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Electronic Tendering: Recognising a More Effective Use of Information Communications Technology in the Irish Construction Industry

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Electronic Tendering; Recognising a More Effective Use of Information Communications Technology in the Irish Construction Industry.

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Declaration

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Abstract

When undertaking a traditional tender in Ireland, computer applications are heavily relied upon. Documents, from drawings to Bills of Quantities, are created with an array of computer applications. These documents are subsequently exchanged from surveying firms to a number of main contractors and, additionally, from the main contractors to subcontractors. However, even though the documents have originated in an electronic form, the majority of the documents are communicated in a paper format. Therefore, with each new communication between the parties more paperwork is created. This system of communication is inefficient and process gains can be made through the utilization of already existing Information Communication Technologies (ICT) .

The thesis initially provides an analysis of the literature relating to the existing traditional tender process in the Irish construction industry. These findings are then compared with techniques being undertaken in other parts of the world, where ICT is implemented to a greater degree in the tender process.

An observation study, subsequently, reveals a clearer picture of the tender process to the author. In particular, the tasks a contractor completes when pricing a competitive tender are clarified. The communication methods used by the contractor between both the PQS and subcontractors are also investigated. This investigation shows that a relatively low level of eCommunication is being undertaken by the individuals within the industry.

A survey carried out by the author in the summer of 2008, establishes the current level of ICT usage in Irish construction companies with respect to the tendering process. These results show that there is a similar level of eTendering uptake to that of other countries. However, this uptake is significantly discouraged by a number of barriers identified by the author.

Finally, the thesis presents an industry led pilot project. This pilot project clarifies the potential cost savings that the Irish construction industry achieved through the application of integrated ICT tools in the construction tendering process.

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List of Acronyms

Abbreviation	Meaning
AEC/FM	Architecture, Engineering, Construction and Facilities Management
ACEI	The Association of Consulting Engineers in Ireland
BOLTS	Buildsoft OnLine Tendering System
BOQ	Bill of Quantities
CAD	Computer Aided Design
CCDC	Canadian Construction Documents Commission
CD-Rom	Compact Disc Read Only Memory
CIB	Construction Industry Board
CIF	Construction Industry Federation
CIOB	Chartered Institute of Building
CITA	Construction Information Technology Alliance
CITAX	Construction Information Technology Alliance eXchange
CITE	Construction Industry Trading Electronically
CQS	Contractors Quantity Surveyor
CRC	Cooperative Research Centre
CSO	Central Statistics Office
DETE	Department of Enterprise, Trade and Employment
DOEHLG	Department of Environment, Heritage and Local Government
EI	Engineers Ireland
eCommunication	Electronic Communication
EDI	Electronic Data Interchange
eProcurement	Electronic Procurement
eSubmittal	Electronic Submittal
eTendering	Electronic Tendering
EU	European Union
FTP	File Transfer Protocol
GNP	Gross National Product
ICT	Information Communications Technology
ITEF	Internet Engineering Task Force
IT	Information Technology
LC	Liaison Committee
LCPN	Liaison Committee Practice Notes
NCCTP	Network for Construction Collaboration Technology Providers
NSW	New South Wales
OJEU	Official Journal of European Union
PC	Personal Computer
PDF	Portable Document Format
PQS	Clients Project Quantity Surveyor
QS	Quantity Surveyor
RIAI	The Royal Institute of the Architects of Ireland
RICS	Royal Institution of Chartered Surveyors
RSNI	Road Service Northern Ireland
SCS	Society of Chartered Surveyors
SIG	Special Interest Group
SME	Small and Medium Enterprises
TLS	Transport Layer Security
TTP	Trusted Third Party
UK	United Kingdom

Chapter 1

Introduction

1.1 Background

Thomas (1999) suggested that the communication practices of the Irish construction industry predominantly revolved around the traditional telephone, facsimile machines and networked personal computers. Additionally, his study indicated that any additional use of Information Communications Technology (ICT) was relatively unsophisticated (Thomas, 1999). More recently, in 2008 the CSO has shown that 97% of construction companies predominately utilise ICT in the form of email and internet usage (CSO, 2008).

However, the information entered into these ICT tools is almost invariably passed from one ICT system to another by producing paper-based electronic documents, which in turn are re-entered into various other ICT systems along the Architecture, Engineering, Construction and Facilities Management (AEC/FM) life cycle (Froese, 2003). It has been extensively reported by many authorities that traditional paper-based collaborative exchange of data between construction project participants is not efficient and that sensible use of ICT enhances productivity (Thomas, 1999 and Gunnigan et al., 2004). It has subsequently been concluded by Hore and West (2005a) that electronic transmission of business documents offers savings in time, paper and postage. Furthermore, Hore (2007) found that firms can make significant monetary savings, in addition to direct process gains, through direct links between company's technological infrastructure.

The Irish government acknowledged that these inefficiencies cannot be attributed to any one specific process or party within the industry (DETE, 2006). However, one of the core processes firms in the Irish construction industry complete is a process known as “tendering”. Tendering costs have been found to account for up to 6% of the total value of a project cost to a client on a typical construction project (Hughes, 2003 and CCDC, 2005). Hughes' percentage was calculated through a survey of construction companies, while the Canadian Construction Documents Commission (CCDC) completed a review of the work undertaken during the tendering process. Furthermore, an additional review of the documents that were exchanged between parties involved in the process was undertaken. It was established that the tender participants exchanged many standard tender documents, such as, drawings, project specifications and Bills of Quantities (BOQ). In the majority of cases it was reported

that each of these documents were reproduced and dispatched in hard copy format. This overdependency resulted in an expense that invariably impacts on the industry's clients.

This thesis reviews the Irish construction industry's current tendering process and the inefficient processes that are embedded within it. Furthermore, a questionnaire survey of the industry explores the Irish construction industry's views on the impact that ICT is having on the traditional tender processes. Finally, of the author reports on an industry led pilot project, where it was demonstrated that sensible use of ICT can assist the construction tender process. The pilot illustrates how the present inefficient communication processes in tendering and, as a result, the costs of the tender process can be reduced through the introduction of a simple, accessible and cost effective ICT solution (O'Connell, et al., 2007).

1.2 Thesis Aim and Objectives

The author’s hypothesis for the work was “If you undertake the tendering process in an electronic fashion, then you reduce its inherent inefficiencies and save money”. This was translated into twin aims. The overall aim of the author's study was to examine the inefficiencies within the Irish construction industry's tendering process. In addition to this the author researched how an advancement in Electronic Tendering (eTendering) could enhance this process and reduce the investigated inefficient processes. To facilitate these twin aims, it was necessary to subdivide the aims into a number of smaller more focused objectives. These included:

1. Critically examining the tendering process adopted in the construction industry.
2. Identifying the inefficiencies present in the current methods of tendering for projects in the construction industry.
3. An examination of the extent to which ICT can support and improve the tendering process.
4. An observation of multiple tender processes to confirm the process tasks and inefficient processes.
5. Completing an investigation into the construction industry's uptake of ICT, with particular focus on eTendering.

6. Considering the constructions industry's opinion on the drivers and barriers of new eTendering practices.
7. The validation of the benefits of eTendering by means of a pilot project.

These objectives were to be met by a broad range of research techniques, which are briefly discussed in section 1.3 below. Further details on meeting these objectives are discussed in chapter 3.

1.3 Research Methodology

There were a number of research methods used during the course of the author's study. Both quantitative and qualitative methods were used and their organisational structure was planned, prior to the research being undertaken, to assist the author in achieving the overall aim. The linkage between the thesis objectives and the chosen research methods is shown in table 1.1.

Thesis Objective	Focus	Selected Research Methodologies	Relevant Chapters
1	Existing Tender Process	Literature Review	2
2	Inefficiencies	Literature Review	2
3	Potential ICT Support	Literature Review	2
4	Process tasks / inefficiencies	Observation study / Interviews	4
5	eTender Status	Questionnaire survey	5
6	Drivers & Barriers	Questionnaire survey	5
7	Comparison of Traditional –v– ICT enhanced process	Pilot study / Interviews	6

Table 1.1 Chapter Focus and Appropriate Research Methodology

The author began reviewing a wide range of literature on the topic of tendering. This strong foundation of research included utilising the many primary research resources, such as academic conference papers and journals, as well as governmental and industry publications, in conjunction with the most recent secondary research resources available. This led the author to establish an understanding of the existing tender process and it’s inefficient practices. In addition to this research, the author also

reviewed the most recent documents relating to emerging technologies, that could assist in reducing, and in some cases removing, the identified inefficient practices encountered in the current traditional tender process.

Following this work, the methodology allowed the author to undertake an observation of current tendering procedures, their inefficiencies and the use of ICT in the tender process. A number of projects were observed, with greater in-depth analysis completed on each progressive project. This observation and the participant exchanges that occurred over the observation's course, assisted the author in obtaining a greater understanding, particularly on a micro level, of the tender process tasks that are undertaken. Additionally, this research also allowed any inefficient processes to be individually identified and examined.

With the completion of the observation study an industry wide survey was completed in 2008. This survey focused on the three main parties involved in the tender process, the private quantity surveyor, the main contractor and the subcontractor. These parties were surveyed to capture an understanding of the industry's views on the current status of ICT in the tender process, and the drivers and barriers behind the further introduction of a range of ICT solutions identified by the author. The final method of research applied by the author was the undertaking of a co-ordinating role within a pilot project managed by the Construction Information Technology Alliance (CITA). Following a traditional tender simulation, the group piloted an electronic solution for the same scope of works. The pilot aimed to provide data to prove that it is possible to reduce, and where in some instances remove, the inefficient processes encountered during the previous research. This group, which included the author and a range of experienced professionals working in tandem with each other, completed the pilot process in a fashion that was both accurate and comparable to the industry's current procedures.

1.4 Chapter Outlines

Chapter two reviews the objectives behind the tendering process used within the Irish construction industry. With these facts established the author progresses through the typical workflow of the most commonly used selective tender process. Through this review the author elaborates on tendering practices and processes. In addition to this, inefficient practices that are used within the industry, due to the specific methods of

tendering are identified. This is followed by a discussion of the scope and possible impact that ICT could have on the Irish construction industry's current tendering practices.

Chapter three's subject matter is based on the author's observation study. A direct investigation of the tender process leads to a greater understanding of the process and its individual tasks. Furthermore, inefficient processes are highlighted and a series of recommendations are made by the author.

Chapter four is the focus of an online survey of the industry, in respect to views on both current tender practices and the emergence of eTendering. The author presents the responses received from the Irish construction industries' main tender participants. Subject matters, such as, current tendering practices and their cost are examined. Additionally, the topic of eTendering is presented to the respondents for their considered views. Finally, the author compares the key survey findings with similar surveys completed on the topic by other researchers.

Chapter five documents a pilot project of an eTendering solution. The author begins by detailing the group's methodology in undertaking the pilot. The groups work, including the drawing up and completion of process maps, for both the existing and proposed new software, is also discussed. Furthermore, the results of the pilot are shown in comparison with the existing, hard copy based, tender process and the group’s assessment of the range of savings that a firm could expect from undertaking an eTender.

The thesis concludes with a chapter that reports on the types of research carried out and the main conclusions reached. A further appraisal of what research objectives were met and what objectives could be further explored are also considered. This is followed by a number of recommendations for further research on the topic of eTendering and ICT implementation in construction.

Chapter 2

Literature Review

2.1 Introduction

Naoum (2007) stated that one of the first steps of thesis research should be a literature review on the selected topic. This chapter details the author's literature review which was undertaken to meet the author's first three objectives. The first objective met is the critical examination of the tendering process. This is followed by the author identifying the inefficiencies present in the current methods of tendering and finally an examination of the extent to which ICT can support and improve the tendering process is completed.

The Irish construction industry employed approximately 255,000 people in the second quarter of 2008. It had an estimated value of €38.5bn to the Irish economy in 2007, and contributed to approximately 23.9% of the Gross National Product (GNP) (DKM, 2008). The construction sector was thus a significant contributor to the Irish economy. Yet the same DKM report further outlines how the construction industry is highly cyclical in nature and how it is now entering a downward cycle with reduced levels of output being predicted in future years.

In a previous report, DKM (2005) had shown that the Irish construction industry had sustained significant growth over a large number of years. Over this extended period of growth Aylward et al. (2007) had found that there were productivity improvements in the residential sector of the market. However, even with these improvements, DKM (2005) argued that there were concerns about the productivity of the workforce in the construction industry and about the processes that are rooted within the industry. These inefficient processes must now be increasingly evident due to tighter profit margins and the current downward cycle of the industry.

The question therefore arises, by what means can an entire industry ensure that it can increase its productivity? An investment in new and developing technologies has been suggested as a way to improve productivity. In 1999, Technology Foresight Ireland acknowledged that a failure to invest in the technological development of the construction industry would adversely affect its ability to maintain its contribution to the economy, to compete in the developing European and global construction environment and to provide and sustain the physical infrastructure we need between now and 2015. An investment, as described by Technology Foresight Ireland, in Information Communication Technologies (ICT) could be a possible solution. More recently, Forfas (2007) concurred that, when implemented correctly, ICT can be a key driver of

productivity improvements.

One of the main areas where this investment could be made is in the entire procurement process. In the 2001 PWC report (Price Waterhouse Coopers) the government published its Strategy for the implementation of Electronic Procurement (eProcurement) in the Irish public sector. This report highlighted that, with an increase in the use of ICT, cost savings of between 2 and 20% were available depending on the type of eProcurement system implemented. eProcurement was defined by Przymus (2003 p8) as, "*the acquisition of goods and services without the use of the paper processes*". Additionally, Eadie et al. (2007 p103) understood the standpoint of the Irish government (PWC, 2001), when he cited a number of references suggesting that "*eProcurement will bring improvements to all aspects of the procurement process*."

One of the eProcurement systems discussed in the Irish governmental report (PWC, 2001) was Electronic Tendering (eTendering). The report pointed out that in Canada an eTendering system, MERX, had made a 15% saving on the cost of obtaining public services. Since this report was published, the Irish local government procurement website www.etenders.gov.ie has been established. This website has initiated the eTendering process in Ireland and has reduced the costs of the traditional newspaper-based advertising process, introducing savings of up to 75% (IBM, 2003). Further advancements by the government in the implementation of this technology were reported by both DETE (2006) and Forfas (2008).

However, scant information is available on the application of this technology in the private sector. With regard to this, the Construction Information Technology Alliance (CITA) undertook a survey of the Irish construction industry in 2006. CITA found that the majority of respondents recognised the potential savings and advantages of eTendering, with 73% of respondents previously partaking in the electronic receipt of documents. However, only 27% electronically submitted the tender documents. CITA also found that the majority of respondents still had concerns regarding the adoption of a definitive eTendering strategy. These findings were found to be due to security and legality concerns (CITA, 2006). The question maybe asked, do these inhibiting concerns outweigh the potential savings and gains from the use of eTendering?

To surmise, the author has established that the Irish construction industry faces the challenges of an economic downturn and that the productivity of the sector has been questioned. Yet there are emerging technologies, which could improve the tender

process. This chapter aims to critically examine the process of tendering in the Irish construction industry and then consider whether the emerging technology can reduce the process' inefficiencies. This aim is realised through a review of the relevant literature on the topic. To facilitate this aim a clear introduction to the topic of tendering is provided. This leads to a discussion on the problems or inefficiencies of the process and finally a detailed discussion on suggested solutions to the identified inefficiencies.

2.2 An Overview of Tendering in Construction

Tendering in construction was portrayed by Runeson and Skitmore (1999) as a process that connects the buyer/client to the market place/construction firm. This process informs the client what construction firms are willing to sell and also indicates the price they are willing to sell those services to the client. The Aqua group (2006, P. 27) expanded on this by defining tendering as: "*A procedure to select a suitable contractor, at a time appropriate to the circumstances, and to obtain from him at the proper time an acceptable offer upon which a contract can be let.*"

The high level traditional tendering processes are shown in figure 2.1. The Construction Industry Board (CIB, 1997) in the United Kingdom (UK) indicated, that there were four main steps in the tendering selection process. The four steps were established to be the high level process required to complete the tender process.

