV and the other will not be considered as a DV. Conclusions, therefore, cannot be drawn as to a cause and effect and would be unable to ascertain which variable was having an effect on the other.

1.6.2 Types of Experimental Design.

Hicks said that there were two basic designs within this area, one being for projects where just one group of subjects were used in all conditions and the other where two or more groups were used:

- **Related** – Using one group
- **Unrelated** – Using two or more groups

1.6.2.1 Same-(Related- or Within-) Subject Designs

Again, according to Hicks, the use of different subjects in some hypotheses will not be possible and these will, therefore, use just one group which may be measured under all conditions and a comparison made of its performance in each condition. These projects fall under the banner of being the Same Subject. There is, apparently, an advantage with this in its ability to eliminate individual subject difference

distortions but it cannot be used for fixed differences of sex, race, age etc.

1.6.2.2 Different- (Unrelated- or Between-) Subject Designs

This is an unrelated design and can be used where there are two or more subject groups that differ from each other and is, according to Hicks, essential to use when comparisons between race, sex, age etc are being made although a major disadvantage in this, it seems, is that individual differences among the subjects may cause distortions to the results although there are possible ways of overcoming the problem.

1.6.2.3 Matched- Subject Designs

Hicks described a way of overcoming the disadvantages of using Different- or Same-Subject designs by matching two or more groups on a range of characteristics. This is done, apparently, by identifying all the possible characteristics that may influence the results and then selecting a subject to assess against each characteristic. This subject is then matched with another, thus forming a "pair". The process is continued along these lines, using matching subject "pairs", although each pair does not necessarily have to match the others. It would appear that the major disadvantage with this is the difficulty in finding well matched pairs together with the uncertainty in the researcher's ability to choose ideal matches.

1.6.3 Sources of Error

1.6.3.1 Order Effects

Hicks wrote that an experimenter manipulates an IV in the hope that it will have a significant effect on the DV. Changes that occur to the DV by this means, she says, are known as the Experimental Effect. However there are apparently other influences that can affect outcomes. If experiments are carried out in a Same-Subject Design in a particular order, the subject group being used may improve their performance in a staged way, getting better with each test. This has been called the Practice Effect. Similarly the reverse could happen and performances could deteriorate due to staleness or tiredness. This has been called the Fatigue Effect. Apparently, Hicks says, these effects can be overcome with a method known as Counterbalancing, where the groupings are divided into two and the experiments carried out in reverse order.

1.6.3.2 Experimenter Bias Effects

There was a warning here from Hicks that care had to be taken in this regard. It seems that enthusiasm and/or anxiety to obtain the outcome that has been predicted can influence the results. This may happen if the researcher possibly chooses to ignore information that will not suit the prediction. Apparently this can occur either deliberately or unwittingly. Also during interviews or discussions it would appear that these same effects can happen with influence occurring on a personal basis either knowingly or otherwise. These are known as Experimenter Bias Effects. Hicks suggested that to counter this an independent person could be used to collect all the data, by whatever means is necessary and appropriate and the person should not be aware of the hypothesis This counter measure Hicks called a Blind Procedure.

1.6.3.3 Constant Errors

According to Hicks, all possible sources of bias and influence that affect results in a predictable and constant way are known as Constant Errors. Seemingly results can be distorted in comparisons between groups working under different but constant conditions. A simple example may be of one subject group being based in an outdoor environment and being compared directly with another group, undertaking the same work but in an indoor environment in controlled atmospheric conditions. If both groups remain within their own environment throughout the study then there will almost certainly be a Constant Error in the predictable way in which these results will become distorted. A possibility such as this needs to be identified, Hicks says, and either eliminated or controlled. With the above example, one possible way would be by exchanging the group environments at the half way stage of the study, perhaps.

1.6.3.4 Random Errors

This type of error, said Hicks, occurs in a random way and with random distribution throughout the study. Apparently, this then has an unpredictable affect upon the outcome. Examples of the cause of this type of error which may affect the answers given or the way in which the answers are given, are:

- Moods
- Transitory health changes
- Personalities

- Attitudes
- Beliefs
- Motivations

Hicks felt that very little could be done about these factors except to ensure that, as far as is possible, subjects are selected in a random way which should then provide a group that may be fairly typical of the type being researched and therefore not biased specifically towards good, bad, problematic etc. sections.

1.6.4 Probabilities

Hicks explained a method by which the effect of Random Errors may be overcome. The method apparently, lies in the use of statistical tests which can provide as part of the analysis, a probability value or *p* value**,** expressed in either a decimal or a percentage form. This value shows how probable it is that the results of the trial are due to random error. This value, seemingly, is the basis of all statistical analyses and is therefore of great importance. The smaller the *p* value the less likely it is that the results have been affected by random error. Hicks extends this explanation to illustrate the point that , by implication, the smaller the possibility that the results are due to random error then the greater the possibility that the outcome will be due to the relationship predicted in the hypothesis.

1.6.5 Significance Levels

A small *p* value then, Hicks said, will demonstrate support for the hypothesis and therefore reject the null hypothesis which will mean that the results are Significant. Determination of the Significance Level is not seemingly a matter of science but more of human decision making. Apparently a level of 5% or .05 would be a normal level of expectancy for a trial but there will be areas where this level will be too great. This, according to Hicks, occurs where the outcome can have serious repercussions. If the hypothesis predicts the occurrence of a particular situation will mean that death or serious injury will ensue, then it would be reasonable to assume that a significance level of .05 meaning that there would be a 5% chance of the results being due to random error, then it may be assumed that this level would be too high and the risk too great. In this situation Hicks suggests that in all probability this particular significance level would be nearer .01 with a resultant risk of 1%. The level of

significance then, according to Hicks, is decided upon by the researcher, taking into account the degree of severity of the outcome. All of the implications of any errors that will develop from these decisions need to be thoroughly considered.

1.6.6 Errors

Hicks pointed out the possibility of making errors in the Conclusions, regarding Significance, and demonstrated two ways of safeguarding the situation, categorising them as follows:

1.6.6.1 Type 1 Errors

- These it seems, are situations where the conclusion has been that the hypothesis has been supported but that this is not the case because an incorrect significance level has been used. Therefore ensure that the correct significance level is properly considered and selected.
- Credibility can be attained by replication of the study by independent research.

1.6.6.2 Type 2 Errors

In cases where the experimental hypothesis is rejected in favour of the null hypothesis when in reality the experimental hypothesis should have been supported, can be rectified by:

- Increasing the sample size.
- Using a significance level that is less stringent.

In giving consideration to these sources of error as they have been set out, the reasoning and methods used to counteract the possibility of errors are as follows:

1.6.6.3 Parametric and Non Parametric Tests.

The explanation given by Hicks is that a Parametric Test is more sensitive than a Non-Parametric Test. The difference apparently is similar to using kitchen or bathroom scales to weigh cooking ingredients. However, it would appear that it is not just as simple as making a direct choice between the two. In order to be able to use the Parametric Test there are four conditions that need to be met, one of which is critical and the other three not quite so important. The critical condition is that the measurement data being used must be scale data of an interval/ratio level of

measurement. This condition apparently cannot be violated. The other three conditions are, it seems, a little more flexible but attempts should nonetheless be made to achieve them. They are:

- Randomly select subjects.
- Measurement data should be normally distributed which will apparently appear on a distribution graph as an inverted U shape.
- There should be rough similarities in the variation of results from each condition.

Hicks then gives a clear indication of test selection for Experimental Designs which are Different Subject Designs in Table 1, as follows:

Table 1

Subject Group		**Condition**		**Non-parametric Test**	**Parametric Test**
Subject Group 1 Subject Group 2	takes part in takes part in	Condition 1 Condition 2	Compared for Differences Between Conditions	Chi-squared test (if data is nominal) or Mann-Whitney U test (if data is other than nominal)	Unrelated *t* test (if data is interval/ratio)

According to Pallant (2003) there are two different Chi-squared tests:

- Chi-square for goodness of fit (one-sample Chi-square), which explores the proportion of cases, in various categories of a single variable. These are compared with hypothesised values.
- Chi-square test for independence, which determines the relationship between two categorical variables.

1.7 Survey Sampling

Robson pointed out the close link that exists between sampling and external validity to the results of a study, which he also described as the extent to which what is found in a particular situation at a particular time applies more generally.

Another description of sampling came from Smith (1975, p 105) as *"the search for typicality"*

Hicks thought it seemingly impossible to involve every person that will be of interest, from both practical and financial viewpoints. There is a need though for the sample to be representative of the area being covered, as a whole. In order that this becomes representative the sample must cover the right areas, it was said.

In agreement with this was Wood (2003) in saying that it was impossible, more often than not, to obtain data from a complete area of study and therefore there would be no choice but to take a sample. In doing so, he continued, this pattern must reflect the pattern of the whole as closely as possible.

If further reinforcement of this point was necessary then Kumar (1999) explained the concept in this way. Sampling, he said, was the process of selecting a few from a larger number to become the basis for predicting the outcome of the larger number.

That collecting a sample is a problem was acknowledged by Rowntree (1981, p 23) who described this as the *"paradox of sampling"*. He went on to talk about how misleading a sample could be unless it was representative and that it could only be representative if what was needed to be known was already known. In this case, he continued, there would be no need for a sample. Thus, apparently, the paradox cannot be completely resolved and some degree of uncertainty remains. It is because of this uncertainty that the use of a statistical methodology helps to make the collection of samples as representative as possible and the analysis of the data collected to show the degree to which the probability of random error has occurred.

1.8 Constructing Schedules and Questionnaires

Parten (1965) offered a 17 point guideline for the construction of a schedule or questionnaire, as follows:

1. In developing the questionnaire, the format for use by a person asking the questions and entering the replies should be different to that filled out by the informant. In this regard, the exact wording will be secondary to fundamental meaning as the interviewer can assure a uniformity of interpretations.

2. Brevity is a recommendation, in that a respondent will be more amenable to answering questions if they are aware that the interview will not take much from their working day, although Oppenheim (1992) considered that the length of the form will depend upon the topic and the degree of interest to the respondent.

3. On creating the terminology of the questions, these can be much more technical if it is known that they will be addressed to specialists in the subject, than if they are directed at a general cross section of people.

4. Consideration should be given to appearance with more care needed to be taken to presentation if the form is to be despatched by post than one where the questioner is holding the questionnaire and filling out the answers from the participant, the reasoning being that an attractively presented form holds more likelihood of being used if given to the participant to complete personally. Oppenheim had a similar point to make on this.

5. Attention needs be paid to the sequencing of questions and whether it is important for certain questions to follow others or for them to be set into sections. This is of greater importance if there are a large amount of questions which will require more detailed planning. Oppenheim described this as the "funnel approach" and the sub-questions as "filter" questions.

6. Determination of the purpose of the questions has to be deliberated on, with consideration being given as to whether they have to ascertain facts, investigate knowledge or assess the opinions/beliefs/attitudes of the interviewee.

7. If the work is to be used in further surveys then the form design has to reflect the necessity for comparability and uniformity of the results.

8. There ought to be an awareness of what is to happen to the questionnaire once it has been completed. It may need to be analysed by direct tabulation or by being coded for use in a mechanised form.

9. Sizing of the paper has a bearing in the way in which the form will be presented at the interview and the analysis stages. A form for use by one individual might need to be on A4 paper if it is being used during a personal interview, whereas a form designed to be used for a large number of individuals may possibly need to be larger and one for a postal survey could be done on a postcard.

10. If the form is to be left to the participant to complete then it may be necessary to indicate whether or not more than one answer can be given to each question.

11. A decision needs to be made on the number of forms to be printed with an allowance for damage and loss and for those used for practice purposes.

12. Provide a title that will enable those being questioned to see, if they wish, a description of the work that they are helping with and will also be identification for the survey for everyone needing to work with it at any stage. A number on each form could also be useful.

13. Decide upon the desired method of identifying the participant, which may be by name, age, sex etc.

14. If the survey has a sponsor then their name should also appear. This was also mentioned by Oppenheim in item 3 of his suggested benefits (see below, p 13).

15. Other items to be considered are; address, date and time, interviewer's name, telephone number, place of interview, marital status, religion, etc. However, Oppenheim is of the opinion that the inclusion of these types of questions may have a detrimental effect on the respondents' interest.
16. Where there is identification then a statement should be added to assure the contributor that the information provided will be confidential and not disclosed in any form that will identify the individual concerned.

17. The intention is to elucidate the problems with which the survey is concerned and therefore the questions require pertinence and to be put in a way that will extract as much useful information as is possible in the space and time available.

1.9 Process for Decisions on Question Selection

Parten also gave nine processes to follow in deciding upon which questions to include, as:

1. Those that directly concern the problem or the means of evaluating the methodology are the only ones that should be included. There is no justification for the inclusion of questions falling beyond the scope of the survey.

2. Questions whose answers can be more effectively gained elsewhere should be avoided but with the proviso for those needed as a cross check on other sources or as a development or an extension of previously attained information.

3. Show awareness of how the data gained from the questionnaire will be tabulated at the analysis stage.

4. Obtain comparable data from previous studies if this is possible and if identical questions can be used then this will help ensure the merits of the study by comparing the results of those carried out previously.

5. Avoid questions of a personal nature unless they are relative to the study.

6. Ensure, within reason, that the informants can be expected to know the answers to the questions.

7. Unless adequate precautions can be taken, avoid the type of questions that can produce an imprecise reply. Examples of this are people's qualifications or other personal achievements which can often, apparently, be exaggerated.

8. Keep the questions simple, steering away from making demands on the respondent.

9. Unless the survey is concerned with opinions rather than facts, then these types of questions should not be used.

1.10 Methods of Obtaining Personal Opinions

For methods to obtain information on what respondents think about particular issues or subjects, Parten said that the following seven items should be considered:

1. Open ended questions which will give each person freedom to express their own opinions. These tend to be suitable for smaller surveys or pilot studies as they are inclined to be difficult to classify and analyse. Oppenheim suggested that, with these types of questions, consideration needs to be given to the amount of space to be allowed as this may restrict the answers given and he agreed that they can be difficult to analyse but added that they are easy to ask and hard to answer.

2. Use conversations to glean respondents' opinions without asking specific questions, with a style known as Free Story and Case Method. This procedure is often undertaken by people trained in the art of extracting the desired information by encouraging the respondent to provide opinions on that particular subject.

3. Market survey questions can be carried out with Coincidental, Recall and Recognition methods. Examples of these are:

    - Coincidental method can be where a person is asked whether they are listening to the radio and, if so, what programme they are listening to.
    - Recall method could follow from above by asking the same person to describe the programme they heard prior to the time when the questioning began.

- Recognition method may involve radio listeners being shown a list of programmes available at the time that they were listening and then indicating the programmes that were listened to.

4. By presenting opposite alternatives such as “yes” or “no” answers, which are known as Dichotomous questions.

5. One way of using multi choice questions is by providing Check Lists which are usually created by providing a statement and requesting that an answer be checked from a list of three to fifteen possible answers.

6. Lists of words, phrases, statements etc., can be set out in an order of merit by a respondent, known as Ranking of Items.

7. Where an issue is not sufficiently clear cut that it can be answered dichotomously then the interviewer can offer the interviewee a choice of differing opinions from which to choose an answer, which is known as a Multiple Choice question and differs slightly from the Check List above by providing a totally comprehensive list from which to choose.

Using the above information as an aid for constructing the questionnaire, a five point check list for the procedure was also helpful, offered by Oppenheim, above, which was:

1. Decide upon the main type of data collection instruments with examples being given as observational techniques, postal questionnaires, interviews etc.

2. Determine the method of approach to respondents, such as length of questionnaires, confidentiality, stating the purpose of the research etc.

3. Build up the question sequence and the order in which the questions will be placed

4. Designate sub-questions and set these in their correct modules

5. Make decisions on the question types as to whether to use “closed questions” or to allow a “free response” as was mentioned by Parten in 1 above

1.11 Types of Questionnaire

Oppenheim also set out descriptions of the types of questionnaires that can be used as:

1.11.1 Postal Questionnaires

The advantages of those sent by post were given as:

- Of low cost in the production of data and processing
- An avoidance of bias
- The ease of reaching recipients who can be widely dispersed and/or a considerable distance from the base

Disadvantages of this method were:

- A probable low response rate
- Difficulties in explaining questions
- Lack of control over incomplete responses
- An inability to make observations of the workplace in which the recipient is operating

1.11.2 Standardised Interviews

The advantages seen were:

- A high response rate
- An opportunity to correct misunderstandings or misinterpretations
- An ability to observe what is going on around the respondent

Disadvantages were said to be:

- Their high cost
- A possible interviewer bias
- Their inability to reach widely dispersed respondents

On the final point it seems not so much an inability as a time consuming and costly exercise involving a great deal of travel that would prove to be a stumbling block.

1.11.3 Self Administered Questionnaires

These are presented to the respondents and their purpose is explained before the respondent is left to complete the questionnaire alone.

The advantages of using this method are:

- That they can ensure a high response rate
- A sampling accuracy
- A minimising of interviewer bias whilst affording an opportunity for observation and personal contact

1.11.4 Group administered questionnaires

These are given to groups of people and are usually administered by two or more people who can offer non-directive help to the recipients and check the completed forms.

It would seem that, with this method the researcher can be certain that all respondents complete the questionnaire but that there is a possibility of contamination by visual or oral comparison by the respondents.

1.12 Methods of Approach

Adding to Parten on surveys, Oppenheim, *op cit,* considered the following methods to be useful:

1. Provide advanced warning of an impending study

2. Explain why the respondents have been chosen and the sampling method

3. If there are sponsors or the study is being supported in some way by other individuals or organisations then explaining this could be of benefit.

4. Ensure that the appearance of the first envelope is inviting and, if possible, personally addressed to the respondent.

5. Advance publicity of the survey with the local media

6. Provide rewards for participation

7. Ensure confidentiality and provide written assurance of this to the respondent

8. Be aware of the need for reminders to be sent out if the response rate is slow or poor

9. If the work is based on interviews, try to develop a rapport with the interviewee

10. The inclusion of a stamped, addressed, return envelope should improve the response rate of a postal survey

1.13 Sources of Error with Standardised Interview Techniques

Fowler (1990) listed items that he considered needed to be guarded against when standardising questions for interviews:

1.13.1 Sample Surveys

A survey based on a sample is subject to sampling errors which occur when:

- Some types of people are excluded from the sampling frame
- The chance that by some probability the sample does not reflect the population from which it is drawn
- When some people in the survey do not provide answers to all of the questions.

1.13.2 Questionnaire Wording

The wording of questions may have a bearing on the accuracy of the answers when:

- They are misunderstood
- Require information that the respondents cannot provide
- There is an unwillingness to give accurate answers

1.13.3 Interviewer Attitude

The manner in which the interviewer interacts with the interviewee can influence the amount and type of errors by:

- The questions are being put to the interviewee incorrectly
- There is a bias in the relationship between the two people
- If the questions are recorded inaccurately

1.13.4 Data Analysis

Analysis of the data can be influenced by errors during the process of entering the information when:

- The judgement used in inputting the information is faulty
- If data is entered incorrectly

1.14 The Delphi Technique

The technique for carrying out a Delphi study was found from Hicks (1999).

1.14.1 Principal Aim

To arrive at a consensus of professional opinion on any given topic; it being particularly useful if decisions have to be made where there is too little or too much information or where there is contradictory evidence.

1.14.2 Method

- Postal Survey targeting relevant experts
- Identify expert professionals
- Send Survey Form either by:
    1. Inviting expert opinions in an unstructured, free response way
    2. Outlining a topic perspective and requesting level of agreement, usually using a numerical rating scale.
- Received forms are then compiled as a list of the most endorsed viewpoints and re-distributed back to experts with a request that they be ranked according to importance
- This procedure is repeated several times until a shortlist of items is obtained that has the total agreement of the experts

- Separate subjects into categories e.g. communication; education; training; qualification
- Try to obtain agreement on categories with other researcher or use Thesaurus to cross check semantically similar words
- Perform a Kendall coefficient of concordance on the rankings in order to assess the level of agreement among the experts
- Rank subjects into order i.e. total scores received for each subject then rank as highest being the one with the lowest total and so on
- Subjects then re-presented to experts in order of importance with the list clearly stated as a group response where each expert is free to agree or disagree
- Experts invited to re –rank the subjects with the option of changing their previous rankings
- Perform Kendall coefficient of concordance test on replies. The test can be stopped if there is a high level of agreement amongst the experts. Otherwise it needs to continue until there is

1.14.3 Advantages

- Encourages unbiased answers free from peer pressure and top-down pressure
- Allows well informed but less dominant, more inhibited people to express opinions
- Using postal method means:
    1. Uncontamination from interviewer pressure
    2. Allowing collection of a large quantity of data from a wide range of experts
    3. Ensures content validity through tapping into a range of expert opinions
- Highly flexible technique that can be used on a range of professional disciplines

1.14.4 Disadvantages

1.14.4.1 Sampling:

- No recommended inclusion criteria for selection of experts
- Difficult to associate the size of the sample with genuine population size

1.14.4.2 Reliability and Validity

- Establishing reliable categories after the first round may be problematic with no well defined guidelines for achieving this
- Wearing down of experts with constant re-introduction of Forms
- No means of comparing changes in individual responses between rounds

1.14.5 Experimenter Bias Effects

Researcher can influence results by:

- Deciding the point at which consensus is reached
- Excluding outlying views which may eliminate valuable perspectives
- Classification of initial responses under broader headings may involve arbitrary assumptions and decisions
- Categories may reflect researchers personal agenda

1.14.6 Conclusion

A useful database can be provided for future decision making provided a sound and justifiable methodology is adopted.

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Appendix 2 Estimator-QS Job Advertisement Details

Table 1. Trainees/Assistant QSs

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.1	Trainee QS	Assist in Surveying Dept.	Midlands	General Construction £65m	05/09/03 Anders Elite	12,000-18,000	Relevant Surveying Qualificatio
2.1	Assistant QS	Assist in Projects £3.5m-£12m	Portsmouth	General Construction £90m+	08/09/03 Anders Elite	15,000-17,500	6 months min. experience with contractor
3.1	Assistant QS	Assist in Surveying Dept.	Radlett	Civil Engineering Groundworks Medium	09/09/03 Anders Elite	18,000-26,000	Min. HND
4.1	Assistant QS	Assist in Major Roadwork	London & South East	Civil Engineering Major Contractor	15/09/03 Anders Elite	16,000-22,000	HNC or Degree in Surveying + working for RICS
5.1	Assistant QS	Trainee/ Assist in Surveying Dept.	York	Housebuilding Medium	12/09/03 Anders Elite	13,000-16,000	Graduate or HNC
6.1	Trainee QS	Assist in Surveying Dept.	Hook	Civil Engineering Large	10/09/03 Anders Elite	16,500-19,000	Graduate
7.1	Trainee QS	Assist in Project Work	Bristol	Civil Engineering Major	27/08/03 Anders Elite	10,000-19,000	Should be working for either ONC/HNC or BSc
8.1	Trainee QS	Assistant QS	Manchester	Management and Consultancy Services	05/09/03 Anders Elite	16,000-22,000	QS Graduate
9.1	Trainee QS	Assistant to 2-3 QSs	Essex	General Construction Medium	25/07/2003 Cordon Recruitment	16,000-19,000	HNC or Degree with Some Experience Preferred
10.1	Assistant QS	Assistant to Project QS on New Build	Wales	General Construction Medium	08/10/2003 Anders Elite	19,000-22,000 + Car	None Given

Table 1. Trainees/Assistant QSs (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
11.1	Graduate QS	Helping to Target New Opportunities	Wales	General Construction Medium	18/08/2003 Anders Elite	18,000-20,000	Degree + Min 1 yr Appropriate Experience
12.1	Assistant QS	Working within a Large Team of QSs but Occasionally on Initiative	Wales	Facilities Management Medium	18/08/2003 Anders Elite	18,000-22,000 + Benefits	Min HNC Self Disciplined and Confident at Working on Own Initiative
13.1	Assistant QS	Working as Student QS in Homes Division	Scotland	Housebuilder Medium	15/07/2003 Anders Elite	15,000-22,000 + Benefits + Given 1.5 days/week to Continue studies	In 3rd or 4th yr of BSc in Quantity Surveying with Hands On QS Experience with Housebuilder or Contractor
14.1	Assistant QS	Working on Water Projects from £20K-£3m	Scotland	Civil Engineering Medium	09/10/2003 Construction jobsuk.com	23,000-27,000 + Car + Pension + Bonus	2-3 yrs Experience
15.1	Assistant QS	QS Support on Highways Bridges and Tunnels	London	Civil Engineering Consultancy Top 10	01/08/2003 Henry Recruitment	To 27,000 + Benefits	Non Given
16.1	Assistant QS	Working with Cost Manager on a Variety of Projects	London	QS Consultancy	01/08/2003 Calco Technical Recruitment	To 34,000 + Benefits	Degree + 2 yrs Post Grad Experience + Working Towards or Recently Qualified MRICS

Table 2. Trainees/Assistant Estimators

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.2	Trainee Est.	Assist in Estimating Dept.	Midlands	General Construction £65m	10/09/03 Anders Elite	12,000-18,000	Qualification Preferred but not Specified
2.2	Trainee Est.	Assist in Estimating Dept.	Essex	General Construction £10m	10/09/2003 U Recruit	16,000	Studying ONC/HNC
3.2	Assistant Estimator	Training and Assisting in Estimating	East Anglia	Modular Building Contractor Medium	17/09/03 Elliot Marsh Ltd	£25,000+	Junior QS with interest in estimating
4.2	Assistant Estimator	Assist in Estimating Dept.	Mitcham	General Construction Medium	24/07/03 Anders Elite	19,000-25,000	2 yrs Experience or recent Graduate
5.2	Assistant Est.	Assist in Estimating Dept.	Frimley	General Construction £302m	12/09/03 Anders Elite	20,000-26,000 + Car/Bonus /Pension	Flexible on Previous Experience
6.2	Trainee Est.	Assist in Estimating Dept.	Mile End	Interior Refurbishment £40m	02/09/03 Anders Elite	20,000-25,000 + Car	Offers Training + Day Release
7.2	Trainee Est.	Assist in Estimating Dept.	Bristol	General Construction £20m	27/08/03 Anders Elite	20,000-25,000	Graduate looking to Specialise/ Transfer to Edtimating or Early Career Person with min HND
8.2	Trainee Estimator	Training & Assisting in Estimating Dept.	Beds	General Construction Medium	16/09/03 Hays Personnel	To £20,000 + Car/H.C./Pension	Non Required with or without Construction Experience

Table 2. Trainees/Assistant Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
9.2	Trainee Estimator	Training & Assisting in Estimating Dept	Manchester	Civil Engineering Large	15/09/2003 Hays Personnel	£17,000-£20.000 + Car/Bonus/ Pension	Degree and 1-2 yrs Experience as CE or Estimator
10.2	Assistant Estimator	Assisting Senior Estimator with Enquiries and Estimates	Yorkshire	General Construction National Contractor	22/09/2003 Anders Elite	16,000-23,000 + Excellent Package	Relevant Degree + Good Sound Knowledge of CI. Experience Not Required
11.2	Assistant Estimator	Dealing with Enquiries and Quotations	Rugby	General Construction Medium	16/09/2003 Hays Personnel	To £20,000 + Car + Profit Share	Min 5 yrs Experience + Commercial Background + Sub-Contract Experience
12.2	Assistant Estimator	Assisting with Estimating	Cockfosters	Property Development Major	21/09/2003 Hays Personnel	25,000-30,000 + Car + H/Care + Pension	Min 2 yrs into HNC/HND/BTEC + Previous Experience with Estimating on Housing
13.2	Assistant Estimator	Assisting with Estimating	Barnet	General Construction Medium	08/08/2003 Hays Personnel	To 30,000 + Car + H/Care + Pension	Min 2 yrs into HNC/HND/BTEC + Previous Experience with Estimating

Table 2. Trainees/Assistant Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
14.2	Trainee Estimator	Working on Projects 250K-£2.5m Work in close contact with Clients to Enable Co-ordination with Site Staff/Contract Managers/S/ Contractors	Midlands	General Contractor Medium	02/10/2003 Anders Elite	10,000-14,000	No Experience Required/ Aptitude for Construction/ Proven Dedication towards the Industry
15.2	Assistant Estimator	Training Alongside Managing Estimator	Salford	General Contractor Medium	17/10/2003 Construction Jobs UK	14,000 + Benefits	Working toward ONC/HNC Level + Ambitious with Some Construction Knowledge Particularly Housing/Day Release
16.2	Trainee Estimator	Working in a Team Environment +Training	Preston	General Contractor Large	05/11/2003 Hill McGlynn	17,000-20,000 + Car + Bonus + Pension	Degree + 1-2 yrs Experience in Civils or Estimating/ Experience working with Team

Table 3. Standard QSs

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.3	QS	QS on £1m-£10m Projects under guidance of Senior QS	Midlands	General Construction National Contractor £500m+	10/09/03 Anders Elite	25,000-35,000 + Benefits	Qualification Preferred but not Specified
2.3	QS	QS on £500k-£3m Projects	Basingstoke	General Construction Large Contractor	11/09/03 Anders Elite	34,000-37,500	No Qualification Required but Experience at this Level
3.3	QS	QS on Housing Projects	North West	Housebuilding Large Contractor	12/09/03 Anders Elite	26,000-30,000 + Car/H.C.	Experience in Private Housing. Computer Literate. Work on Own Initiative
4.3	QS	QS on £25m+ Projects	Cosham	General Construction Large Contractor	2003 Anders Elite	34,000-37,500	Experience on Major Projects + PFI & D& B
5.3	QS	QS on £250k-£10m Projects	Streatham	General Construction and Interiors Medium Size	15/09/03 Anders Elite	30,000-35,000 + Car & Benefits	Qualification Required but not Specified. Experience can be Sufficient
6.3	QS	QS on £1m+ Projects	Nottingham	Social Housing Medium	03/09/03 Hays Personnel	To 34,000 + Benefits	Experience of Social Housing Projects
7.3	QS	QS	Chelmsford	Social Housing Medium	31/07/03 Hays Personnel	20,000-40,000 + Benefits	CIOB or Degree

Table 3. Standard QSs (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
8.3	QS	QS	Birmingham	Private Practice QS & Project Management	11/08/2003 Anders Elite	30,000-35,000 + Car Allowance/ Pension/H.C.	Either RICS or Graduate with Post Grad. Experience working toward RICS
9.3	QS	QS on Projects of £1m-£5m	Midlands	General Construction £24m	10/07/2003 Anders Elite	26,000-30,000 + Benefits	Experience
10.3	QS	QS for Pre & Post Contract Work	North West	General Construction £100m Divisional (7 Divisions)	10/07/2003 Anders Elite	24,000-30,000+ Car + Benefits	Experience of this Type of Work but Supervision will Add to Training
11.3	QS	Play Important Role in Fast Track Projects and Maintain Strong Links with Blue Chip Clients	East Midlands	Multi Disciplinary Consultancy	18/07/2003 Judd Farris Property Recruitment	To 30,000 + Benefits	Up To 3 yrs Post MRICS Experience + Retail Experience
12.3	QS	Traditional Private QS Work + Employers Agent and Project Management	Bath	QS Practice	18/07/2003Judd Farris Property Recruitment	To 30,000	6 months Commercial Surveying Experience

Table 3. Standard QSs (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
13.3	QS	Work on Large Rail, Commercial and PFI Projects	Exeter	International Cost Consultancy	18/07/2003 Judd Farris Property Recruitment	To 35,000 + Package	18 months Commercial Experience with either PQS or Contractor
14.3	QS	Work with Team Running Projects from £750K- £3m	Wales	General Contractor Medium	18/10/2003 Anders Elite	31,000-34,000 + Bonus	Attitude and Approach are Most Essential + Commercial Astuteness Beneficial
15.3	QS	Responsible for Residential Projects	Wales	Housebuilder £350m	31/07/2003 Anders Elite	29,000-33,000 + Benefits	Min 5 yrs Experience with Stable background and Drive to Succeed
16.3	QS	Responsible for Residential Projects from Conception to Completion	Scotland	Housebuilder + General Construction Large	10/09/2003 Anders Elite	22,000-28,000 + Car + Pension + Bonus	Experience + Excellent Management Skills
17.3	QS	Preparation of Computerised B o Qs + Post Contract PQS Work	Scotland	Property Development Medium	28/08/2003A nders Elite	25,000 + Benefits	Degree and PQS Experience
18.3	QS	To Work on Contracts£3m-£20m Be in Control of Site/Supervise Junior QS	Newcastle upon Tyne	General Construction/ Civil Engineering £350m	30/09/2003A nders Elite	26,500-29,000 + Car/Allowance +Pension	Experience with Main Contractor, New Build & Supervision of Junior QS/Solid Background/ Knowledge of NECI

Table 4. Standard Estimators

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.4	Estimator	Estimating on Projects to £10m	Nottingham	General Construction National Contractor	17/09/03 Elliot Marsh	35,000 + Benefits	Min 7 yrs Experience & ideally full working knowledge of Conquest CAE System
2.4	Estimator	Estimating Civil Engineering Projects to £3m+	Maidenhead	Civil Engineering Medium	08/08/03 Hays Personnel	45,000 + Car/Pension/ H.C./Bonus	Degree & min 6 yrs Civils Experience
3.4	Estimator	Estimating on Projects	Altrincham	General Construction £130m+	17/09/03 Hays Personnel	To 37,000 + Bonus 8-15%/H.C.	Not Specified
4.4	Estimator	Estimating including BoQs/Plan & Spec.	Eastleigh	General Construction Large	09/09/03 Hays Personnel	To 36,000 + Car Allowance/ Pension/H.C.	Experience in BoQs/Plan & Spec./Eye for Detail
5.4	Estimator	Estimating Projects to £3m	Harrow	General Construction Medium	31/07/03 Hays Personnel	To 30,000 Benefits.	2 yrs Experience
6.4	Estimator	Estimating	West Midlands	General Construction £10m+	16/09/03 Hays Personnel	20,000-£40,000+ Car & Benefits	Construction Related Qualification
7.4	Estimator	Estimating on Projects to £5m	Essex	Interior Fitting Out Medium Size	11/06/03 Hays Personnel	To 37,000	Min 5 yrs Experience on Fitting Out Works
8.4	Estimator	Estimating on Projects 200k- £2-3m	West Midlands	General Construction £15m	16/09/03 Anders Elite	25,000-£30,000+ Benefits	Relevant Experience
9.4	Estimator	Estimating on Projects £1m - £8m	West Midlands	General Construction Medium Size	24/07/2003 Anders Elite	20,000-35,000	Previous Estimating Experience with Main Contractor

Table 4. Standard Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
10.4	Estimator	Estimating on Projects	Burnley	Civil Engineering Medium Size	22/07/2003Anders Elite	30,000-35,000	Min 5 yrs Experience on with Respectable Contractor
11.4	Estimator	Estimating on a Variety of Projects	Midlands	General Construction £23m	18/07/2003 Hays Montrose	25,000 + Car + Pension +Bonus	Previous Experience with GC + Enthusiasm, Drive and Good Attention to Detail
12.4	Estimator	Estimating on Tenders up to 500k	Berkshire	General Construction Large	25/07/2003Hays Montrose	28,000	Previous Experience from People at All
13.4	Project Estimator	Estimating on Tenders up to £2m	N.Beds.	General Construction £90m	25/07/2003Hays Montrose	30,000 + Benefits	Experience of Estimating in Commercial, Retail and Leisure + Well Motivated with a Strong Drive to Succeed and used to Working Successfully Within a Team
14.4	Estimator	Working with Estimating Team on Civil, Building and Mining Projects	Wales	Building and Civil Engineering £960m	19/09/2003Anders Elite	22,000-27,000 + Car + H/Care + Benefits	Degree Preferred with 1-2 yrs Post Grad. Experience of Housing or Main Contracting
15.4	Estimator	Working in Team on 250K to £9m	Wales	General Construction Large	02/10/2003Anders Elite	25,000-30,000 + Car + H/Care +	Min 5 yrs Experience
16.4	Estimator	Responsible for Estimating from Drawings and BoQs	Scotland	Concrete and Masonry Sub Contractor Medium	26/02/2003 Hays Personnel	16,000-20,000	Degree Preferred + Estimating Experience in Construction + Commercial Awareness + Computer Literacy

Table 4. Standard Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
17.4	Estimator	Working in Team on £1m-£5m Projects	Wales	General Construction Major Company	17/09/2003 Anders Elite	20,000-40,000 Car + H/Care + Benefits	Degree Preferred With Min 5 yrs Experience as QS or
18.4	Estimator	Conception and Costing of Civil Engineering Projects	Scotland	Civil Engineering Contractor Large	30/01/2003 Hays Personnel	23,000-26,000	MICE + Civil Engineering Experience of Road, Rail and Marine Projects

Table 5. Senior QSs

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.5	Senior QS	Managing 3 QSs Liaising with Board	Croydon	Refurbishment and Fitting Out Medium	27/08/2003 Anders Elite	39,000-42,000+ Car + Benefits	MCIOB & or BSc
2.5	Senior QS	Support to Commercial Management Site Team	Chichester	General Construction/ Civil Engineering	12/09/2003 Anders Elite	33,000-36,000+ Benefits	Experience/ Solid Commercial Acumen
3.5	Senior QS	Managing 3-4 Projects to £10m	Hull	General Construction Large	11/09/2003 Anders Elite	30,000-35,000+ Car + Benefits	Arbitration Experience & Senior Level Experience
4.5	Senior QS	Managing Number of £6m Projects	North West	General Construction Medium	10/09/2003 Anders Elite	33,000-35,000+ Car + Benefits	Min. HND or Experience of Similar Work
5.5	Senior QS	Managing QS Site Work	London & South East	Civil Engineering £900m	04/09/2003 Anders Elite	35,000-40,000+ Car + Benefits	Computer Literate & Able to Work Under Pressure
6.5	Senior QS	Managing QS Site Work	Purley	Construction Services International Company	04/09/2003 Anders Elite	34,000-37,000 +Benefits	Computer Literate with Good Communication Skills
7.5	Senior QS	Managing QS Work on Projects to £10m	Midlands	General Construction Large	16/09/2003 Hill McGlynn Careers	40,000 Car + Benefits + 20% Bonus	Experience More Important than Qualification
8.5	Senior QS	Managing QS Work on Projects 500k to £10m	Midlands	General Construction Large Contractor	08/08/2003 Hill McGlynn Careers	35,000-40,000	Experience More Important than Qualification
9.5	Senior QS	Managing QS Work on Projects to £5m	Greater London	Interiors £50m	11/09/2003 Construction Jobs UK	40,000 Car + Benefits	Non Given

Table 5. Senior QSs (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
10.5	Senior QS	Managing QS Work on Projects to £15m	North West	General Construction Large Contractor	16/09/2003 Construction Jobs UK	40,000 Car +	Non Given
11.5	Senior QS	Management of Projects	West Midlands	Project and Construction Management Medium	18/07/2003 Judd Farris Property Recruitment	To 40,000 + Benefits	Experience with Education or Healthcare Projects
12.5	Senior QS	Control of Large Conversion Project	Wales	Housing Developer Large	06/10/2003 Anders Elite	30,000-38,000 + Car + Benefits	Intermediate Level Ready to ProgressMin 3 yrs Housebuilding Experience + Spec/LA Housing Knowledge
13.5	Senior QS	Manage a Mix of D & B, New and Refurbishment Projects	Wales	General Construction Medium	31/07/2003 Anders Elite	33,000-35,000	Excellent Communication Skills Client Focused and Highly Motivated Team Player
14.5	Senior QS	Oversee All Commercial Matters on Residential Multiple Developments	Scotland	Housebuilder Medium	09/07/2003 Anders Elite	24,000-32,000	Experience with Main or Sub-Contractor
15.5	Senior QS	Responsible for Preparation of Contract Accounts and Negotiation of Claims for M&E Work	Scotland	Consulting Engineer Large	18/09/2003Anders Elite	30,000-35,000 + Package	MRICS Preferred + Min 5 yrs Experience with M&E Consultancy
16.5	Senior QS	To be Responsible for £15m Project	London	Development Company Large	01/08/2003 CALCO Technical Recruitment	40,000 + Benefits	Experience in Senior Project QS Role

Table 5. Senior QSs (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
17.5	Senior QS	Site Based Responsibility for 3 QSs on New Build Project	Newcastle upon Tyne	General Contractor Major	30/10/2003 Anders Elite	33,000-36,000 + Car/Allowance + Pension + H/Care	Experienced in Senior/Managing QS Role with National Contractor + Wealth of Experience on New Build
18.5	Senior QS	Responsible for Several Projects + Some Estimating + Sub-Contract Procurement	East Anglia	Developer Large	10/11/2003 Construction Jobs UK	35,000	Experienced QS / Existing good Relationship with Local S/Contractors an Advantage + Excellent communication and Negotiating Skills

Table 6. Senior Estimators

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.6	Senior Estimator	Estimating on Large Projects & Negotiating Contracts	Reigate	General Construction £160m	27/08/2003 Anders Elite	40,000-50,000+ Car +Benefits	Experience of Tender Adjudication/ CAE
2.6	Senior Estimator	Estimating on Infrastructure Contracts	South East	Civil Engineering International Company	15/09/2003 Anders Elite	35,000-42,000+ Car +Benefits	Well Qualified with 1st Class Communication Skills
3.6	Senior Estimator	Preparation of Tenders	Yorkshire	Civil Engineering £50m	16/09/2003 Anders Elite	25,000-40,000+	Experience Including Take Off
4.6	Senior Estimator	Estimating on Large D & B Projects to £15m	North West	General Construction £80m	12/09/2003 Anders Elite	36,000-40,000 +Benefits	Computer Literate & Conversant with Conquest CAE
5.6	Senior Estimator	Set Up & Manage Estimating Dept.	London & South East	Housebuilding Medium	25/07/2003 Anders Elite	37,000-45,000+ Car +Benefits	Experience / Excellent Communication & Man Management Skills
6.6	Senior Estimator	Complete Preparation of Tenders to £10m	Enfield	General Construction Medium Size	10/07/2003 Anders Elite	25,000-35,000 +Benefits	3 yrs Experience with Main Contractor
7.6	Senior Estimator	Tendering on Large Projects & Negotiating Contracts up to £400m	Midlands	General Construction Leading UK Company	16/09/2003 Hill McGlynn Careers	To 45,000 +Car +Benefits	Established Estimator/Experienced with Solid IT Skills
8.6	Senior Estimator	Complete Preparation of Tenders to £10m	Enfield	General Construction Medium Size	10/07/2003 Anders Elite	25,000-35,000 +Benefits	3 yrs Experience with Main Contractor
9.6	Senior Estimator	Tendering on Projects	North West	General Construction Medium	17/09/2003 Construction Jobs UK	To 30,000 +Car +Benefits	Accomplished Estimator/Experienced with Variety of Work

Table 6. Senior Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
10.6	Senior Estimator	Estimating on Projects of 100k-£5m	Greater London	General Construction Medium	11/09/2003 Construction Jobs UK	To 40,000	Estimator/Experienced
11.6	Senior Estimator	Tendering on £Multi Million Water Projects	Scotland	Building and Engineering Contractor Large	09/10/2003 Construction jobsuk.com	34,000-38,000 + Car + Benefits	Experienced M & E Estimator with ability to interpret tender documents and produce M & E Prices + Producing Text for Tender Submission
12.6	Senior Estimator	Tendering for Commercial and Housing Projects to £7m	Scotland	General Construction and Housing Medium	15/04/2003 Hays Personnel	20,000-40,000	Good Commercial Skills and Ability to Adapt to Changing Situations
13.6	Senior Estimator	Senior Management Position within the Tendering Department	Scotland	Civil Engineering Department Medium	21/08/2003 Hays Personnel	30,000-35,000 + Car + Pension + H/Care	MICE or MCIOB with Strong Track Record of Estimating with Building or Civils
14.6	Senior Estimator	Full Responsibility for All Estimates	Scotland	Civil Engineering Medium	16/01/2003 Hays Personnel	32,000-35,000 + Benefits	MCIOB
15.6	Senior Estimator	Dealing with Tenders 200K-£6m	Midlands	General Construction up to £10m	12/09/2003 Anders Elite	30,000-35,000 + Good Benefits Package	Experience in dealing with Tenders from BoQs, Plan & Spec. or D&B
16.6	Senior Estimator	Dealing with Tenders to £15m	Bristol	Civil Engineering £56m	27/08/2003 Anders Elite	34,000-38,000 + Car + Pension + Bonus	Needs to be able to Act Autonomously and Provide Strategic Decision Making Input

Table 6. Senior Estimators (contd)

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
17.6	Senior Estimator	Dealing with Tenders from 200K-£6m	Midlands	General Construction to £10m	12/09/2003 Anders Elite	30,000-35,000 + Benefits Package	Experience with GC on 200K-£6m Projects on D & B/ BoQ/ Plan & Spec
18.6	Senior Estimator	Estimating on Projects with ability to Expand	Essex	General Construction Medium	07/11/2003 Construction Jobs UK	To 35,000 + Excellent Benefits Package + Pension + H/Care + Car Allowance + 4 weeks Holiday	Experience with Main Contractor min 4 yrs as Est or Senior/Commercial or Public + Team Leader + Build Projects with Small Companies/Sociable Personality & Excellent Communication Skills

Table 7. Head/Chief/Regional QSs

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.7	Regional QS	Running Projects from Land Acquisition to Contractor Negotiations	Gloucestershire	Developer Medium	18/07/2003 Judd Ferris Property Recruitment	To 40,000 Car + Bonus up to 30% + Package	Considerable QS Experience Preferably with both Private QS and Contractor
2.7	Principal QS	Heading Team Providing Construction Cost and Procurement Advice	Birmingham	City Council Large	25/07/2003 Birmingham City Council	27,420-32,127	MRICS

Table 7. Head/Chief/Regional Estimators

Ref	Job	Descript	Area	Contractor Type/Size	Date & Source	Salary £	Qual.
1.8	Chief Estimator	Manage Estimating Teams on New Build Projects	Essex	General Construction Medium	25/07/2003 Coyle Personnel PLC	50,000+ + Car + Benefits	Experience in a similar role Essential
2.8	Estimating Director	Manage Estimating Teams on Refurbishment Projects	Essex	General Construction Medium	25/07/2003 Coyle Personnel PLC	50,000+ + Car + Benefits	Experience in a similar role Essential

Appendix 3 Estimating/Tendering Module Content Tables from HE

Table 1. Estimating / Tendering Module Content Tables from HE

Year	University/ College	Module	Qualification	Credits/ Subjects
2	Aston University	Estimation	Construction Management BSc	1 of 12 modules in 2 year
2	Aston University	Estimation	Construction Economics BSc	1 of 12 modules in 2 year
2	Bolton Institute	Procurement and Estimating	Construction Management BSc (Hons)	1 of 7 Modules in year 2
2	Bolton Institute	Procurement and Estimating	Construction BSc (Hons)	1 of 7 Modules in year 2
2	Bolton Institute	Procurement and Estimating	Quantity Surveying and Commercial Management BSc (Hons)	1 of 7 Modules in year 2
Not Given	University of Brighton	Tendering and Estimating	Building Studies – Quantity Surveying HND	1 of 8 Modules in 2 years
Not Given	University of Brighton	Specification Measurement and Pricing	Construction Management BSc (Hons)	1 of 19 Subjects in 3 years
2	Bristol University of the West of England	Tendering and Estimating	Construction Quantity Surveying BSc (Hons)	1 of 6 Subjects in second year
2	Bristol University of the West of England	Tendering and Estimating	Construction Management and Economics BSc (Hons)	1 of 6 Subjects in second year
2	Coventry University	Tendering and Estimating	Building HND	1 of 5 Subjects in second year
Not Given	Dudley College	Tendering and Estimating	Building Studies HND	1 of 9 Options added to a course of 6 Core Units

Table 1. Estimating / Tendering Module Content Tables from HE (contd.)

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Year	University/ College	Module	Qualification	Credits/ Subjects
Level 1	Glasgow Caledonian	Construction Resource Estimating	Quantity Surveying (BSc Hons).	20
Level 2	Glasgow Caledonian	Tendering and Contract Realisation	Quantity Surveying (BSc Hons).	20
Level 1	Glasgow Caledonian	Construction Resource Estimating	Construction Management. BSc & BSc (Hons)	20
2	Robert Gordon University, Aberdeen	Estimating	Construction Design and Management. BSc (Hons)	1 of 8 Modules in second year
1	Leeds Metropolitan University	Documentation of Estimating	Quantity Surveying BSc (Hons)	1 of 9 Modules in first year
2	Leeds Metropolitan University	Estimating and Tendering A & B	Quantity Surveying BSc (Hons)	1 of 10 Modules in second year
1	Leeds Metropolitan University	Documentation of Estimating	Building Studies HND	1 of 9 Modules in first year
1	Leeds Metropolitan University	Documentation of Estimating	Construction Management BSc (Hons)	1 of 9 Modules in first year
2	Leeds Metropolitan University	Estimating and Tendering	Construction Management BSc (Hons)	1 of 7 Modules in second year
2	Liverpool John Moores University	Building Cost and Prices **	Construction Economics and Management (Quantity Surveying) BSc (Hons) & BSc	1 of 8 Modules in second year

Table 1. Estimating / Tendering Module Content Tables from HE (contd.)

Year	University/ College	Module	Qualification	Credits/ Subjects
Not Given	LLandrillo College	Tendering and Estimating	Construction HNC	Optional Module to be added to 6 Core Modules
2	Loughborough	Contractors' Estimating	Commercial Management and Quantity Surveying (BSc).	10
3	Napier University, Edinburgh	Cost and Value Engineering	Quantity Surveying with Computing BSc (Hons)	1 of 8 Subjects in third year
3	Napier University, Edinburgh	Cost and Value Engineering	Quantity Surveying BSc (Hons)	1 of 7 Subjects in third year
2	Northumbria University	Estimating, Tendering and Payment	Commercial Quantity Surveying BSc (Hons)	1 of 10 Subjects in second year
Not Given	Nottingham Trent University	Measurement and Cost **	Construction Management BSc (Hons)	1 of 11 Core Subjects
4	Sheffield Hallam University	Construction Cost Studies **	Construction Commercial Management BSc (Hons)	1 of 6 Modules in fourth year
4	Sheffield Hallam University	Construction Cost Studies **	Quantity Surveying BSc (Hons)	1 of 8 Modules in fourth year
Not Given	Swansea Institute	Tendering and Estimating	Building Studies HND	1 of 4 QS Modules within a total of 19 in 2 year course

Table 1. Estimating / Tendering Module Content Tables from HE (contd.)

Year	University/ College	Module	Qualification	Credits/ Subjects
1	University of Central England	Measurement and Cost 1 - Domestic Substructure	Quantity Surveying BSc (Hons).	12
1	University of Central England	Measurement and Cost 2 - Domestic Substructure	Quantity Surveying BSc (Hons).	12
2	University of Central England	Measurement and Cost 3	Quantity Surveying BSc (Hons).	12
2	University of Central England	Measurement and Cost 4	Quantity Surveying BSc (Hons).	12
3	University of Central England	Measurement and Cost 5	Quantity Surveying BSc (Hons).	12
2	University of Manchester Institute of Science and Technology (UMIST)	Estimating and Cost Control	Commercial Management and Quantity Surveying BSc.	1 of 11 Modules in second year
2	UMIST	Estimating and Cost Control	Construction Management BSc	1 of 11 Modules in second year
1B	University of Reading	Measurement and Estimating for Building Work	Construction Management BSc	1 of 4 subjects
3	University of Reading	Tendering and Finance (Optional	Construction Management BSc	1 of 2 options from a total of 5
3	University of Reading	Tendering and Finance (Optional)	Quantity Surveying BSc.	1 of 2 options from a total of 4

Table 1. Estimating / Tendering Module Content Tables from HE (contd.)

Year	University/ College	Module	Qualification	Credits/ Subjects
3	University of Reading	Tendering and Finance (Optional)	Building Surveying BSc	1 of 2 options from a total of 4
2	University of Ulster	Measurement and Cost Studies **	Construction Engineering and Management BSc (Hons)	1 of 6 Subjects in second year
1	University of Westminster	Principles of Measurement and Tendering	Building Engineering BSc (Hons)	1 of 8 Modules in first year
1	University of Westminster	Principles of Measurement and Tendering	Construction Management BSc (Hons)	1 of 8 Modules in first year
Not Given	University of Wolverhampton	Tendering and Estimating	Building Studies HND	1 of 17 suggested Modules in two year course
Not Given	Wigan and Leigh College	Tendering and Estimating	Construction Studies HNC	1 of 14 Core Subjects in two year course

Table 2. Estimating/Tendering Modules in Foundation Degree Courses

Level	University/ College	Module	Qualification	Credits/ Subjects
1	Blackburn College	Tendering	Construction Engineering FdTech	1 of 10 units
2	St Helens College	Measurement and Estimating/IT	Construction FdTech	1 of 8 modules in two year course
Not Given	University of Kent at Canterbury	Tendering and Estimating	Civil Engineering FdEng	1 of 13 options to add to 8 core modules
Not Given	University of Kent at Canterbury	Tendering and Estimating	Construction FdSc	1 of 16 options to add to 8 core modules

Table 3. HE Modules Offered for Estimating and/or Tendering

Total Number of;	Level 1	Level 2	Level 3	Level 4	Unknown Level	Qualification
Subject Modules	2	5	0	0	0	BSc (Hons)
Subject Modules	0	2	0	0	0	BSc
Subject Modules	1	1	0	0	4	HND
Subject Modules	0	0	0	0	2	HNC
20 Credit Modules	2	0	0	0	0	BSc (Hons)
20 Credit Modules	1	0	0	0	0	BSc
10 Credit Modules	0	1	0	0	0	BSc
Total	**6**	**9**	**0**	**0**	**6**	

Table 4. HE Part Modules Offered for Estimating and/or Tendering

Total Number of;	Level 1	Level 2	Level 3	Level 4	Unknown Level	Qualification
Part Subject Modules	1	4	0	0	1	BSc (Hons)
Part Subject Modules	2	2	3	0	0	BSc
Part 20 Credit Modules	0	1	0	0	0	BSc (Hons)
Total	**3**	**7**	**3**	**0**	**1**	

Table 5. HE Modules that may possibly include Estimating and/or Tendering

Total Number of;	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Unknown Level**	**Qualification**
Part Subject Modules	0	2	2	2	1	BSc (Hons)
Part Subject Modules	0	1	0	0	0	BSc
Part 12 Credit Modules	2	2	1	0	0	BSc
Total	**2**	**5**	**3**	**2**	**1**	

Table 6. HE Modules Offered for Estimating and/or Tendering at Foundation Degree Level

Total Number of;	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Unknown Level**	**Qualification**
Subject Modules	1	1	0	0	2	Fd
Total	**1**	**1**	**0**	**0**	**2**	

The qualifications, credits and levels, shown above are set under the formulation of the National Qualifications Framework and an explanation of their credibility is as follows:

National Qualifications Framework for Higher Education (England, Wales and Northern Ireland).

According to the National Qualifications Framework website (2004), the qualifications framework does not specify minimum levels of learning by using units of credit. Not all institutions, it seems, use the credit system and there is no national structure in place for such use. The website continues that it is for the providers of the higher education programmes to decide upon the use of a credit structure or otherwise. It is possible to design programmes based on the use of study time rather than on the number of credits. The general framework design is in place to help provide an opportunity for course programmes to achieve qualification outcomes in an holistic way. These qualifications are listed on this site under headings graded according to their level of achievement, viz:

Certificate of Higher Education

Provides a sound knowledge of the basic concepts of subjects, including differing approaches to problem solving and accurate communication. This will offer the qualities required for employment which requires exercising some level of personal responsibility.

Qualifications; Certificate of Higher Education

Intermediate Level

Develops a sound knowledge of principles for students' particular vocation and provides the necessary qualities for employment requiring the exercise of responsibility and decision making.

Qualifications; Bachelors Degrees (non-honours), Foundation Degree, Higher Education Diplomas and other higher Diplomas

Honours Level

Furthers the development of an ordinary Degree in expanding knowledge to create an understanding of more complex problems. At this level the graduates will have obtained an understanding to enable them to analyse, evaluate, and formulate arguments etc in order to reach sound judgements.

Qualifications; Honours Degrees, typically lasting three years, together with short courses and professional 'conversion' courses which will lead to Graduate Certificates and Graduate Diplomas.

Masters Level

Develops the skills obtained at Honours level to provide students with the ability to attain sound judgement, work on their own initiative and accept personal responsibility in a professional environment that may be unpredictable and complex in its nature.

Qualifications; Masters Degrees usually of one year duration if full time or longer if undertaken as research Degrees on a part time basis. There are also advanced short courses which lead to Postgraduate Certificates and Postgraduate Diplomas.

Doctoral Level

These awards are for the development of an ability to create and interpret knowledge which can expand the forefront of a discipline and are usually undertaken by research. Students should be able to undertake original projects from their concept through to their implementation. Added to the skills obtained at Masters Level should be an ability to innovate and to solve problems.

Qualifications; Doctor of Philosophy PhD is awarded for original research but there is also a Doctorate with a taught element which can offer the inclusion of that particular discipline within the title eg. EdD, for Doctor of Education. The time period at this level is equivalent to three years full time study.

Estimating / Tendering Modules Contained Within Courses Organised by the CITB and PBs.

The CITB

The CITB website, Construction Skills section, provides an Advanced Modern Apprenticeship (AMA) for training as an Estimating Assistant-Construction, as indicated in the following table, which the CITB headline as Off –The – Job - Training:

Table 7. Estimating / Tendering Module Content Table 1 (Off-The Job Training)

Year	Body	Module	Qualification	Credits
Level 2	CITB	Measuring Tendering and Estimating Processes	National Certificate in Construction BTEC	1 Specific Unit added to 5 Core Units in two year course

Following this, under the banner of On –The – Job - Training are the following 'components' which, say the CITB, are delivered during induction programmes that are undergone both off and on the job which require confirmation of there being carried out :

Table No 8. Estimating / Tendering Module Content Table 2 (On-The-Job-Training).

Year	Body	Module	Qualification	Credits
Level 3	CITB	Contribute to the processing of Tenders	NVQ Construction Contracting - Estimating Option	1 of 7 units
Level 3	CITB	Contribute to the Preparation and Submission of Tenders	NVQ Construction Contracting - Estimating Option	1 of 7 units

This course is based upon work being carried out within the workplace with supervision and support by the employers and over a period that the CITB says will be for as long as is necessary. They suggest that the training can be provided by further education colleges, private training providers or employers. Assessment can be done in several ways, such as observation, written testimony, workplace documentation, oral questioning, personal records etc., by the assessors' judgement on the competencies of the trainees.

Again, as On –The – Job – Training, there are Estimating elements taken to a more advanced stage as detailed in the following table:

Table 9. Estimating / Tendering Module Content Table 3 (On-The-Job-Training)

Year	Body	Module	Qualification	Credits
Level 4	CITB	Obtain and Select Tenders	NVQ Construction Contracting - Estimating Option	1 of 7 units
Level 4	CITB	Prepare and Submit Tenders	NVQ Construction Contracting - Estimating Option	1 of 7 units

Workplace training is again accepted by further education colleges, private training providers, employers and, in addition, universities. Assessment, as before at Level 3, is on the judgement of the assessors'.