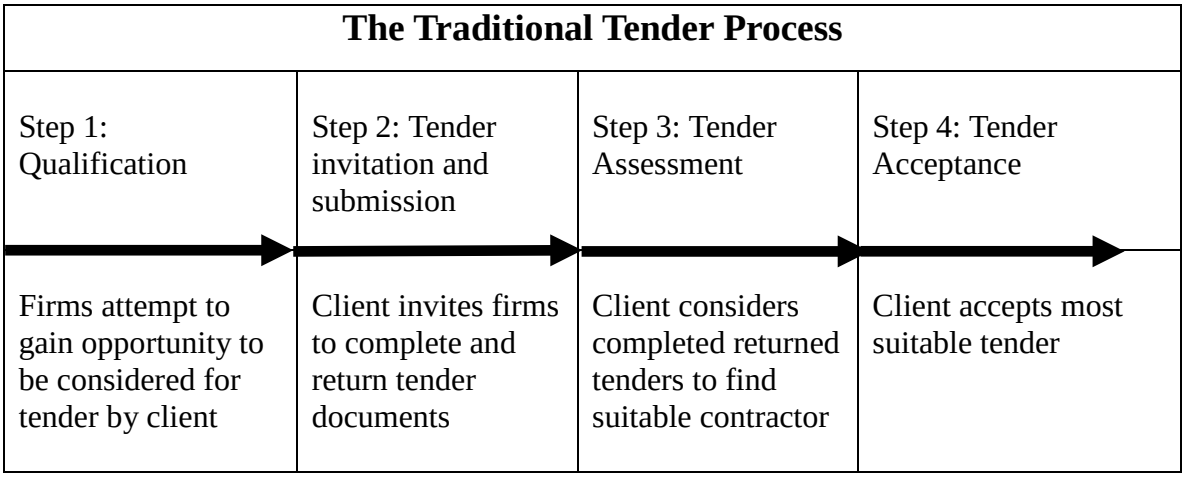

Figure 2.1 The Traditional Tender Process (Adapted from CIB, 1997)

The first step involved is qualification. This is the provision by a contractor of information, as part of a preselection process (Chartered Institute of Building, CIOB, 1997). The client can then review this information to compile a list of suitable contractors to tender for the works. Seeley (1997) maintained that this procedure can be completed without documentation being sent to the contractors. The client can himself compile a list from his/her previous experiences with firms or by drawing up an ad hoc list of contractors who, from common knowledge, would be capable of completing the type of works involved.

The qualified contractors are subsequently invited, at stage two, to submit their tenders for the project. The form of the tender and its documents take into account items, such as, the size of the project, level of pricing, resources of the firms and the character of the project (Hore, et. al, 1997). This documentation typically includes all relevant drawings, BOQ and the contractual forms, under which, the contract will be carried out. The BOQ is subsequently priced and the form of tender is completed. These documents are then submitted by the contractor on or before the deadline date.

During stage three, the submitted tenders are then appraised and examined for errors by the client's Project Quantity Surveyor (PQS). Smith (1995, P. 203) comments that choosing the best buy "*seems absurdly simple*". However, he points out that tenders should not only be assessed on the basis of the lowest price but also on factors, such as, project timescale and safety records. Once a contractor is chosen, be it on price alone or a number of criteria, the client and the contractor will sign and counter sign the contractual documents, thus completing the fourth stage (tender acceptance).

2.3 Objectives of Construction Tendering

The tendering process begins due to the client's requirement for a new or renovated piece of architecture or similarly engineering works. For that reason, the overall aim of the tender process must be to acquire a firm with the relevant skills to construct this project. However, there are a number of objectives which stem from this overall aim, as can be seen in figure 2.2.

Smith (1995) suggested that the client wishes to obtain a completed building with a acceptable quality and over a suitable timescale. The Aqua group (2006) concurred with Smith's logic, however, they put the client's objectives simply, as the

client wanting a building to be completed to the highest quality, at the lowest cost and in the shortest amount of time. Therefore, it can be understood that the client's main objectives with the tendering process, is to arrive at a point where s/he has obtained an offer of a new building at an acceptable cost, over an acceptable time and to a satisfactory standard or quality.

However, there are other sub-objectives, as shown in figure 2.2, that must be considered on occasions. Brooks (2008) noted that political factors have meant that many public projects must be tendered to ensure the public are securing the most cost effective tenderer to carry out the works. This has parallels with the Aqua group's (2006) understanding that accountability must be considered when selecting a contractor. The Aqua group proceed to suggest that, through the tendering process, the decision to choose one contractor over another must be justifiable.

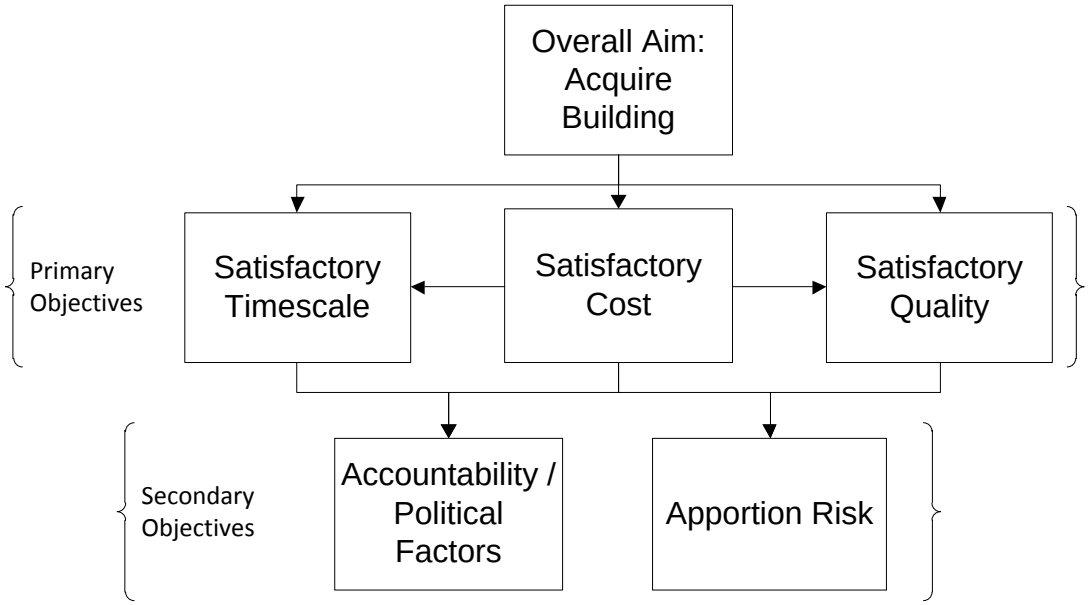

Figure 2.2 Client's Objectives

The client's decision to tender will also be made on a consideration of the risk involved. Through the tender process the client will show the contractor the items of work that s/he will be undertaking and the conditions under which they will be carried out. Therefore, a price is received that will show the clients liability to undertake the works. This should negate the possible loss (The Aqua Group, 2006) or risk from commissioning the building.

The contractor's objectives are quite straight forward. Smith (1995) states that

because the contractor is a profit-seeking organisation, their main reason to tender is to obtain profitable work. Therefore, the tender process is a process where both parties objectives can be achieved. The contractor obtains a contract to complete profitable work and the client obtains a contract for a suitable firm to complete his/her proposed schedule of works.

2.4 Traditional Construction Tendering Procedures

In Ireland there are set procedures published for the execution of the tendering process in the private sector. An organisation composed of key members of the construction industry, the Royal Institute of the Architects of Ireland (RIAI), the Society of Chartered Surveyors (SCS), the Construction Industry Federation (CIF), the Association of Consulting Engineers in Ireland (ACEI) and Engineers Ireland (EI) formed a body know as the Liaison Committee (LC). Their code of practice, the Liaison Committee Practice Notes (LCPN, 2006) are guidelines of what should occur when good tendering practice is carried out within the construction industry. The following is a detailed account of the recommendations within the various stages of the LCPN (2006).

2.4.1 Stage 1: Qualification

The LCPN suggests that the tender process begins, as shown in figure 2.3, with the client and his/her representatives drawing up a list of potential contractors interested in tendering for work. Following this task, the Private Practice Quantity Surveyor (PQS) will send out a preliminary invitation to tender for the prospective works. This preliminary enquiry informs the contractor of who the client is, who their representatives will be and an overview of the type, approximated cost, timescale and location of the project.

The LCPN suggests that a pre-qualification questionnaire be attached to the preliminary enquiry. This should save time, for both the contractor and the PQS, as interested firms can reply promptly with the relevant information to the PQS firm. This questionnaire will require information about the company and other projects, of similar nature to the tender works, which it has successfully completed in the last two to three years.

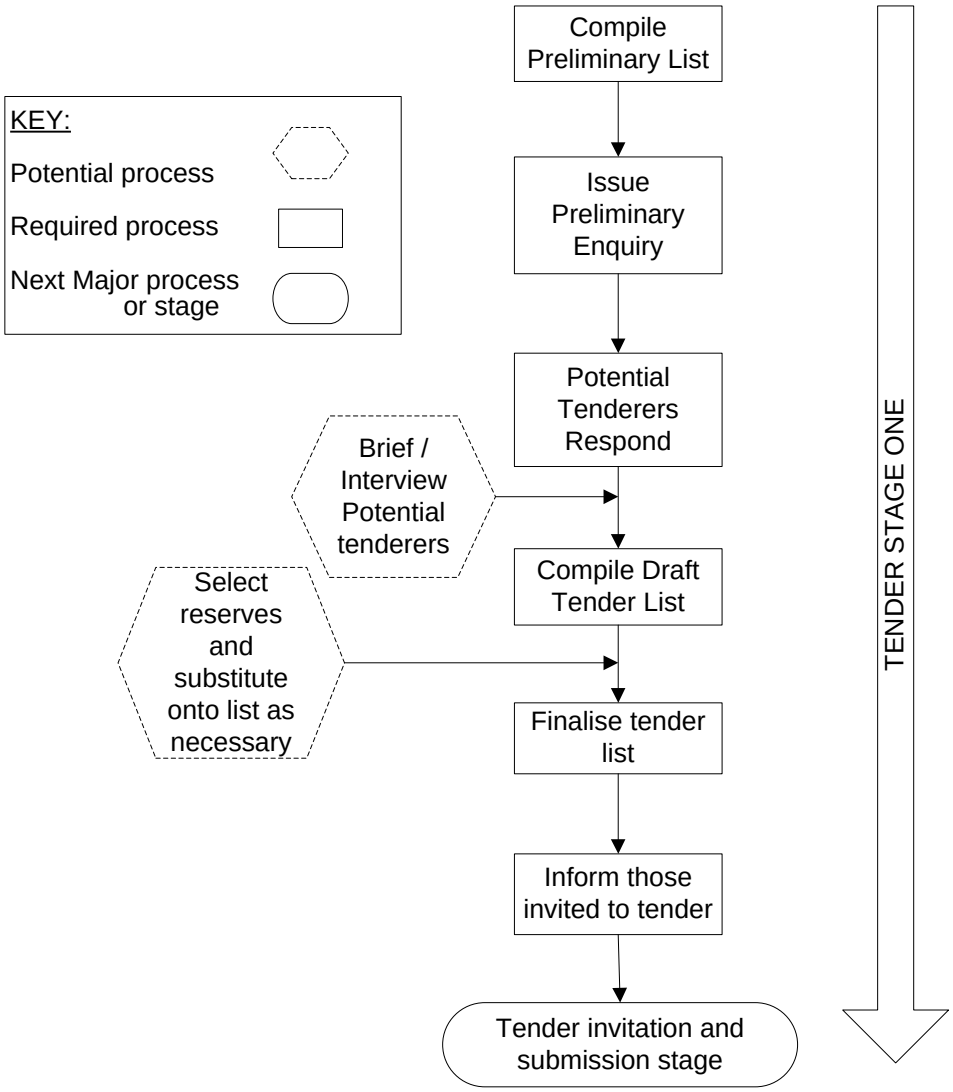

Figure 2.3 Stage 1: Tender Pre-qualification (adapted from CIB, 1997)

The LCPN also makes mention of the requirement to reduce the number of contractors tendering for the same projects. It explains that, due to the high cost of tendering, any unsuccessful tenderers simply allow for that unsuccessful tender by increasing their tender prices in the long run. Therefore, having received an adequate number of responses from contractors willing to tender, a final list of six to eight contractors is drawn up. Two additional names of suitable contractors should be included on a stand-by list. In case of subsequent withdrawals, these contractors can be substituted onto the main list.

Following the above tasks, the PQS will then inform the contractors who are not to be considered for the remainder of the tender process. With prequalification complete, section 9.8 of the LCPN states, "*this process will mean that the final selection of a contractor should be on the most cost effective basis only*."

Internationally there are also a number of codes produced for ensuring that tendering is carried out in line with good practice. In the UK the Chartered Institute of Building (CIOB) has developed the Code of Estimating Practice (1997). This code advocates that an interview can be used to help the pre-qualification process. This it says can be advantageous to all parties involved, possibly as it introduces the key individuals who would be involved in any potential project. This view is similarly reflected in the UK's Construction Industry Boards (CIB) Code of Practice (1997).

2.4.2 Stage 2: Tender Invitation and Submission

With a list of suitable contractors willing to price for the proposed package of works, the finalised tender documentation should be dispatched within four to six weeks of the receipt of the preliminary enquiries. These are the first two tasks, as shown in figure 2.4. Should this time extend beyond three months, the contractor should be asked to reconfirm his/her willingness to submit a tender.

The LCPN (2006) advise that the documents can be issued in both electronic and hard copy format. The documents discussed by the LCPN include:

1. The BOQ (If electronic/ Hard copy only upon request).
2. Specifications (If electronic/ Hard copy only upon request).
3. Drawings (Electronic and hard copy).
4. The form of Tender (If electronic/ Hard copy only upon request).
5. Instructions for return of the form of tender and BOQ (If electronic/ Hard copy only upon request).
6. Preliminary health and safety plan (If electronic/ Hard copy only upon request).
7. One copy of the relevant statutory consents, or if not obtained at the date of formal invitation to tender, a statement on whether they have been applied for or not and the intended date for commencement of the works (If electronic/ hard copy only upon request).

The drawings and BOQ should outline the final scale of the project and the items that are required to complete the works to the client's standards. The LCPN outline that a minimum of twenty working days should be allowed for the all of the contractor's sub-tasks, between the time from when the contractors receive the tender documents to the

time when they finally submit the tenders. Furthermore, they suggest, that for varying degrees of works, such as major projects, and also in cases where there is a departure from the standard forms of contract, that a longer period of time should be allowed.

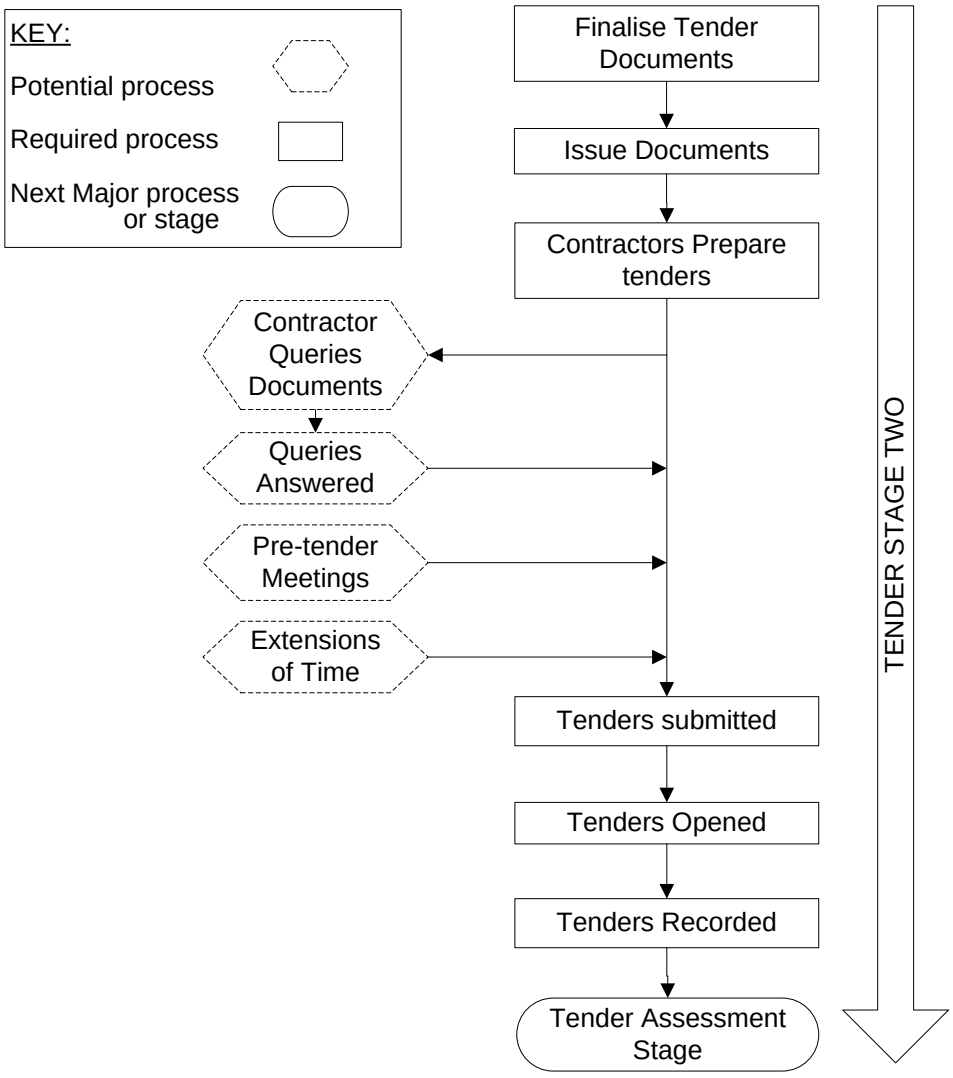

Figure 2.4 Stage 2:Tender Invitation and Submission (adapted from CIB, 1997)

With the contractor now in receipt of the documents, they will undertake to complete and return the documents within the timescale outlined. The LCPN do not outline the extent of the sub-tasks required by the contractor to complete the documents. However, both Betts (1990) and Skitmore et. al. (1993) show these sub-tasks of tendering. They explain that there are different systems and logic used by contractors when it comes to submitting a tender. Nonetheless, Betts stressed that the basic model

does not deviate widely (see figure 2.5). This figure shows the sub-processes that the main contractor can undertake when confirming the costs from their various sub-contractors and suppliers to carry out the work.

The contractor, having received the relevant quotes and having completed any other work they deem necessary to confirm their prices, should then return the documents. A hard copy of the completed tender documents are subsequently returned in a separate sealed and endorsed envelope. However, an electronic copy of the BOQ, where items are coded, as per the original BOQ and are easily identifiable to the PQS, can be submitted in lieu of a hard copy.

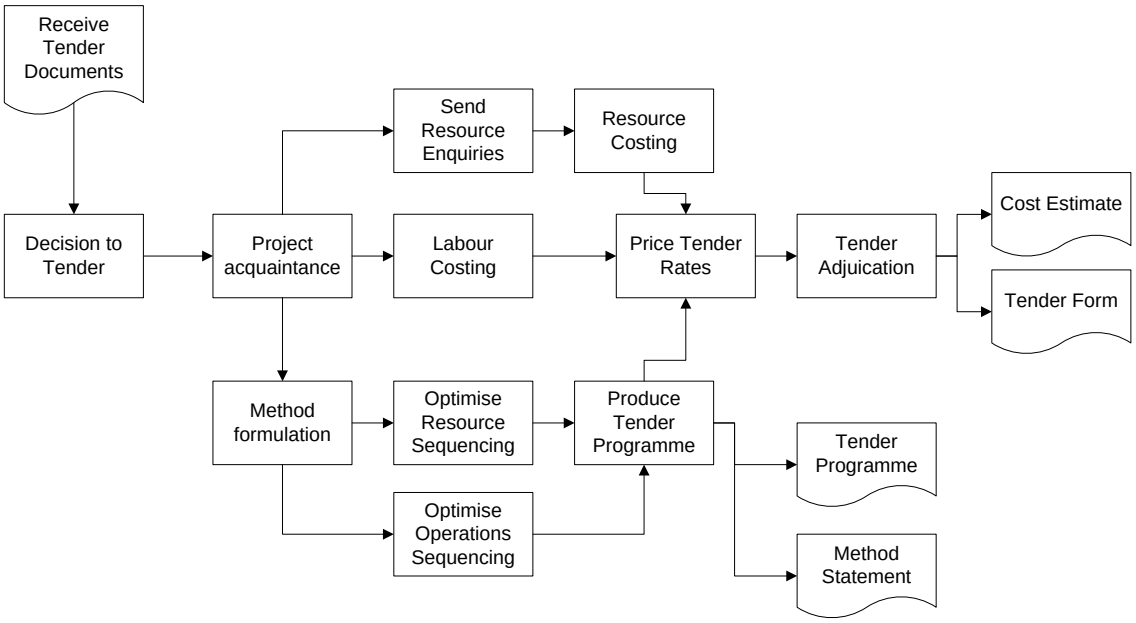

Figure 2.5 Tendering Procedures (Betts, 1990)

Further communication is required between the parties when a change occurs in either the specification or the design of the scheme. The LCPN stress that these changes should be kept to an absolute minimum. However, should any changes be made to the documents, the contractors should be notified in writing. These changes should occur, no less than ten working days before the tender deadline. If these changes are significant then an extension of time for contractors to complete the tender should be considered.

In general the procedures for this stage of the tendering process in the UK follow the same protocol. However, different proposals are made to ensure the process is still fair and clear to all parties concerned.

The CIB (1997) suggest that a separate document containing a checklist of all information that is included in the tender package is sent to the contractors. This ensures

that all contractors can request any documents they may not have received through an administrative error. Also, by default, this document will ensure that there is a clear understanding of what documents and the information enclosed within are included in any forthcoming contract.

Brook (2008) also points out that a clearly marked pre-addressed return envelope should be included in the tender documentation. Brook claims that this will prevent the received tender from being opened too early or opened by the wrong person leading to an opportunity to tamper with the tender.

According to the CIB (1997), standard forms of contract should be used. They suggest that the number of compliant tenders increases when a standard form of contract is used. This is due to the contractor's previous knowledge and experience with documents used. If standard forms are not used, it is advised that some additional time be given to the tenderers and that the contract terms are *"unambiguous, consistent and complete"* (CIB, 1997, P. 17).

On occasions where there is a change from the information given in the preliminary invitation to tender, the CIOB (1997) suggests that the contractor will need to be afforded the opportunity to examine the documents, in detail, to establish whether the changes are of such significance to discourage tendering.

2.4.3 Stage 3: Tender Assessment

All tenders received before the tender deadline will now be assessed by the client and his/her representatives. The LCPN suggest that all tender packages, but not BOQs, are opened to find the contractor who has submitted the lowest tender. This is the first of the tasks, as shown in figure 2.6 below, during this stage of the tender process. The client will then instruct the PQS to open the BOQ of the lowest tender. The PQS will examine the priced BOQ with the object of detecting any errors or qualifications within the bill. All rates and quotes given are expected to be confidential.

Should the tender contain no qualifications or errors in the computation, the PQS will recommend the tender for acceptance. However, should any errors or qualifications be found, the LCPN maintain that:

- In the case of qualifications, that the tenderer is given opportunity to withdraw the qualifications, with no amendment to the tender price. If the qualifications are not removed then the tender is rejected.
- In the case of errors, that the tenderer will be notified of the errors contained within the BOQ. S/He can then accept the previous overall total sum of the BOQ or reject this overall sum total. Upon accepting, the contractor agrees to reduce or increase his/her unit rates for the notified errors and the PQS will recommend the tender for acceptance by the client.

Should the lowest tenderer withdraw, the PQS will contact the second lowest tenderer to obtain permission to open his/her BOQ. The process is repeated until the client is advised to accept a tender.

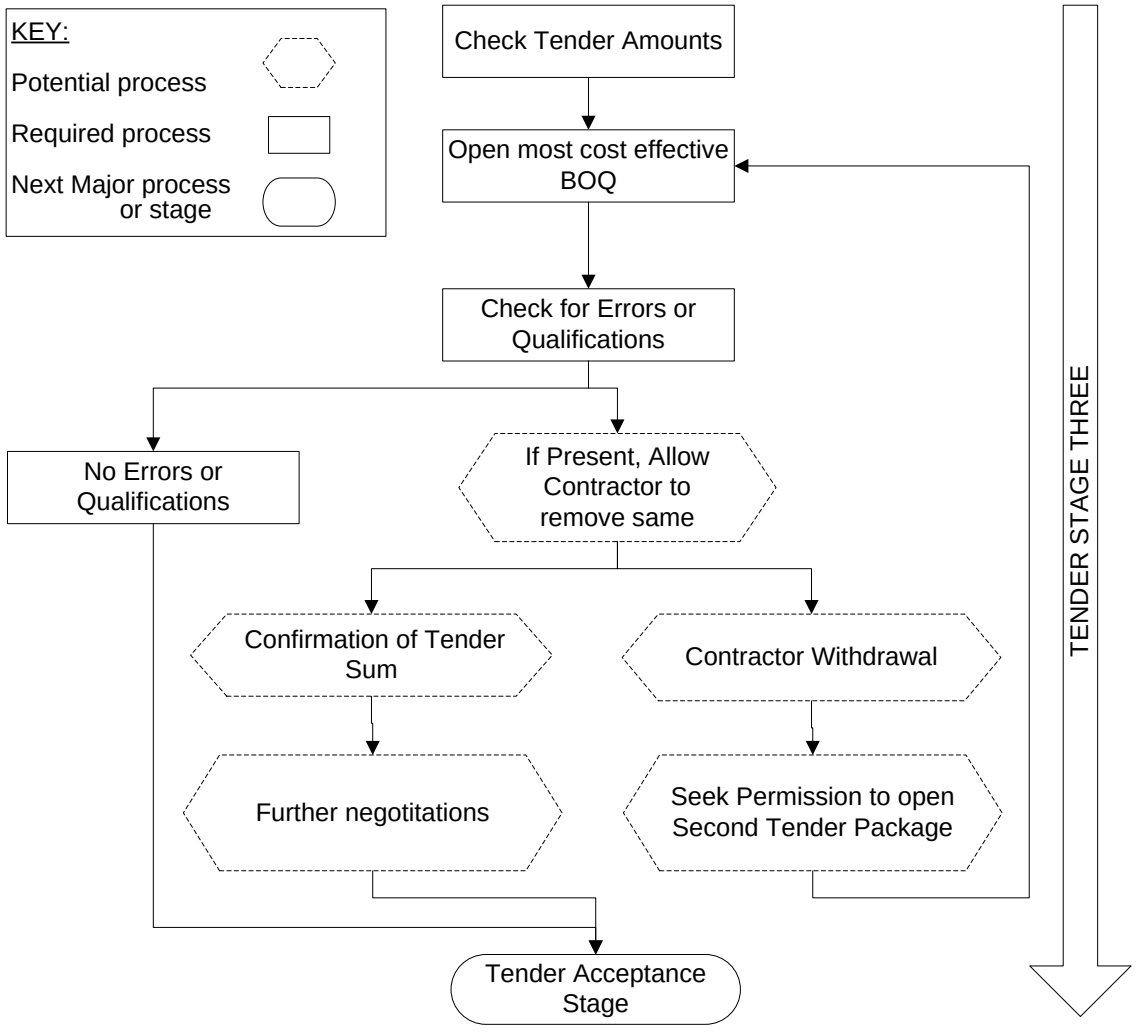

Figure 2.6 Stage 3: Tender Assessment (adapted from CIB, 1997)

In the UK a similar approach is again used. However, the CIB (1997) makes reference to including a clause in the tender documentation should arithmetical errors occur in the tender. It suggests that a clause should be inserted stating whether the overall price or rates are dominant. This should increase the clarity of the process.

Wong et al. (2000) ascertained that the U.K. construction industry was, in fact, moving away from the ‘lowest price wins’ philosophy towards a best value for money assessment approach. Wong contends that thirty-seven factors, ranging from time to complete the project, to the contractor’s head office location relative to the site location, could be considered. Each factor could be given a specific rank and value to help evaluate the tenderer’s bid for the works. Their survey concludes, however, that the vast majority of clients still opt for a 'lowest price wins' criteria. Sixty six percent of the public sector and 62% of the private sector still consider the tender price to be more important than any other project specific criteria.

2.4.4 Stage 4: Tender Acceptance

Upon choosing an acceptable tender the client will, in effect, be rejecting the other contractor's tenders. Therefore, the LCPN suggests that within two days all tendering companies are informed that a successful tender has been chosen. Also this notice should inform the contractors of all tender amounts received in numerical order. Following this, the formal contract documentation will have to be completed by both parties to seal the agreement.

2.4.5 Process particulars

It is important to note that throughout the entire process all parties are treated in a fair and reasonable manner. The CIB (1997) also stresses that a number of key principles must be up held during the process. These include:

- Clear procedures throughout the tender process.
- Identical conditions for all bidding contractors.
- Confidentiality of all parties involved.
- Practices that avoid or discourage collusion should be followed.

- Tender prices should not change on unaltered scopes of work.
- There should be a commitment to teamwork from all parties.

Following these principles should mean that there is a clear, efficient way of receiving compliant tenders for a client who wishes to carry out construction work. Additionally, this process should be confidential and ensure that the client gets the best deal possible. However, as previously suggested, in particular by Eadie et al., (2007) eTendering, as opposed to the traditional tender process, appears to be a more efficient method of completing the tender process.

2.5 Particular Problems to be Addressed within Traditional Tendering

Hughes (2003) highlighted the substantial cost that is involved in tendering finding that the cost to contractors of tendering was approximately 1.17% of the value of the work. When considered against a success ratio of, say, one in five, Hughes reported that the cost of each winning bid can be as much as 6% of the value of the work. The Canadian Construction Association (2005), found that tendering costs can account for up to 5.9% of the total value of a project cost to a client on a typical construction project (CCDC, 2005). Construction companies must recuperate this substantial cost, so that it can remain profitable. In addition, the cost of tendering was considered to be very expensive by 93% of respondents to an eTendering survey carried out by CITA in 2006. Some of the main concerns reported by authorities in respect to eTendering include:

2.5.1 Rekeying of Information

Hore and West (2005b) discussed how the re-keying of information in the construction materials acquisition process was inefficient. This logic can be similarly directed towards tendering. Tender documents are largely passed between parties in paper format due to the requirements of the LCPN (2006). Brooks (2008) pointed out that computers are used throughout the tendering process. The Construction Industry Trading Electronically Group, CITE (2000), went further in indicating that there is a significant element of re-keying of information occurring. With each page of a detailed BOQ requiring item numbering, item description and unit of measurement to be re-keyed, there is a large amount of clerical work to be completed. The CRC in 2006 agreed with

these findings. In further studies, Hore and West (2004), found that the cost of producing an invoice could be reduced by over 85% with the removal of inefficient communication processes. The figures Hore found were in line with the findings of Laage-Hellman and Gaade's (1996) findings for Electronic Data Interchange (EDI) usage in a Swedish company. However, Hore and West noted that costs such as web hosting, etc. were not included in the analysis.

2.5.2 Security Concerns

Du et al., (2004) concluded that the traditional tendering process was open to abuse. The authors cited Thorpe and Bailey (1996) and Atlas et al., (1993). Du et al., considered that through a lack of adequate security measures with the traditional system, prospective bids delivered to the PQS had the possibility to be tampered with. Tender prices may even be revealed to other prospective contractors. This leads to a tender process which lacks the key requirements of fair play and clarity that are required for a tender process, as laid out by the CIB (1997).

2.5.3 Subcontracting

A further inefficient process outlined by CITA (Curtis, 2006) is the labour intensive nature of preparing, sending and receiving accurate sub-contractor tenders for trade packages. Curtis outlined that there are many stages included in this subprocess of tendering. The most labour intensive was seen to be the preparation of the tender package for each trade. Each trade package may contain drawings, specifications and other documentation that the contractor deems necessary to fully describe the project. This individual trade information has to be sorted, photocopied, compiled for each subcontractor and finally checked that all information is present before it is delivered in hard copy to the subcontractor. Curtis explained that, on occasion after completing this work, the subcontractor may not even price the work. This can lead to a large amount of time and resources (photocopying/paper) being spent without any return. Hore et al., (2007) identified inefficient processes in practice and furthermore acknowledged that substantial information was replicated by the main contractor, when issuing documentation to subcontractors for pricing.