Professional Bodies.

Chartered Institute of Building (CIOB)

Table 10.Estimating / Tendering Module Content Tables within their Educational Framework Table

Year	Institute	Module	Qualification	Credits
3	CIOB	Estimating and Tendering	MCIOB	15 of 360

Royal Institute of Chartered Surveyors (RICS)

As with the Measurement and Cost module at UCE, it is not clear as to the extent that 'Costing' covers estimating and the possibility is that the majority of this module encompasses costing for the QS at pre contract stage rather than tender stage, this being a more identifiable measure of the QS role in construction costing, as described *op cit.*

Table 11. Extract from RICS Examination Curriculum.

Year	Institute	Module	Qualification	Credits
Level 3*	RICS	Measurement and Costing of Construction Works	MRICS	1 of 6 Core Competencies

Level 3 is defined by the RICS as "Reasoned advice and/or depth of technical knowledge" and is the highest of 3 set levels.

Appendix 3 Estimating/Tendering Module Charts

Chart 1 BSc (Hons)

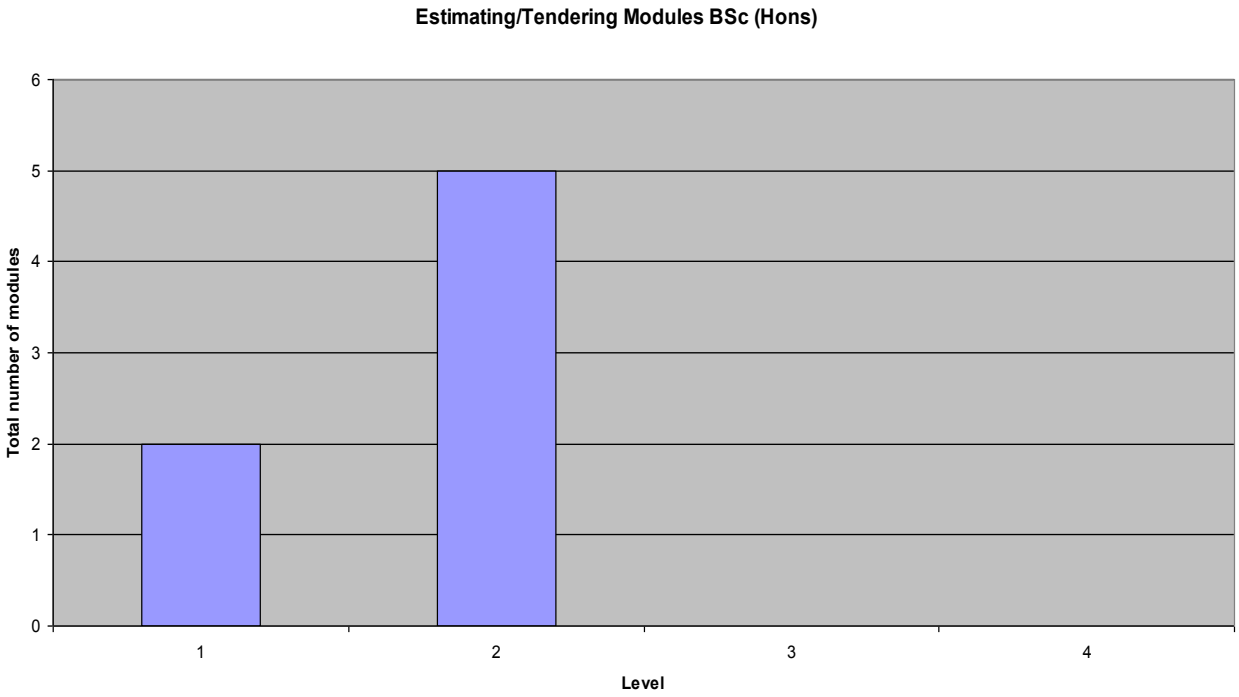


Chart 2 BSc (Hons) 20 Credit Modules

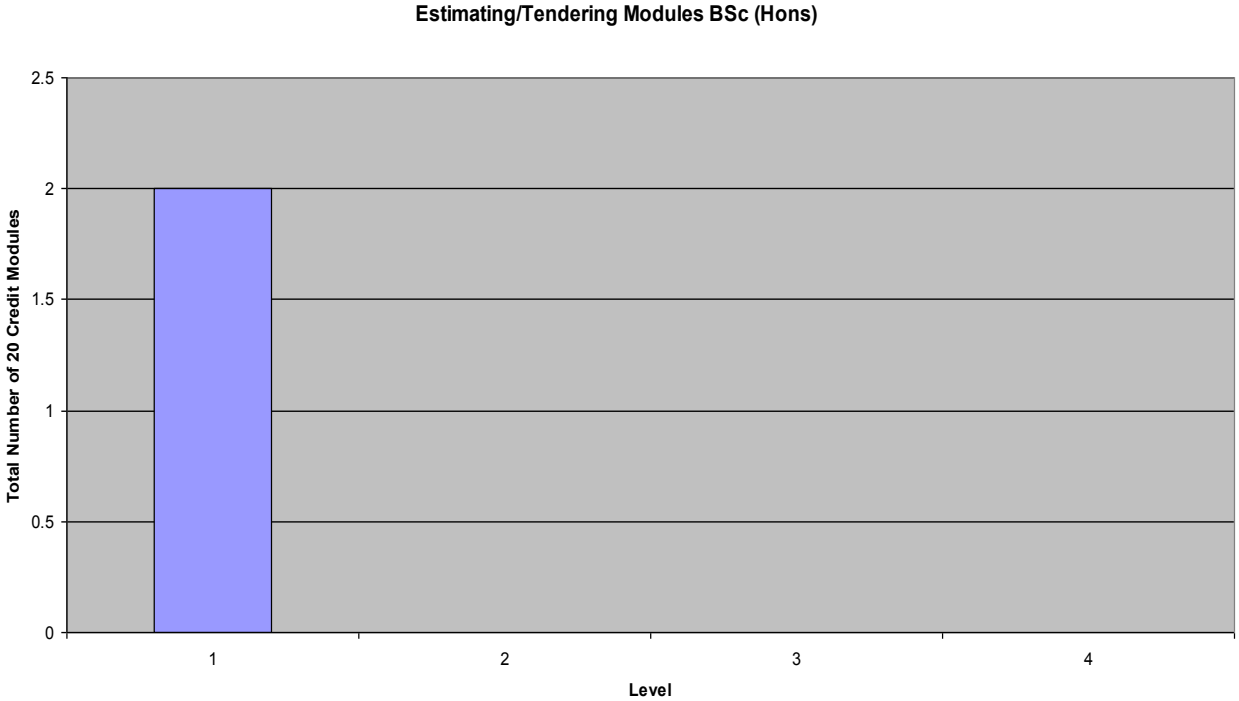


Chart 3 BSc

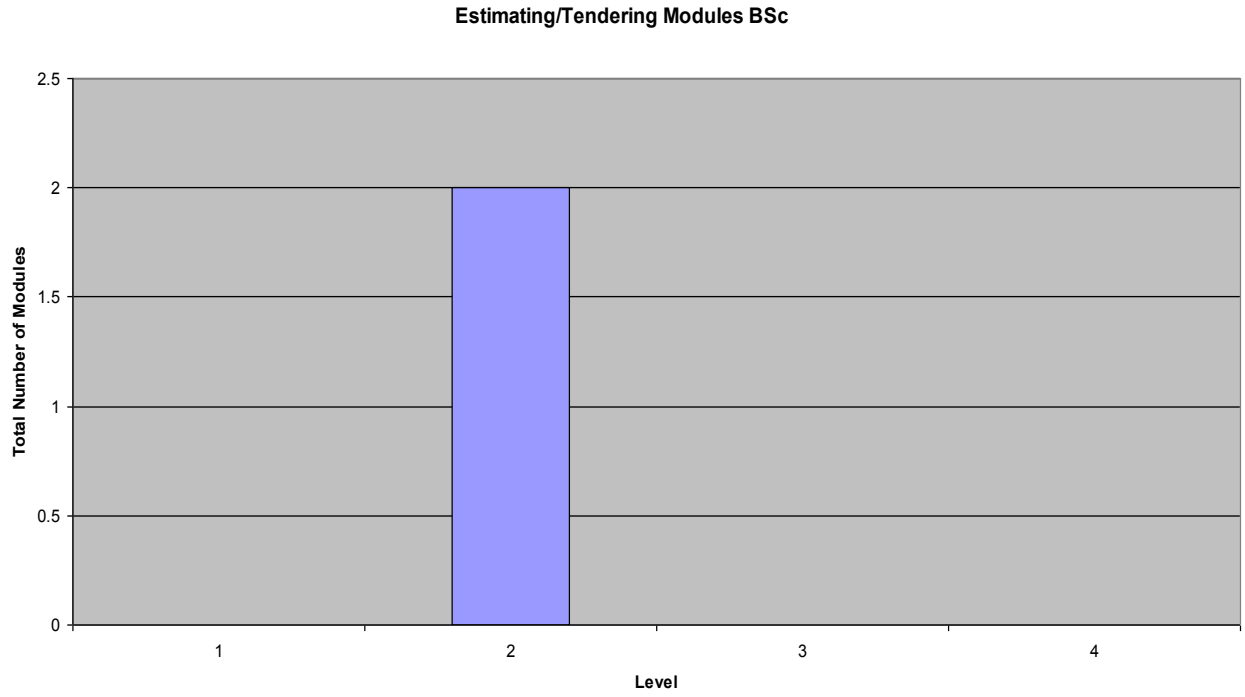


Chart 4 BSc 20 Credit Modules

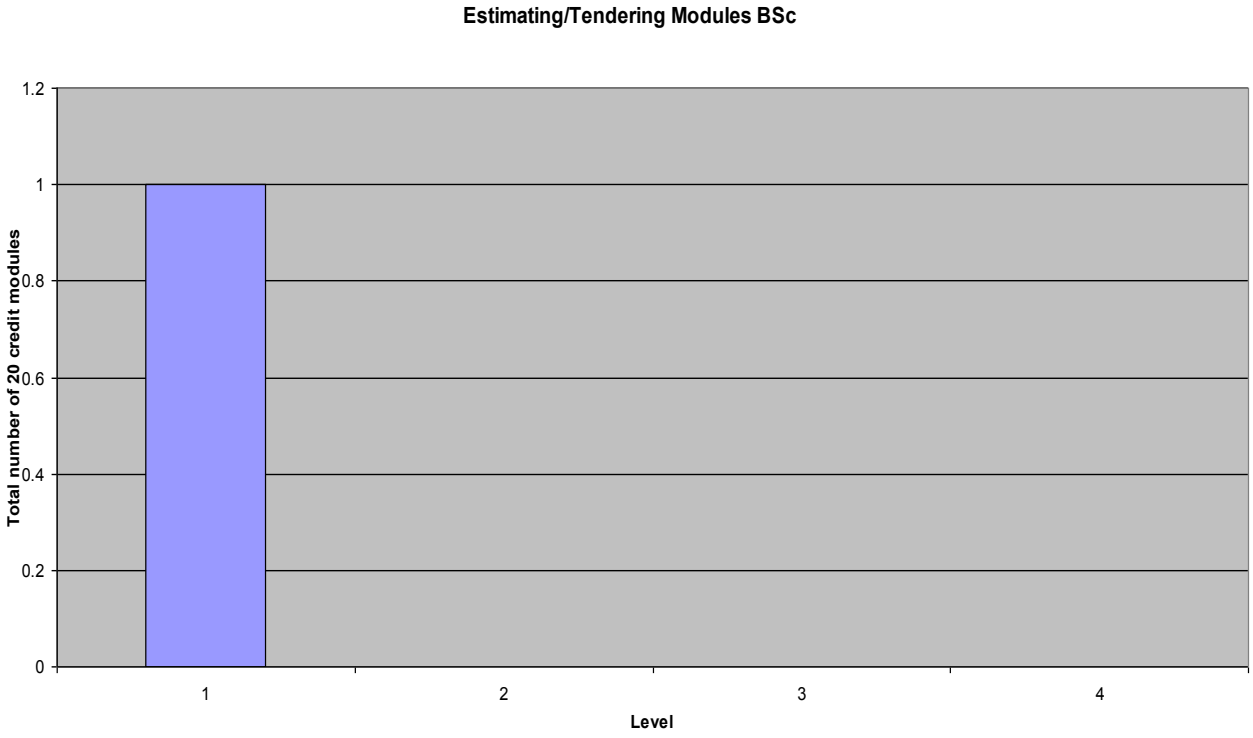


Chart 5 BSc 10 Credit Modules

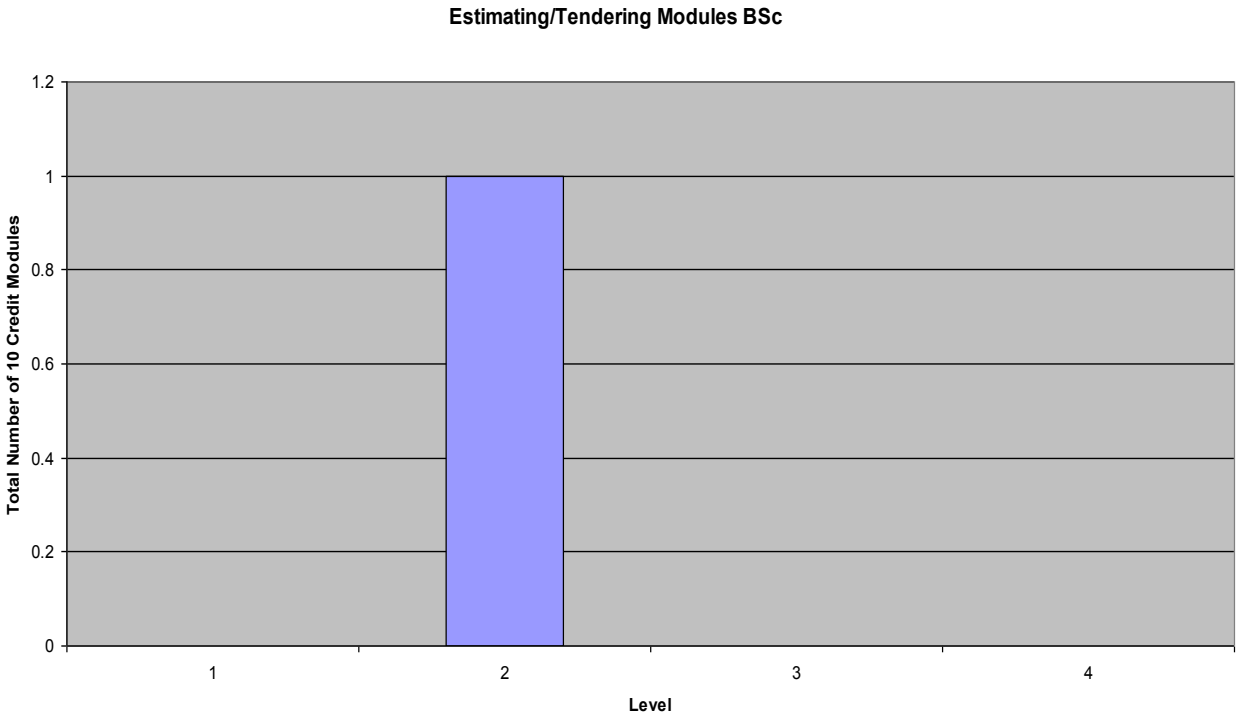


Chart 6 HND

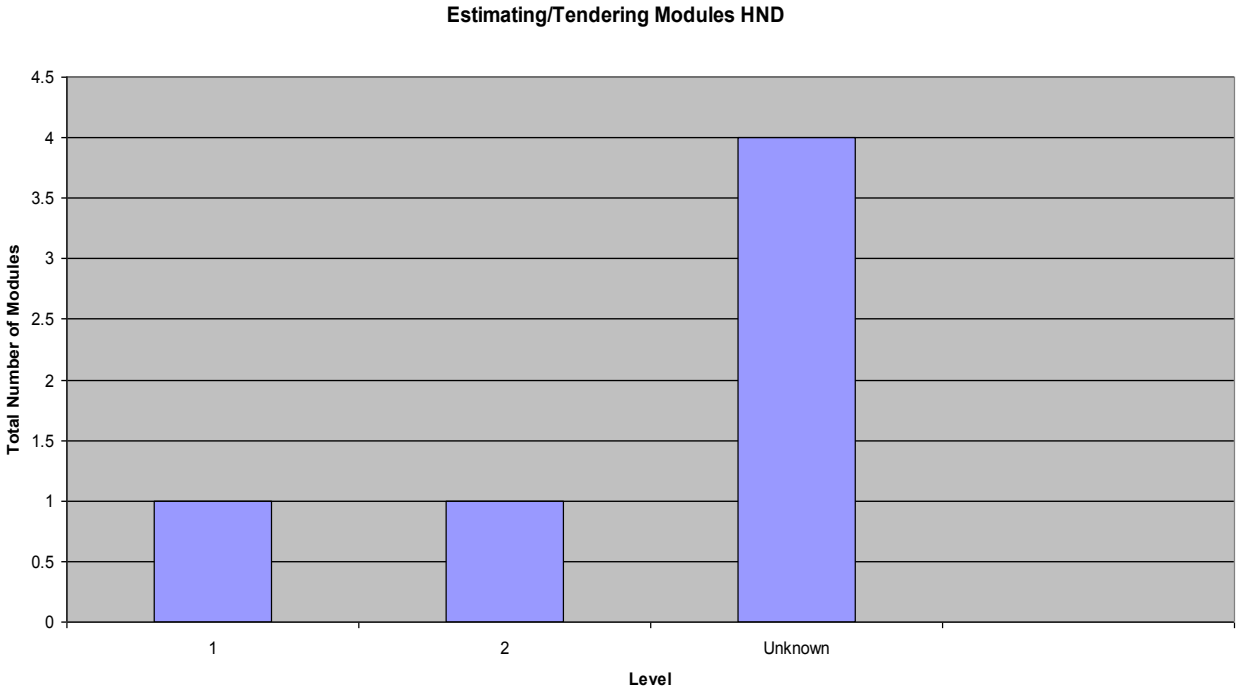


Chart 7 HNC

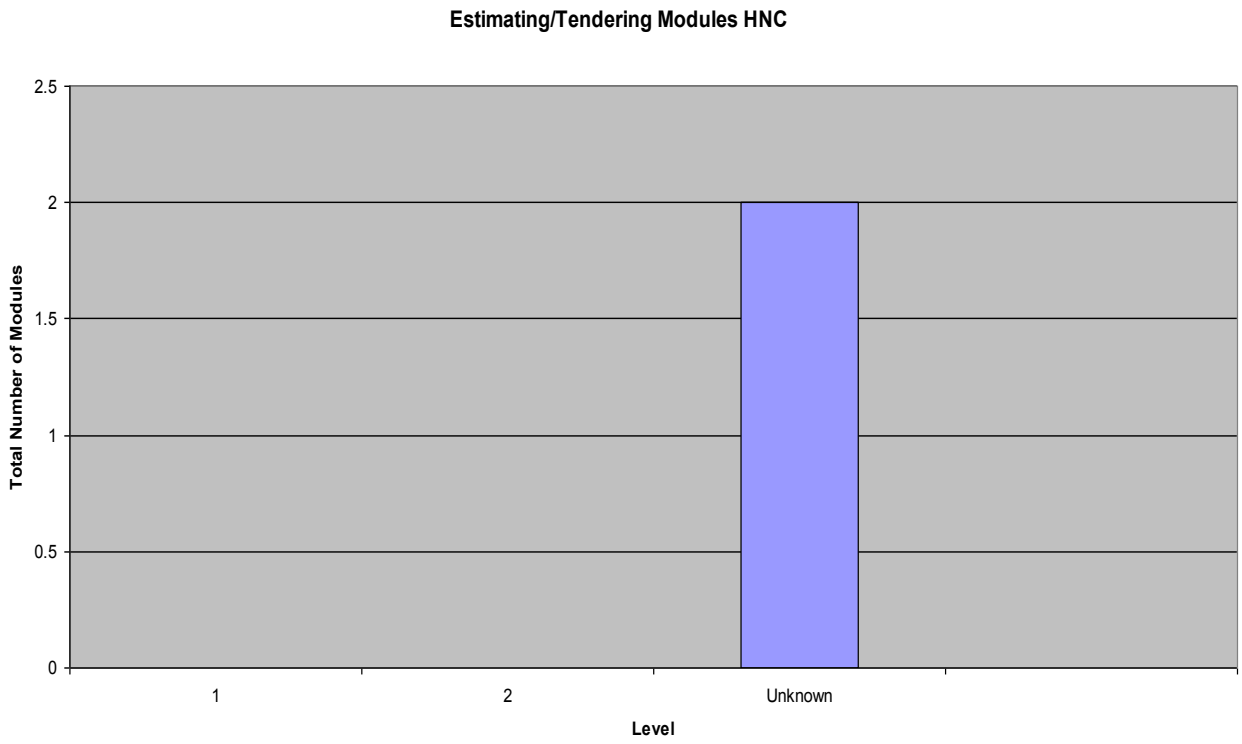
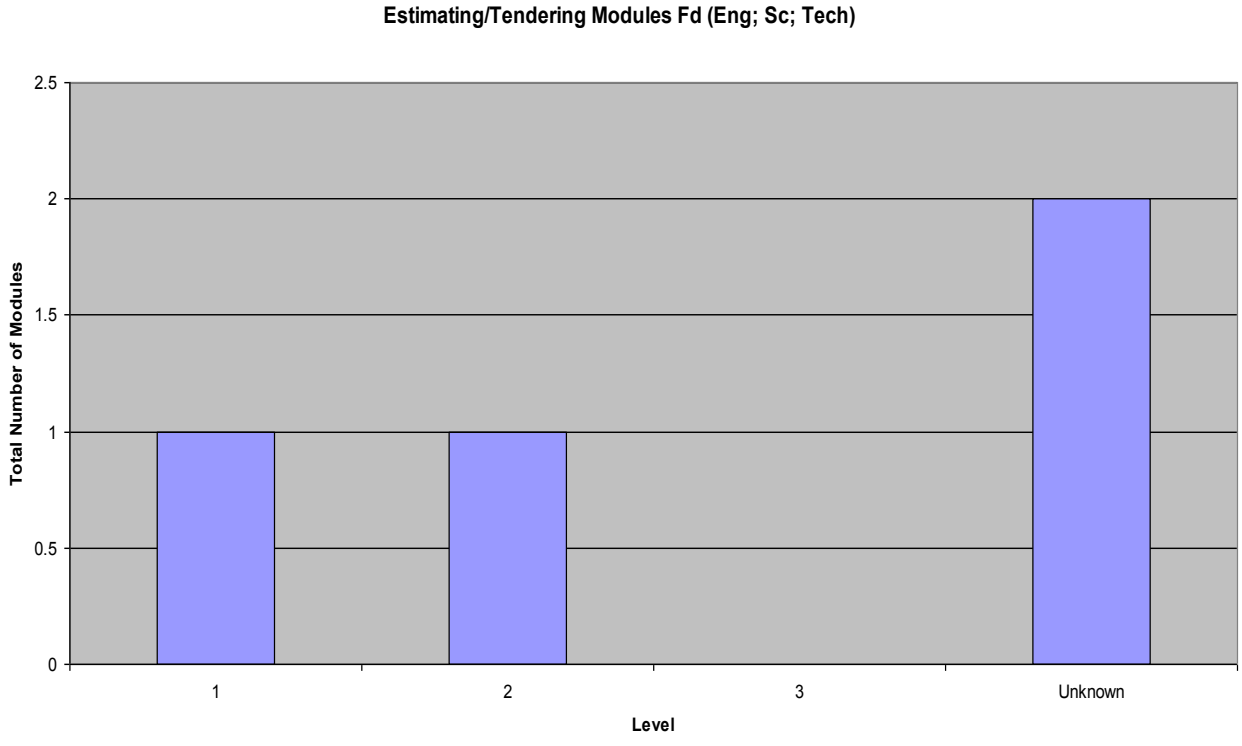


Chart 8 Fd



Partial Estimating Modules

Chart 9 BSc (Hons)

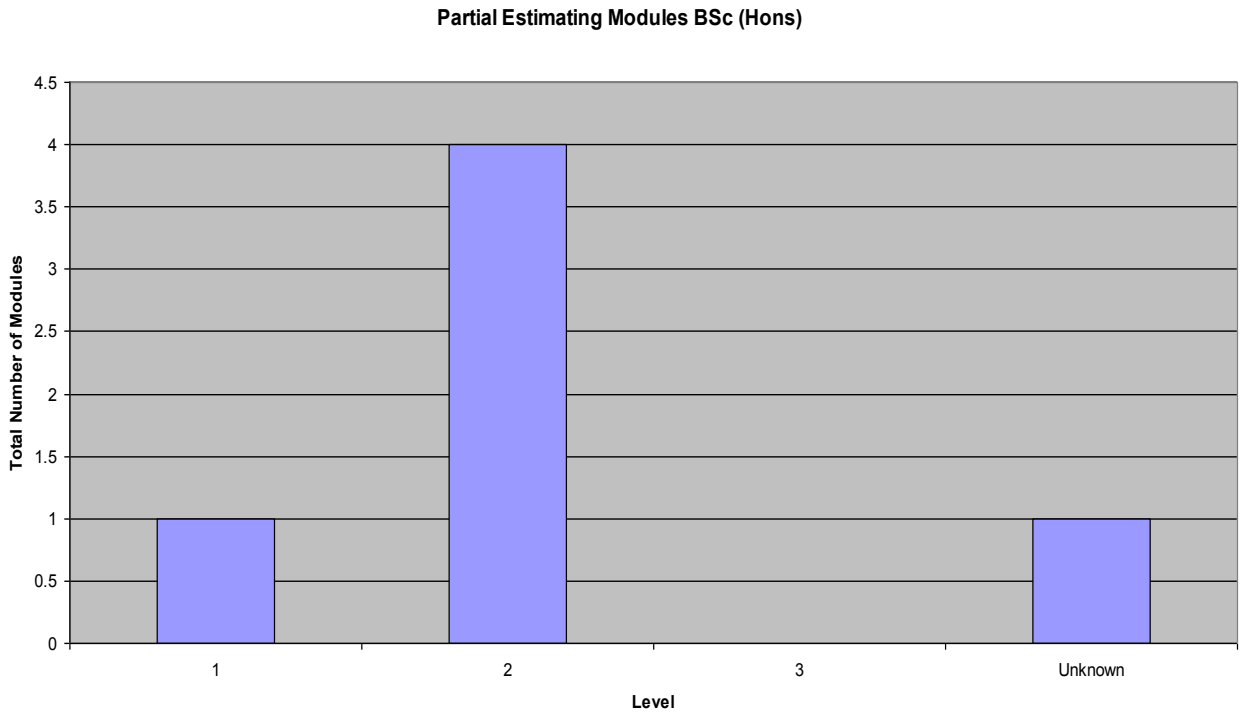
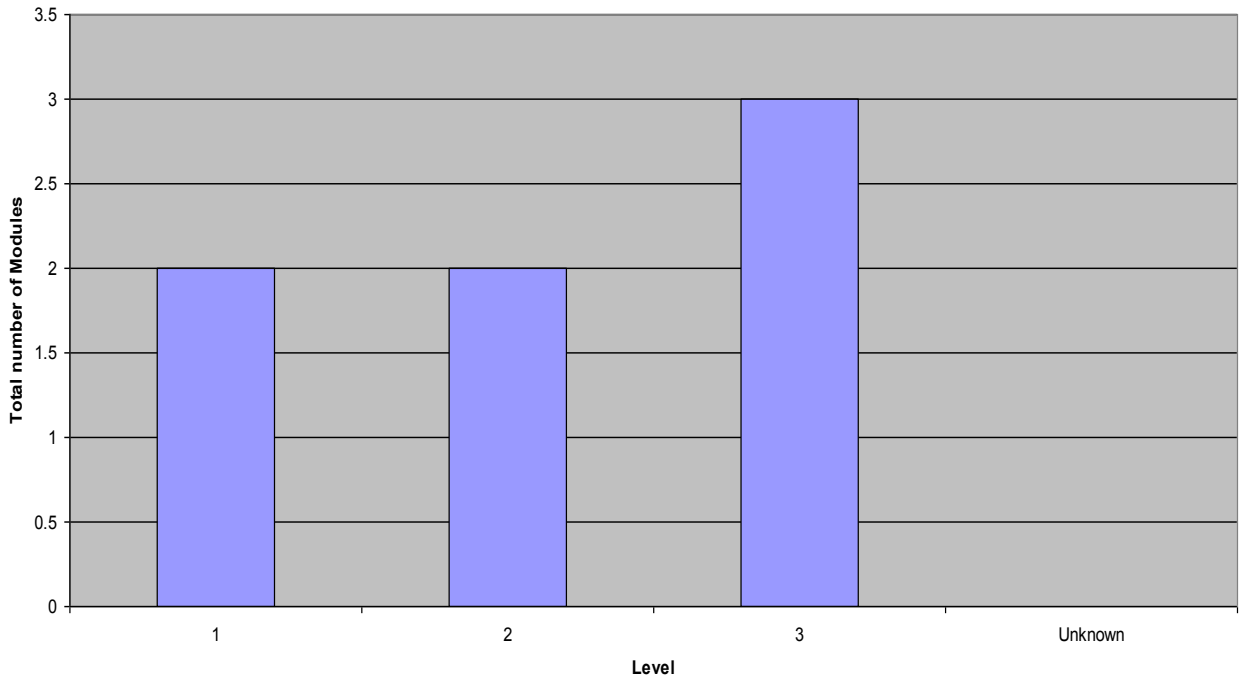
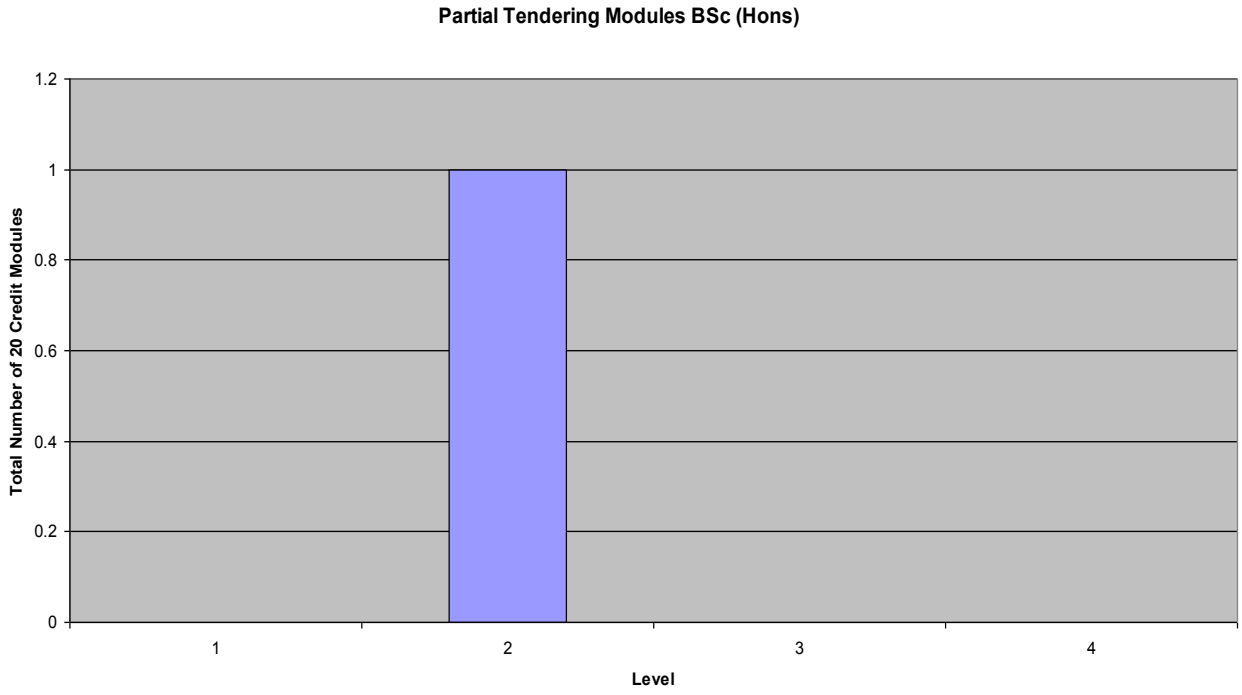