2.6 Use of ICT in Construction

2.6.1 ICT Uptake

The construction industry approaches any change in business processes, whether it involves technology or not, with some trepidation (Rankin et al., 2006). In 1999, IT Metrics Strategies observed that, of the major industries, the construction industry had the lowest investment in I.T. and that this was due to inertia within the industry. However, Castle (2006) concluded that new technology and its use in construction should not be seen as a threat but rather an opportunity. He maintained that, to gain the maximum benefit from any available new technologies, surveyors and the construction industry would have to adopt new working practices and develop new skills. This led the author to ask: has the construction industry begun to reap the benefits of this available technology and how widespread is its use?

In a recent survey the Central Statistics Office (CSO, 2008) have found that 98% of firms in the Irish construction industry with 20 or more staff, utilise computers. Additionally, a marginally smaller percentage (97%) also use email and the internet. Sun and Howard (2004) noted that, in the UK, computer uptake was at similar levels. They also discussed how the improvement in computer processing capabilities has helped to drive the growth, shown in figure 2.7, to almost 100% of the construction industry. Also, in Sweden, Samuelson (2008) reported that over 80% of Swedish office based workers in the construction industry have their own computer.

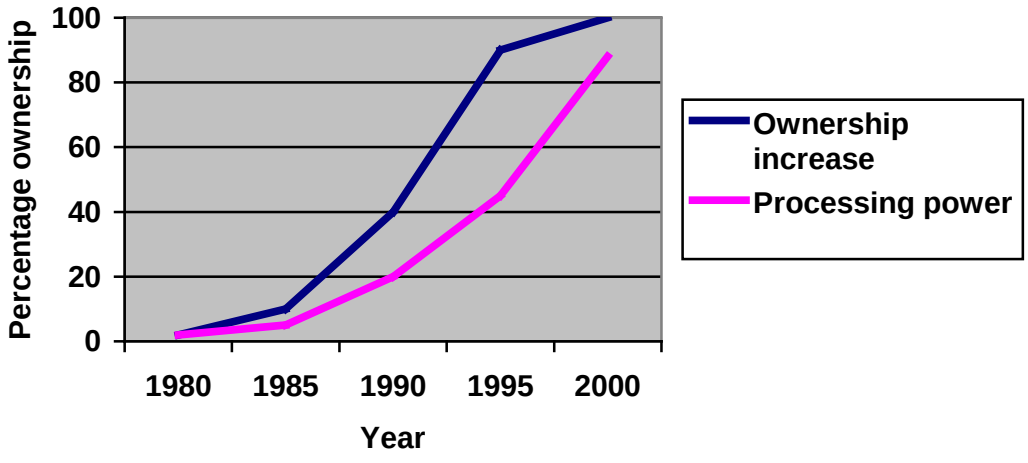

Figure 2.7 Personal Computer Ownership in the UK (Sun and Howard, 2004)

Samuelson (2008) noted that the simplest use of ICT (email and internet) was both closely and directly correlated to the numbers of individuals who had computer access, showing that of the 80% of workers who had access to computers, approximately 95% had access to email and internet functions.

Specifically in Ireland, CITA was formed in 2001 with a view to increasing the knowledge, uptake and use of ICT in the construction industry (www.cita.ie). CITA has identified a number of key areas where improvements can be made in the sector. The areas covered by the alliance range from the use of project extranets to the use of mobile technology in construction. Many of the major Irish construction companies have become members of the alliance with a view to assisting it in obtaining its strategic goals (Thomas and Hore, 2003).

The construction industry can therefore be acknowledged to have high levels of computer ownership. Furthermore, Sarshar, et. al (2002) concluded that construction spending on ICT and associated training was beginning to increase. It was believed that construction companies were beginning to contemplate ICT and its use as an important strategic tool. It would thus appear that all interested parties have relevant access to the most basic of computer applications (i.e. Word, excel, etc.), while Samuelson's (2008) and the CSO's (2008) findings indicate that they also have access to ICT technologies, such as, email and the internet.

2.6.2 Redesigned Business Processes

In a survey of journal papers, El-Gandour and Al-Hussein (2004) found that there were up to 43 areas where computer applications were applied in the construction industry, ranging from estimating and cost control to dispute management. Additionally, through a series of case studies in Canada completed by Rivard et. al in 2004, it was found that several firms across Canada were at the cutting edge in their use of ICT at that time. Canadian companies were using three-dimensional Computer Aided Design (CAD) tools, collaboration software and dedicated custom designed web sites hosted by construction companies. Yet Rivard also found that these companies are the exception in the Canadian construction industry rather than normal practice.

More recently, Samuelson (2008) suggested that the focus of construction companies, when it comes to ICT, is to support the existing processes that they

undertake. Whilst the support does improve the processes, further improvements could be possible with a further degree of ICT incorporation. With both Samuelson's and Rivard's findings, it is, therefore, arguable that the high levels of ICT usage are being used to support rather than to improve the existing processes to the highest possible standards. Hore and West (2005a), cited both Li (1996) and Hammer and Champy (1993) in concluding that, for construction companies to gain maximum benefit from the information technologies revolution, the processes need to be redesigned around ICT rather than ICT being imposed upon an already inefficient processes.

An example of re-engineering the process, is shown in a number of papers by Hore et al. (2004-2007). These papers discussed how ICT was used to re-engineer the material's purchasing process. Hore's research suggested that the cost of the purchasing process, per purchase, could be reduced by over 85%. This work included a re-engineered pilot project, in which the feedback from the companies revealed that they were satisfied with the new processes of eOrdering and eInvoicing (Hore, 2007).

2.7 Current Use of ICT in Construction Tendering

The CIOB (1997) established that the two main uses for computers in estimating are:

1. To have a database of the names of suppliers and sub contractors, and
2. To produce a priced BOQ.

The CIOB designed a workflow which includes 15 items of work to be carried out by an estimator and an assistant, when inputting a BOQ into a computer system. This workflow includes tasks, such as, the manual input of the entire BOQ into the software used, coding the items by trade, as well as, checking that summary pages are totalling correctly. However, the CIOB suggested that when this is completed, the BOQ can be easily broken into individual subcontract packages, printed and sent out for pricing. Thus, the computer can be used by the estimator for collecting, reorganising and distributing information. The main processes in this workflow can be seen in figure 2.8.

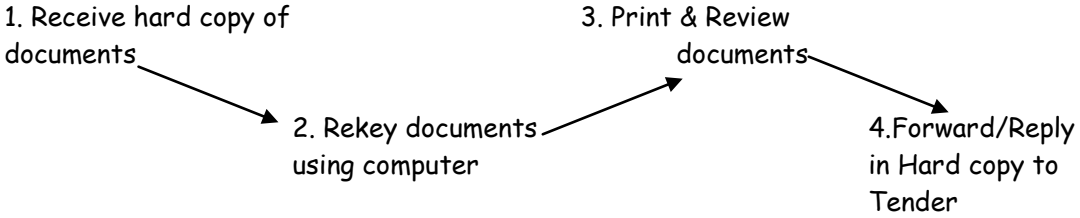

Figure 2.8 Receipt of Tender Documents CIOB (1997) Workflow

More recently, Brooks (2008) stressed that computers are an integral part of the estimating process, outlining that many estimators and QS's are using a wide range of specialist software. This software is used in-house for a considerable number of tasks including cost planning, calculating bar schedules and rate build-ups. It is, therefore, reasonable to assume, based on the previous references, that the production of the majority of documentation used in the tender process is carried out by electronic means. Consequently IT is currently a fundamental part of the tendering process.

However, with IT being such a stable ingredient in the tendering process, Brooks (2008) was disappointed by the refusal of companies to begin exchanging certain tender documents in electronic format in lieu of hard copy. CITE, also known as the Building Centre Trust (2000), recognised that many companies used different estimating software and that the different software packages were not compatible with each other. CITE had developed software which enabled construction professionals involved in the tender process to open many different formats of BOQ, no matter what software was originally installed on the computer. This assisted in the exchange of electronic tender documents and eliminated the re-typing of the BOQ. They suggested that with this electronic communication, the processes required to be involved would change from figure 2.8 to that as shown in figure 2.9

This was the beginning of electronic communication of tender documents. To further investigate the uptake of this technology, Westcott and Mayer (2002) surveyed contractors' experiences of internet/electronic tendering and the exchange of tender documents electronically in the UK. Through these surveys, they found that between 15% and 24% of construction companies had experienced eTendering, while one survey claimed that 41% of the companies had no knowledge of tendering using electronic means. This would seem to somewhat substantiate Brook (2008) claims of limited electronic communication of tender documents in construction.

Figure 2.9 Receipt of Tender Documents New Workflow

The Royal Institution of Chartered Surveyors (RICS) issued guidance notes on eTendering in 2005. These notes were seen as a response by the RICS to the growth in preparation/issuing/receiving of tender documents in electronic format. This growth was further reported in CITA's eTendering survey in 2006. CITA found that 73% of the respondents had received tender documents electronically and that 53% of the companies were seeking subcontract tenders electronically.

To conclude, ICT is very much a part of the tendering process in Ireland. There is wide scale preparation of tender documents using ICT. In more recent times, focus has however, shifted from the basics of simply preparing the documents using ICT to using the available technology to electronically transmit this information.

2.8 Overview of eTendering

In 2005, the RICS defined eTendering as *"the electronic issuing and receipt of any tender documentation as part of the procurement process"*. A fully operational eTendering process will allow for all stages of the traditional tendering process to take place electronically. This can take place through a web-enabled tender system. The RICS (2005) further explained that a web-enabled tender system is a unique website/extranet that enables access to all the participants of the tender process, via a login name and password, in order to upload and/or download documents. Betts (2006) refers to this website/extranet the "*tender box*". Technology is already available to allow communication of this type to take place, and is frequently called collaboration software.

2.8.1 eTendering Process

An illustration of the change in communication in respect to eTendering can be seen in figure 2.10. This figure represents the Network for Construction Collaboration Technology Providers (NCCTP, 2006) view of communications before collaboration technology, and how communication can be improved with the addition of this technology. The NCCPT describe collaboration software, as a system that is used to eradicate linear communication between team members. This linear communication can lead to islands of information existing between different members of the project team.

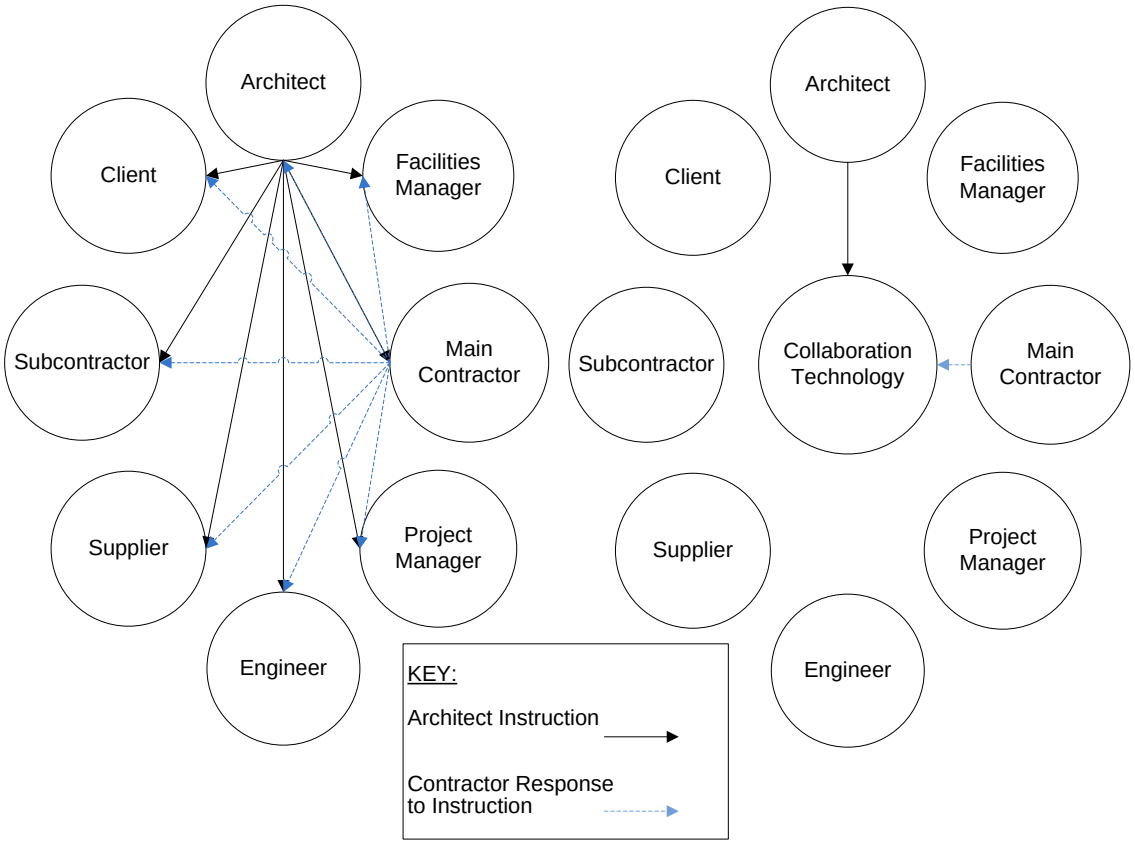

Figure 2.10 Project Collaboration (NCCTP, 2006)

A feature of the web enabled tender system is that all the information is lodged in the tender box and parties can access designated levels of information (RICS, 2005). The parties involved can include those involved in the normal tender process, the PQS and a number of main contractors, to additional participants, such as, the client and main contractors sub-contractors or suppliers. Individual parties will also have different views of the web space. The author has prepared an illustration shown in Figure 2.11 that represents the communications and views that the parties have through this system. It shows that, similar to the collaboration technology, the interested parties can access the tender box and view the information that is held in electronic format. However, different parties have separate options and accessibility to items held in this fashion. As per the normal tendering process, the tender submission can only be viewed by the client and his/her representatives and only after the tender deadline has passed.

Betts et al (2006) noted that there are two separate types of web-enabled systems being applied at the moment. They are:

1. Principle based; The client administrates security, authenticity etc. aspects of the tender box.

2. Trusted Third Party (TTP); A third party administrates security, authenticity etc. aspects of the tender box.

The RICS eTendering Guidelines (2005) suggested that the majority of systems are third party based and subject to a subscription fee. The TTP will then complete a range of tasks to ensure the process is secure, confidential and clear to all parties involved. These tasks include monitoring all tender alterations and notifying the tenderers of these changes, as they occur (CITA, 2006). Another task carried out by the TTP is to ensure the tender responses are held securely in the tender box until the deadline for submissions has expired (www.etenders.gov.ie). A member of the client's team can then 'unlock' the tender box to allow access to the contents.

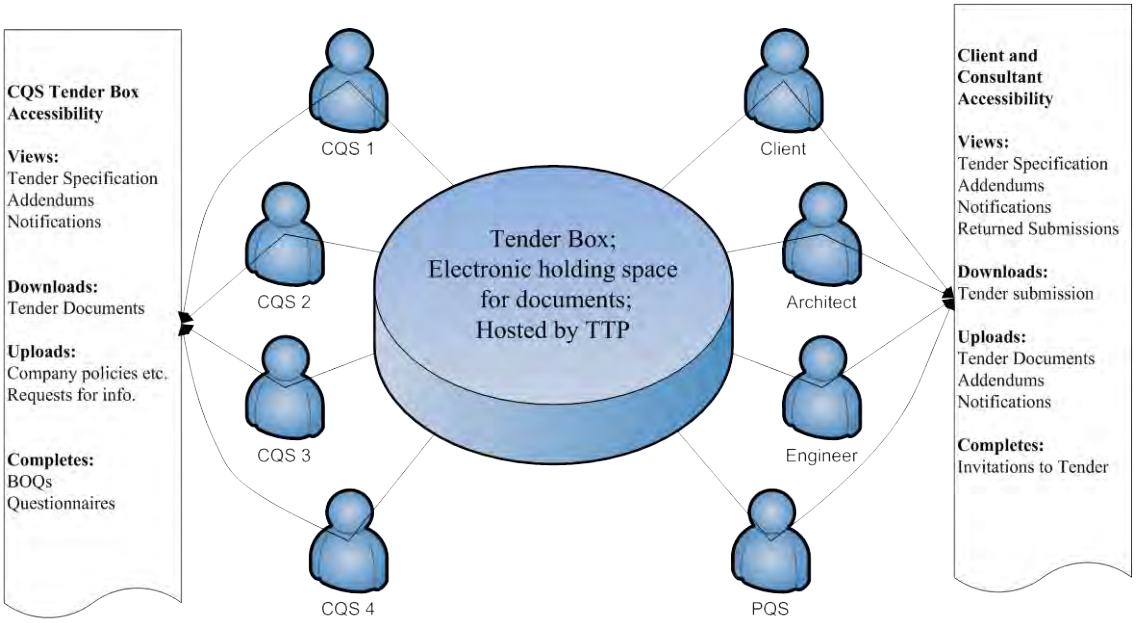

Figure 2.11 TTP Tender Box

2.9 eTendering: Perceived Gains, Efficiencies and Barriers

The benefits of eTendering are perceived to be spread among the clients, their representatives, main contractors and the sub-contractors who are tendering for the works. For the most part, however, they fall under a number of headings.

2.9.1 Time Savings

As seen earlier in figures 2.8 and 2.9 the issuing of tender documents removes the aspect of having to re-key received tender documents into an estimator's computer. This can lead to significant time savings, which can be seen as the main efficiency generated from the use of eTendering.

These simple changes in the process were implemented in case studies by the Building Centre Trust (2000). One such study carried out with the Northern Ireland Department of Environment found that a saving of 95% on time was accrued due to the tender being sent to the contractor in an electronic form. This 95% saving was generated by elimination of the possibility of 50 pages of the tender not having to be "scanned, printed and verified", an exercise which could have taken upwards of three hours. Instead, the documents were received in an electronic format leading to a download time of just three minutes to the surveyor's computer (Building Centre Trust, 2000).

Booty (2004), in an interview with Leigh Fyffe of Scottish Life, also found that there was up to 1.5 days saved per tender, when an eTendering system was introduced to their facilities management department. However, it was stressed that when tendering for large construction projects with numerous companies, this time saving could be greater. These time savings can be viewed as substantial, when seen from the employer's perspective. The time saved by reducing such tedious and repetitive tasks, which includes the re-keying of information, can be utilised more effectively by a highly qualified member of staff.

Time savings can also be evident in the tender appraisal. The RICS guidance notes state that the return of an eTender should allow for more rigorous assessment. This is due to the tenders being returned in a standard computerised format, which means all the information can easily be inserted into one spreadsheet showing all the relevant figures. This removes the re-keying and re-typing exercise that is still required of the client's quantity surveyor's staff.

Time savings were also seen in a pilot study by Woking Borough Council (2003). They found that, through the use of eTendering, they reduced the time required to complete the processes of sourcing tenderers, to creating tenders, distributing tenders and assessing the final tenders, by over 75%. They verified these figures by undertaking the same tender process in the traditional method, as well as electronically. Overall time

savings of approx 58% were achieved. This resulted in an approximate savings of £7,700STG per tender.

2.9.2 Cost Savings

Following from the above time savings, it is easy to understand that there will also be cost savings on individual tenders due to staff not having to spend large amounts of time checking re-keying and verifying information. However, this is not the only form of saving that is generated through the use of eTendering.

There are also savings to be made on the administration and printing costs. Returning to the earlier example of time savings per tender for Scottish Life (Booty, 2004), they reported a further saving of £1,500 per tender due to the use of a closed-bid eTendering system. This was merely in the photocopying and other resource areas required to complete the tender package. However, will the clients only benefit from these savings or are these costs merely passed onto the supplier? Passing these costs on to the supplier will in turn only serve to further increase each and every tender price.

This was not seen to be the case, however, with the fit out contractors, Interior Design Concepts. They used this system to win contracts from Scottish Life. Booty interviewed their managing director, Mike Aksoy and found that approximately £250 was saved per tender through decreased paperwork and courier costs. Thus, it can be seen that savings can accrue to all parties involved in the tender process.

Again Woking Borough Council (2003) documented their savings by utilising a ‘paper less’ tendering system. They concluded that up to £650 was saved per tender in using this system.

2.9.3 Improved Accuracy

In the traditional paper based system, errors can occur in the computation of the tender sum during the manual completion of a BOQ. This task is also known as “inking” a BOQ. The CIB (1997) made particular reference to this. They said specific terms should be defined within the tender documentation regarding computational errors in a BOQ. Specifically the terms should state whether the tender rates or overall price is dominant when an error occurs.

With eTendering these computational errors should not occur. Initially, the BOQ

will be received in an electronic format, with only the rate column being accessible for adjustment by the main contractors (CITA, 2006). The software used for the input of information will systematically calculate the overall price based on these rates. This will mean that errors in computation can be removed from the process. This aspect of eTendering was seen by respondents to CITA's eTendering Survey (2006) as one of the main factors that attracted industry professionals to the system.

2.9.4 Security

Du et al., (2004), suggested that the traditional hard copy tendering system was not as secure, as required for tenderers to feel safe that their confidentiality was protected. However, Du et al., described how the technology is available, when it is carefully integrated into the eTendering system, to fully secure all access, uploads and downloads to a web-enabled tender system. This they suggested not only improved efficiency but the security and reliability of the traditional system.

2.9.5 Barriers

Martin (2003) found during his UK survey that project collaboration technologies had a number of advantages, some of which were discussed in the above paragraphs, and disadvantages. As discussed earlier, the advantages of such a system includes items, such as, increased transparency, speed of information transfer and increased accessibility. On the negative side, Martin found that individuals revealed there was a cost, in both time and money, to print scale drawings. Additionally, it was established that some members did not have adequate IT and there was a lack of a filing index.

More relevant to eTendering is the paper by Eadie et al., (2007). Their literature review and survey suggest that there were eleven marked barriers to the eTendering process being undertaken in Northern Ireland. These barriers were: the legal position of e-procurement, company culture, upper management support, IT infrastructure, IT systems too costly, lack of technical expertise, lack of e-procurement knowledge / skilled personnel, lack of business relationship with suppliers providing e-procurement,

security of transactions, interoperability concerns, no business benefit realised.

2.10 eTendering: National and International Developments

The development of the eTender process can be traced back to 2000 (Building Centre Trust). However, considering the advantages to the use of the process, it should be noted that its use is not prevalent in the Irish construction industry, as a whole.

Betts et. al. (2006) suggested that there are three separate stages to the development of a fully operational system of eTendering. These are:

1. Principle to tenderer communication (advertisement and issuing of documents).
2. Tender submission and two-way communication.
3. Electronic contract formation and contract administration.

On a larger scale, at what stage are Ireland, the UK and other nationalities in implementing this process?

2.10.1 Irish Perspective

In the public sector, in 2001, the Irish government commissioned a report by Price Waterhouse Cooper (PWC) to investigate the possibilities of gains from implementing an eTendering system for the procurement of all its commodities and services. They found that large savings could be made though the effective use of ICT tools. According to the report, the process could generate potential savings of €177 million per annum after 2007. This relates to approximately 2% of the projected spend of €8.8 billion on commodities and services included in the report.

Based on this report, the government procurement website www.etenders.gov.ie, as shown in Figure 2.12, was introduced. This acted as a catalogue of prospective supply only and supply and install public projects that were available to tender. The tender information could also be downloaded by prospective suppliers from this website. It was also acknowledged (www.etenders.gov.ie; 21/6/06) that Ireland was second among all European countries for advancement in electronic procurement. The website confirmed that it publishes 95.2% of all public tender notices required by the OJEU(Official Journal of European Union) in electronic format, where as the average percentage across the EU was at only 57.4%. This system of publishing tender

documentation has generated up to 75% cost savings when compared to the traditional newspaper advertisement process (IBM, 2003).

However, in recent times www.etenders.gov.ie has further developed. The website will also accept returned and completed tender documentation. The www.etenders.gov.ie website calls this a secure post box facility. Thus it can be seen that stage two of Betts developmental process has begun in the public sector in Ireland. In addition to this, a Department of Trade, Enterprise and Employment report (2006) concluded that the final 3rd stage of eTendering, online evaluation, should be introduced, coinciding with additional training and promotion of the available eProcurement systems. However, even with these progressive steps the CSO (2008) reported that only 29% of construction firms have undertaken a public electronic tender.

Consequently it can be seen that, from an Irish perspective, eTendering in the public sector has by and large completed stage one of the development process and is in the beginning of implementing stage two of the development. However, as noted by Westcott (2002), there is one main drawback to the implementation of stage two of the eTendering process. Due to the nature of the market having to be entirely open for government jobs, both electronic and paper based tenders must be accepted to ensure competition and that all interested parties can compete.

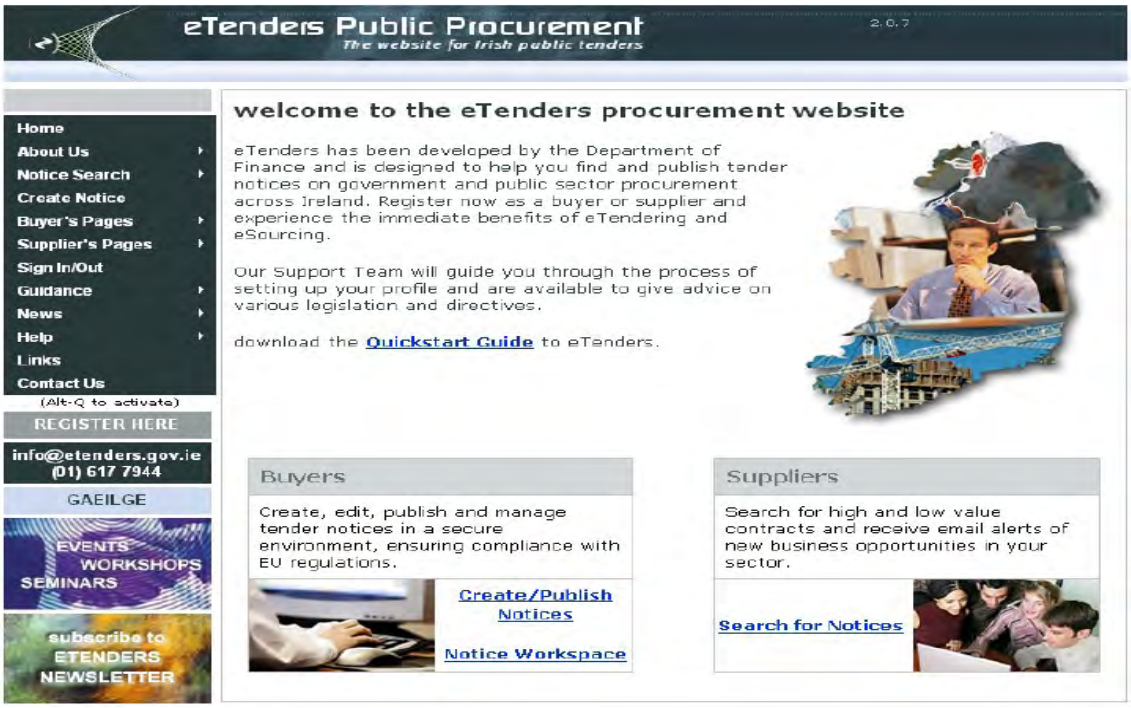

Figure 2.12 www.etenders.gov.ie

In the private sector, a good barometer of opinion was CITA's eTendering survey (2006). This survey confirmed that the respondents understood that there were benefits and savings to be made with the implementation of eTender systems. The survey also found that 93% of the respondents were willing to consider using secure web-based technologies.

CITA's report also summarised, however, that the Irish construction industry had large concerns with the implementation of this process. The respondents suggested that a lack of government drive and leadership, software standard issues and the lack of security of tender documents were the main causes behind a slow uptake figure. Of all the companies surveyed, only 27% were returning the tender documentation electronically.

Another major drawback which prevents the process from being supported in its entirety by the industry is a Liaison Committee note (14.2), which states that completed forms of tender shall be submitted in printed format only. This can only compound the observation of CITA that eTendering will take time to establish in Ireland, due to a number of unresolved issues.

2.10.2 UK Developments

As previously stated, due to the rise in electronic preparation of bill of quantities, the RICS published its own set of notes on eTendering in 2005. These practice notes encourage the use of eTendering. However, they emphasise the fact that many companies do not use identical software, which can thereby lead to compatibility problems. For example, in a pre-qualification questionnaire they list all the standard items that would be deemed necessary in a normal tendering process such as: project details, company details, preliminary health and safety plan etc. However, they also include a detailed information checklist, an extract of which is shown in figure 2.13, which includes a list of formats in which information can be provided (word processor, spreadsheets, photographs etc.) and then asks the company to provide details of the preferred file type, in which they would wish to obtain the electronic information.

In the UK's private sector, Building Centre Trust (2000) encouraged the use of such software. In 2000, they conducted a number of case studies using eTendering. In three separate studies they found that there were many benefits to the use of such

technology. For the most part, they found that electronic exchange of data released trained staff to use their skills effectively rather than in a clerical fashion. A range of companies are now offering a disperse combination of ICT services for construction companies.

Information Type	**Package**	**Software Vendor**	**Version**	**Preferred File Format**
Standard Business Applications				
Word Processing	***Word***	***Microsoft***	***9.0.3822***	***Microsoft Word Document***

Figure 2.13 eTendering Pre-qualification Questionnaire (RICS, 2005)

Additionally these companies also actively encourage the use of their eTendering software. The companies include 4Projects, Asite, Buildsofts BOLTS, BIW Tendering, RICS eTendering and Sarcophagus. The majority of these companies, through their websites, also issue white papers discussing the advantages and benefits of their systems over the traditional systems that are in place.

Of the above-mentioned eTendering companies in the UK, Sir John Egan's Asite has performed particularly well for Laing O'Rourke on the New Terminal 5 building at Heathrow airport. Through using eTendering for the procurement of subcontract packages Laing O'Rourke reduced the actual tendering cost by approximately 70% (www.asite.co.uk). This was mainly due to reduced time required to complete their work by the Laing O'Rourke staff. Also the RICS' eTendering solution, available at www.ricsetendering.com, suggests that time savings of 29% are possible when using its system. It also outlines the cost of its service to be from £325 - £500 per tender package. These costs were identified in the RICS' case studies, as more than reasonable.

With a wide range of eTendering solutions available to companies, Martin, in both 2003 and 2008, has completed survey based research on the utilisation of ICT tools in the construction industry. The initial research was completed on the topic of eProcurement and extranets in the UK construction industry. In this survey both consultants and contractors were surveyed. He found that a slight majority of BOQ were prepared on word processors or spreadsheets in the UK. Additionally, four proprietary systems (CATO, Masterbill, RIPAC and Snape) dominated the remainder of the market. However, only 29% of the electronically prepared documents were then exchanged

electronically.

The electronic transfer of these documents was broken down as being: 45% being sent on disk, 52% being emailed and the remaining 3% being sent using a web portal. Additionally, when the documents were sent electronically, one particularly large PQS firm responded that 65% of documents were sent in PDF format to avoid tampering. Martin subsequently established, but did not rank, a number of both attractions and barriers to potential users of project extranets. These can be seen in table 2.1.

Martin's (2008) most recent research was a survey that was carried out in 2006 by BCIS in the UK. The survey was sent to 4000 members of the RICS and a response rate 7.4% was achieved. The respondents had been involved in approximately 25 tenders in the previous year.

When asked if the respondents would utilise a web based portal system, all costs being equal, over one third responded negatively to the idea of utilising the technology. Additionally, 90% of clients either rarely or did not encourage the use of the technology during a tender request. Furthermore, it was established that the percentage exchange of tender documents in electronic format was at 35% for the issue of documents, while a lower percentage of 26% was recorded for the submittal of tender documents. When asked how the respondents electronically transferred the documents, the following results were obtained: 29% use physical methods (e.g. CD-Rom) to transport the electronic data, 64% used email to communicate the documents and only 7% had utilized a web based portal.

Attractions	**Barriers**
Instant availability of information	Costs of printing shifted down supply chain
Reduces risks	Copyright issues
Better information to all parties	CAD training
Reduces resource input and remaining time means an increase in output quality	IT infrastructure
Transparency of process	ICT access can be unachievable in some areas
Improved communication	Inflexible system
Increased accessibility	Lack of indexing
Audit Trails available if required	
Reduced risk of using out of date data	

Table 2.1 Project Extranet (Martin, 2003)

A number of drivers were subsequently put to the respondents. The majority of respondents agreed that lower administrative costs, better access to information, reduction in effort to analyze tender documentation and a deduction in tender timescale were all drivers to the introduction of eTendering. The paper did not disclose any survey results on barriers to eTenderings adoption.