Chart 10 BSc



Partial Tendering Modules

Chart 11 BSc (Hons) 20 Credit Modules



Possible Partial Estimating Modules

Chart 12 BSc (Hons) 12 Credit Modules

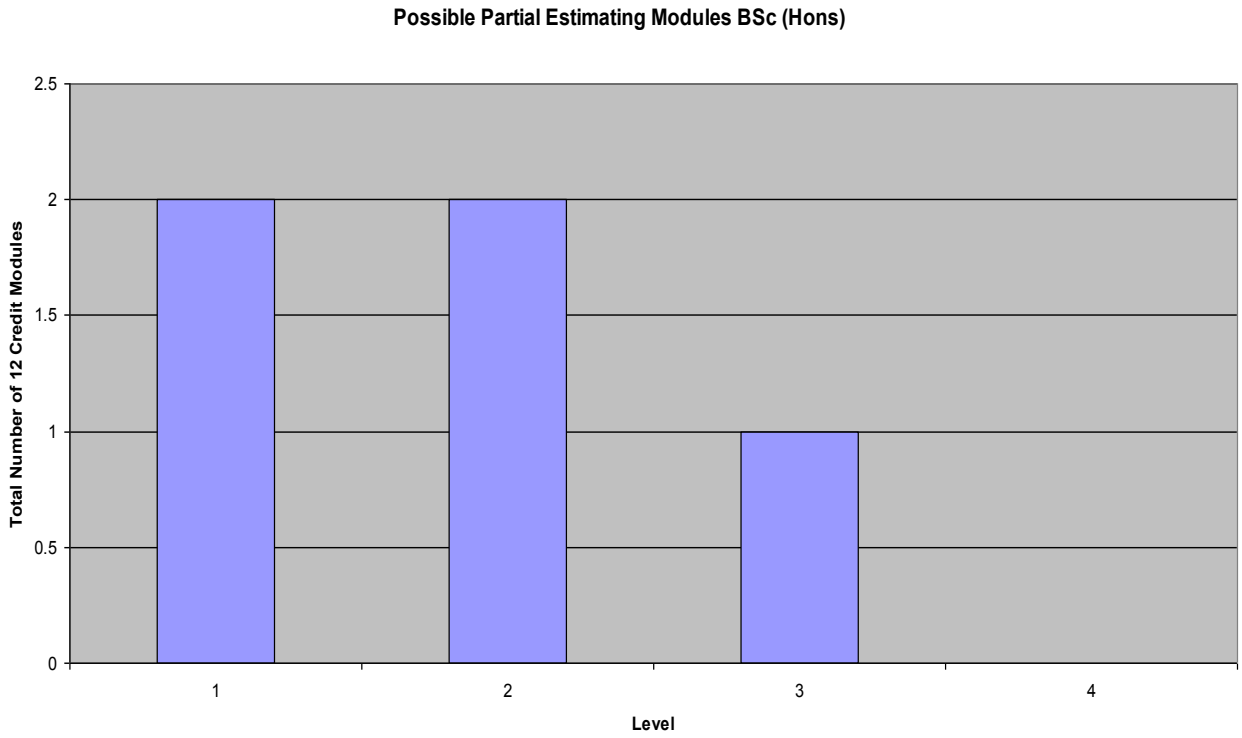
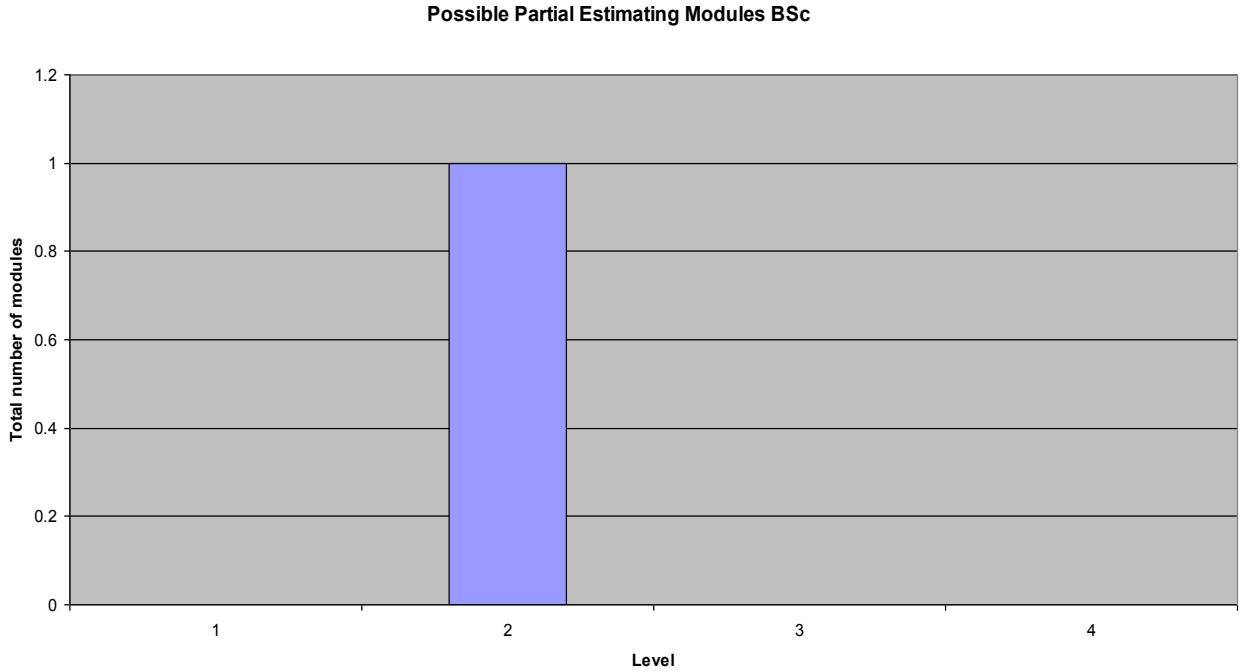


Chart 13 BSc



Appendix 4 Delphi Study Round 2 Questionnaire

QS Categories page 1

1 **Good Personal Qualities**

eg: honesty; ability to work under pressure; integrity

0 10

2 **Good Communicational/Teamwork Skills**

eg: integrates; shares knowledge and ideas; conveys information

0 10

3 **Intelligence & Cognitive Abilility/Style**

eg: logical; numeric; having good grammar

0 10

4 **Cost Estimating Skills**

eg: ability to build up and analyse rates; design and price temporary works; build up all-in labour rate

0 10

5 **Relevant Experience**

0 10

6 **Management Skills**

eg: organise; supervise; lead

0 10

QS Categories page 2

7 **Good Formal Education**

eg: A levels; HND; Bachelors Degree

0 10

8 **Professional Training Initial & Ongoing**

eg: MRICS; Continuous Professional Development

0 10

9 **Thorough Knowledge of Construction**

eg: includes total building structures; roads; bridges; power stations

0 10

10 **Knowledge of Contracts & Contract Law**

eg: good working knowledge of JCT, D & B, Partnering Contracts

0 10

11 **Ability to Prepare Select & Appraise Tenders**

eg: provide complete information for tendering; select right companies; analyse returned tenders

0 10

12 **Ability to Measure Work & Prepare BoQs**

eg: read drawings; take off quantities; prepare BoQs

0 10

QS Categories page 3

13 **Good Negotiating Skills**

eg: reach agreements on contractual, financial, personal matters

0 10

14 **Able to Provide Pre Contract Financial & Construction Advice to Client/Employer**

eg: cost planning; cost analyses; life cycle costing

0 10

15 **Able to Provide Post Contract Financial & Construction Advice to Client/Employer**

eg; interim valuations; collection and analysis of data; cash flow forecasts

0 10

16 **Commercial Business Acumen**

eg: customer care; business management; understand business culture

0 10

17 **IT Skills**

eg: use Word; spreadsheets; job specific specialist packages

0 10

18 **Conflict Management**

eg: dispute resolution; conflict avoidance

0 10

19 **Risk Management**

eg: assess contractual risks; provide risk solutions

0 10

Estimator Categories page 1

1 **Good Personal Qualities**

eg: honesty; ability to work under pressure; integrity

0 10

2 **Good Communicational/Teamwork Skills**

eg: integrates; shares knowledge and ideas; conveys information

0 10

3 **Intelligence & Cognitive Ability/Style**

eg: logical; numeric; having good grammar

0 10

4 **Cost Estimating Skills**

eg: ability to build up and analyse rates; design and price temporary works; build up all-in labour rate

0 10

5 **Relevant Experience**

0 10

6 **Management Skills**

eg: organise; supervise; lead

0 10

Estimator Categories page 2

7 **Good Formal Education**

eg: A levels; HND; Bachelors Degree

0 10

8 **Professional Training Initial & Ongoing**

eg: MRICS; Continuous Professional Development

0 10

9 **Thorough Knowledge of Construction**

eg: includes total building structures; roads; bridges; power stations

0 10

10 **Knowledge of Contracts & Contract Law**

eg: good working knowledge of JCT, D & B, Partnering Contracts

0 10

11 **Ability to Prepare Select & Appraise Tenders**

eg: provide complete information for tendering; select right companies; analyse returned tenders

0 10

12 **Ability to Measure Work & Prepare BoQs**

eg: read drawings; take off quantities; prepare BoQs

0 10

Estimator Categories page 3

13 **Good Negotiating Skills**

eg: reach agreements on contractual, financial, personal matters

0 10

14 **Able to Provide Pre Contract Financial & Construction Advice to Client/Employer**

eg: cost planning; cost analyses; life cycle costing

0 10

15 **Able to Provide Post Contract Financial & Construction Advice to Client/Employer**

eg: interim valuations; collection and analysis of data; cash flow forecasts

0 10

16 **Commercial Business Acumen**

eg: customer care; business management; understand business culture

0 10

17 **IT Skills**

eg: use Word; spreadsheets; job specific specialist packages

0 10

18 **Risk Management**

eg: assess contractual risks; provide risk solutions

0 10

Appendix 4 Kendal test displaying average marks

Table 1. Quantity Surveyors

Rank	QS Average Marks for Ranking Positions (lowest mark = highest position)	Total	Avg for 13 respondents
1	Good Personal Qualities	67.00	5.15
2	Good Communicational/Teamwork Skills	75.50	5.81
3	Able to Provide Post Contract Financial & Construction Advice to Client/Employer	81.00	6.23
4	Intelligence & Cognitive Abililty/Style	96.00	7.38
5	Able to Provide Pre Contract Financial & Construction Advice to Client/Employer	102.50	7.88
6	Ability to Measure Work & Prepare BQs	104.50	8.04
7	Ability to Prepare Select & Appraise Tenders	105.50	8.12
8	Commercial Business Acumen	120.50	9.27
9	IT Skills	120.50	9.27
10	Risk Management	122.00	9.38
11	Good Negotiating Skills	124.50	9.58
12	Thorough Knowledge of Construction	129.00	9.92
13	Cost Estimating Skills	132.50	10.19
14	Knowledge of Contracts & Contract Law	152.50	11.73
15	Conflict Management	152.50	11.73
16	Professional Training Initial & Ongoing	174.50	13.42
17	Relevant Experience	191.00	14.69
18	Management Skills	207.50	15.96
19	Good Formal Education	211.00	16.23

Table 2. Estimators

Rank	Estimator Average Marks for Ranking Positions (lowest mark = highest position)	Total	Avg for 9 respondents
1	Cost Estimating Skills	19.50	2.17
2	Ability to Prepare Select & Appraise Tenders	44.50	4.94
3	Intelligence & Cognitive Abililty/Style	49.00	5.44
4	Good Personal Qualities	58.00	6.44
5	Good Communicational/Teamwork Skills	63.50	7.06
6	Thorough Knowledge of Construction	67.50	7.50
7	IT Skills	74.50	8.28
8	Ability to Measure Work & Prepare BQs	75.00	8.33
9	Relevant Experience	79.50	8.83
10	Risk Management	86.50	9.61
11	Knowledge of Contracts & Contract Law	94.00	10.44
12	Good Negotiating Skills	97.50	10.83
13	Able to Provide Pre Contract Financial & Construction Advice to Client/Employer	109.50	12.17
14	Good Formal Education	111.50	12.39
15	Professional Training Initial & Ongoing	118.00	13.11
16	Management Skills	119.00	13.22
17	Commercial Business Acumen	122.50	13.61
18	Able to Provide Post Contract Financial & Construction Advice to Client/Employer	142.50	15.83

Appendix 4 Main and Individual Attributes Collected from Delphi Study

Main Categories and Grouped Attributes

Attributes highlighted in bold italics were those offered by QSs only.

20. Good Personal Qualities

a. Accountability
b. Confidentiality
c. Courage
d. Empathy
e. Fairness
f. Flexibility
g. Hold current driving licence
h. Honesty
i. Humility
j. Integrity
k. Interested in the work
l. Inventive
m. Limitation awareness
n. Legible
o. Methodical
p. Non discriminatory
q. Objectivity
r. Openness
s. Organised
t. Precision
u. Pride in appearance
v. Punctuality
w. Reliability
x. Resourceful
y. Respect
z. Sense of humour
aa. Tenacity
bb. Vision

cc. Well behaved

dd. Work under pressure

21. Good Communicational/Teamwork Skills

a. Accepts help from others

b. Communicates at all levels

c. Integrates

d. Offers help to others

e. Shares ideas

f. Shares knowledge

22. Intelligence and Cognitive Ability/Style

a. Able

b. Analytical

c. Bright

d. Clever

e. Coherent

f. Good grammar

g. Good memory

h. Logical

i. Numeric

j. Rational

k. Sharp

l. Solves problems

23. Cost Estimating Skills

a. Awareness of changes in costs

b. Awareness of changes in regulations

c. Build up all-in labour rate

d. Build up and analyse individual rates

e. Collect retrieve and analyse information and data

f. Decide upon and cost preliminaries

g. Design and price temporary works

h. Knowledge of alternative plant and materials

i. Knowledge of alternative working methods
j. Logistics

24. Relevant Experience

Having acquired the necessary knowledge, training and ability through effort and time spent at the following levels:

a. Trainee
b. Project
c. Senior
d. Head

25. Management Skills

a. Control individuals
b. Control material
c. Control organisations
d. Control other companies
e. Control plant
f. Control resources
g. Good leadership
h. Organise
i. Recruitment and selection ability
j. Sound knowledge of employment law
k. Supervise

26. Good Formal Education

a. A-level
b. Bachelors degree;
c. Foundation degree
d. GCSE
e. HNC
f. HND
g. Masters degree
h. ONC
i. OND

27. Professional Training Initial and Ongoing

a. Continuous professional development
b. Develop awareness of new products
c. In-house training
d. MCIOB
e. MRICS
f. NVQ
g. Personal effort
h. Solutions to improve technique and ability
i. Innovations to improve technique and ability

28. Thorough Knowledge of Construction

In Each Organisation's Specific Field which could include all work from:

Foundations to Roof Structures of:

a. Flats
b. Houses
c. Leisure facilities
d. Offices
e. Public buildings
f. Sports stadia

Engineering Works:

a. Bridges
b. Oil installations
c. Power stations
d. Rail infrastructure
e. Roads

Building and Engineering Items:

a. Construction process/sequence
b. Design
c. Electrical installations
d. External works

e. Gas installations
f. Knowledge of plant and equipment
g. Preliminaries
h. Sewers
i. Temporary works
j. Water installations

29. Knowledge of Contracts and Contract Law

a. Design and build contracts
b. Bonds
c. Construction, design and management regulations
d. Guarantees
e. Housing regulations
f. ICE contracts
g. JCT minor, intermediate and major building works contracts
h. NEC contracts
i. Partnering
j. PFI
k. Warranties

30. Ability to Prepare, Select and Appraise Tenders

a. Analyse the returned tender information and select the most suitable company to carry out the work
b. Select the right companies for the right projects
c. Collect retrieve and analyse information and data
d. Put together complete package of information to enable projects to be priced
e. Report writing

31. Ability to Measure Work and Prepare BQs

a. Calculate the quantities and produce a BQ either as a standard method of measurement, builders quantities or other specified form
b. ***Knowledge of standard method of measurement***
c. Mapping skills

d. Read and understand architectural/engineering drawings and specifications, interpret drawings and specifications to take off quantities for all trades with accuracy

32. Good Negotiating Skills

In Each Organisations Specific Field, Reach Agreements on:

a. Contractual matters
b. Financial matters
c. Personal matters

33. Able to Provide Pre-Contract Finance and Construction Advice to Client/Employer

a. ***Advising on contract brief and preferred procurement routes***
b. ***Assessment of grant and taxation implications***
c. Budget costing
d. Cash flow forecasts
e. Collect retrieve and analyse information and data
f. Cost analyses
g. Cost plans
h. Development appraisals
i. ***Investment appraisal***
j. Life cycle costing
k. Objective selection of procurement strategies
l. ***Pre-contract cost control***
m. Providing programme and financial reports
n. Value engineering

34. Able to Provide Post-Contract Finance and Construction Advice to Client/Employer

a. ***Agreeing interim valuations***
b. Cash flow forecasts
c. Collect retrieve and analyse information and data
d. ***Document information for contractual purposes***
e. ***Final accounts***

f. ***Providing programme and financial reports***

g. ***Site measurement***

35. Commercial Business Acumen

a. ***Apply financial management***

b. ***Business management***

c. ***Commercial management accounting principles and procedures***

d. Customer care

e. Develop an understanding of business and business culture

f. Environmental awareness

g. Provide client satisfaction

h. Work for profitability

36. IT Skills

a. BQ software

b. Collect retrieve and analyse information and data

c. Computer aided estimating software

d. Digitised take off software

e. Electronic transfer of information

f. ***E-mail***

g. Spreadsheet software

h. Word software

37. Conflict Management

a. ***Conflict avoidance***

b. ***Dispute resolution***

38. Risk Management

a. Contractual risks

b. Financial risks

c. Personal risks

d. Provide solutions to minimising risks

Estimator Main Categories and Grouped Attributes

To avoid duplication Estimator categories matched the categories for QSs with the exception of item 18 Conflict Management which was not mentioned in Estimator responses.

Appendix 5 Ethnographical Studies

Ethnography Study Company 1

Estimators Office of company with an annual turnover around £3.5m

Single Estimator working on:

Office Fit -Out Project Valued at £150,000

Enquiry sent by post consisting of;

Specification only

Action taken;

1. Read document
2. Highlighted sections for sending to specialist trades
3. Discussed specialist trades with Contracts Manager (CM) and decision made on companies to send information to
4. Made telephone calls to those companies to ensure their capacity to tender
5. Sent out documents for each trade by post
6. Selected sections from specification that involved direct company involvement i.e. carpentry, brickwork, labouring and highlighted ready for site visit
7. Arranged for key collection from agent and set up site visit with some of the specialists
8. Drove to agent, collected keys, drove to site

9. Met specialists, walked around building with each of them

10. At same visit measured work that required pricing for direct company input

11. Drove to office and began take off of work measured on site

12. Extracted quantities of materials from take off and obtained prices and delivery times from suppliers

13. Discussed labour rates with CM and Managing Director (MD) and commenced work on pricing individual rates for work by directly employed tradesmen
14. Continued pricing direct items including filing material rates as prices began to arrive from suppliers

15. Drove to site for meeting with remaining specialists and checking queries

16. Completed pricing of direct works, obtained list of labour requirements from estimate by totalling labour outputs by hand and began assessment of Preliminaries with consultation with CM using total labour outputs to determine time period for direct works and building it into assessment of periods for specialist works to provide an overall contract period and therefore a determination of weekly preliminary costs

17. Began assessment of received tenders from specialists and telephoned those that had not yet returned tenders to speed their returns

18. Made final selections of specialist tenders and inserting the prices into the estimate
19. Contacted chosen specialists where necessary to check on proposed timescales

20. Altered timescales as necessary and re-assessed preliminaries and overall contract period

21. Used calculator to extend and total estimate rates to sub and final totals. Arrangements were made for all calculations to be independently checked for errors

22. Checked through estimate for omissions and set out item pricing to suit tender return requirements

23. Arranged meeting with MD to determine level of overheads and profit to be added to estimate which involved providing an assessment of the likelihood of success, known competition and possible profitability and risk. In addition an assessment was made of the number of operatives likely to be available for the duration of the contract in comparison with the contract labour requirement and the impact this would have on its success in achieving completion on time, quality and profitability. Once this information had been considered the final margin was decided upon

24. Add margin to estimate to arrive at tender sum, calculate the final total, arrange for an independent check on the calculation and enter the information into the Form of Tender including the time period required by the company to complete the work and despatch tender by post

Building Refurbishment Project Valued at £600,000

Enquiry sent by post consisting of;

Specification and detailed drawings.

Action taken;

1. Read documents and study drawings

2. Discuss details with CM to decide upon work to be undertaken by directly employed tradesmen, labour only sub-contractors, work to be sent to specialist contractors, how many contractors to invite to tender and which ones

3. Mark up items in specification for individual sub-contractors and identify work for each selected area

4. Select drawings required for each specialist

5. Contact chosen specialist contractors for confirmation of their wish to be included on the tender lists

6. Arrange for specification work and materials sections, contract conditions, selected drawings and main contractor conditions to be copied and despatched to chosen specialists with covering letter detailing tender return date and site viewing arrangements

7. Commence preparation of BQ and take off of quantities for work to be carried out by directly employed and labour only trades

8. Whilst taking off quantities, build up materials schedules for enquiries to be sent to suppliers

9. BQ preparation takes up a three week time period, including working on project above, staff discussions on various company matters related to projects underway, a project already completed, some reading of “Building” magazine and a site visit described below

10. The site visit was to gauge access conditions, space for storage of materials, positioning of waste disposal facilities, determination of the logistics of getting materials into position and also a means of introducing the company to the client’s representative

11. Once the take off process had been completed work began on pricing the required items. Because the time was now limited, materials prices had to be obtained quickly over the phone rather than a written schedule

12. A discussion was had with the CM and the MD to determine labour rates

13. A five day period remained to complete the pricing of all individual items, enter the quantities, extend the rates, assess sub-contract tenders, chase tenders not yet received, enter the chosen contractors prices, calculate the labour resources, discuss preliminaries with the CM, calculate preliminary costs, add the BQ for a nett total, arrange for the estimate to be checked mathematically and check through the priced items for possible errors and omissions. This involved working late into the evening on four occasions and until early morning on the fifth

14. On the morning in which the tender was due for submission a meeting was held with the MD to discuss the project in much the same way as item 23 above

15. The percentage for overheads and profit was added and checked as item 24 above and the tender document prepared but because the delivery was required in London and the contractor was Birmingham based, permission had to be obtained to fax the tender summary to the client’s representative, which was granted. The tender was also sent by post

Work carried out following a request from the client's representative (CR) for a priced BQ to be submitted for checking prior to the contractor being offered a contract to carry out the project.

The project was valued at approximately £357,000 which was tendered on the basis of drawings and a specification and with a BQ prepared by the Estimator.

1. Estimator entered into negotiations with the CR on the level of information to be offered as, this being tendered on the issue of drawings and specification only, there was no obligation for the tendering contractor to provide a detailed cost breakdown. However it was explained that the CR wanted a complete priced breakdown.

2. Estimator discussed the CR's requirements with his MD and it was agreed that neither wanted to fully disclose the detailed costs but they did not want to jeopardise their chances of being awarded the contract.

3. The Estimator entered into discussions with the CR and offered an elemental breakdown which would provide individual costs that he felt could be used for comparison, checking for errors and omissions and also for valuations, explaining further that he was only obliged to provide a total price.

4. CR came back to Estimator and accepted the situation.

5. Estimator spent three days collating prices into the elemental sections that had been offered, checking totals and having these total checked independently. In addition he held discussions with the QS on the set out of the breakdown to ensure that the QS would find it usable for the preparation of valuations, variations and final account

6. The re-arranged BQ was then shown to and discussed with the MD to obtain his agreement to the way that it was to be presented to the CR

7. The BQ was then despatched to the CR for them to check and compare costs

8. Following acceptance of the tender the Estimator made his work available to the CM, QS and MD who then took over their responsibilities for the construction stage of the project

General Communication

The Estimator shared office space with the Buyer and both spent a considerable proportion of their working days at the desk in fairly close proximity to each other. During the course of the study the communication between them was more to do with day to day activities of life, football, nights out, politics, their wives and families etc. There was interaction on materials prices with the Estimator obtaining information from the Buyer on latest prices for materials that concerned the estimates being worked on, which, because the work was done manually, avoided the necessity to wait for supplier prices and therefore helped to speed up the operation. However, the information from this source was limited, with supplier pricing being necessary for the majority of the items. In turn, the Buyer requested price details from estimates that had been successful and for which he was working on at the time.

Apart from site visits, the Estimator spent the remainder of his time in the office.