As shown above, Martin identified, that a level of eTendering was occurring in the UK. Furthermore, a number of key drivers that encouraged the use of eTendering were established. However, Martin concluded that while the survey's respondents accept eTendering and the possible benefits and cost savings it could have to their company, that it has yet to be taken seriously by the UK construction industry. This conclusion was based on the finding that a majority, 63% of respondents, had failed to read their own societies guidelines on the topic. Furthermore, Martin suggests that from his experiences, there was a significant level of industry inertia towards using eTendering products.

To this end Eadie et al., (2007), has completed research on the drivers and barriers to eProcurement in Northern Ireland. This survey was based on contractors survey responses. The main drivers and barriers identified by Eadie can be seen below in table 2.2 and 2.3 respectively. The survey analysed the drivers and barriers based on a CD-Rom method of communication, which was then applied by the Road Service Northern Ireland (RSNI), and a web based portal method of procurement. The main attractions and barriers established by the survey, were subsequently compared with those found in other studies. The main conclusions of the research led the author to conclude that eProcurement in construction was very different to what was established

Driver	Rank: CDR based	Rank: Web Based	Overall Rank
Improving Communication	1	1	1
Reduced administration costs	1	3	2
Price reduction in tendering	3	4	3
Gain competitive advantage	6	2	4
Reduce time to source materials	3	6	5
Reduce operating and inventory cost	5	4	5
Reduce Staff levels in procurement	7	7	6
Enhance Decision making and market intelligence	8	8	7

Table 2.2 eProcurement Drivers For Contractors in Northern Ireland (Eadie et al., 2007)

in other industries. The main difference being the specialised and varied nature of construction work when compared to the manufacturing sector. This conclusion was established due to the marked differences in the driver and barrier rankings by the Northern Ireland construction industry compared to surveys of general goods and services in America and Australia.

Barrier	Rank: CDR based	Rank: Web Based	Overall Rank
Security of transactions	1	2	1
Unsure of legality	2	1	1
Lack of business relationship with suppliers providing eTendering	3	3	3
Lack of eProcurement knowledge/skilled personnel	4	4	4
Interoperability concerns	5	6	5
Lack of technical expertise	6	5	5
No business benefit realised	7	7	7
Company culture	8	8	8
Upper management support	9	9	9
It systems too costly	10	10	10
Lack of Infrastructure	11	11	11

Table 2.3 eProcurement Barriers For Contractors in Northern Ireland (Eadie et al., 2007)

In the UK's public sector, the eProcurement Scotl@nd initiative was given particular attention by Forfas (2008). The service offers eTendering facilities though secure participant login and password system. This system has generated an approximated £200m savings on a total spend of £2bn in 2007. However, on this site there are no clear indications of the level of the systems use for the construction tendering process. More recently, however, Millstream Associates have been contracted to launch www.publiccontractsscotland.gov.uk.This site operates in a similar manner to Millstreams Irish eTenders equivalent.

From the range of sources found, the author's understanding is that eTendering is at a slightly more advanced stage in the UK's private sector (Martin, 2008) than in Ireland. However, adjudication of the public sector is more difficult. Forfas (2008) shows the UK at being more advanced at this stage of procurement. Yet the most recent initiatives, as seen in the www.publiccontractsScotland.gov.uk website, are not as well established as their Irish counterparts. One aspect of the UK's undertaking of this technology stands out however. Through the publication of practice notes, the RICS

seem to have accepted that eTendering is becoming more prevalent and that they need to standardise the delivery and execution of the process. This should ensure that the process is carried out in a clear, concise, secure and fair manner.

2.10.3 EU Perspective

"A clear priority for the EU is to close the important gaps in the Single Market, particularly in services, and this includes: ... public procurement." (European Commission, 2008, P.7). This quote from the European commission is in relation to the use of ICT and eProcurement in developing a single European market place. Westcott (2002) suggested that e-procurement, including etendering, was a central plank of developing the single European market. E-Procurement, suggests Westcott, can be used to break down barriers to trade between member states and it can encourage intra-state trade by requiring public procurement of works and services to be advertised throughout the EU.

Overall the EU views and timetables on E-procurement and tendering are outlined in their "Action Plan for the Implementation of the Legal Framework for Electronic Public Procurement" (European Commission, 2004). The European goal, according to this report, is to save 5% and between 50-80% on procurement and transaction costs respectively by means of electronic communication. The report also stresses the need for interoperability in both electronic signatures and other formats of document use. On a final note, the report states the sooner such reforms of the procurement system are in place the better for all its citizens and businesses.

Similarly in a report prepared by Romboll management, 2004, for the EU it was noted that the total expenditure on goods and services contracted by European government bodies was worth approximately €1,500 billion. This equates to approximately 16% of total EU GDP. The report continues to point out that through increased cross-border trading and procurement initiatives the prices paid by national regional and local authorities for supplies, works and services has dropped by up to 30%.

An internet site similar to that of www.etenders.gov.ie, has helped to achieve these cost savings. It is called Tenders Electronic Daily. This site publishes all European tenders by public bodies above the required threshold amount which varies for the types

of contract being tendered. These tender opportunities were originally published in hard copy but from as far back as 1998, have been available in electronic format only. All works in EU states required to go to public tender can be easily found through means of a search engine.

Individual countries are moving at different paces when it comes to adapting to these new technologies. In the EU's Impact Assessment Action Plan on e-public procurement (Romboll Management, 2004) it can be seen that Ireland was to a large extent compliant with eTender notification and public notification, while in countries like France this process was still undergoing pilot projects. More recently, however, a Forfas (2008) report noted that France had progressed above Ireland to providing a complete eProcurement system. This report also noted that of 15 EU countries, Denmark was the current leader in the implementation of eProcurement technologies, as they have introduced the additional phase of eInvoicing. Samuelson (2008) reported that 60% of Swedish survey respondents utilise ICT communications over 60% of the time when communicating tender documents. Furthermore, Samuelson established that this was a significant increase in eDocument transfer when compared to earlier surveys.

The EU has stated that *"Public services are a major part of the European economy"* and that *"A key challenge is to make these services better, more accessible and more cost-effective."* (European Commission, 2005, p.9) Due to this the commission is regularly checking and promoting a European wide eProcurement strategy. This can be seen in the establishment of websites similar to those of the Irish eTenders website. However, their levels of uptake as show by the DG Internal markets report, 2007, can vary from late or little adoption of electronic techniques to an advanced state.

2.10.4 Other International Perspectives

In the Australian public sector, each state has developed their own eTender platform. These platforms are described in an industry report by the Co-operative Research Centre (CRC, 2003). This report shows how many of the Australian state governments have enacted the second stage of eTendering. More recently as stated by the New South Wales tenders website, (https://tenders.nsw.gov.au), *"Under Premier's Memorandum 2006-11 NSW Procurement Reforms, all NSW Government agencies, other than State*

Owned Corporations, are to make Requests for Tender documentation available and tenders able to be lodged through the NSW Government eTendering system by June 2007."

Additionally the CRC in Australian have published a number of documents in regard to the considered uptake in eTendering technologies. In 2006 a guideline on the successful implementation of the technology was produced for the industry. In addition to this a further report regarding concerns on security and legal requirements was published. This report suggests that considerable money was spent by state bodies and that the current tender process was largely paper based. The report wished to reassure individuals of the secure and legal manner of eTendering.

Another area where the introduction of eTendering is being discussed is the middle east. Al-Lawati and Aibinu, (2008), surveyed 100 potential respondents chosen at random from the Omani government tender board listings. Four groups were represented within this survey: consultants, contractors, suppliers and clients, with 25 members of each group being sent survey questionnaires by post. A high response rate of 64% was achieved with the majority of individuals being previously involved in over thirty tenders. Initially the respondents were questioned on their satisfaction with the current tender process in Oman. A majority of 53% of respondents were satisfied with the procedure, while only 20% of respondents were dissatisfied. The remaining percentage had no significant feeling of either satisfaction or dissatisfaction towards the process.

The survey proceeded to ascertain each of the four groups' willingness to undertake eTendering. All groups, with the exception of the consultants, were willing to undertake the proposed Omani eTendering system. Additionally, the survey asked respondents to indicate what items would either encourage or discourage their willingness to implement the technology. From 17 literature reviewed possible items, it was found that internet threats, clarity and simplicity of an eTendering systems, efficiently designed websites and the potential for time savings were likely to have strongest influence on the willingness of organisations to participate in eTendering.

Finally, it was proposed that increased awareness of eTendering and its benefits, would be the best route for the Omani government to undertake, when attempting to promote the use of such technology in future years.

2.11 Conclusions

The author began this chapter with a number of objectives that were to lead to the completion of an overall chapter aim discussed in section 2.1. The first objective was to understand and critically discuss the tender process in the construction industry. This objective was realised by defining tendering as the process required to obtain a firm price from a suitable contractor to complete the works the client requires (The Aqua Group, 2006). Further to this, the tender process was broken down into a four-stage process; Pre-qualification, Tender invitation and submission; Assessment and Contract award (CIB, 1997). The author proceeded to examine these four stages of the process. Having discussed the process, the author then assessed the process inefficiencies and the possibility that emerging technology could reduce the inefficient nature of the process.

With the detail in which the Liaison Committee Practice Notes (2006) defined the tender process, the author found it difficult to understand why inefficient processes would be "designed into" the process. Therefore, a key conclusion of the author is that the key processes are not inefficient. Then, as per the author's second objective, the processes prevailing inefficiencies were identified. They were established to exist within the tender processes communications between the client, contractor and subcontractor (Building Centre Trust, 2000; Curtis, 2006; Hore et al., 2007).

These inefficiencies have been highlighted with the rapid expansion and growth of ICT within the construction industry (CSO, 2008; Martin 2003 and 2008). This rapid growth has lead to the establishment of web-enabled tendering systems. These systems reduce the need for labour intensive processes, prior to and after the receipt to the communication of any tender documentation. They also ensure that the parties involved are always able to access the information and use it at their discretion when completing a tender for a project.

The final objective was to establish if eTendering can assist in the reduction or possible removal of the researched inefficient processes. This objective was met when the author showed that web-enabled tendering systems can significantly reduce labour intensive and costly sub processes within the tender guidelines (Woking Borough Council, 2004). This can result in cost savings to both the client and the contractor. The research in hand will further explore this chapters findings and the extent to which benefits can accrue due to the use of eTendering. Additionally the research will seek to provide a greater understanding of how this process can be undertaken in a safe, secure

and efficient manner by the Irish Construction Industry.

Chapter 3

Research Methodology

3.1 Introduction

Naoum's (2007) understanding of a research process, as shown in figure 3.1, suggests that research should be completed over 3 stages: proposal, executing and documenting. Following the literature review stage, the author reviewed possible research techniques. The techniques revolved around collecting data and data analysis.

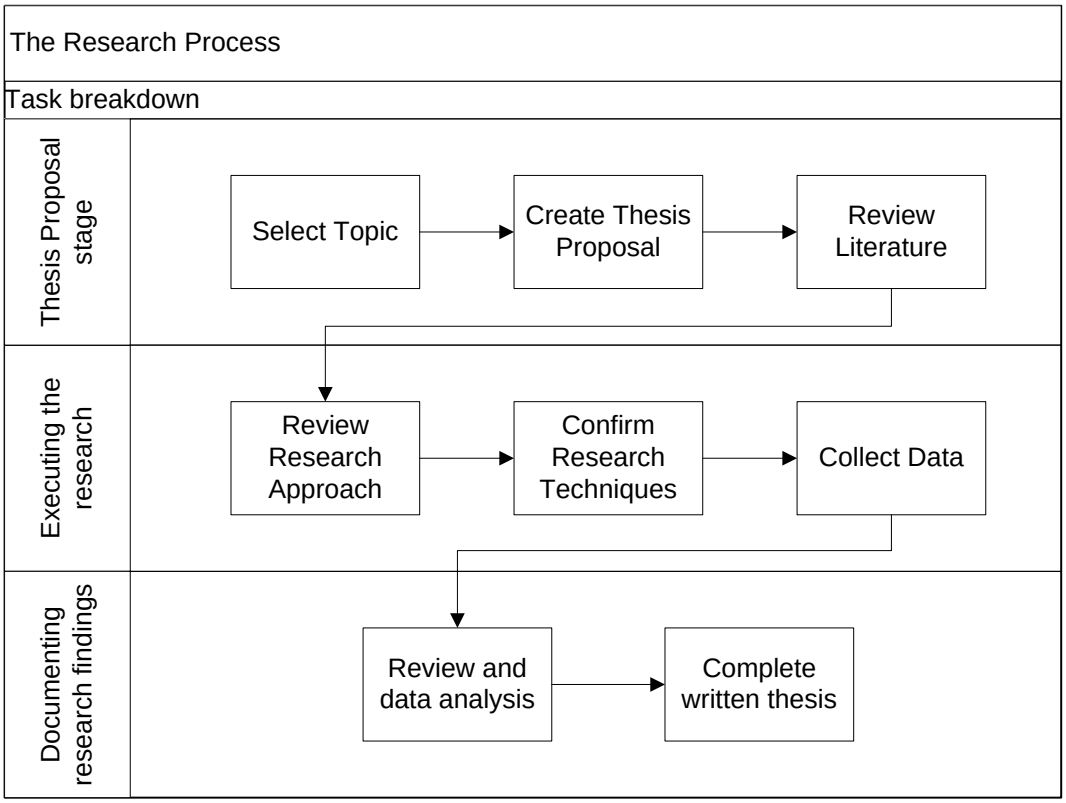

Figure 3.1 Research Process(Adapted from Naoum 2007)

The author's literature research did not provide any information that significantly contradicted the original research hypothesis. Expanding on this point, the findings of the literature review allowed the author to more fully understand the tender process. The inefficient tasks within the tender process were identified and it was established that these inefficient processes could be reduced or removed from the tender process with the introduction of an electronic system.

3.2 Methods Selected

When considering the initial research aims and objectives the author constructed a table

of research aims and objectives and possible research methodologies. Table 3.1 shows a summarised version of the author's review of the research aims and objectives, as well as, the finalised research method agreed between the author and his tutor. In constructing this table it was confirmed to the author that a number of the aims and objectives had been completed during the literature review.

Thesis Objective	Focus	Selected Research Methodologies	Relevant Chapters	Data to be collected	Qualitative –v– Quantitative
1	Existing Tender Process	Literature Review	2	Reports, Government and industry publications, journal articles etc.	Qualitative
2	Inefficiencies	Literature Review	2		
3	Potential ICT Support	Literature Review	2		
4	Process tasks / Inefficiencies	Observation study / interviews	4	Process mapping, log of inefficient practices	Qualitative
5	eTender Status	Questionnaire survey	5	Questionnaire responses	Quantitative
6	Drivers & Barriers	Questionnaire survey	5		
7	Comparison of Traditional –v– ICT enhanced process	Pilot study / interviews	6	Analysis of tender methods, Participant review of pilot	Both

Table 3.1Review of Aims and Objectives

Table 3.1 allowed the author to confirm his objectives and the remaining research could be planned accordingly. The structure of the upcoming work was also designed to allow the author to continually progress his understanding of the topic to a key point of completing a comparison of the traditional tender process against the traditional process.

As shown in table 3.1, the research involved a range of data types being collected and assessed. This data collection and analysis can be described broadly under the two distinct types of research qualitative and quantitative. Naoum (2007) stated that qualitative methods emphasise meanings and experiences of individuals. The qualitative research would be carried out through the literature review and interviews on the topic. Quantitative research was said by Fellows, (2008) to establish the what, how much and

how many of the topic. This form of research would be completed though the collection of data during the observation, the collation of survey responses and the analysis of the pilot project work.

The author's objectives contained both of these broad descriptions of research. This combination of methods would therefore result in a research method called triangulation.

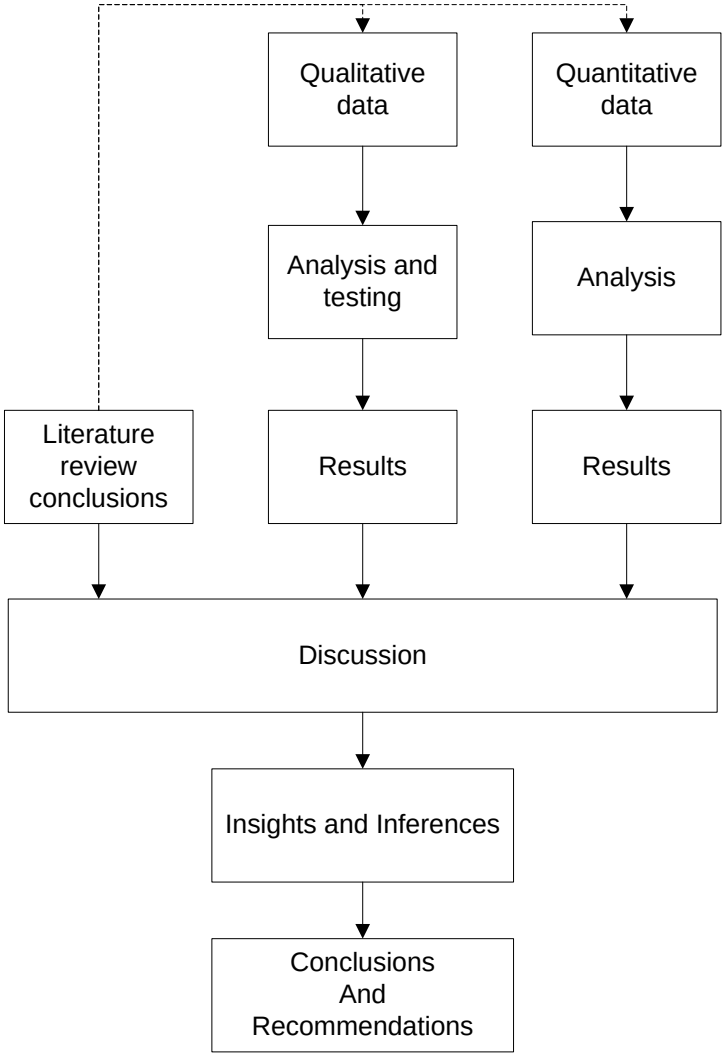

Figure 3.2 Triangulation Method, (Fellows, 2008 edited)

3.2.1 Triangulation

The method of triangulation is shown above in figure 3.2. Triangulation is the use of a combination of research methods to establish a considered and well rounded set of research. Therefore triangulation was established to be an effective process to complete

the objectives set out before the author. It's effectiveness in this case was due to the fact that a number of the research objectives could not be thoroughly explored through the use of a single research method. As shown in figure 3.2, triangulation involves the undertaking of a number of research techniques which all contribute to the progression of the information into a set of conclusions and recommendations. Therefore, to complete the triangulation method of research the author needed to investigate a number of other established research methods. The methods which best reflected his research objectives could then be selected. The methods chosen are discussed in greater detail below.

However, the author undertook a slightly different view, to that of Fellows (2008), on the completion of the triangulation method of research. The author's change in approach is illustrated by the dashed lines in figure 3.2. The author preferred to progress each research method based on the previous research findings rather than progressing all of the topics simultaneously. Thereby further informing the later research methods as the data collection progressed leading to a more accurate approach to these research methods. The triangulation form of research led to a strong foundation on the topic. Furthermore, the research would be continually narrowing to the decisive point, i.e. proving or otherwise the author's hypothesis, with the preceding research findings being utilised to assist in completing an appropriate pilot.

3.2.2 Literature Review

The literature review is an essential part of any research. It informs the author of existing knowledge and best practice on the topic from which further developments can be made. It should comprise of the most up to date information on the topic. Furthermore, while the author did keep the section open to review upon the arrival of new information it does require a cut off point for the researcher to enable him to complete the work (Fellows, 2008). As per figure 3.1, shown above, the author has informed his qualitative and quantitative research with the findings of his literature review prior to undertaking any further research. This leads to a well established foundation for the work prior to its further conception.

A literature review does have the obvious limitation that research on a certain topic may not exist, thus resulting in the individual completing the research. This was the case with the author, when researching the topic of tendering in specific relation to

Ireland. Therefore international procedures were discussed with extended discussions included on the region with the most similarities to Ireland (U.K.) and also the region with a direct input into Irish governance (Europe). Also it is important to understand that all information on the topic is given an equal appraisal by the researcher even if it may contradict any of the researcher's findings.

3.2.3 Observation Study

It was established in the literature review that tendering was a process or procedure that had formalised procedures attached to it i.e. the Liaison Committee Practice Notes. The procedures were established to be extensive and appeared from the research to be well established. However, in reality were these policies actually applied? Consideration was required to be given to the everyday range of factors, which included social factors, technological factors, personal factors, geographical representation etc. The author sought to clarify this information by an observation of the process.

The main form of data to be collected in this section of qualitative research was from observational notes during the author's time within the industry. To ensure the author's findings were accurate the observational notes would subsequently be supplemented with interviews. The interviews were to be based on the author's findings at the time of the interview.

3.2.4 Qualitative Interviews

Qualitative interviews were utilised at two distinct junctures during the author's research. Two interviews were undertaken during the author's observation study and subsequently following the completion of the pilot project research. As both research methods would involve input from experienced professionals, their feedback in relation to the research findings would be an important vetting process.

Generally, open and close ended questions were compiled in a semi-structured fashion prior to the interview. The semi structured format, as discussed by Naoum (2007), would allow the author to probe all areas in relation to the research and also afford the author the freedom to discuss areas that may not have been considered prior to the interview. The interviews were recorded and this recorded material was then transcribed by the author. Analysis of the data gathered during this research method

began during the author's transcription. At this stage the author would highlight key passages of the conversation and further consider the interviewees responses.

3.2.5 Survey Questionnaire

The status of and the drivers and barriers of eTendering within the Irish construction industry were identified as objectives in the author's research. Analysis of the quantitative data collected, in relation to these objectives would allow the author to establish an eTendering pilot suitable for uptake within the construction industry. An introduction to these objectives was achieved through the interviews completed in the observation study. However, the author would now have to increase the breadth and depth of the data collection for these objectives to be completed. A questionnaire was chosen over other possible methods of research. Forums and discussion groups were considered to be difficult to measure any potential findings. They also required a sizable proportion of the participant's time in an already busy process of the industry. Therefore the questionnaire survey was established to be the data collection method to be undertaken. It was understood to be a quick and easy method for individuals undertake while statistical analysis could be completed from any data collected.

A potential limitation was identified by Fellows (2008). He suggested that a questionnaire can lack depth whilst achieving a wide breadth of information. As the author was continually informing his upcoming research, by means of triangulation, this research limitation was addressed. The previous research led the author to question specifics on the topic which clearly related to his outlined objectives.

3.2.6 Pilot Project

Even with planning to complete the above research methods the thesis' hypothesis, "if you undertake the tendering process in an electronic fashion then you reduce its inherent inefficiencies and save money", still remained to be tested. The author and his tutor chose to undertake a pilot project to clearly test the hypothesis' validity. This data collection and analysis technique would allow the author the opportunity to directly compare the traditional tender process to the eTendering process in a similar fashion to that of Woking Borough Council (2003).

It was organised for the author to join an industry led group who were already

interested in undertaking this research. The author would add his research to date to the group's experience. The group would then proceed to establish a comparison of the tender methods by means of simulating identical tender processes, one simulation being based on the traditional tender method and the second being an eTender process.

Following the pilot, interviews between the author and the group's participants were completed. This would allow the author and pilot participants reflect on the work completed and clarify any areas where the group felt further research or clarifications were required.

3.3 Conclusion

The author found that good research technique leads any researcher to review and refocus, as appropriate, the initial planned research (Naoum, 2007). This chapter has been aimed at detailing how the author carried out this task. The author has discussed how his initial thesis proposal accurately reflected the literature review findings. This in turn led to the author's thesis aims and objectives being firmly re-established in this chapter.

In addition to the reaffirmation of the author's aims, this chapter has also briefly detailed the consideration that was given to the available range of research techniques and how the utilisation of specific techniques would allow the author to progress the thesis hypothesis. Subject to this discussion, it was recognised that a combination of the research techniques, known as triangulation, was required to progress the study in a structured and fitting manner. The use of triangulation would also assist in reducing the effective limitations any one specific research method may possess.

To surmise, this chapter has enabled the author to discuss the methodology review process which was adopted. Through this review he has noted that there were a number of possible limitations to the methods of research being undertaking. There will be further discussion on any specific limitations on both data collection and analysis, encountered with the specific research methods in their relevant chapters.

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Chapter 4

Observation Study

4.1 Introduction

Following the completed literature review and methodology chapters the author set about verifying the Irish tender process' tasks and inefficiencies. To realise this objective the author undertook an observation study which would be supplemented with interviews. To achieve the analysis of how effective the process was the author would have to collect data on three separate items: the tender process map, the inefficient processes within the process map and finally a measurement of the scale of the inefficient processes.

The author gathered data, on the above objectives, over the course of three observations and two qualitative interviews. This data collection was completed during the author's active participation within multiple live tenders completed by a large construction firm operating within the Irish construction industry. Following each stage of data collection the author attained an increasingly thorough comprehension of the subject matter. This comprehension assisted the author's to consistently focus and direct his research towards the outlined chapter objectives.

To conclude, this chapter outlines the findings of the author's observation study. It begins with the identification of a company actively involved in the tendering process in the Irish construction industry. Following a review of the company and any literature they possess, the author actively participated in a number of tenders. This participation is discussed with an analysis focused on the findings of the preceding literature review.

4.2 Outline Methodology

The author began this stage of research by gaining an understanding of the observational method of research. An observation study is a form of qualitative research. Qualitative research is a method which has the potential to get beneath the manifestations of problems or issues and, therefore, facilitates the researchers understanding of the subject matter (Fellows 2008).

Fellows and Liu, (2008), outlined Morse's three stages of observational research that are required to be completed in order to establish a well rounded set of research. Stage one involves comprehension of the subject matter. Comprehension is when an in-depth understanding of the subject matter is achieved. Through an initial collection of company data, observation and a semi-structured interview, combined with the

knowledge gained from the literature review, the first comprehension stage of the observation of tender processes is completed. As shown in figure 4.1, the comprehension stage would result in the author to establishing a tender process model and to reaffirm or dispute his initial findings.

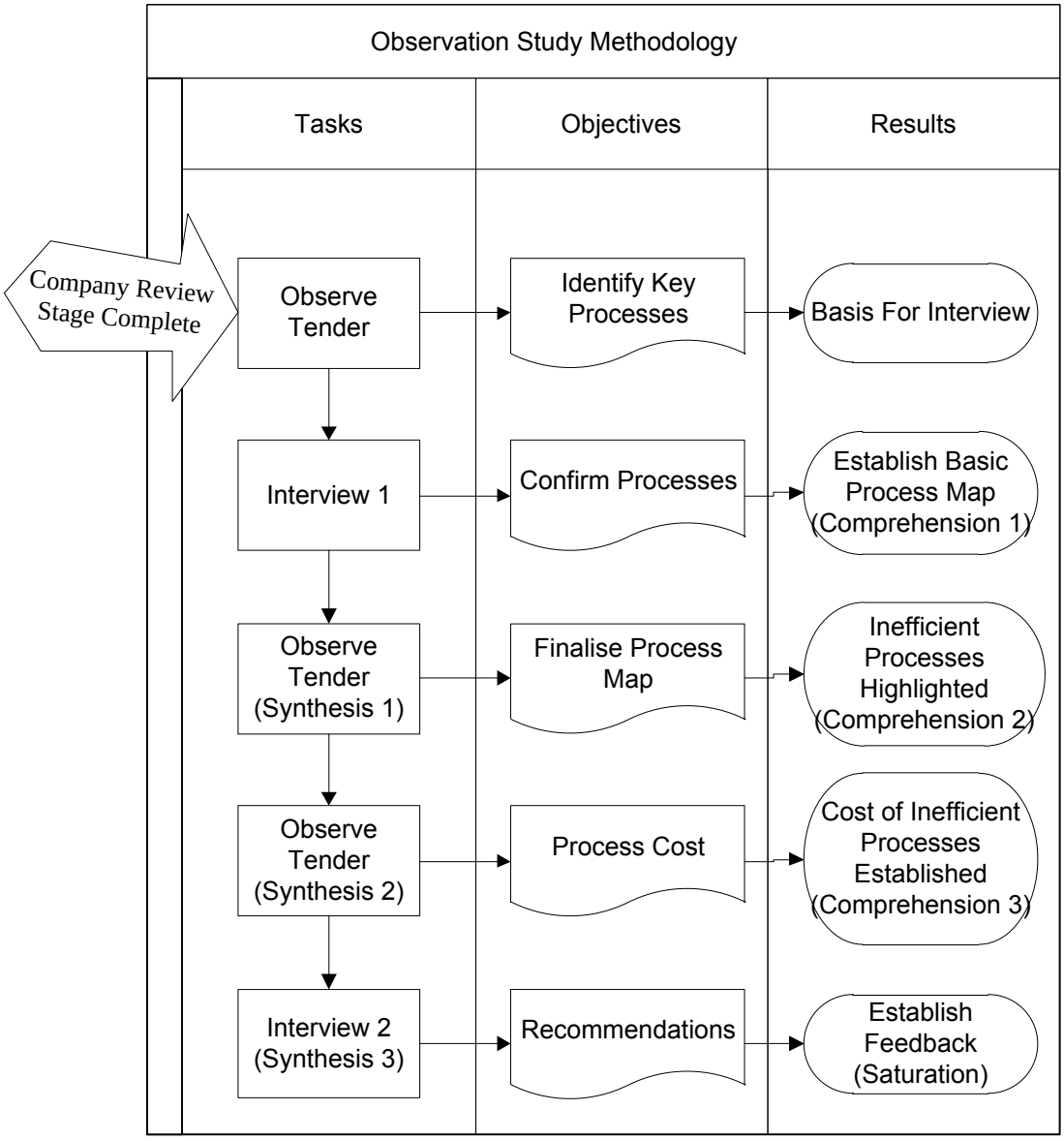

Figure 4.1 Observation Methodology

Following this the synthesis stage one of the research can be progressed. Fellows and Liu, (2008), described synthesis, as the point where comprehension data analysis directs the researcher toward further aspects of research. Synthesis one would begin, in the author's case, following the stage shown in figure 4.1 where the Irish specific process map was completed. Further synthesis to comprehension stages would then be completed as per figure 4.1. In the remaining comprehension stages the author sought to

fully understand first the inefficient processes and then their associated costs. A final synthesis was envisaged to bring the author to the point of research saturation. Morse (1994) suggested that this was the point where no further research or additional study can gain further understanding of the subject matter.

Over the course of the outlined methodology map, the author undertook two separate data collection exercises. These were an active participation in the tender process and interviews of individuals involved in the tender process.

Data gathered during active participation was based on noting and recording the tendering experience. These observational notes would be primarily in two forms. To begin with, occurrences where the tender process was or was not like the literature reviewed process were recorded. This would lead to the development of a process map. The second form of observational notes referenced the established process map and the author would thereby build-up a cost of the tender process based on recording all of the labour, plant and materials used. Consequential reviews of all the observational notes gathered would be periodically undertaken to ensure the synthesis phase of the research was properly completed.

Additionally, it was seen by the author to be pertinent to interview the individuals at Company A regarding his findings at key stages of the research. Naoum (2007) suggested that interviews were a major research technique suitable when completing research that requires questioning of how and why things happen the way they do. The purpose of the interviews was to establish if the author's observational notes and analysis was accurate. Therefore, interviews were planned to be undertaken at specific junctures of the research. As seen in figure 4.1, the interviews were placed at stages where it was believed that saturation of the data that was being collected and analysed, would occur. These interviews would give the author feedback on any insights or recommendations gathered during his time with Company A.

The interviews were carried out in a semi-structured fashion. The interviews used both open and closed ended questions to establish "*as much as possible about the specific issues related to the subject area*" (Naoum, Pg. 57, 2007). The interviews were recorded. The recorded material was then transcribed by the author and included in appendix A2 and A3. During this transcription, to assist in analysing the data, the author highlighted key passages of the conversation and subjected them to further thought.