Ethnography Study Company 2

Estimators Office of company with an annual turnover around £580m

This company was separated into geographical regions of the UK. This region had a turnover of approximately £85m

One Senior Estimator (SE), three Estimators and one assistant Estimator working on:

New build office project valued at £4.5m

Enquiry sent by e-mail consisting of;

Drawings, BQ and Specification, which was for a client for whom several projects had been carried out previously and was to be negotiated with the QS representing the client (PQS)

Action taken;

1. The SE made the decision to work on this project with one of the Estimators

2. The BQ was broken up into trade sections that each could work on individually

3. Each Estimator "marked up" his sections of the BQ on computer for transfer to individual specialist companies and materials suppliers together with developing a list of drawings to be sent with each

4. The responsibility for despatching drawings, specifications, BQ sections, project contract details and specific company requirements was handed over to another office as was the decision on which, and how many, contractors would be invited to tender for each trade and this was done electronically

5. It was explained that the company employed tradesmen; carpenters, bricklayers, drainlayers, concreters and labourers, directly but not in sufficient numbers to enable them to carry out all of their work. Therefore the timing of the project would determine the manner in which the project was undertaken with regard to the employment of labour. On this basis, the Estimators were expected to prepare BQ sections, for these trades, to be sent out to specialist companies also as well as pricing the work for directly employed operatives

6. Each Estimator worked on a personal computer (PC) using a CAE system that complemented the system being used by the PQS and the complete set of documents were loaded onto one PCs CAE system by the Estimator, who also printed off a hard copy of the contract details, specifications and drawings for shared use

7. Several hours were spent in reading the documents and studying the drawings and there was a considerable amount of discussion between the SE and the Estimator about specific detail on drawings, contract conditions, how they each felt the project might be carried out physically and how they planned to price the work initially, as it had to be presented to and negotiated with the PQS

8. The Estimator then spent a morning adjusting and setting up the BQ on his PC to enable it to be worked on by the CAE system. Apparently it is often the case that, even when BQs are transferred by complementing systems, in this case Conquest to Conquest, they still require adjusting to ensure that they can be worked on efficiently. Once the set up was complete the Estimator copied the document onto a memory stick and handed it to the SE for use on his own PC

9. At the same time the SE carried out the calculation of the labour rates to be used for this specific project and both Estimators then entered them into their standard databases

10. Both Estimators were then able to commence work on pricing their allocated sections and each PC was linked to the standard database for labour, materials and plant prices. Prices for materials and plant were taken from previous projects

The following three weeks were spent in working on;

11. Pricing trade items

12. Collecting information on materials prices and delivery times

13. Assessing prices from different suppliers

14. Deciding on which prices to use

15. Changing the material price from the one used initially to the one selected, which automatically adjusted all affected rates totals and sub-totals

16. Collecting information on sub-contract tenders and any special conditions attached

17. Assessing tenders from different contractors

18. Deciding on which tenders to use to use

19. Entering the selected values into the estimate

20. A site visit was made by the SE, the Estimator and the Senior Contracts Manager (SCM) which involved discussions on logistics, positioning of office accommodation, problems and solutions to delivering materials to the required areas, storage, ways of minimising the impact of the construction works on the surrounding area, local labour supply, importation costs and consequences for staff and operatives, ground conditions, working space, security and protection

21. Once the pricing of direct works was complete, and all tenders for these specific trades had been returned, a decision then had to be made about whether to use the priced items or the tendered prices. As at this stage a final decision would not be taken, the SE made decisions on how the work was to be allocated by comparing the tendered prices with the collective totals from the pricework that had been carried out by them and both Estimators made adjustments accordingly

22. Records of these adjustments were made, to be presented to the SCM, together with an assessment of the consequences of each individual trade if using direct labour or sub-contractor

23. The Estimator copied his work onto a memory stick and transferred it to the SE's PC where it was added to the SE's work

24. Resource data was then obtained; again this was immediate once all the work had been collected. This data enabled the Estimators to decide upon staff levels, accommodation requirements, crane and other mechanical equipment times etc to enable them to produce preliminary costs, setting these into the estimate by using a company standard database of preliminary items

25. A meeting then took place with the MD, SCM and SE where the project was discussed in detail, possible problem areas highlighted, risks discussed, assessment of using direct or sub-contract labour presented, decisions made on the level of overheads and profit to be added and the arrangement of pricing to be offered to the PQS for use during negotiations. The SE was given the responsibility of negotiating the tender and a minimum level was set below which he would have to refer back to the MD in the event of failure to agree

26. The SE added the percentage for overheads and profit to the estimate and sent the tender documents to the PQS, electronically, for his assessment

27. The PQS, several days later, contacted the SE with a request to lower the tender level and arrangements were made to meet to discuss this

28. An agreement was reached that was acceptable to both parties and the SE made adjustments to the tender accordingly and re-submitted the tender summary together with a revised BQ, again electronically

29. Following the receipt of contract documents the SE produced a tender report for the MD, and the Estimator circulated the priced BQ, complete with item breakdowns, to the QS and Purchasing Departments

Extension and Enhancement of an NHS Trust Hospital valued at £5.2m

Enquiry sent by e-mail consisting of;

Employer's Requirements (ERs) and a design brief, together with outline Planning Permission, for a Design and Build Proposal to be undertaken as a competitive tender, with contractors needing to submit detailed designs, full cost breakdown, cash flow forecasts and timescales, to fit within a declared budget, start date and stated latest completion date

This project came into their office during the period in which the estimate above was being carried out. Limitations on research time meant that only part of the work was studied

Action taken;

MD informed the Estimating Department that an invitation to tender for this project had been accepted and that the company would enter a tender proposal in conjunction with a selected Architect, chosen from an approved list issued with the ERs. The timescale for submission was six months and the Estimators were to work with the Architects in producing overall pre tender budgets until the design met the limits set together with specific and alternative design budgets for individual areas. Once all the criteria had been met, a BQ was to be prepared and used to provide a final estimate, a tender submission a cash flow forecast and a detailed work programme.

In the time spent at their office;

An Estimator and the Assistant Estimator had meetings with the Architect to gain an idea of how they wanted the design to fit within the requirements. Two of these meetings were held on site and the Estimator used this time to assess the site conditions and gain an idea of where accommodation and storage facilities could be sited. Initially, because the drawings were sketches of limited detail and the Estimators inexperienced in preparing cost budgets, a company QS had to be included in the team to help with the preparation of the information. The QS had his own

projects to operate and therefore was restricted in the time that he was able to provide. At times this led to conflicts, with the QS trying to provide information on schemes that were little more than line drawings and needing more time to devote to it than he had available. The Estimator was then calling for help from the SE, busily engaged in the office project described above and limited not only in time but his knowledge of budget forecasting. Requests for more detailed information from the Architects were met with some resistance because it was felt they too were carrying out the design at risk and were trying to limit their expenditure. For the design and build teams whose proposals failed to gain acceptance it had been stated in the ERs that there was to be no recovery fee.

At the time that the study period ended, three weeks into the work, there had been little progress in the design and a considerable degree of concern was being raised about the prospect of the proposal being ready in time together with worries concerning the amount of abortive costs, in the event of failing to win the contract, due to a seemingly unforeseen lack of expertise from the team overall.

A telephone conversation (mid May 2006) to the company disclosed that the design was a long way from complete and was being over designed financially. Budgets had been done but not always been very accurately, being carried out in the main by Estimators lacking experience and expertise in budget costing which has also been the reason attributed to delays in the completion of some of this work. Alternative design solutions had also been provided where there was concern that the Architects ideas had gone beyond the ERs. The project was then being priced by the Estimators based on their construction knowledge and some judicial assessments of how they thought the design would work. They involved communication by e-mail, phone, fax and personal meetings to specialist contractors who they felt were suitable to carry out this type of work and would also be prepared to give some input into alternative design solutions. The QS had to leave them to work without his help due to pressures from his own projects and there was a major concern about the time being allocated to the design stage, which was causing problems with new enquiries, some of which were being turned away due to the restricted estimating time available. Attempts were made to bring in Estimators from other regions of the company, enlist the help of QS consultants and to recruit Estimators with pr-contract financial expertise. Other

regions were unable to help as it seemed that they too had Estimator resource problems. Consultant QSs were available but there was a concern that their fees would add too much to an already heavy financial risk. The recruitment of additional Estimators was, apparently, an ongoing and almost permanent exercise as, according to the SE, the estimating team was permanently understaffed and therefore either working long hours, turning work away or finding consultants, usually QSs, to help with their estimates. The results, he said, meant that Estimators were overstretched and stressed, which was causing errors in estimates, work which might have been profitable was being lost together with a possible loss of reputation in refusal to tender and the Estimates prepared by QSs were both expensive to produce and lacking in quality due to the inexperience of most QSs with estimating techniques to the required standard and with understanding the company's methods of operation.

Another difficulty with delays in design work was that the company was unable to send out clear and definable enquiries to sub-contractors and the Estimators were therefore pricing individual trades "in house" some of which was based on assumptions. This led to quite a considerable amount of re-pricing as the design details slowly improved. Eventually enough information arrived to make sub-contract enquiries viable but a management report was prepared setting out the limitations of the information supplied to specialists and the risks associated with it.

The company made contact in late September 2006 to say that the tender had been submitted on time but that they had been so concerned at the lack of design detail that they had included a contingency to cover what was felt would have been a financial risk. This had also meant that their works programme had included a time allowance to cover the design concerns. These allowances had put their costs above the initial budget, their time frame beyond the requirement and had also left them adrift of the lowest tender, resulting in a failure to obtain the contract. This information was included in a tender report and it has apparently altered the company procedures for accepting enquiries in that there are now consultations with senior managers prior to work of this nature being accepted for tender.

Ethnography Study Company 3

Estimators Office of company with an annual turnover around £700m

This company was separated into geographical regions of the UK. This region had a turnover of approximately £100m

It was explained that over the past two to three years the company had changed the way in which they carried out their projects. Before, the work had been done using tradesmen who were employed on a contract by contract basis, known in the industry as labour only subcontractors, together with specialist contractors. This system had been changed so that all the work was done by specialist contractors, with the work previously done by labour only bricklayers, carpenters and groundworkers being done by companies who provided a complete service for these specific trades including supplying materials, plant, personal protective equipment etc. This new method meant that the estimating procedure had also changed. The Estimators were no longer spending time building up individual item rates for the labour only trades and inputting selected specialist costs. Instead, all of the work was being divided into specialist packages and sent out for competitive prices in this way. The only variation on this was in cases where the project tender times were restricted and specialists, such as bricklayers, were unable to provide prices for materials in time. In these cases, the Estimators were using the labour element given to them by the specialist and building up an additional rate for materials, plant etc from their own resource information. It was explained that this was for pricing purposes only and that, in the event of the company winning the tender the work was still being done in the same way, once the specialists had agreed "all in" rates for their work.

One Regional Procurement Manager (RPM) and three Project Estimators working on

A local authority (LA) housing scheme under a Frameworks contract. (Value not disclosed) but for a development of 115 affordable houses replacing two existing tower blocks.

Enquiry sent onto an internet website with drawings and specification

It was explained that this type of work was restricted to three tendering contractors who were on an approved list where the work was distributed between the three during a five year time period in which they were guaranteed a minimum value of work. This meant that while it was important to achieve a competitive tender price, depending on each companies workload and ability to fulfil the 'employer's requirements', the lowest tender did not always win the work. It was apparently more important to ensure that the 'requirements' were properly allowed for in producing the 'most desirable tender' rather than the most competitive.

Action taken

1. The Regional Procurement Manager (RPM) had met with representatives from the LA and had discussed the project prior to being given permission to tender.

2. A password and website address was issued by the LA to the RPM who had then used the password to access the tender documents.

3. The documents were downloaded by a Project Estimator (PE) and distributed to the estimating team for scrutiny.

4. During a team meeting the RPM detailed the project to the PEs and between them decisions were made on work packages with each PE being allocated specific work sections as their responsibility. These sections covered work in 'traditional' trades of groundworks, bricklaying, carpentry, concrete and steel reinforcement work.

5. A site visit was done with all Estimators and a Senior Contracts Manager (SCM).

6. Each PE worked through their relevant documents and began to take off quantities and make decisions on preferred sub-contractors (S/Cs). Before sending out details the projects were discussed with the S/Cs to ensure their commitment to tender.

7. Once all S/Cs had been decided on each PE listed appropriate documents for each S/C on a standard document issue form and an assistant transferred this information to each S/C electronically together with details of access to the website for them to download the required information.

8. Each PE took off quantities and prepared BQs on the sections for which they were responsible and then carried out pricing individual items as would have been done when tradesmen were directly employed with the pricing done using a CAE package. The difference appeared to be that materials prices and labour rates were obtained from a database rather than from individual suppliers but it seemed that this was acceptable as the work was being used as a check on prices that would eventually arrive rather than be used as definitive costs.

9. The RPM co-ordinated the work and began developing a programme schedule as information became available. This was being collected from labour schedules provided by the CAE package with each work section.

10. All Estimators handled queries from S/Cs that tended to arrive on a regular basis throughout the tender period.

11. As S/Cs prices arrived the PEs gathered the costs for which they were responsible and chased up S/Cs who were late in returning documents. Comparisons were regularly being made with S/Cs prices and the PEs calculations so that a picture began to emerge of which S/Cs costs they felt would be the most suitable to use in the tender. The final assessments were made with consultation with the RPM and prices entered into the CAE system, gradually building up a total cost.

12. On this project the RPM had the responsibility for preparing the preliminaries which was done in conjunction with the SCM. At that stage the works programme had been completed and was scrutinised by the SCM prior to the information being used to aid preliminary item calculations.

13. The RPM entered the preliminary costs onto the software to complete the estimate.

14. The BQ was expected to be included in the tender return and therefore each PE produced a report on what had been included by them, any provisional sum allowances, potential financial risks, labour risks, possible material cost risks, cost comparisons of S/C prices used and prices built up by the PEs, items of possible cost savings and each PEs assessment of what they called 'project potential' where they were free to express their thoughts on the value of the project to the company compared to the inherent risk.

15. The RPM spent some time reading the reports before meeting the Managing Director (MD) and discussing the project, leading to a decision on the percentage to be applied to cover their overheads and profit.

The company's tender was shortlisted with one other and the RPM became involved in several meetings, working through item costs, programme queries and existing workload with that LA before they were informed that the contract would be awarded to the other contractor. They were, at the same time give positive news, though, in that there was a similar project planned for commencement three months later and that the LA was prepared to negotiate the work using the tender information provided for this work.

Because of time limitations it was only possible to view one project process but a discussion with the RPM provided descriptions of other procedures that were carried out.

Depending upon which format the enquiry had taken determined the preparatory work that was required prior to the sections being sent out to subcontractors. It may have arrived in one of several formats such as; specification only, plan and specification or BQ and drawings. If a BQ was not available then the Estimator takes off the quantities and prepares one, sending out selected sections with tender documents for trade specialists.

This company is working toward developing relationships with clients that will lead to; repeat business, negotiated contracts, partnering etc and has developed two initiatives, the first with what it calls “Frameworks”, as the project above, with local authorities where they are assured of a minimum amount of suitable work over a five year period and a second, “integrated teams” where the whole team, consultants and contractors, is kept together on repeat contracts. This has meant that the estimating work now incorporates cost analyses, life cycle cost preparations, cost plans, development appraisals, feasibility studies, value engineering and value creation, all of which are being offered to their clients, as part of a package, to develop ongoing relationships.

With their competitive tendering work the Estimators are contributing to a group wide data base, providing known information on previous clients and consultants that will be used in the decision making process when invitations to tender are received, as to whether or not the invitations will be accepted.

The production of risk assessments has become an important part of the estimating role. Any possible type of risk is now recorded and a list produced for use during the estimate development with costs built in to each risk. It is now also a major report for inclusion with the final estimate, presented to the MD during the tender assessment, is being offered to clients, with the tender documents and project personnel, at the beginning of the construction phase.

Also, more time is being spent in working with the company’s project planners in preparing the project programmes. Is has been found that in giving more consideration to the timing and sequence of work, adjustments often need to be made to preliminary items and to sub contractor costs for such things as separate visits, out of sequence working, plant and equipment for shared use etc.

For this company, the estimating procedure, in being less intensive in item pricing breakdowns has therefore fanned out into aiding the work of other roles and has, in doing so, developed the company’s teamwork which, it seems, has increased job satisfaction.

Ethnography Study Company 4

Estimators Office of company with an annual turnover around £100m

Senior Estimator (SE) and Trainee Estimator (TE) working on:

Refurbishment of kitchens and bathrooms in 280 existing housing association (HA) properties (value approximately £2.4m) under a Frameworks contract

Enquiry sent by post consisting of:
Project details, employer's requirements and specification plus an "information pack".

Action taken:

Preparation of information for the "information pack" prepared by SE and TE as the tender progressed. The SE went to great pains to explain that the majority of his company's work was on "Framework" contracts where they had developed relationships with housing associations requiring the refurbishment of housing stocks. As far as the Estimating procedure was concerned there was still a requirement to price the work in the normal way but where the role had changed was that these contracts had a lesser reliance on cost and a far greater one on other aspects of the company's position and outlook. Each invitation to tender was made up of the equivalent of two A4 lever arch files of documents where the contractor had to provide a range of information on the company ethics, health and safety procedures, safety record, financial position, training of staff and tradesmen, qualifications of the workforce, ethical philosophy, mission statement, adversarial philosophy, ratio of workforce between directly and indirectly employed personnel, lists of potential specialist sub-contractors, risk assessments, method statements, work programme, site preliminaries breakdown, cash flow forecast, cost analyses, intended number of site employees both maximum, minimum and average, quality control measures, policy on employing local tradesmen, suppliers and specialist companies etc. It appears that the make up of this information was rated by the client and the information provided counted for between 60% and 70% of the consideration with their tender sum accounting for between 30% and 40% of the overall value. The Estimating team were

therefore lead members in the team that put the package together, providing the estimate, advising on the tender sum and working with the other team members to produce the information pack.

The contract was not local but situated two hours north of their office. Once the details of work requirements had been absorbed there was considerable time spent by the SE in sourcing local tradesmen. Despite the company employing labour directly, in order for them to comply with the requirements of the HA they had to be assured that quality labour, local to the project, could be found and was affordable. The work entailed stripping out existing fittings, alterations to openings, electrics, plastering, new bathroom suites, new kitchen units, carpentry, tiling, decorations, scaffolding and roofing to accommodate openings for mechanical ventilation. This meant that specialist work for everything other than stripping out, alterations and carpentry needed to be sourced locally also and assurances had to be made that the chosen companies had sufficient manpower and availability to meet the timescales set by the HA.

Once this had been done the TE and an assistant organised the prepared documentation for despatch to the required specialists. This was done by hand and the documents sent by post.

The only drawings provided were of the site layout which gave indication of the number and position of each house type. This therefore involved a site visit and the SE made arrangements with the HA to ensure that entry could be gained into each house type and sufficient time allowed for taking measurements, photographs, assessing access, storage, site accommodation and the logistics of bringing large delivery vehicles into an existing housing estate through surrounding similarly sized roads. The visit arrangements also had to correspond with suitable times for specialists and, again, a lot of time was spent in co-ordinating this to avoid the sensitive issue of competing contractors overlapping.

Eventually four visits had to be arranged and a PE drafted into the team to develop the arrangements and make the additional site visits.

As this proceeded the SE and the TE took off the quantities for the work that they intended to employ direct labour on. This was a relatively short task as each house type was duplicated between 30 and 40 times. Similarly, the specialist prices came in quite quickly as, with just eight house types and with standardised equipment the take off and pricing was a small proportion of the overall tender time. Apparently there was a specialist CAE package for their use but the Regional Estimator (RE) had developed an estimating system using an Excel spreadsheet and the SE considered that this was easier to use and more flexible than their CAE package and the tendency was to use that in preference which was how it was during this study.

The SE worked continuously for four weeks on the project and included the TE in all of the everyday tasks, allowing him the space to be able to watch and learn and allocating specific items that he felt could be carried out without supervision. The majority of this time was spent in organising and planning, updating the "information pack" and finally collecting in the tenders from specialists, some of whom had declined the invitation to tender following site visits and had, therefore, to be replaced by alternative contractors which added two further visits to site for the PE.

The returned specialist tenders were appraised and specific contractors selected for inclusion along with the pricing carried out on individual trades. Probably because the basic estimating task had not been time consuming there was a period before the tender return was due when the SE could look at the estimate and carry out some "what if" exercises. He was concerned about the project being so far away and having to use local labour and was looking at the possibility of using specialist companies for the stripping out, carpentry and alterations. He, along with the PE that had undertaken the site visits and the TE increased the labour rates to a level that the SE felt might be demanded by specialist companies. With the software this proved to be an easy task that could be done in seconds, the outcome viewed and reversed equally quickly. He left the PE with a list of these calculations to carry out and a request for a report on the consequences of each action.

As this was being done the SE prepared the preliminaries in conjunction with the RE. Some of the information needed for this was included in a works programme. This

programme had been produced by the PE involved in the site visits, evolving as the estimate progressed.

Reports on the project, costs, risks of carrying out the works from such a distance, using unknown untried S/Cs, possibly needing to employ direct labour on short term contracts, the logistics of getting materials into houses which apparently would be occupied until entry for the work to be carried out and a very exacting time schedule were all prepared and heavily emphasised on the most critical parts of the operation.

The meeting to assess the project involved the MD, RE and SE and a percentage addition was set.

Normally this would be the final task prior to the tender return but it was, in this case not even the half way stage. The "information pack" and tender sum were despatched to the client but that was for their assessment of the overall package. Once the package had been accepted there were meetings with the HA in the HAs offices, on site, at the contractors office and with the selected specialists. Everything was discussed extremely thoroughly and the SE headed the team of managers from his company and from the specialists companies, going through two files of employers requirements mentioned above. As they had said at the beginning, the price was not the most important factor. From the discussions that were open there was a great deal of concern regarding timing of works as the householders had to be re-housed for very specific time periods, which were expected to be both stressful for them and expensive for the HA, particularly if things went awry. In all, the discussions lasted five weeks with several meeting each week.

Finally the company was informed that they would not be awarded the contract, even though their tender was apparently the lowest. The reason given was that the HA was concerned about the lack of main contractor knowledge of S/Cs being used which they felt might jeopardise the timescales for householder changeovers.

As this project was different at the tender stage to any that had been experienced before, the total time spent with the contractor's Estimators revolved around this work.

Additional Estimator Attributes from Ethnography Studies

1. **Cost Estimating Skills**
    1) Visit site to assess site conditions
    2) Check for omissions and errors
    3) Create 'what if' scenarios
    4) Re-arrange estimate information to suit contract requirements
    5) Produce and maintain resource databases

2. **Ability to Prepare Select and Appraise Tenders**
    6) Produce resource schedules
    7) Make price adjustments
    8) Decide between using direct or sub-contract labour

3. **Good Communication/Teamwork Skills**
    9) Share knowledge
    10) Hold high level project and financial discussions with senior management
    11) Hold discussions with sub-contractors
    12) Hold discussions with suppliers
    13) Represent company at client meetings
    14) Agree basic labour rates with senior managers
    15) Collaborate with Architects, QSs, Buyers, Managers, Clients
    16) Organise team structures
    17) Discuss design briefs with Architects
    18) Work with consultants on financial matters

4. **Thorough Knowledge of Construction**
    19) Keep up to date with current construction methods

5. **IT Skills**
    20) Use plotter for printing A1 drawings
    21) Use printer for printing information from PC
    22) Input data sent electronically into CAE packages

23) Copy information onto disc/memory stick/CD

6. Ability to Measure Work and Prepare BQs

24) Site measurement

7. Risk Management

25) Provide information on project risks

8. Knowledge of Contracts and Contract Law

26) Competitive tendering techniques

9. Good Negotiating Skills

27) Negotiate with consultants

10. Ability to Provide Pre Contract Financial and Construction Advice to Client/Employer

28) Produce tender reports

29) Provide advice on project risks

11. Management Skills

30) Recruitment and selection of individuals/contractors

31) Integrate other roles into project team

12. Programming and Planning

32) Use labour resource lists for preparing activity/time schedules

33) Co-ordinate schedules to produce project work programmes

Appendix 6 Estimator Training Needs Questionnaire

Page 1

Training Needs Questionnaire

When answering questions, as many boxes as are applicable can be ticked, it is not limited to ticking one box only.

Item	Question										
1	**Job Title**	Trainee ☐	Assistant ☐	Estimator ☐	Senior ☐	Head ☐					
2	**Formal Education**	None ☐	ONC ☐	HNC ☐	OND ☐	HND ☐	Foundation Degree ☐	Bachelors Degree ☐	Masters Degree ☐	Other (State) ☐	
3	**Professional Education**	None ☐	MCIOB ☐	MICE ☐	MRICS ☐	Other (State) ☐					
4	**Work Type**										
	a **Competitive Tender**	Specification Only ☐	Plan & Specification ☐	Quantified Plan & Specification ☐	BQ & Drawings ☐	Design & Build ☐	Private Finance Initiative ☐	Framework ☐			
	b **Negotiated**	Specification Only ☐	Plan & Specification ☐	Quantified Plan & Specification ☐	BQ & Drawings ☐	Design & Build ☐	Private Finance Initiative ☐	Partnering ☐	Framework ☐	Spec. Housing ☐	
	c **Other (State)** ☐										
5	**Estimating Process**	Directly Employed Trade and Specialists ☐		Directly Employed Trade Labour Only & Specialists ☐		Labour Only & Specialists ☐	Labour & Materials Contractors & Specialists ☐		Other (State) ☐		
6	**Method of Estimating**	Pricing Trades & Inserting Chosen Specialists ☐		Pricing Trades as Check on Labour & Materials Contractors & Inserting Chosen Specialists ☐		Inserting Chosen Specialists Only ☐	Pricing Trades, Resources and Chosen Specialists ☐		Other (State) ☐		

7	**Pre Contract Information**	
a	**Provide Information to Client/Employer**	Cost Analyses ☐ Life Cycle Costing ☐ Forecasts ☐ Budgets ☐ Cost Plans ☐ Development Appraisals ☐ Feasibility Studies ☐ Value Engineering ☐ Value Creation ☐ Other ☐
b	**Negotiating Skills (Are you required to negotiate with clients/consultants on:)**	Design & Build ☐ PFI ☐ Partnering ☐ Frameworks) ☐ Integrated Teams ☐ Target Contracts ☐
8	**Post Contract Information**	
a	**Construction Phase**	Are You Required to Price Additional Works During the Construction Phase ☐ Do you retrieve and analyse information and data from projects for future use ☐
b	**Negotiating Skills**	Are you required to negotiate prices with suppliers ☐ Are you required to negotiate prices with sub-contractors ☐
9	**Measurement and BQ Preparation**	
a	**Taking Off Quantities**	By Hand ☐ By Digitiser ☐ Planimeter ☐ Done Externally ☐ None ☐ Other (State) ☐
b	**BQ Preparation**	By Hand ☐ By Digitiser ☐ Directly onto PC ☐ Planimeter ☐ Done Externally ☐ None ☐ Other (State) ☐
10	**Estimating Skills**	
a	**Estimator Training**	Gained Formally ☐ Gained Professionally ☐ Gained "On the Job" ☐ Other (State) ☐
b	**Knowledge of Construction**	Gained Formally ☐ Gained Professionally ☐ Gained "On the Job" ☐ Other (State) ☐
c	**Preparation, Selection and Appraisal of Tenders**	Do you select sub-contractors lists ☐ Do you send out drawings and documents ☐ Are sub-contract tenders appraised and selected by you ☐

11	IT	
	a Estimate Preparation	Carried Out by Hand ☐ Carried Out by Spreadsheet ☐ Carried Out by CAE Standard Software ☐ Carried Out by CAE Bespoke Software ☐ Other (State) ☐
	b Use of Spreadsheet	Additions & Multiplications ☐ Use of Formulae to Automatically Update Totals if Individual Costs are Revised ☐ Use of Formulae to Automatically Update Totals if Individual Costs are Revised & Provision of Automatic Resource Information ☐ None ☐
	c Historical Cost Data	Is data from previous estimates saved for future use ☐ Is data from previous estimates used in future estimates ☐
	d Electronic Document Transfer	Can Specifications be received and sent ☐ Can Drawings be received and sent ☐ Can BQs be received and sent ☐
	e Use of Word	None ☐ Reasonable ☐ Good ☐
12	Form of Contract Knowledge	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
13	Knowledge of Contract Law	
	a Construction Design & Management Regulations	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	b Housing Regulations	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	Building Regulations	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	Disability Regulations	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	Housing Corporation Design Requirements	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	Waste Management Environmental Clauses	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	Streetworks Act	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	British Research Establishment Environmental Assessment Method	None ☐ Pre Tender Clauses Only ☐ Working ☐ Thorough ☐
	c Other Relevant Regulations	

14	**Communication/Teamwork**	
	a **Pricing Information used by**	QS ☐ Buyer ☐ Site Management ☐ Office Management ☐
	b **Resource Information used by**	QS ☐ Buyer ☐ Site Management ☐ Office Management ☐
	c **Reports used by**	QS ☐ Buyer ☐ Site Management ☐ Office Management ☐
	d **Estimate pricing used by**	By Individual ☐ By Team ☐
15	**Innovation**	Awarenes of New Methods of Operation ☐ Awareness of New Types of Materials & Plant ☐
16	**Risk Management**	Assessment of Contractual Risks ☐ Assessment of Financial Risks ☐ Assessment of Personal Risks ☐ Provide Risk Solutions ☐
17	**Commercial Business Acumen**	Consideration of Company Profitability ☐ Consideration of Client Satisfaction ☐ Consideration of Environmental Issues Affecting Material Selection ☐ Consideration of Issues Affecting Labour Resources ☐ Consideration of Project Sensitivity ☐

18	**Management Skills**	
a	**Individual Management**	Are you Required to Manage other Estimators ☐ Are you required to Manage other Roles ☐
b	**Management Training**	Have you Received Training in the Management of Individuals ☐
	Your View on Future Improvements:	
19	**Formal Education**	Foundation Degree ☐ Bachelors Degree ☐ Masters Degree ☐ Sandwich Degree Part Work Part University ☐ None ☐ Other (State) ☐
20	**Professional Education & Training**	RICS ☐ CIOB ☐ ICE ☐ New Estimating Institute ☐ Qualification from University/Employer Joint Venture ☐ NVQ from CITB Training ☐ None ☐ Other (State) ☐
21	**Ongoing Training**	In Conjunction with Professional Institute ☐ Developed with Employer ☐ University/ Employer Joint Venture ☐ CITB/Employer Joint Venture ☐ CITB Courses ☐ None ☐ Other (State) ☐
22	**Company Information**	
a	**Turnover**	Up to £1m ☐ £1m-£10m ☐ Over £10m ☐
b	**Type**	Construction ☐ Civil Engineering ☐ Construction & Civil Engineering ☐
	Confidentiality statement	
	Information given will be used for statistical purposes only. The confidence of the informant will be respected.	

Appendix 7 Published Article for ECAM Journal

Estimating as a Profession in UK Construction

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Abstract:

Purpose

Both Quantity Surveyors (QSs) and Estimators have pivotal roles in the profitability of construction contracts; however, only the QS is classified as a professional. Preliminary examination of the responsibilities of the Estimator and the level of qualification required in comparison to the QS suggests that the current failure to recognise estimating as a profession may be an anomaly. The purpose of this inquiry was to consider the role of the Estimator relative to the accepted criteria attaching to professional status.

Methodology

To achieve this, available definitions of a profession were distilled into core criteria which were then used to compare QSs and Estimators in terms of remuneration, education and professional representation.

Findings

A statistical analysis on each of these criteria suggested that there was no significant difference in terms of salary offered or education required by employers. Further investigation, however, did reveal a considerable difference in educational and professional opportunities available to QSs. With regard to the key defining criteria of a profession and the consideration given by employers, the results indicate that there is no difference between the two groups.

Originality/value

Given the information revealed by this research it may therefore be the case that the current standing of Estimators should be reconsidered with the purpose of upgrading estimating to a professional status.

Keywords: Estimators, Quantity Surveyors, construction, engineering, estimating, profession

Article Type: Research paper

INTRODUCTION

There are surprisingly varied opinions on the value of Estimators and estimating within the UK construction industry (CI), covering general construction and civil engineering. Negatively, Delargy (1999) suggested that Estimators were "boring 50 year olds" and "anything but dynamic." The Construction Industry Training Board's (CITB) website (2006) classifies Estimators as Technical Support and describes estimating as a technician's role. The Chartered Institute of Building's (CIOB) website (2004) is similarly dismissive in that the role of the Estimator is underplayed to the extent that estimating is not even listed among the 15 roles that it classifies as "design and management" in its section on "Careers in Construction". Anecdotal evidence from a member of staff at the CIOB (2003) suggested that Estimators come from a trade background and that their roles were to "put together an estimate that would fit with the considered total price that was generally known at the outset". Skitmore and Lowe (1995) say that this role is often undertaken by QSs, intimating that it does not require specific training.

In complete contrast to the CIOB, Harris and McCaffer (1995) described the function of Estimators as building up the estimates "from scratch" to arrive at a final price that was accurate, competitive and workable. According to Akintoye and Skitmore (1991), cost estimating is crucial and, if inaccurate, has a significant impact on contracting business, with overestimates leading to tenders being unacceptable and underestimates resulting in contractors losing money on the projects. Smith (1995) stresses the importance of early estimates as being seminal to both the client's brief and the viability of the entire project. In mentioning estimating careers for commercially-minded Engineers, McCaffer and Baldwin (1991) highlight the importance that estimating and tendering have on growth and prosperity and add that failure to gain contracts at the right price can jeopardise a company's future. A more extreme assessment came from Hicks (1992) who thought that if the estimate was not accurate then nothing could be done to prevent a loss on a project, irrespective of know-how, management competence or financial strength, other than an act of God. While this is not entirely true, as in some cases inaccurate but overpriced tenders do get accepted, thus affording an opportunity for increased profit, the point was made just how important he considered this work to be.

Such views indicate that opinions regarding the value of Estimators are polarised but, irrespective of their worth, if they have the potential to undermine a project as Akintoye and Skitmore, McCaffer, and Hicks (*op. cit*.) believe, then it has to be important to ensure the standards and accuracy of the estimating process. One way of achieving this would be through improved education and higher regulation, suggesting that the professionalisation of Estimators may be a solution. Given that QSs are carrying out many similar tasks in their involvement with construction costs and already have professional status, particularly through the Royal Institute of Chartered Surveyors (RICS), this lends further support to the argument that the current position of Estimators may need to be reviewed.

This study will demonstrate that the Estimator function is no longer confined to building up a project cost. Alternative forms of contract such as Partnering, Private Finance Initiatives (PFIs) and Frameworks are engaging Estimators in providing pre-tender information for clients and requiring them to work with design teams of qualified professionals. The need for respect and peer standing in these teams adds to the argument for a specific education and professional qualification.

In their book, "Professionalization", Vollmer and Mills (1966, p.v) quote Hughes as saying that

> In his own studies "I passed from the false question, is this occupation a profession?" to the more fundamental, "what are the circumstances in which people in an occupation attempt to turn it into a profession and themselves into professional people?"

Proposals, of the conditions that they believe exist for professional recognition, have come from Larson (1977), in that professionalisation has its roots in times of radical and rapid change and from Stinchcombe (1959), that organisations in new forms have a tendency to appear at a time when it is precisely possible to found them and when they can effectively function within a new structure.

Radical change is happening with the introduction of these different forms of project procurement, and the 'Integrated Teams' approach proposed by Sir John Egan in "Rethinking Construction" (Department of Trade and Industry (Dti), 1998) and

"Accelerating Change" (Strategic Forum for Construction, 2002), together with an economy that appears to be in good shape, with figures from the Dti website (2006) showing a steady increase in UK construction output from £62b in 1994 to £80b in 2004, and the Construction Confederation's (CC) website (2006) illustrating an increase to £93b during 2006.

The objective of the study, therefore, is to enquire whether it would benefit the CI as a whole and Estimators individually, if Estimators in the UK were to be professionalised. To inform of this possibility, the intention is to demonstrate why estimating should fit within a framework of what constitutes professional organisations by developing five methodologies. These will:

- List some of the definitions and views on professionalism from authors
- Catalogue job competencies
- Produce hypotheses on salaries/benefits offered and qualifications desired by employers

To add weight to the argument it does so, where necessary, in direct comparison with QSs.

1. Definition of Professions

Introduction

Currently there is no definitive list of occupations that are considered to be professions but the CI seems to have developed an inclination toward certain disciplines in some areas. Fleming (1980) classified three occupations: Architects, Surveyors and Engineers. A fourth group, Building, was added by Betts (1991, p208) following the formation of the CIOB. Butler and Savage (1995, p103) added a further six roles and the Construction Industry Council (CIC), with the Department of Trade and Industry (Dti), in a Professional Services Survey (2001/2002), categorised 43 professions, none being estimating. This does not relate to other countries, such as the USA, where estimating has long been regarded as a profession and has at least two professional organisations representing Estimators. (U.S. Department of Labor website, 2006).

Definitions of a profession vary widely but whereas they were originally considered to encompass medical, legal and scholastic institutions working “for the common good” (Etzioni, 1969: Macdonald, 1995) and highlighted by authors such as Friedson (1973) who considered professions to be prepared to surrender self interest for that of their clients, they have evolved into embracing disciplines within capitalist organisations that reflect a change in the relationship between society and individuals (Krause, 1996; Schmidt, 2000).

Aims

To discover a range of attributes that authors considered were essential in order for individuals or groups to be considered professional.

Methodology

Definitions of a profession, described in the introduction, are summarised from a larger study on professions [1]. Author definitions held a number of common themes which have been categorised, with author accreditation.

Take in Table I.

Results

A breakdown of the various definitions and descriptions of what does or should constitute a profession and a professional was undertaken and the work summarised as individual attributes together with the frequency with which these were mentioned.

Take in Table II.

Conclusions

There is no classic definition of a profession; they have evolved from the original tightly constrained concept, to which most professions currently in existence, or being created, would fail to conform. They have developed by adapting a broader range of attributes and core criteria within which it is possible to operate, which means that they can be employer-oriented and work within teams as well as autonomously for a client.

2. Estimator Match to Defining Professional Criteria

Aims

To establish the key criteria that form a prerequisite for professional status as it relates to estimating.

Methodology

From the list of definitions displayed in Table II, columns were added indicating attributes that would be considered necessary and achievable for Estimators with a 'Y' and those that would be considered unlikely or unachievable with an 'N'.
Take in Table III

Results

Of 15 attributes, construction Estimators could be expected to achieve 11 which compared equally to construction QSs; consultant Estimators achieve 12 which also compared equally to consultant QSs.

Conclusions

For QSs and Estimators working for construction organisations, 11 attributes from a total of 15 may appear low, but three of these emanate from original professions: Creating a Monopoly, Mediating/ Fiduciary role, Core Meaning of Life. The fourth, Personal Responsibility, has been entered as "no" because the criterion for this was considered to be whether or not professional indemnity insurance (PI) was required. For employees within industrial organisations in the UK, including recognised professional people, it is not normally needed. Both consultant Estimators and QSs miss on three counts as above, being: Creating a Monopoly, Mediating/ Fiduciary role and Core Meaning of Life. In their case Personal Responsibility has been entered as "yes" since, following the outcome of the England and Wales Court of Appeal (Civil Division) Decisions, Merrett v Babb (2001), they may be held personally responsible for their work in certain circumstances, making PI advisable. (A summary of this can be read on the British and Irish Legal Information Institute website (2006).)

3. Attributes Comparison

Aims

To develop lists of core competencies for both disciplines, by providing a summarised "body of knowledge" for each, in order to compare their abilities.

Methodology

Job descriptions for QSs were obtained from: the RICS website (2003), the RICS website (2004), Cornick and Osbon (1994), Skitmore and Smith, both above. Further descriptions were extracted from detailed job advertisements specifying employers' requirements. These came from recruitment agencies: Anders Elite (2003), Calco (2003), Construction Jobs UK (2003), Cordon Recruitment (2003), Coyle Personnel Recruitment (2003), Elliot Marsh (2003) and Judd Farris (2003).

Sources for Estimators came from: Harris and McCaffer, above, Learn Direct website (2004), an RICS survey (2002), Skitmore and Smith, both above, and from recruitment agencies Anders Elite, Construction Jobs UK, Cordon Recruitment, Coyle Personnel Recruitment, Elliot Marsh), all above, Hays Personnel (2003), Henry Recruitment (2003) and Hill McGlynn (2003).

Following the above surveys, a Delphi study [2] was undertaken to underpin and develop the information. This provided data from experts in estimating and quantity surveying on which attributes they considered were necessary in order for each discipline to perform its tasks. The same four groups were selected as for methodology 2 and sampling these groups was determined by a combination of two methods, in that a random method would provide fairness and, because of the need to sub-divide the groups, this should be a Stratified Random Sample. Added to this would be the need to ensure that each sub-group was adequately represented and therefore an element of Quota and Dimensional Sampling also required consideration. To represent each group, experts were selected from:

- *Employers* – Chief/Regional/Senior, QSs and Estimators
- *Educators* – Individuals responsible for the provision of QS courses and Estimating/Tendering modules

- *Professional bodies* – Staff responsible for setting up examination, training and ongoing professional development for QSs and Estimators
- *Public Bodies* - Personnel responsible for training and examination of QSs and Estimators

100 people were chosen from each discipline producing a total of 400 requests to Estimators and QSs undertaking work for construction and consultancy companies. Addresses were obtained from: Building Magazine (2004), CIOB (2004), RICS (2004), University and Colleges Admissions Service (UCAS) (2004) and 10 local authorities (LAs) that were selected at random. The requests, defined as Round 1 of the study, were sent out by e-mail. However, Round 2 involved participants placing appraisals on a Visual Analogue Line, to be measured by the assessor, thus this round needed to be sent out by post and returned in the same way.

Results

More than 150 competencies were recorded from the surveys and Round 1 of the Delphi study, which were condensed into specific headings e.g. "Good Personal Qualities" included honesty and integrity, "Intelligence and Cognitive Ability" included being logical and rational. The lists are set in tables with the source of the information alongside each item.

Take in Table IV for Estimator list and Table V for QS list.

Round 1 of the Delphi study enhanced the survey by confirming its results and providing additional competencies. Round 2 provided supplementary data that aided the comparison by producing "order of importance" rankings of the agreed competencies. From these rankings Kendall Coefficient of Concordance tests were carried out which demonstrated that, amongst each group and sub group, there was no significant (.05) diversity in their opinions as to which attributes were required of each role. These tests were done with:

Estimators as:

- A complete group
- A construction sub-group

QSs as:

- A complete group
- A construction sub-group
- A consultant sub-group

Consultant Estimators could not be included as a sub-group as just two people responded, thus rendering the return too low for a test to be performed.

Statistical calculations and the collated data have been excluded due to their volume. As consultant Estimators could not be included, the comparison was judged on each overall group. From the tables, $p<.0005$ for a single-tailed test, therefore the level of agreement on the core competencies was significant which meant that there was no significant diversity on either QS or Estimator groups' views on their core competencies.

An Estimator-QS comparison of how each group ranked the importance of individual competencies was also included in Round 2 of the Delphi study and was determined by a Spearman Rank Correlation test. This demonstrated that, although both disciplines required similar abilities, the level of importance of each one differed to the extent that there was a significant (.05) diversity of views on core strengths.
Take in Table VI

The overall response to the Delphi study, although disappointing in that just 28 responses were received in Round 1, dropping to 22 respondents in Round 2, was encouraging in that there was significant concordance achieved amongst their groups, saying much for the quality of the information provided by them, and was well inside the limitations of the Statistical Probability Tables used to determine the results.

Conclusions

The results indicate a clear picture of Estimators and QSs requiring a similar attribute base but necessitating differing levels of knowledge, skill and ability in each, thus linking them intellectually but demonstrating diverse job requirements.

4. Salary Comparison

Aims

To determine and compare salary levels and other benefit packages being offered by employers at trainee, project, senior and head levels.

Methodology

Two hypotheses were developed on the assumption that the QSs, being a professional occupation, would receive greater remuneration and supplementary benefits than Estimators. To test these, details of salaries and benefits offered were extracted from job applications of both. A survey was carried out using information from 108 advertisements placed by recruitment agencies through:

- "Building" magazines (2003)
- Internet Websites of construction recruitment agencies, above
- The "Express and Star" newspapers (2003)

Where there was insufficient information within the context of each advertisement the agencies were contacted to fulfil these requirements. In order to undertake this work, decisions were required on the sampling method or methods that would be most appropriate and therefore the factors that needed to be taken into consideration before making such decisions were:

- That it should be a "snapshot" survey of the CI during 2003, between September and November. Stevens (1996, p6) says that "For the purposes of statistical analysis, samples of 100 or more are considered adequate since power is not an issue". The sample should therefore cover at least 100 advertisements and could provide a minimum of 50 for each role
- That there should also be a comparable numbers of QSs and Estimators, segregated by skill levels
- That samples should be selected at random from these subgroups using as impartial a method as possible

Sampling methods were as for the Delphi study above (p 12).

In order to obtain a fair sample, the numbers of jobs advertised were selected on an even basis although recruitment is not, it seems, evenly balanced, with a total of 1,526 QS jobs on offer compared to 305 for Estimators, giving a ratio of 5:1 (2003).
The information was collated by specified divisions, determined by the Department of Trade and Industry (Dti) from their Construction Statistics and Economics website (2004), in providing information on CI turnover, number of employees and number of companies. This categorised companies as:

- Small; employing 1-13 people with turnover <£1m
- Medium; employing 14-79 people; turnover >£1m - <£10m
- Large; employing 80-1,200 people; turnover > £10m

However, it was found that, almost exclusively, small companies could not be included as there were few, if any, QS- or Estimator-specific roles within those organisations as the work is usually undertaken in a dual role. Coverage therefore encompassed medium and large companies.
Take in Table VII.

Tables, not shown here due to volume of information, were designed to contain information on:

- Job type
- Job description
- Date and source of information
- Salary
- Benefits and qualifications

Data obtained was entered and then collated using the Statistical Package for Social Sciences (SPSS).

In addition, a comparison was made between salaries gleaned from this survey and a September 2000 salary guide published by one of the recruitment agencies, Hays Personnel (website 2003). Figures for Head positions have been excluded as there were insufficient numbers of advertisements for these positions to provide viable information.

Because of the volume of work needed to produce this study, this section being completed over two years ago, an updated survey carried out in 2005 is also included from the Hays Personnel website (2006).

Results

Results in the form of hypotheses are listed below. In each case, where applicable, the significance level was taken as 5% (.05).

(a) H_1 *At similar grades, QSs are offered salaries in excess of those offered to Estimators.*

Salary levels were collated from job advertisements in four separate bands: £5,000, Median, Minimum and Maximum. Tests showed that, in all four, there was no significant difference between QSs and Estimators and therefore the hypothesis was not supported.

Take in Table VIII.

(b) H_1 *At similar grades, QSs are offered a greater range of benefits than those offered to Estimators*.

A range of benefits were derived from the information, categorised as:

- General Benefits
- Car or Allowance
- Bonus
- Pension
- Health Care
- Profit Scheme
- Study time

Using t-tests and Fisher's Exact Probability tests, three benefits held significant results: Car/Allowance, Pension and Health Care, but all three were significant in favour of Estimators. As all of the other results showed no significant difference between each group, the hypothesis was not supported.

Take in Table IX.

The salary survey comparisons suggest that there is sufficient similarity between each sub-group level for the figures used in the statistical analyses to be viewed with a degree of confidence.

Take in Table X

The updated survey from Hays Personnel, above, demonstrates that, while salaries have increased, a close comparison between each group and sub-group remains, which endorses the current relevance of the analyses.

Take in Table XI

Conclusions

Almost every test carried out failed to demonstrate any significant difference between Estimators and QSs in the way in which their roles appear to be valued by their prospective employers. In the instances where there was a significant difference, each of these cases favoured Estimators and went against the hypotheses. It can be concluded, therefore, that employers value Estimators at least as highly as they do QSs.

5. Qualification Comparison

Aims

To verify the educational preparation for Estimators and QSs at course levels:

- Undergraduate
- Foundation Degree
- HND
- HNC

together with initial and ongoing training provided by:

- The CITB
- Professional Bodies (PBs)

It was also considered appropriate to test employers' expectations in regard to the education of both disciplines.

Methodology

Two hypotheses were developed, based around the assumption that employers' requirements of QSs would be greater than those of Estimators. To assess these, an initial search was made for construction courses designed specifically for each role and a comprehensive list obtained from UCAS (2004). This listed 582 courses related to Building, covering all areas of the CI. However, whilst yielding 49 courses specifically designed for quantity surveying, no courses were found for estimating. Therefore, a refinement to the search criteria was made to locate courses that would provide core estimating subjects, identified in Table IV as preparing the estimate, which Harris and McCaffer emphasised as being important to the process of calculating the project cost. Each course likely to contain an estimating and/or tendering module was searched, via UCAS, and information was also gathered for PBs and the CITB. A table was designed to collate this information which contained: the year or level for that module, the university or college, the module title, the qualification and course title and, where possible, the number of credits offered, but this has not been reproduced here due to the volume of information. The universities and colleges offering these modules are provided in the reference section. In much the same way, modules were shown from PB training courses and the CITB in tables showing: level, module title, qualification and again, where possible, number of credits.

To augment this work, an attribute-ranking list was produced from the Delphi study that gave an indication of the measure of importance attached to education and professional training by the CI.

Results

The two hypotheses and their outcomes were:

(a) H_1 *At similar grades, QSs are required to hold better formal qualifications than those required of Estimators*.

The assumption of "minimum expected cell frequency", using a Chi-squared test, was violated and because it was a 2x5 table it was not possible to carry out a Fisher's

Exact Probability test. The information obtained was therefore tabulated in a descriptive form only.
Take in Table XII (top row).

These descriptive statistics show a low requirement by employers for clearly defined formal qualifications. For QSs, almost 65% did not specify any form of formal qualifications and for Estimators the figure was just over 70%. Where qualifications were asked for there appeared to be little difference in the demand from either discipline, and therefore there seemed to be little difference between QSs and Estimators that could support the hypothesis.

(b) H_1 *At similar grades, QSs are required to hold better professional qualifications than those required of Estimators*.

The assumption of "minimum expected cell frequency", using a Chi-squared test, was again violated and because it was a 2x5 table it was not possible to carry out a Fisher's Exact Probability test. The information obtained was therefore tabulated in a descriptive form only.
Take in Table XII (bottom row).

There is a greater requirement for QSs with an RICS membership (MRICS) but as they are part of the institution that provides this qualification this is understandable. Again, the majority of advertisements were non-specific regarding qualifications - at 83% in the case of QSs and 93% in the case of Estimators, and there is therefore little evidence to show any significant difference between the groups that would provide support for the hypothesis.

A gulf exists between educational opportunities for these two groups:

- QSs had 49 undergraduate Degree courses available, either distinctively or with another subject. [3]
- . Estimators were not provided for specifically in 2004 and the current position has not changed

- 21 Estimating/Tendering modules were on offer at undergraduate/higher national level
- 14 Estimating/Tendering part-modules were on offer at undergraduate/higher national level
- 4 Estimating/Tendering modules were on offer at Foundation Degree level
- The CITB offered some core estimating content with its BTEC National Certificate in Construction and further modules in its NVQs
- An Estimating/Tendering module is included by the CIOB (2003) in its MCIOB qualification but with just 15 credits from a total of 360
- It is not clear whether the RICS part-module, entitled "Measuring and Costing Construction Works", includes estimating in its MRICS qualification
- The Association of Cost Engineers (ACostE) estimated that 10% of their 2,000 members might be employed as Estimators (website 2004). Information in the tables cannot be offered as they had no independent training or examination process in place. This had not changed two years later although they have now developed a continual professional development programme (CPD) (ACostE, 2006)

Take in Table XIII

Rankings from the Delphi study for Estimators place:

- Formal education at 14th of 18 places
- Professional training at 15th of 18 places

Take in Table XIV

Rankings from the Delphi study for QSs place:

- Formal education at 19th of 19 places
- Professional training at 16th of 19 places

Take in Table XV

The competencies in each list differed only in one extra item, "Conflict Management", which was contained only within the QS list.

An indication of the number of Estimating/Tendering modules, found from University and HE courses, their levels and resulting qualifications, without distinguishing between credits offered, is provided in two charts (full and partial modules).
Take in Figures 1 and 2

Conclusions

At present, QSs have the confidence of specific qualifications from universities and the RICS, Estimators can obtain Degrees in Quantity Surveying, Construction Management, Construction Studies etc. but not in Estimating or even in Quantity Surveying with Estimating. This implies that Estimators do not require a specific formal qualification and that their work is therefore envisaged as being of less significance than that of QSs. Within the HE courses where Estimating/Tendering modules are available, the number of complete modules for Estimators is less than half the number of specific degrees for QSs. There are PBs that house Estimators but none offers a comprehensive training programme or a specifically recognised section within their organisations.

From the information obtained on employer requirements (Table XII) and the importance rankings from the Delphi study (Tables XIV and XV), there appears to be a considerable degree of either apathy or disaffection within the industry toward the formal and professional education currently offered.

The results of the Delphi study cannot be regarded as definitive due to the poor response. The study achieved the minimum requirements and is therefore valid, but more confidence could be placed on its conclusions if a larger group could be surveyed.

SUMMARY

This study has developed a number of aims intended to provide a modern view of the role and status of Estimators in the CI. It began by unearthing considered definitions of today's professions and demonstrated that many of these criteria would not sit incongruously if inculcated into the estimating role. To provide a project cost that is accurate and competitive requires knowledge, needing a high level of study to

achieve, skill and ability, which are among the many criteria expected of a modern profession. Estimators have been shown to meet these criteria and compare equally with QSs.

A further comparison with quantity surveying looked at the skills and core competencies required. This determined a level of ability for Estimators and demonstrated that, whereas the roles serve different purposes, there is an overlap in almost all key competencies essential to both.

Another Estimator-QS comparison was based on remuneration offered and qualifications required by employers and this failed to find any significant difference between them on any of the proffered hypotheses. Both appear to receive similar recognition.

In comparing educational opportunities, there was considerable divergence. QSs have accessibility to an education that is tailored to their needs within the university system and a professional body that is geared to providing specific QS training and a continual programme of ongoing development (CPD). Estimators, on the other hand, whilst able to find courses that will provide a comprehensive knowledge of construction, an ability to understand and measure architectural drawings and prepare Bills of Quantities (BQs), are badly neglected in respect of their core subject of Tendering/Estimating within these courses and totally neglected in the provision of being afforded a specific Estimating Degree. Professionally there are opportunities to join organisations that will afford them a professional qualification but palpably little specific Estimator training or CPD. There is, therefore, an educational chasm that needs to be bridged, not only by educators but also by employers, training organisations and PBs.

Akintoye, Skitmore, McCaffer and Hicks have all described the consequential damage that impacts upon construction projects, emanating from inaccurate estimating. A high level of performance from Estimators is therefore crucial to project financial viability. A fulfilment of the skills and abilities that have been described here, together with other criteria, could bring with it professional status.

Informal discussions with Estimators during this study have left the impression that a specific Degree, as a sandwich course, and a professional qualification would be welcomed, would make their job more attractive and desirable, and would bring much needed "new blood" and quality trainees into the industry. However, to attain this, the desire, drive and co-operation of the CI, educators, trainers and PBs are needed, which at present do not seem to be there.

In essence, Estimators do not differ from QSs in terms of required ability, responsibility or potential for financial damage, yet they do not have a similar job preparation. This means that the preparatory safeguards afforded to QSs are unavailable to Estimators. Therefore there is more risk attached to the Estimators' roles because they may not be afforded a sufficient skills- or knowledge-base. The provision of specialist educational training would reduce this risk and would enhance their eligibility for professional status. Achieving this will incur costs in university fees and professional training but would surely advance the recruitment rate and excellence of trainees and in so doing, improve the quality of contractors' estimates, enhance the worth of the information now being provided at pre-tender stage, reduce project financial risk and provide construction clients with greater confidence in the contractors that are entrusted with developing their projects.

[1] "What Constitutes a Profession" is a section of the lead author's PhD research.
[2] "Delphi Study" is a section of the lead author's PhD research.
[3] Updated, this figure is now 53 (UCAS, 2006)

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Appendix 8 Estimating Comparison UK-US

15.1 Introduction

The Estimator-QS comparisons in Chapters 5, 6, 7 and 8 established that Estimators had a similar knowledge requirement to QSs, and that CI employers valued their services equally. It was also shown that this equality did not extend into education and training provision, formally, professionally or industrially. Superficially this appeared to be an anomaly but, given the knowledge and expertise contained within the CI, this would make it unlikely that education and training possibilities would have been overlooked. It therefore had to be assumed that there was a general consensus that the status quo was adequate for the needs of the industry. With this in mind, it was decided that research should be carried out to discover how Estimators were regarded and provided for with ETPs, beyond the influence of the UK.

15.2 Research Aims

To aid the second and third objectives, of discovering the regard to which Estimators were held and the provision of education and training, two aims were conceived, which were:

1) To develop a wider perspective of available Estimator-specific education by obtaining a brief overview of estimating practiced outside the UK CI (results to be found in attribute lists at 15.4.1, formal education at 15.4.2 and professional training at 15.4.3, below)
2) To examine the way in which Estimators were regarded professionally and educationally beyond the sphere of the UK CI (results to be found at 15.4 and 15.5, below)

15.3 Methodology

The elected country chosen for comparison would be the United States of America (US) as it was perceived to have similar construction and costing methods, as was explained in Chapter 1, objective 2 b). To ensure that Estimators in the US carried out their role in a similar way to those in the UK websites were researched to find and list details of Estimator job attributes required by the US CI. Further website searches were then made to gain an insight into the regard to which Estimators were held, by:

- Determining the extent of its educational and training opportunities

- Researching the extent to which relevant professional bodies, if in place, had encompassed Estimators into their organisations
- Carrying out an Estimator- QS salary comparison within the US CI

15.4 Results

15.4.1 Job Competencies

A website for the U.S. Department of Labor, Bureau of Labor Statistics (USDL) (2004), defined the nature of estimating in the US as the accurate forecasting of future projects, which was of vital importance to any business survival. It stated that cost Estimators developed the cost information needed by companies in order that these companies could make a bid for a contract, determine whether or not a proposed new product would be profitable and establish which of the companies' enterprises were making a profit. The importance of the level of ability required was further emphasised by their statement that inaccurate estimating could cause a company to lose a bid or lose money on a project. The USDL added that 50% of all US cost estimators worked in the CI but irrespective of the industry in which they operated their aim was to compile and analyse data on all aspects of cost. Lists produced to determine their estimating process indicated that there were Estimators working for contractors and also for clients. It was useful, therefore, to provide tables of required competencies for both sectors separately. These are shown in Tables 1 and 2 below:

Table 1 Estimators working for Project Design Teams

Competencies	Source
Prepare budgets for Architect or Client	USDL
Track the actual costs in relation to bid specifications as the project progresses.	USDL

Table 2 Estimators working for Contractors

Competencies	Source
Decision to submit a bid	USDL
Review preliminary drawings and specifications	USDL
Visit site of proposed project	USDL
Gather information on access, services availability, topography and drainage and provide a signed site report for inclusion in the final project estimate.	USDL
Determination of quantities of material and labour required, called a 'quantity survey' or 'take off'.	USDL
Estimate cost of all work to be undertaken directly by the contractor.	USDL
Analyse the costs of all sub-contract prices for inclusion in the estimate.	USDL
Make decisions regarding equipment needs, sequence of operations and labour size.	USDL
Incorporate allowances for waste on materials, inclement weather, shipping delays etc.	USDL
Prepare total project cost summary covering contractor's direct work, overheads, taxes, insurance and mark up plus any other likely costs that will affect the project.	USDL
Bid proposal prepared by chief Estimator.	USDL
An ability to work under pressure and stress particularly when faced with bid deadlines.	USDL
Have an aptitude for maths.	USDL
An ability to compare, analyse and interpret detailed and, on occasions, poorly defined information and make sound, accurate judgements from this knowledge.	USDL
Being assertive and self confident in the support and presentation of conclusions.	USDL
Having strong communication and interpersonal skills.	USDL
Ability to work as part of a team with Managers, Owners, Designers, Engineers etc.	USDL
Knowledge of computers and computer packages such as Word and Spreadsheets plus possible familiarity with estimating software or programming skills.	USDL

The USDL then provided a section on training, qualifications and advancement. It indicated that employers increasingly preferred individual entry to be by degree in Building Construction, Construction Management, Construction Science, Engineering or Architecture. It added that most Estimators had considerable construction experience by way of work within the industry, internships or co-operative educational programmes. Much of the training was considered to be achieved 'on-the-job', due, it was thought, to the individual way in which each company chose to

prepare its estimates. Therefore, working with an experienced Estimator helped them to familiarise themselves with each step in the process, in the preferred manner of their employer. In this way, seemingly, Estimators new to the industry would learn to read specifications and drawings, measurement, observe work being carried out on site and perform other tasks. As Estimators gained experience then the training progressed to tabulating quantities from drawings and selecting appropriate materials prices.

15.4.2 Formal Education

The USDL also offered information on formal education. Estimating appeared to be in a similar position to that of the UK in that it was not provided with the opportunity of Estimator-specific degrees at undergraduate level. They illustrated that many Colleges and Universities included Cost Estimating as part of Bachelor and Associate degree curricula in main subjects such as Civil Engineering, Construction Management and Construction Engineering Technology. Beyond that level, they added, cost estimating then formed a significant part of many programmes in Construction Science or Construction Engineering Technology at Masters Degree level. Education from this point on appeared to be developed by professional organisations who would undertake aid to students training and to keeping experienced Estimators abreast of changes within the profession, which could be ratified in the form of Professional Certification. There was also a means of providing Voluntary Certification to present an indication to present and prospective employers of their competency and experience. Information on organisations found is added below:

The American Society of Professional Estimators (ASPE), described at p.159, below, sponsored and provided accreditation for 54 Baccalaureate degree programmes and provided details on its website (2004) of 54 Universities offering these courses. A sample of 13 of these Universities (Arizona State, Bradley, Clemson, Florida International, Louisiana State, Oregon State, Southern Polytechnic State, Little Rock Arkansas, Nebraska, Oklahoma, Virginia Polytechnic Institute, Washington and Washington State) revealed a similar pattern to that of UK Universities in that none of the degrees were Estimator specific and provided further confirmation that there were no undergraduate degrees in Estimating (AACE described this as Cost Engineering).

15.4.3 Professional Organisations

Six professional organisations were found that were committed to training and to ongoing professional competence:

Association for the Advancement of Cost Engineering (AACE)

In the introduction to their website's 'education section', AACE claimed that almost any large University offered upper level courses or electives in Engineering, Construction Technology or Business that were relevant to the attainment of "cost engineering skills" such as Cost Estimating, Cost Control etc. They concurred with the USDL in saying that there were no undergraduate degrees in Cost Engineering on offer (2004). AACE had their own education programmes and provided distance learning with courses such as Introduction to Construction Estimating, Introduction to Blueprint Reading, Construction Cost Awareness and Production Control, Estimating and Bidding 1 & 2 and Fundamental Skills and Knowledge of Cost Engineering. They offered a qualification as a Certified Cost Engineer (CCE) or a Certified Cost Consultant (CCC) and Table 3, below, gives a breakdown of the subjects in their examination under the module Estimating and Cost Control that offered the opportunity for 100 of a total 400 points towards qualification:

Table 3 AACE Examination Modules

Institute	Module	Module Breakdown	Qualification	Credits
AACE	Cost Estimating and Control	1) Elements of Cost 2) Chart of Accounts/Work Breakdown Structure 3) Costing and Pricing 4) Estimating Methods 5) Types and Purpose of Estimates 6) Operating/Manufacturing Costs 7) Cost Indices and Escalation Factors 8) Risk Analysis/Contingency 9) Budgeting and Cashflow	CCE/CCC	100 of a total of 400 points (280 points required for pass)

The Society of Cost Estimating and Analysis (SCEA)

Their website (2004) declared them to be "open to all interested individuals in the Cost Estimating and Cost Analysis professions and related disciplines". It would appear that their organisation was open for all involved industries not just the CI. Their aim was to improve cost estimating and analysis and enhanced professional competence and achievement. A Professional Development Training Programme was offered, leading to a Certified Cost Estimator/Analyst examination (CCE/A). Examples of reading material as opposed to examination modules offered were:

- Cost Analysis and Related Disciplines
- Estimating Techniques for Cost and Price Analysis
- Price Analysis
- Cost Analysis
- Cost Analysis and Estimating
- Shifting US Priorities
- Review of Basic and Advanced Statistical Concepts (video series)
- Advanced Quantitative Methods (video series)

American Society of Professional Estimators (ASPE)

The stated aim from their website (2004) was to serve "construction estimators by providing education, fellowship and opportunity for professional development". This society, formed in 1956, offers a Certification Programme leading to an award of Certified Professional Estimator (CPE). The process necessitated:

- A workshop attendance
- Submission of a Professional Evaluation Application and technical paper
- Successful completion of written examinations
- Participation in the Continuing Certification Programme

In addition, San Jose State University (2004), in conjunction with ASPE, offered a course in Construction Estimating, leading to a Professional Development Certificate in Estimating.

Professional Construction Estimators Association of America (PCEA)

This organisation was formed in 1956 but there did not appear to be any route to a professional qualification although their website (2004) did suggest that there were

plans to inculcate a Professional Construction Estimators Certificate Programme. Information obtained from the same source (2005)[4], displayed a number of educational opportunities that were being recommended at Colleges and Universities in:

- Florida (5)
- Georgia (7)
- North Carolina (30)
- South Carolina (10)
- Virginia (7)

Construction Estimating Institute (CEI)

The CEI offered training and education for contractors to prepare for the Florida Contractors Examination. Their website (2003) provided a single-page description of being in business for over 20 years and "being dedicated to increasing the estimating and management skills of those working in the construction industry". Education in estimating was provided by their training staff with a five-day course in Building Estimating, several courses under the banner of Sitework and Civil Estimating, lasting between two and five days and a Blueprint Reading course.

Turnkey Construction Management Institute, Inc (TCMII)

Although not specifically designed for Estimators, the TCMII website (2004) offered an Estimator training course covering two periods, the first for 12 weeks and the second for 14 weeks.

15.4.4 Comparison with QSs

It would appear that the use of QSs was not nearly as widespread as in the UK. The numbers of offices shown on the RICS website (2004) for QS specialists was just two plus one office for cost consultants and one for contract claims. Apart from the RICS website, no other organisation was found that represented QSs in the USA. The information provided was limited to Surveyors office addresses with no further data found that could be used to develop a salary comparison.

[4] From an update of the PCEA website (2008) there was an indication that certification was to be gained by the same process as outlined by the ASPE

15.5 Conclusions

It seemed that the formal education system for undergraduates in the US appeared to offer a similar level of estimating education to that of the UK at Bachelors degree level. However, the US claims to have Masters degree courses with substantial estimating content and had professional bodies representing Estimators. Some of these bodies were creating links with Universities to develop partial estimating courses which would lead to professional recognition, although not to a specific degree. This situation remained unchanged in 2008 where The World Wide Learn (2008) website gave information on many modules that could aid the development of Estimators but there was no indication of any University offering a specific degree.

This was a surprising outcome to the research as all the indications from Chapter 2, Professions, was that professional recognition was attained after a long and thorough education. In the case of the US Estimators have been offered professional status by several professional Estimator organisations and yet their formal education system, at University Bachelors degree level, appeared to be no further advanced than in the UK. This, though, may change with the possibility of an inchoate Estimating degree in the US, with ASPE (2003) shown to be conducting a survey on behalf of Lawrence Technology University of Southfield, Michigan, who were looking at the development of an undergraduate curriculum in the field of Estimating[5].

In comparing competencies, Estimators in the UK (competencies developed at Chapters 4, 6 and 8) and US demonstrated a great deal of similarity in what was expected of them, although the US list was far more condensed, being obtained from just one source. The competency tables for Estimators within construction companies were described in slightly different ways, but the basic requirements and abilities seemed markedly similar. One perceptible difference was that, in the US, the tendency seemed to be for Estimators to be employed to provide cost information within the design team whereas in the UK this work is more likely to be done by QSs. This would to some extent explain the limited number of QSs found to be working

[5] The Lawrence Technological University (2008) website showed modules in Engineering Degree courses but, four years after announcing that a view was being taken on an estimating curriculum it was still not showing a specific Estimating Degree course.

there and, therefore, the lack of available salary data with which to carry out a salary comparison.

US Employers also appeared to hold a preference for experience, as in the UK, and while they seemed increasingly to be looking for degree qualifications, they were not expecting these to be Estimator-specific.

As an indicator of the regard in which Estimators were held, attitudes between the two countries did vary. The USDL considered Estimators as professionals and promoted their work as being vitally important to any business survival. It was also very emphatic about the necessity for quality and the consequences that followed when that quality was not in place. The USDL viewpoint on Estimators being professionals was confirmed with the discovery of at least five professional organisations, all working exclusively to promote Estimator education, at its initial stages and ongoing, which does not appear to be the case in the UK. Although, while five professional organisations were found to exist, which appeared to put the US far in advance of the UK, comparisons have to be tempered by size differences. At the beginning of the 21st century the US had a population almost five times greater that the UK, according to the Population website (2004), which showed that in 2000 the USA had almost 287.5m inhabitants and the UK almost 60m. On that basis, if the US could accommodate five professional organisations then the UK ought to be able to justify one or even the creation of a specialist section within an existing PB.

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Appendix 9 Estimator Education and Training Adoption by the CI

16.1 Introduction

Research in this thesis had shown that ETPs for Estimators were viable. This stemmed from:

- The Estimator-QS educational availability study, Chapter 8, which, although highlighting a far more extensive availability of ETPs for QSs, showed that there was a solid platform of estimating content course modules available within QS and other courses
- The Delphi study, Chapter 9, which had displayed many similarities between the knowledge requirements of QSs and Estimators
- The development of a TNA instrument, Chapter 12, which provided a structure that could be used to help create proposals for Estimator ETPs

The development of proposals for Bachelor degree courses and PB training programmes, which have not been found to be available in the UK, would be a means of encouraging the CI to initiate Estimator-specific ETPs. This would be another step towards professional recognition for their role

16.2 Research Aims

There were three aims:

1. To create a standardised table of information which could compare all learnable attributes, shown in their main category headings, in order to provide an assessment of:
    - How closely or otherwise Estimators could be integrated into existing QS modules at Universities and with PBs
    - How many existing modules would need to be developed further to enable Estimators' needs to be met
    - How many additional modules would be required to complete the requirements of Estimator specific course structures

    (the information to be found at 16.5, below)

2. To use the table created at 1, to:
    - Assess information researched from existing University QS degree courses for possible integration by Estimators (results to be found at 16.5, below)
    - Create a proposed Estimating degree programme (results to be found at 16.5, below)
    - Assess information researched from an existing QS Assessment of Professional Competence (APC) course, for possible integration by Estimators (results to be found at 16.5, below)
    - Create a proposed Estimating APC programme (results to be found at 16.5, below)
3. Make approaches to PBs, Universities and construction representative bodies, in order to encourage the introduction of training and educational structures for Estimators (results to be found at 16.5, below)

16.3 Research Method

The revised IRS that was described by Blaikie and used in Chapters 3, 4, 5, 11 and 12 was adopted for this study as a means of collating, analysing and classifying information on Estimator related education and training from the appropriate studies in this thesis and from existing QS course structures. These techniques are relevant to this study in establishing Estimator ETPs at University and PB levels. The technique has also been used in education literature - for example, Eastmond (2008) produced literature on the processes required in developing education courses.

The disadvantages described in Chapter 3 notwithstanding, this method was, therefore, considered to be an appropriate tool for use in this study provided a sound and justifiable methodology was adopted.

16.4 Methodology

16.4.1 Design

The revised IRS method, described in Chapter 3, was used to collate, analyse and classify information on Estimator education and collected data from estimating related modules in existing University and PB courses.

The revised IRS disadvantages, described in Chapter 3, together with the disadvantages relating to the data collection methods and the Course Proposal Instruments (CPIs) were addressed in this study by the following means:

3. Reliability and Validity
    - Reliability of information on "what" questions necessary for entering into the CPIs was established by using main attribute category headings from the Delphi study and TNQ and selecting appropriate information from existing University and PB course structures with the supervisor independently checking the data
      Data input into the CPIs was independently entered by the supervisor and researcher and then correlated
    - Content validity was enhanced by ensuring that the comprehensive range of data included in the CPIs represented the purpose for which the study was intended, was extracted from the Delphi study, TNQ and recognised and established PBs and education providers, judged by the researcher and independently corroborated by the supervisor
    - Construct validity was addressed by ensuring that the CPIs fulfilled the purpose for which they were intended by including main category data that was relevant and classifying it in a format that had been developed and organised, by the use of experts, in the Delphi study
    - Face validity was aided by the completed CPIs having the appearance of containing the information intended, arranged and developed logically and meeting their objectives

16.4.2 Sources of information used to develop CPIs

Information was found from five sources and the completed CPIs offered to three sources, these being:

- Course modules were designated by using 13 main attribute categories from the Spearman test ranking list in the Delphi study
- Estimator-related modules were selected from three Universities and the RICS APC course structure
- Approaches for CPI adoptions were made to three established bodies with educational involvement in the CI, the RICS, Loughborough University and the Construction Industry Council (CIC)

16.4.3 Materials

As there had been shown to be a marked reluctance toward the provision of Estimator ETPs it was felt that it may be easier to break down barriers by providing course proposals that could, to some extent, be integrated into existing course structures. This would involve creating Estimator programmes based on part-integration into existing QS courses. By this method, in having part of the work already in place, proposals would be more cost effective and risks reduced which meant that they might, therefore, be more readily accepted by educators.

A Table was designed that enabled an assessment to be made of the possibility of Estimator integration into existing QS courses at University level. This displayed modules for QS competency requirements that could be taught and/or trained to Estimators. Chosen from the Delphi study, the 19 main QS categories are shown below:

1. Good Personal Qualities
2. Good Communicational/Teamwork Skills
3. Able to Provide Post Contract Financial and Construction Advice to Client/Employer
4. Intelligence and Cognitive Ability/Style
5. Able to Provide Pre Contract Financial and Construction Advice to Client/Employer
6. Ability to Measure Work and Prepare BQs

7. Ability to Prepare Select and Appraise Tenders
8. Commercial Business Acumen
9. IT Skills
10. Risk Management
11. Good Negotiating Skills
12. Thorough Knowledge of Construction
13. Cost Estimating Skills
14. Knowledge of Contracts and Contract Law
15. Conflict Management
16. Professional Training Initial and Ongoing
17. Relevant Experience
18. Management Skills
19. Good Formal Education

Items 1 and 4 (personal qualities and abilities), 15 (required by QSs but not Estimators), 16, 17 and 19 (educational and training ideals), were deleted from the table as they were not required for Estimator education. An additional category was added, Programming and Planning, which was taken from the TNQ. These categories were then set out in columns from left to right with the first four columns described as follows:

a. QS rank order of importance
b. Category
c. Average rank positions for QSs
d. Average rank positions for Estimators

The remaining five columns were used to make the assessment of possible Estimator integration into QS course categories. These were graded:

1. Equal
2. Similar
3. Lesser
4. Greater
5. New

These headings were chosen for the following reasons with the numbers related to the column numbers above:

1. QS importance ranking from the Delphi study
2. QS main attribute category

3. QS average marks from the Kendall test (see Appendix 4)
4. Estimator average marks from the Kendall test (see Appendix 4)

The five further columns were provided to demonstrate whether or not any of the QS categories, which would be set as proposed modules for their education and training courses, could be integrated into an estimating course and to what extent. These used the average rank placings from the Kendal tests as a guide. An arbitrary view was taken when deciding upon these divisions in that:

5. A difference of 5% or less, between the averages of columns 3 and 4, would not be significant and they could therefore be classified as of equal importance
6. A margin of 5-25% would be classified as of similar levels of importance
7. Beyond 25% for categories to be considered of lesser importance if the QS rank was rated higher (more important)
8. Beyond 25% for categories to be considered of greater importance if the QS rank was lower (less important).
9. Allowed for the Programming and Planning category found to be required by Estimators

See format in Table 1, below:

Table 1 Form for Assessment of Estimator Integration into QS courses

QS Rank (Delphi)	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
				Equal	Similar	Lesser	Greater	New
2	Communicational/Teamwork Skills							
3	Post Contract Financial & Construction Advice to Client/Employer							
5	Pre Contract Financial & Construction Advice to Client/Employer							
6	Measure Work & Prepare BQs							
7	Prepare Select & Appraise Tenders							
8	Commercial Business Acumen							
9	IT Skills							
10	Risk Management							
11	Negotiating Skills							
12	Knowledge of Construction							
13	Cost Estimating Skills							
14	Contracts & Contract Law							
18	Management Skills							
	Programming and Planning							

The above form was then extended for use with information taken from existing QS Bachelors degree courses at three Universities:

- Leeds Metropolitan
- Reading
- Liverpool John Moores

And one PB APC course:

- The RICS

For this, a column was provided that displayed the course module and another showing the course year, denoted as level at which the module was set (this replaced the Delphi rank). The main heading column was used to enter categories deemed to be an appropriate match to the course modules. Using the information from those assessments a proposed Estimator degree course and a proposed APC course could be developed.

The table for University Degree Courses is shown in Table 2, below:

Table 2 Sample Form for Estimator Content in QS Degree Courses

Degree Course									
Level	Module	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
					Equal	Similar	Lesser	Greater	New
1	CAD & IT	IT							
1	Introduction to Construction Technology	IT							
1	Legal Frameworks in the Built Environment	Contracts and Contract Law							
1	Documentation	Contracts and Contract Law							
1	Estimating	Cost Estimating Skills							
1	Economics	Pre & Post Contract Financial & Construction Advice to Client/Employer							
1	Finance & the Constuction Industry	Pre & Post Contract Financial & Construction Advice to Client/Employer							
1	Measuring Building Quantities	Measure Work & Prepare BQs							
1	Construction Materials	Knowledge of Construction							
1	Environment and Services	Knowledge of Construction							
2	Construction Contracts	Contracts and Contract Law							
2	Advanced Construction Technology	IT							
2	Quantity Surveying Practice & Procedure	Pre & Post Contract Financial & Construction Advice to Client/Employer							
2	Measurement Estimating & Tendering	Measure Work & Prepare BQs/Cost Estimating Skills							
2	Management: Planning and Resources	Management Skills: Programming & Planning							
2	Project	*Interdisciplinary*							
3	Contemporary Economic Modelling	Pre & Post Contract Financial & Construction Advice to Client/Employer/IT							
3	Issues in Construction Management	Management Skills: Contracts and Contract Law							
3	Financial & Corporate Management	Management Skills: Commercial Business Acumen							
3	Interprofessional Studies	Communicational/Teamwork Skills							
3	Dissertation	*Interdisciplinary*							

The RICS QS APC form information was taken from the RICS guide to their Quantity Surveying and Construction APC tests (2007). This showed 18 modules, at three levels, with all modules being repeated in each level but at an increasingly demanding standard as they progressed. This information was set into the same format as for degree courses above. See Table 3, below:

Table 3 Form for Estimator Content in RICS APC Course

MRICS with Assessment of Professional Competency APC RICS									
Level	Module	Category	QS Avg	Est Avg	Estimator Integration with Existing QS Module				
			Rank	Rank	Equal	Similar	Lesser	Greater	New
1	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer							
1	Commercial Management of Construction	Commercial Business Acumen							
1	Conflict Avoidance, Management & Dispute Resolution	Conflict Management							
1	Construction Technology & Environmental Services	Knowledge of Construction							
1	Contract Administration	Contracts and Contract Law; Management Skills							
1	Contract Practice	Contracts and Contract Law							
1	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer							
1	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer							
1	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer							
1	Heath & Safety	Contracts and Contract Law							
1	Insurance	Contracts and Contract Law							
1	Procurement and Tendering	Prepare Select & Appraise Tenders							
1	Programming & Planning	Programming & Planning							
1	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer							
1	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer							
1	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills							
1	Risk Management	Risk Management							
1	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer							
2	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer							
2	Commercial Management of Construction	Commercial Business Acumen							
2	Conflict Avoidance, Management & Dispute Resolution	Conflict Management							
2	Construction Technology & Environmental Services	Knowledge of Construction							
2	Contract Administration	Contracts and Contract Law; Management Skills							
2	Contract Practice	Contracts and Contract Law							
2	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer							
2	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer							
2	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer							
2	Heath & Safety	Contracts and Contract Law							
2	Insurance	Contracts and Contract Law							
2	Procurement and Tendering	Prepare Select & Appraise Tenders							
2	Programming & Planning	Programming & Planning							
2	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer							
2	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer							
2	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills							
2	Risk Management	Risk Management							
2	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer							
3	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer							
3	Commercial Management of Construction	Commercial Business Acumen							
3	Conflict Avoidance, Management & Dispute Resolution	Conflict Management							
3	Construction Technology & Environmental Services	Knowledge of Construction							
3	Contract Administration	Contracts and Contract Law; Management Skills							
3	Contract Practice	Contracts and Contract Law							
3	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer							
3	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer							
3	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer							
3	Heath & Safety	Contracts and Contract Law							
3	Insurance	Contracts and Contract Law							
3	Procurement and Tendering	Prepare Select & Appraise Tenders							
3	Programming & Planning	Programming & Planning							
3	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer							
3	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer							
3	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills							
3	Risk Management	Risk Management							
3	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer							

16.4.4 Procedure

16.4.4.1 Assessment of possible Estimator integration into QS courses

QS and Estimator Delphi study ranking positions were extracted and placed in their appropriate cells in the form. The average marks employed to calculate ranking positions from the Kendall test were used for this purpose. Calculations of % differences between the marks for the two groups, on each category, were performed and recorded. Using the method of assessment shown in Materials, above, a ✓ was entered into the appropriate cell, designating whether each category required an equal, similar, lesser or greater level of education or if it was a new subject. The calculations and cell allocations were then checked by the supervisor. This would demonstrate the work required to enable specific Estimator programmes to be produced by sharing appropriate modules with QSs, extending the work in other modules and providing necessary additional modules. .

16.4.4.2 Development of instrument for University degree proposal

QS Degree course information was placed into three tables, one for each University and the same analysis was carried out, as described above. 'Interdisciplinary' items were highlighted for categories where modules would likely be tailored to suit specific course needs.

From those three tables individual modules were selected, where it was thought that they were relevant, and these were inserted into a final table as a proposed structure for a BSc Estimating course, this having three columns indicating:

- The level (course year)
- Module
- Main Category heading

For a structure proposal, it was decided to use a four year sandwich course model, having work experience semesters built into each year. This decision was based on information obtained from the structured interviews in Chapter 11 where, when asked about a preferred method of delivery for a University education, almost 77% of interviewees had said that a degree as a "sandwich" course was their preferred option, compared to just over 23% for a full time course. This was then designed to ensure

that all 14 Main Categories were covered and that it developed with the aim that, in the fourth and final year, the learning process from the first three years would be used to produce staged projects. These would encompass the complete estimating procedure of a building/civil engineering project and, in doing so, would expect students to demonstrate an all round knowledge of all work categories from the first three years. As before, the work was checked and correlated with the supervisor.

16.4.4.3 Development of instrument for PB APC proposal

The APC course information was analysed using the same procedure as described above and, as with the degree course proposal, an Estimator APC proposal was designed to ensure that all 14 remaining Main Categories were incorporated into the proposal but, in this case, the RICS procedure of repeating each module at all three levels was adhered to.

16.4.4.4 Approach to the CI

Information from the Estimator degree and APC proposals was then used to encourage the uptake of ETPs for Estimators by approaches to the following organisations:

- RICS
- Loughborough University
- Construction Industry Council (CIC)

The reasons for selecting these three organisations were:

1. *The RICS* - An initial approach was made to the CIOB, as they were the preferred choice of the Estimators who took part in the structured interviews (almost 62%). There was no response from them to a request to open up a dialogue on Estimator training and, therefore, the RICS, the second choice at almost 39%, was approached. As the major professional body in the UK representing QSs, with their members having closely related job attributes and a need to work with Estimators on a regular basis, this organisation could be well placed to be able to develop an Estimator section and an APC within their organisation. This working relationship extended to:

- Consultants' QSs, in providing the tender information, including BQs, for Estimators to price, and later entering into discussions with Estimators whose work had produced favourable tenders.
- Contractors' QSs, in using the tender information provided by Estimators, enabling them to produce valuations, agree additional costs and prepare final accounts.

Therefore, it seemed logical that having both disciplines within one organisation would give Estimators an equal standing, helping them command respect, make estimating a more attractive proposition for students and provide a greater opportunity for dialogue with QSs. It could also be beneficial in improving the quality of information currently being shared.

2. *Loughborough University* - It was chosen because its Professor of Construction Management/Director of Business Partnerships was also Editor of the Engineering, Construction and Architectural Management Journal (ECAM) which published an article, based on part of this thesis (Hackett and Hicks 2007). It was considered that they may therefore have some empathy with estimating in wishing to see its future development along a degree route, and thus be interested in playing a part in the process.

3. *The CIC* - Its website (2007) claimed it to be the representative body for professional bodies, research organisations and specialist business associations, within the CI. For this reason it was felt that it may have some influence, in these spheres, in aiding the development of an estimating course.

The method chosen to contact these organisations was, initially, by e-mail, directed at the people considered most likely to be able to initiate a course strategy. For this purpose the following people were chosen:

- *RICS* - The Director, Built Environment Group

- *Loughborough University* - The Professor of Construction Management/Director of Business Partnerships
- *CIC* - The Director of Lifelong Learning

16.5 Results

16.5.1 Assessment of possible Estimator integration into QS courses

Of the thirteen shared main attributes requiring education seven (almost 54%) had equal or similar emphasis levels, with three of these (over 23%) being ranked equally, and a further four (almost 31%) ranked similarly. Three (over 23%) showed estimating needing a lesser emphasis and three (over 23%) showed estimating needing a greater emphasis. These are listed below:

Equally-Ranked Subjects

1. Measure Work and Prepare BQs
2. IT Skills
3. Risk Management

Similarly-Ranked Subjects

1. Communication/Teamwork
2. Negotiating
3. Contracts and Contract Law
4. Management Skills

Lesser-Ranked Subjects

1. Post-Contract Financial & Construction Advice to Client/Employer
2. Pre-Contract Financial & Construction Advice to Client/Employer
3. Commercial Business Acumen

Greater-Ranked Subjects

1. Prepare, Select and Appraise Tenders
2. Knowledge of Construction
3. Cost Estimating Skills

The 14th Estimator category, Programming and Planning is shown in the fifth column as a new subject. See Table 4, below:

Table 4 Possible Estimator Integration into QS Course Categories

QS Rank (Delphi)	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
				Equal	Similar	Lesser	Greater	New
2	Communicational/Teamwork Skills	5.81	7.06		√			
3	Post Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
5	Pre Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
6	Measure Work & Prepare BQs	8.04	8.33	√				
7	Prepare Select & Appraise Tenders	8.12	4.94				√	
8	Commercial Business Acumen	9.27	13.61			√		
9	IT Skills	9.27	8.28	√				
10	Risk Management	9.38	9.61	√				
11	Negotiating Skills	9.58	10.83		√			
12	Knowledge of Construction	9.92	7.50				√	
13	Cost Estimating Skills	10.19	2.17				√	
14	Contracts & Contract Law	11.73	10.44		√			
18	Management Skills	15.96	13.22		√			
	Programming and Planning							√

16.5.2 Development of instrument for University degree proposal

Information from Leeds Metropolitan University (2007) showed a three year BSc (Hons) QS degree which had twenty one modules in total, including projects and dissertations. Of those, it was considered that eleven (over 52%) could totally or partially accommodate estimating, consisting of one (almost 5%) completely, where Estimators could be involved in the complete module and ten (almost 48%) to a similar level requirement. Of the remaining ten modules (almost 48%) four (over 19%) would need less estimating emphasis and six (almost 29%) would require a greater emphasis.

From this information it was considered that 71% of the existing course would be either adequate or more than adequate to meet Estimators' needs and the remaining 29% would probably need greater estimating input.

The modules are listed as follows:

*Equally-Ranked Module*s

1. Measuring building quantities

Similarly-Ranked Modules

1. CAD and IT

2. Introduction to construction technology
3. Legal frameworks in the built environment
4. Documentation
5. Construction contracts
6. Advanced construction technology
7. Management planning and services
8. Issues in construction management
9. Financial and corporate management
10. Interprofessional duties

Lesser-Ranked Modules

1. Economics
2. Finance and the construction industry
3. Quantity surveying practice and procedures
4. Contemporary economic modelling

Greater-Ranked Modules

1. Estimating
2. Construction materials
3. Environment and services
4. Measurement estimating and tendering
5. Project
6. Dissertation

See Table 5, below:

Table 5 Estimator Integration into University QS Courses (Leeds Metropolitan)

BSc (Hons) Quantity Surveying: Leeds Metropolitan University									
Level	Module	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
					Equal	Similar	Lesser	Greater	New
1	CAD & IT	IT	9.27	8.28		√			
1	Introduction to Construction Technology	IT	9.27	8.28		√			
1	Legal Frameworks in the Built Environment	Contracts and Contract Law	11.73	10.44		√			
1	Documentation	Contracts and Contract Law	11.73	10.44		√			
1	Estimating	Cost Estimating Skills	10.19	2.17				√	
1	Economics	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	Finance & the Constuction Industry	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	Measuring Building Quantities	Measure Work & Prepare BQs	8.04	8.33	√				
1	Construction Materials	Knowledge of Construction	9.92	7.50				√	
1	Environment and Services	Knowledge of Construction	9.92	7.50				√	
2	Construction Contracts	Contracts and Contract Law	11.73	10.44		√			
2	Advanced Construction Technology	IT	9.27	8.28		√			
2	Quantity Surveying Practice & Procedure	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Measurement Estimating & Tendering	Measure Work & Prepare BQs/Cost Estimating Skills	9.12	5.25				√	
2	Management: Planning and Resources	Management Skills: Programming & Planning	15.96	13.22		√			
2	Project	*Interdisciplinary*						√	
3	Contemporary Economic Modelling	Pre & Post Contract Financial & Construction Advice to Client/Employer/IT	7.06	14.00			√		
3	Issues in Construction Management	Management Skills: Contracts and Contract Law	13.85	11.83		√			
3	Financial & Corporate Management	Management Skills: Commercial Business Acumen	12.62	13.42		√			
3	Interprofessional Studies	Communicational/Teamwork Skills	5.81	7.06		√			
3	Dissertation	*Interdisciplinary*						√	

The University of Reading (2007) had a three year BSc QS degree which had 24 modules including projects, dissertations and research studies. Here, eight (over 33%) were thought to contain enough subject matter to accommodate estimating, all of which appeared to be of a similar rather than equal level requirement, five (almost 21%) required a lesser learning level and eleven (almost 46%) would need greater estimating input.

These figures implied that 54% of the course would comfortably meet Estimators' needs and the remaining 46% would appear to require the modules to be given greater estimating emphasis.

These modules are listed as follows:

Similarly-Ranked Modules

1. Construction technology
2. General introduction to law
3. Information and communication
4. Management
5. CAD
6. Construction contract law and management
7. Management
8. Management of construction projects

Lesser-Ranked Modules

1. Economics for construction and engineering
2. Construction economics
3. Business organisation and management
4. Design cost evaluation
5. Measurement and valuation

Greater-Ranked Modules

1. Building science and services
2. Construction and materials
3. Empirical studies
4. Structural design
5. Building pathology
6. Construction systems
7. Environmental systems
8. Research skills
9. Sustainability
10. Dissertation
11. Project

See Table 6, below:

Table 6 Estimator Integration into University QS Courses (Reading)

BSc Quantity Surveying: University of Reading									
Level	Module	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
					Equal	Similar	Lesser	Greater	New
1	Building Science and Services	Knowledge of Construction	9.92	7.50				√	
1	Construction & Materials	Knowledge of Construction	9.92	7.50				√	
1	Construction Technology	IT	9.27	8.28		√			
1	Economics for Construction & Engineering	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	Empirical Studies	*Interdisciplinary*						√	
1	General Introduction to Law	Contracts and Contract Law	11.73	10.44		√			
1	Information & Communication	Communicational/Teamwork Skills	5.81	7.06		√			
1	Management	Management Skills: Commercial Business Acumen	12.62	13.42		√			
1	Structural Design	Knowledge of Construction	9.92	7.50				√	
2	Building Pathology	Knowledge of Construction	9.92	7.50				√	
2	CAD	IT	9.27	8.28		√			
2	Construction Contract Law & Management	Contracts and Contract Law:Management Skills	13.85	11.83		√			
2	Construction Economics	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Construction Systems	Knowledge of Construction	9.92	7.50				√	
2	Environmental Systems	Knowledge of Construction	9.92	7.50				√	
2	Management	Management Skills	15.96	13.22		√			
2	Research Skills	*Interdisciplinary*						√	
2	Sustainability	Knowledge of Construction	9.92	7.50				√	
3	Dissertation	*Interdisciplinary*						√	
3	Project	*Interdisciplinary*						√	
3	Business Organisation & Management	*Commercial Business Acumen*	9.27	13.61			√		
3	Design Cost Evaluation	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
3	Measurement and Valuation	Measure Work & Prepare BQs: Post Contract Financial Advice	7.13	12.08			√		
3	Management of Construction Projects	Management Skills	15.96	13.22		√			

Liverpool John Moores University (2007) had a three year BSc (Hons) QS degree with an option of converting it to a four year sandwich course by providing a year of work experience, where they offered to find work placements for any students that required them. They had twenty five modules, including projects and dissertations but excluding the one year work experience, ten of these (40%) were of the necessary subject matter to totally or partially accommodate estimating, of which two (8%) could do so fully and eight (32%) partially. The remaining fifteen modules (60%) had four (16%) that needed less estimating input and eleven (44%) that would need additional development to accommodate estimating.

The conclusions that could be drawn from this were that 56% of the course would adequately or more than adequately meet Estimators' needs and the remaining 44% would probably need adjusting to provide a more Estimator oriented leaning.

The modules were listed as follows:

*Equally-Ranked Module*s

1. Building quantification
2. Building quantities

Similarly-Ranked Modules

1. English law
2. Information studies
3. Construction law
4. Principles of procurement
5. Building contracts
6. Construction procurement strategy
7. Health and safety management
8. Managing resources

Lesser-Ranked Modules

1. Economics of the built environment
2. Applied construction mathematics
3. Economics of construction design and development
4. Design economics

Greater-Ranked Modules

1. Construction technology and services
2. Integrated design project
3. Management procurement techniques
4. Construction technology
5. Supply chain management
6. Building production
7. Sustainable methods of the built environment
8. Integrated design project
9. Dissertation
10. Integrative projects
11. Professional practice

See Table 7 below:

Table 7 Estimator Integration into University QS Courses (Liverpool, John Moores)

BSc (Hons) Quantity Surveying: Liverpool John Moores University									
Level	Module	Category	QS Avg Rank	Est Avg Rank	Estimator Integration with Existing QS Module				
					Equal	Similar	Lesser	Greater	New
1	Building Quantification	Measure Work & Prepare BQs	8.04	8.33	√				
1	Construction Technology & Services	Knowledge of Construction	9.92	7.50				√	
1	Economics of the Built Environment	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	English Law	Contracts and Contract Law	11.73	10.44		√			
1	Information Studies	Communicational/Teamwork Skills	5.81	7.06		√			
1	Integrated Design Project	*Interdisciplinary*						√	
1	Management & Procurement Techniques	Prepare Select and Appraise Tenders: Management Skills	12.04	9.08				√	
1	Applied Construction Mathematics	Pre & Post Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Building Quantities	Measure Work & Prepare BQs	8.04	8.33	√				
2	Economics of Construction Design and Development	Pre-Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
2	Construction Law	Contracts and Contract Law	11.73	10.44		√			
2	Construction Technology	Knowledge of Construction	9.92	7.50				√	
2	Supply Chain Management	Programming & Planning						√	
2	Building Production	Knowledge of Construction	9.92	7.50				√	
2	Principles of Procurement	Prepare Select and Appraise Tenders: Contracts: Pre-Contract Advice	8.00	8.56		√			
2	Sustainable Methods of the Built Environment	Knowledge of Construction	9.92	7.50				√	
2	Integrated Design Project	*Interdisciplinary*						√	
3	Professional Training Year (Sandwich Course)	*Interdisciplinary*						√	
4	Building Contracts	Contracts and Contract Law	11.73	10.44		√			
4	Construction Procurement Strategy	Prepare Select and Appraise Tenders: Contracts: Pre-Contract Advice	8.00	8.56		√			
4	Design Economics	Pre-Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
4	Dissertation	*Interdisciplinary*						√	
4	Health & Safety Management	Contracts and Contract Law	11.73	10.44		√			
4	Integrative Projects	*Interdisciplinary*						√	
4	Managing Resources	Programming & Planning: Management Skills	15.96	13.22		√			
4	Professional Practice	*Interdisciplinary*						√	

It can be seen in all three tables that *interdisciplinary* had been placed within the category section in locations where either the subjects are research studies, projects or dissertations and that in each case it was considered that the emphasis would need to be placed to a greater extent upon estimating. At Leeds and Liverpool, each had a part module containing Programming and/or Planning, which had not been mentioned as a required attribute by QSs in the Delphi study and hence had not been allocated an average ranking position but an assumption was made that, if knowledge of this subject was offered then it would be on a similar level for both roles.

Averages highlighted in Tables 3, 4 & 5 are the average ranking of modules where two main categories are combined within the module and, therefore, average ranking of both has been used.

Proposed Estimating Degree Course

Modules from each of the three University courses, selected for inclusion within a proposed 4 year degree course, were created from those that appeared to be the most appropriate. This was not done randomly but, even so, the intention was that it should be looked upon as a guide rather than a definitive pathway. It seemed that Universities and PBs had a tendency to decide upon their own programmes as there did not appear to be an industry standard from which to work. The 14 Main Categories were covered and a process was envisaged whereby the course would provide pathways through each phase of a typical project, as follows:

a) The Design Development

1. Knowledge of Construction
2. Pre-Contract Financial Advice
3. Teamwork

b) Document Preparation

1. Knowledge of Construction
2. Measure Work and Prepare BQs
3. Contracts and Contract Law
4. Communication
5. Management Skills
6. IT

c) Estimate and Tender Preparation

1. Knowledge of Construction
2. Cost Estimating Skills
3. IT
4. Prepare Select and Appraise Tenders
5. Communication
6. Risk Management

d) Contract Negotiation

1. Negotiating Skills
2. Communication and Teamwork
3. Commercial Business Acumen

e) Preparing Work Programmes and Scheduling Tasks

1. Programming and Planning

f) Providing Financial Information to Project Team

1. Post-Contract Financial and Construction Advice to Client/Contractor

See Table 8, below:

Table 8 Proposed Estimating Degree Course (4 year Sandwich)

	Proposed BSc Course in Estimating	
Year	Module	Attribute Category
1	Introduction to Construction Technology	*IT*
1	Basic Estimating Techniques	*Cost Estimating Skills*
1	Civil Engineering & Building Structural Design 1	*Knowledge of Construction*
1	Financial Control 1	*Pre & Post Contract Financial & Construction Advice to Client/Employer*
1	Basic Measurement of Structures	*Measure Work & Prepare BQs*
1	General Introduction to Law	*Contracts and Contract Law*
1	Work Placement (Spring & Summer)	*Work Experience*
2	Advanced Construction Technology	*IT*
2	Advanced Estimating	*Cost Estimating Skills*
2	Construction Contracts 1	*Contracts and Contract Law*
2	CAE	*IT*
2	Construction Procurement Strategies	*Prepare Select and Appraise Tenders*
2	Civil Engineering & Building Structural Design 2	*Knowledge of Construction*
2	Advanced Measurement of Structures	*Measure Work & Prepare BQs*
2	Economics of Construction Design and Development	*Pre & Post Contract Financial & Construction Advice to Client/Employer*
2	Work Placement (Spring & Summer)	*Work Experience*
3	Project Scheduling & Task Planning	*Programming & Planning*
3	Negotiating Skills	*Negotiating Skills*
3	Risk Awareness	*Risk Management*
3	Preparing and Pricing BQs	*Measure Work & Prepare BQs: Cost Estimating Skills*
3	Construction Contracts 2	*Contracts and Contract Law*
3	CAE and Spreadsheet Estimating	*Cost Estimating Skills: IT*
3	Civil Engineering & Building Structural Design 3	*Knowledge of Construction*
3	Information, Communication & Teamwork Techniques	*Communicational/Teamwork Skills*
3	Managing Resources	*Programming & Planning: Management Skills*
3	Business Organisation & Management	*Commercial Business Acument: Risk Management*
3	Work Placement (Spring & Summer)	*Work Experience*
4	Total Project Work (Integration of 3 years learning)	
4	Pre-Contract Costing	*Knowledge of Construction: Pre-Contract Financial & Construction Advice to Client/Employer:Teamwork*
4	BQ Document Preparation	*Knowledge of Construction: Measure Work/Prepare BQs: Contracts/Contract Law: Communication: Management Skills: IT*
4	Estimate and Tender Preparation	*Knowledge of Construction: Cost Estimating Skills: IT: Prepare/Select/Appraise Tenders: Communication: Risk Management*
4	Contract Negotiation	*Negotiating Skills: Communication & Teamwork: Commercial Business Acument*
4	Preparing Work Programme and Scheduling Tasks	*Programming & Planning*
4	Providing Financial Information to Project Team	*Post-Contract Financial & Construction Advice to Client/Employer*

16.5.3 Development of instrument for PB APC proposal

Information from the RICS APC demonstrated that fifteen of fifty one modules (over 29%) were at a level that could be shared with Estimators. This consisted of three (almost 6%) equally and twelve (over 23%) to a similar standard. Of the 36 remaining modules (over 70%), twenty four (over 47%) would probably need a lesser estimating input and twelve (over 23%) may need to be expanded to meet Estimators' needs. Here, as in some of the degree courses, the RICS had incorporated a Programming and Planning module, which illustrated and confirmed that this attribute was also being expected of QSs. Without ranking guidance it was decided that Estimators may need additional emphasis here as their work would be to provide a detailed breakdown for the complete construction period of a project whereas QSs would not be expected to produce programmes in such a detailed way.

On this basis around 77% of the overall programme could accommodate Estimators' needs and the 23% remainder of the course, whilst covering their subject matter, would probably need to be given a greater estimating related emphasis. There was also an additional module, Conflict Management that was shown to be exclusive to QSs which has been discounted for that reason.

There were nineteen individual modules, mostly repeated between years 1-3. These were listed just once below:

*Equally Ranked Module*s

1. Risk Management

Similarly Ranked Modules

1. Contract Administration
2. Contract Practice
3. Heath & Safety
4. Insurance
5. Contract Administration
6. Contract Practice

Lesser Ranked Modules

1. Capital allowances and Grants
2. Commercial Management of Construction
3. Corporate Recovery and Insolvency
4. Design, Economics and Cost planning
5. Due Diligence
6. Project Evaluation
7. Project Financial Control & Reporting
8. Sustainability

Greater Ranked Modules

1. Construction Technology & Environmental Services
2. Procurement and Tendering
3. Programming & Planning
4. Quantification and Costing of Construction Works

See Table 9, below:

Table 9 Estimator Integration into RICS QS APC

MRICS with Assessment of Professional Competency APC RICS									
Level	Module	Category	QS Rank	Est Rank	Estimator Integration with Existing QS Module				
					Equal	Similar	Lesser	Greater	New
1	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
1	Commercial Management of Construction	Commercial Business Acumen	9.27	13.61			√		
1	Conflict Avoidance, Management & Dispute Resolution	Conflict Management	N/A	N/A					
1	Construction Technology & Environmental Services	Knowledge of Construction	9.92	7.50				√	
1	Contract Administration	Contracts and Contract Law; Management Skills	13.85	11.83		√			
1	Contract Practice	Contracts and Contract Law	11.73	10.44		√			
1	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
1	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
1	Heath & Safety	Contracts and Contract Law	11.73	10.44		√			
1	Insurance	Contracts and Contract Law	11.73	10.44		√			
1	Procurement and Tendering	Prepare Select & Appraise Tenders	8.12	4.94				√	
1	Programming & Planning	Programming & Planning						√	
1	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
1	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
1	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills	9.12	5.25				√	
1	Risk Management	Risk Management	9.38	9.61	√				
1	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
2	Commercial Management of Construction	Commercial Business Acumen	9.27	13.61			√		
2	Conflict Avoidance, Management & Dispute Resolution	Conflict Management	N/A	N/A					
2	Construction Technology & Environmental Services	Knowledge of Construction	9.92	7.50				√	
2	Contract Administration	Contracts and Contract Law; Management Skills	13.85	11.83		√			
2	Contract Practice	Contracts and Contract Law	11.73	10.44		√			
2	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
2	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
2	Heath & Safety	Contracts and Contract Law	11.73	10.44		√			
2	Insurance	Contracts and Contract Law	11.73	10.44		√			
2	Procurement and Tendering	Prepare Select & Appraise Tenders	8.12	4.94				√	
2	Programming & Planning	Programming & Planning						√	
2	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
2	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
2	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills	9.12	5.25				√	
2	Risk Management	Risk Management	9.38	9.61	√				
2	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
3	Capital allowances and Grants	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
3	Commercial Management of Construction	Commercial Business Acumen	9.27	13.61			√		
3	Conflict Avoidance, Management & Dispute Resolution	Conflict Management	N/A	N/A					
3	Construction Technology & Environmental Services	Knowledge of Construction	9.92	7.50				√	
3	Contract Administration	Contracts and Contract Law; Management Skills	13.85	11.83		√			
3	Contract Practice	Contracts and Contract Law	11.73	10.44		√			
3	Corporate Recovery and Insolvency	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
3	Design, Economics and Cost planning	Pre- and Post-Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
3	Due Diligence	Pre & Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		
3	Heath & Safety	Contracts and Contract Law	11.73	10.44		√			
3	Insurance	Contracts and Contract Law	11.73	10.44		√			
3	Procurement and Tendering	Prepare Select & Appraise Tenders	8.12	4.94				√	
3	Programming & Planning	Programming & Planning						√	
3	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer	7.88	12.17			√		
3	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer	6.23	15.83			√		
3	Quantification and Costing of Construction Works	Measure Work and Prepare BQs; Cost Estimating Skills	9.12	5.25				√	
3	Risk Management	Risk Management	9.38	9.61	√				
3	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer	7.06	14.00			√		

Proposed Estimator Assessment of Professional Competence Course

Whereas the RICS course, above, appeared to include just eleven of fourteen main categories, omitting IT, Negotiating and Communication/Teamwork the proposal for an Estimator APC included these. The fourteen main categories for Estimators were catered for in their selected modules and following the RICS guidelines as follows:

a) Commercial Management of Construction

2. Commercial Business Acumen
3. Management Skills

b) Construction Technology and Environmental Services

1. Knowledge of Construction
2. IT

c) Contract Practice

1. Contracts and Contract Law
2. Management Skills

d) Design, Economics and Cost Planning

1. Pre-Contract Construction Advice to Client/Employer

e) Health and Safety

1. Contracts and Contract Law

f) Insurance

1. Contracts and Contract Law

g) Procurement and Tendering

1. Prepare Select and Appraise Tenders

h) Programming and Planning

1. Programming and Planning

i) Project Evaluation

1. Pre-Contract Construction Advice to Client/Employer

j) Project Financial Control and Reporting

1. Post-Contract Construction Advice to Client/Employer

k) Quantification and Costing of Construction Works

1. Measure Work and Prepare BQs
2. Cost Estimating Skills

l) Risk Management

1. Risk Management

m) Sustainability

1. Pre and Post-Contract Construction Advice to Client/Employer

n) CAE; Electronic Transfer of Documentation

1. IT Skills
2. Communication Skills

o) Contractual and Financial Negotiations

1. Negotiating Skills
2. Communication & Teamwork Skills

p) Cost Estimating

1. Cost Estimating Skills

See Table 10, below:

Table 10 Proposed RICS Estimating APC

MRICS with Assessment of Professional Competency APC RICS		
Level	Module	Category
1	Commercial Management of Construction	Commercial Business Acumen; Management Skills
1	Construction Technology & Environmental Services	Knowledge of Construction
1	Contract Practice	Contracts and Contract Law; Management Skills
1	Design, Economics and Cost planning	Post-Contract Financial & Construction Advice to Client/Employer
1	Heath & Safety	Contracts and Contract Law
1	Insurance	Contracts and Contract Law
1	Procurement and Tendering	Prepare Select & Appraise Tenders
1	Programming & Planning	Programming & Planning
1	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer
1	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer
1	Quantification and Costing of Construction Works	Measure Work and Prepare BQs
1	Risk Management	Risk Management
1	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer
1	CAE; Electronic Transfer of Documentation	IT Skills; Communication Skills
1	Contractual & Financial Negotiations	Negotiating Skills; Communication & Teamwork Skills
1	Cost Estimating	Cost Estimating Skills
2	Commercial Management of Construction	Commercial Business Acumen; Management Skills
2	Construction Technology & Environmental Services	Knowledge of Construction
2	Contract Practice	Contracts and Contract Law; Management Skills
2	Design, Economics and Cost planning	Post-Contract Financial & Construction Advice to Client/Employer
2	Heath & Safety	Contracts and Contract Law
2	Insurance	Contracts and Contract Law
2	Procurement and Tendering	Prepare Select & Appraise Tenders
2	Programming & Planning	Programming & Planning
2	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer
2	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer
2	Quantification and Costing of Construction Works	Measure Work and Prepare BQs
2	Risk Management	Risk Management
2	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer
2	CAE; Electronic Transfer of Documentation	IT Skills; Communication Skills
2	Contractual & Financial Negotiations	Negotiating Skills; Communication & Teamwork Skills
2	Cost Estimating	Cost Estimating Skills
3	Commercial Management of Construction	Commercial Business Acumen; Management Skills
3	Construction Technology & Environmental Services	Knowledge of Construction
3	Contract Practice	Contracts and Contract Law; Management Skills
3	Design, Economics and Cost planning	Post-Contract Financial & Construction Advice to Client/Employer
3	Heath & Safety	Contracts and Contract Law
3	Insurance	Contracts and Contract Law
3	Procurement and Tendering	Prepare Select & Appraise Tenders
3	Programming & Planning	Programming & Planning
3	Project Evaluation	Pre- Contract Financial & Construction Advice to Client/Employer
3	Project Financial Control & Reporting	Post-Contract Financial & Construction Advice to Client/Employer
3	Quantification and Costing of Construction Works	Measure Work and Prepare BQs
3	Risk Management	Risk Management
3	Sustainability	Pre and Post- Contract Financial & Construction Advice to Client/Employer
3	CAE; Electronic Transfer of Documentation	IT Skills; Communication Skills
3	Contractual & Financial Negotiations	Negotiating Skills; Communication & Teamwork Skills
3	Cost Estimating	Cost Estimating Skills

16.5.4 Approach to the CI

16.5.4.1 Approach to RICS

E-mails to the director, Built Environment Group, met with a reasonably positive response. The first reply pointed out that it was not easy for Estimators to gain entry to the organisation, due to its current structures, but that they were now going to consider "testing the market" through the Construction Journal (Badke 2007). A second reply said that there was some merit in investigation but it would depend upon resources and priorities. An idea of the potential market size was requested, Badke (2007), and an estimate sent to them which was constructed from information obtained from the Dti website (2007). This indicated a possible market of 65,000 Estimators working full time and 23,000 working part time, calculated on the basis shown in the two right hand columns in Table 84, below. It was explained to the RICS that there did not appear to be any government or other organisations that provided this information and it had been an experience-based calculation only. A third response confirmed that the information had been passed to the RICS membership development team for further study, Badke (2007). No further response was received. See Table 11, below, for estimated Estimator numbers sent to the RICS:

Table 11 Estimated Numbers of Full- and Part-Time Estimators in the CI

Construction Industry Structure						
Figures at the Third Quarter of 2005						
Number of Employees	Total Annual Turnover (Approx)	Number of Companies	Estimator/ Surveyor/ Manager Assumed	Estimators (Assumed)	Estimators/company	
					P.T	F.T
1 to 7	£12b	170,471	17,000	0	0.1	0
8 to 13	£7b	11,599	6,000	6,000	0.5	0.5
14 to 24	£8b	6,341	0	8,000	0	1.25
25 to 34	£4.4b	2,037	0	4,500	0	2
35 to 59	£8b	1,928	0	7,500	0	4
60 to 79	£4b	573	0	3,500	0	6
80 to 114	£5.2b	469	0	4,000	0	8
115 to 299	£12.2b	556	0	8,500	0	15
300 to 599	£7.6b	148	0	6,000	0	40
600 to 1,199	£5.2b	65	0	4,000	0	60
1,200+	£18b	56	0	13,000	0	230
Total			**23,000**	**65000**		

16.5.4.2 Approach to Loughborough University

An e-mail to the Professor of Construction Management/Director of Business Partnerships received a reply saying that he had passed the suggestion to members of their construction department for consideration, with a comment that his instinct was that estimating, as a free standing degree, was too focused but that there was a discussion to be had on it (McCaffer 2007). No further response was received.

16.5.4.3 Approach to the CIC

Following contact with the CIC a meeting ensued with their Director of Lifelong Learning where a written proposal was provided, which set out a possible course of action that could be taken to instigate the development of a training and educational programme. Notes from that meeting were set out in an e-mail from the CIC, as follows:

> *"Mr Cracknell explained and provided information about the work undertaken in the industry relating to the development of a Sector Qualification Strategy by the ConstructionSkills, the Sector Skills Council for the industry. Amongst other issues, this was concerned with the inter-relationship of academic/training programmes and vocational and professional qualifications and the need for them to provide progression paths for those developing careers in the sector within the national framework of qualifications. This is also based on the premise that provision of programmes reflects industry demand from employers and potential candidates and addresses skills gaps and shortages (such as that identified for estimating).*
>
> *CIC, as a partner in ConstructionSkills, is able to, and would endeavour to, influence the broader strategy for provision through its networks. However, the development of education and training programmes is also influenced by the existence of any competing programmes targeted at the particular discipline; the commercial viability and market size of potential courses and qualifications from the perspective of those organisations that deliver and award them; and the degree to which the sector - particularly organisations such as professional bodies – are likely to recognise new programmes.*

> *In this context, it was suggested that it would be advantageous to approach a number of key bodies (details of which were provided) who may be able to help support the case for provision and recognition."* (Cracknell 2007).

Following the meeting a further e-mail from Cracknell (2007) provided the names of eight people within various organisations and professions who may be able to help further. Contacting these eight people was not pursued, at this time, but would provide useful information for an attempt at instigating a training programme at a later date. It seemed, though, that the CIC had a strong link with the CITB and Construction Skills and information was provided, also by e-mail Cracknell (2007), showing that they had produced NVQ course structures for Construction Skills, three of which were provided for relevant information. These were NVQs in, Quantity Surveying, Construction Contracting and Construction Management, and were structured courses with some estimating elements included. It was pointed out to them that the websites of both the CITB (2007) and Construction Skills (2007) placed estimating in a technical support group category, which, as has been said before, was probably not where they ought to be and, in doing so, was undermining their position and exacerbating the CIs difficulties in recruiting able students. In this regard, Freidson (2001), in discussing technician roles, had said that historically they belonged between craft and profession and relied on practical knowledge with some formal knowledge, which is not a description that appears to fit with estimating. He added though that technicians' roles were in the early stages of professional development. Taking note of this, estimating has been shown to be making changes in adapting to the increasing diversity of project procurement methods, and this may encourage the CITB and others to look again.

That the websites undermined the position of Estimators was accepted by Mr Cracknell and it was said that there would be some discussion with the CITB and Construction Skills, with a view to making an appropriate change to their websites. Since that date little has changed; the CITB website (2008) remained the same[6] and Construction Skills re-directed people, looking for careers, to the website of beconstructive, which offered information on career structures. This website, later,

[6] In 2010 the CITB website still lists Estimators under Technical Support but gives no further information (CITB 2010)

changed Construction Skills (2010) and they had a prospectus of training courses, including a two day course for Estimating and Tendering at a fee of £500.00, following which they suggested that the delegates could produce accurate costings for their companies. The beconstructive website (2007) displayed estimating under their Technical and Professional section and described it as technical support. The job description was pricing work, being organised and needing to be able to communicate. The entry qualification requirement was undemanding and said to be "not necessary" although apparently "three S grade GCSEs (specified subjects) might be helpful"[7].

16.6 Conclusions

The possibilities for the development of education for Estimators have been demonstrated by this study. It also showed that much of the necessary work was already in place, within existing course structures. It seemed feasible, then, that Estimators might participate in parts of the modules for which they required less learning and thus have more time available for the increased training necessary for the modules for which a greater level of knowledge was needed.

With the approaches made to the CII, all three organisations were offered the work that had been done in this Chapter together with the ECAM article, to help persuade them of the benefits and necessity of upgrading estimating.

- Loughborough University had QS courses but the indications were that they thought estimating did not require such a broad course of study
- The RICS gave consideration to an estimating programme but intimated that there was a financial issue to overcome, which depended on the possible number of Estimators they could attract. They did not appear to be persuaded by the argument that much of the subject matter was already in place, thus eliminating the need for a completely fresh set of modules, which would reduce their start-up costs.

[7] beconstructive is now bconstructive and has not changed its description, or its positioning as technical support, for the Estimators' role, in its website bconstructive (2010). It has, though, indicated that training for the role would be in a trade based on-site situation with a day-release for college studies.

- The CIC also expressed interest and empathy but the expectation that they had a wide ranging influence across the CI appeared unfounded and, therefore, the likelihood of them instigating estimating programmes diminished. In an area where they did have authority, with skill training providers, they had not persuaded them of the merits of elevating estimating from its considered position of technical support, as this remained unchanged. They were able to produce course structures for the "National Framework of Qualifications" QS and Construction education and training programmes for NVQs that, from the size of the documentation issued must have taken a great deal of time and finance to create. Unfortunately this finance, it appeared, could not extend into producing an estimating course.

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Glossary of Abbreviations

ACostE Association of Cost Engineers

ALF Animal Liberation Front

APC Assessment of Professional Competence

APM Association of Project Management

ARS Abductive Research Stategy

ASCE American Society of Civil Engineers

BBC British Broadcasting Corporation

BoK Body of Knowledge

BQ Bill of Quantities

BREEAM Building Research Establishment Environmental Assessment Method

CAD Computer Aided Design

CAE Computer Aided Estimating

CDM Construction Design and Management Regulations

CDMC Construction Design and Management Regulation Co-ordinator

CESMM Civil Engineering Standard Method of Measurement

CI Construction Industry

CICA Construction Industry Computing Association

CIOB Chartered Institute of Building

CM Contracts Manager

CPD Continuous Professional Development

CPI Course Proposal Instrument

CR Client's Representative

D&B Design and Build

DRS Deductive Research Strategy

DTI Department of Trade and Industry

DV Dependent Variable

ECAM Engineering Construction and Architectural Management Journal

ER Employer's Requirements

Est. Estimator

ETP Education and Training Programme

HA Housing Association

HE Higher Education

HLS Huntingdon Life Sciences

HNC Higher National Certificate

ICE Institution of Civil Engineers

IRS Inductive Research Strategy

IT Information Technology

IV Independent Variable

KPMG Klynveld Peat Marwick Goerdeler

KSA Knowledge Skill Ability

LA Local Authority

MD Managing Director

MI Methodological Individualism

NEC New Engineering and Construction Contract

NHBC National house Building Council

NVQ Non Vocational Qualifications

PB Professional Body

PC Personal Computer

PE Project Estimator

PFI Private Finance Initiative

PI Professional Indemnity Insurance

PPP Public-Private Partnership

PQS Private Quantity Surveyor

QS Quantity Surveyor

RE Regional Estimator

RICS Royal Institution of Chartered Surveyors

RPM Regional Project Manager

RRS Retroductive Research Strategy

S/C Sub-Contractor

SCM Senior Contracts Manager

SE Senior Estimator

SMM7 Standard Method of Measurement 7

SPSS Statistical Package for Social Sciences

TE Trainee Estimator

TNA Training Needs Analysis

TNQ Training Needs Questionnaire

UK United Kingdom

US United States of America

USDL United States Department of Labor

VAS Visual Analogue Scale