It is important to note at this stage of the research that the author was affiliated to a specific construction company. Due to this affiliation, gaining access to carry out

observational studies with other companies was problematic. Also, it would entail a great degree of time to undertake the observation in a separate organisation. Therefore, as only one company was to be observed, it is important to state that this research has been limited. The processes observed may not be the most common practice within the industry. However, the author's opinion is that the observations completed are typical of experiences that could have been gained in other similar organisations.

4.3 Company A

4.3.1 Company Selection

Before any research could begin a willing participant had to be identified using selection criteria. The author believed it pertinent that the participant should be well-established company within the Irish construction industry and contain a stand-alone estimating and tendering department. This would ensure that the author could call upon:

- Company specific literature.
- A standardised practice that was utilised when completing a tender.
- A wide range of projects being tendered at any one time, giving the author uncomplicated access to live projects.
- Experienced individuals willing to partake in the observation study, and thus allowing the author to interact with individuals who had:
  - Experience knowledge of different tendering arrangements.
  - A wide knowledge of the industry and current practice.

There were a number of companies interested in this particular line of research within an already established research group known as CITAX (Construction Information Technology Alliance eXchange). This group had a number of members actively involved in researching the construction tender process. There were two construction firms and two PQS firms. The firms in this group all met the author's required company selection criteria and the author subsequently approached the group with a view to undertaking the observation study. Following discussions and the author's time limitations, it was decided that one firm from the contracting side would be suitable for the study. The selection of a construction company was due to the fact that they had experience in all the aspects of the tender process. The company involved in the observation will be known as Company A.

4.3.2 Overview of Company A

Company A is a main contractor, which regularly features in Ireland's top 20 Contractors. They regularly undertake a wide range of both building and civil work and have a number of regional offices in Ireland. The author was based in the companies head office in Dublin. Figure 4.2 illustrates companies A's organisational structure. It can be seen that individual departments (Surveying, Estimating, Contracts, etc.) were isolated from one and other. This segmentation led to specialised individuals performing and completing specific tasks for the company.

A key requirement of the participant selection process is the specialised nature of an estimating and tendering department. This specific department accommodated the author during his observation study. It had the main responsibility for the procurement of works for the company in the greater Dublin area. This, in addition to the size of the company, meant that there was a constant flow of tender documentation to be prepared by its staff.

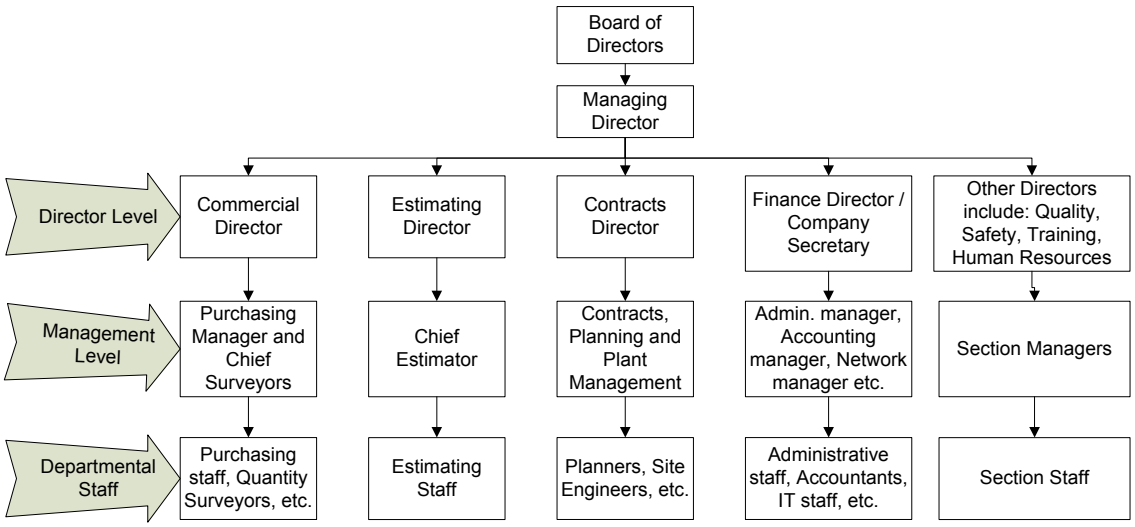

Figure 4.2 Company A –Organisational structure

Company A's estimating department had its own director and staff. At the time of the observation study, the staff included: four senior estimators, one junior estimator and one member of the offices administration staff working full time in the department. Should additional staff be required, they were allocated from the surveying and commercial departments to assist with a greater workload. The department was responsible for the procuring of all works over a value of €1million in the Greater Dublin area. Additionally, there was a small works department in the company. This department priced and completed projects of a value less than €1m exclusively.

4.3.3 Company ICT Usage

Company A had a range of skilled professionals undertaking a wide variety of tasks daily. However, their IT system was relatively basic. The system was configured so that, for the majority of company staff, all information was retained on a central server. Each user had their own space on this server and a password to access their account. No documents were saved on any individual computers. Additionally, a well organised filing system was in place on a separate hard drive. The files on this hard drive contained commonly used documents or company wide information and access was allowed to all users with adequate permissions. The permission was administered through a password control system. All servers were controlled and maintained by the IT department.

Company A's operations were based around their head and regional offices, yet as a contractor they also had many on site offices which were displaced around the country. As a result, on site company staff also required access to information held on the IT systems main server. This is accomplished through the use of high speed broadband connections and Citrix Metaframe XP.

Citrix is an application delivery infrastructure system that lets IT virtualise application resources manage them centrally, accelerate their performance and securely deliver them to users anywhere (www.citrix.com). This means that all on site users had access to the companies most up-to-date software and to the central server.

Company A used an industry specific software know as Coins. This software allows all people who require access to the accounting system (Accounts Department, Commercial Department, Surveying Department, Plant department etc.) instant access to orders, existing accounts, cash flow information etc. Again, this software was accessible on the basis of a password authentication system. Due to the password control, different users gained different levels of options within the program.

The majority of other IT used in the company was relatively standardised software. The network as a whole worked from Windows XP servers, while office 2000 professional suite had company wide usage. Communications were based on the Microsoft Outlook program for which the company provided extensive training as required for new staff members. Additionally, the company had a number of specialised packages for certain departments. These included AutoCAD and Microsoft Project amongst others.

However, the author's attention was specifically focused on the company's estimating department and its use of IT. This department had access to both Buildsoft and Conquest applications. Discussions revealed that when a BOQ was received in soft copy, the majority were an EOX file type. The EOX file type was unique to the Buildsoft software program. Yet Company A preferred to utilise the Conquest software for their estimating. It was seen as an advantage to the company to have both programs available for use, when converting the file types. Freeware software (CITE) available on the internet was used for this task.

4.3.4 Company Literature

Company A's literature for the estimating and tendering department was minimal. However, the company had produced a company flowchart of the procedures required when carrying out a tender. This can be seen in figure 4.3. Furthermore there were generic documents available for some of the sub-processes listed in the flowchart. Individuals within the company suggested that the available company specific literature was sufficient for any "new starts" entering the company. They concluded that the ratio of senior or experienced staff members to that of the junior staff was adequate and advice was always available for those who required it.

As illustrated in figure 4.3, it was primarily the responsibility of the estimating director to seek tenders to price. The tenders would be sought from a wide spectrum of sources. Once the tender documents had arrived, they were all date stamped by Company A's specific estimating stamp. The importance of this sub-process was highlighted by the fact that this relativity minor task was highlighted on a semi-high level process chart. The process of confirming a tender sum would then begin.

The contracts department (Engineers, project managers etc.) would also become involved in the work of pricing a tender. They would advise on building techniques, timetables and the main contractor's preliminary requirements. This task was undertaken in parallel with the division of the BOQ into subcontract tender packages. The tender packages would then be sent out for subcontract pricing. When all these aspects of pricing were complete, the estimating team and the companies managing director met to discuss the final tender sum. At this meeting any adjustments that could be made were discussed. Once the final adjustments, if any, were completed the tender documents were copied for record purposes and finally submitted to the relevant party.

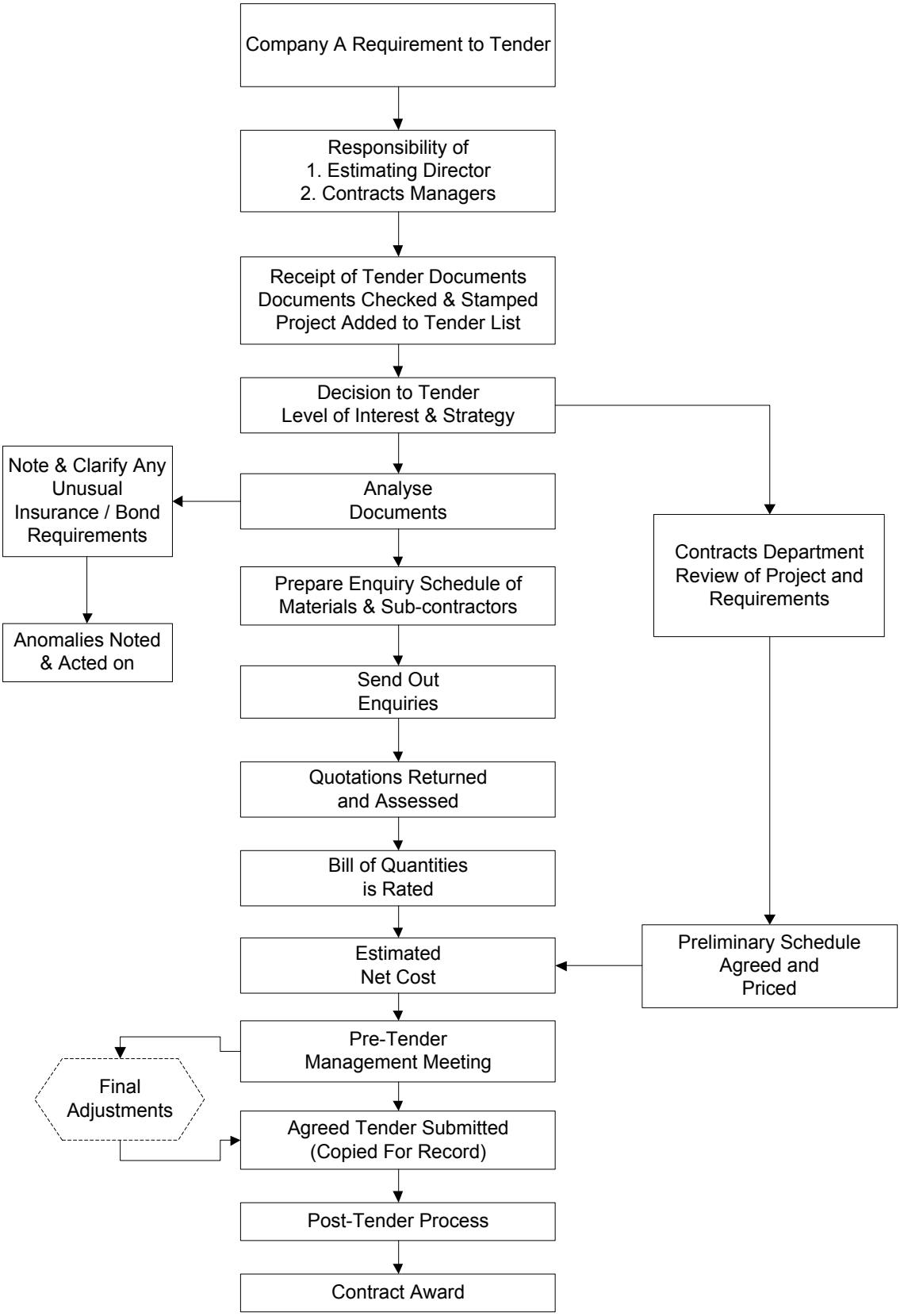

Figure 4.3 Company A Estimating Flowchart

4.4 Observation of Company A

4.4.1 Observation One

Project Details

Between October and December 2006 the author undertook a period of observation on a major commercial and residential project that was in the process of being tendered. Over the course of these eight weeks the author observed and documented the processes undertaken by a contractor when preparing a BOQ for submission. The completed tender was returned to the PQS firm by courier for noon on December 20th.

The tender documents included nine BOQ's totalling four hundred pages. There were also three sets of tender drawings (Structural Engineering drawings, Architectural drawings and associated details), a twenty page tender submission summary and a separate BOQ of addenda (the latter being received during the tender pricing stage of the process). All the information was received in hard copy format. However, Company A always request tender documents in soft copy format. This was provided in due course by means of CD-Rom in the design teams preferred choice of software.

Project Observations

The author had an increased involvement in a number of key processes noted in the tendering flowchart shown in figure 4.3. They were:

a. Prepare enquiry schedule of materials & subcontractors
b. Send out enquiries
c. Quotations returned and assessed
d. Rating of Bill of Quantities

Preparing the enquiry schedule involved a number of tasks. First the soft copy of the BOQ was transferred to Company A's specific estimating software. This BOQ was subsequently broken down into smaller subcontract packages. The staff at Company A commonly called this act "resourcing the bill". Resourcing required coding all the items of the respective Bill to a specific subcontractor code (E.g. D-05 equates to Labour only Joinery or E-15 equates to Miscellaneous Metalwork) in the companies estimating software.

The company's estimating software consequently sorted these coded BOQ items into subcontract tender packages. The estimator was then able to review the number of tender packages that would be required to be issued (In this case 60, See Appendix A.1). Also at this point the estimator got an additional understanding of the scale and scope of each subcontract package. The next task completed by the estimators was the preparation of a subcontract enquiry schedule. The schedule listed the packages required for the project, the documents relevant to the package and a list of contractors to whom Company A were going to issue the package. An example of this document is shown in figure 4.4 below. Furthermore the actual subcontractor list (227 in number) for this project can be seen in Appendix A.1.

SUBCONTRACT ENQUIRIES

Contract: _____ Sheet: ____ of _____

Sub- Contract Package	Boq Pages / Specs / Drawings / etc.	Suitable Sub-contractors
D-05 Labour only Joinery	Appendix 1 Boq, 10,11,12……. Eng Dwg. P346 S004 T	Sub-contractor A Sub-contractor B Sub-contractor C
E-15 Misc. Metalwork	Boq page 54	Sub-contractor Z Sub-contractor Y Sub-contractor X

Figure 4.4 Company A Subcontract Enquires Schedule

The schedule of suitable subcontractors was obtained from the estimator's previous experience and current knowledge, in addition to Company A's database of suitable subcontractors. If further assistance was required for obtaining quotations, either for specialist or unique items, both the commercial department (subcontractors) and the purchasing department (materials) were consulted. Furthermore, it was part of Company A's commercial department remit to regularly update the information databases on existing and new subcontractors.

The task of obtaining interested subcontractors was similar to the PQS process of prequalification, as previously shown in Chapter two figure 2.3. However, in lieu of the paper based process that can occur with a PQS firm, Company A simply phoned the subcontractors to confirm whether they would be able to price the prospective works.

The estimator then prepared and printed one copy of each subcontractor BOQ. He also prepared and printed the company’s standard enquiry cover letter for each one

of the subcontractors included on the subcontractor enquiry schedule. This letter clearly informed the subcontractor of the project details and the date by which his/her final quotation was required to be returned. These documents were subsequently handed to the estimating department's administrative staff. They copied and collated the documents as required per the subcontract enquiries list. The documents were then posted if large scale drawings were required or faxed if all documents were in A4 page size to the subcontractors.

The process of contacting the subcontractors to ensure the tenders were completed and returned on time followed the above tasks. It was common for a junior estimator to undertake this item of work. Company A subsequently received back a large number of quotations from subcontractors. These quotes were primarily received in full by fax. An assessment of all the tenders received and their specific rates was completed by the main contractor. The senior estimator on the project then manually inputted the quotes into the companies estimating software. This software allowed the estimator to further compare rates and tender sums from the subcontractors who priced the work. The quote that was seen to be the most cost effective, based on the information received, was then transferred electronically within the estimating system to what would become Company A's BOQ.

During the tender process a bill of addenda was also received by Company A. This was a document that highlighted changes to a number of bill descriptions, units of measurement and quantities in the BOQ. The bill of addenda contained a large number of changes, which were spaced over all nine BOQs. As the soft copy of the bill was not updated, the estimating staff had to review all the information and input this manually into their estimating software. The process of inputting this information took a senior and junior estimator approximately a full day and a half to complete due to the size of the project. This information was subsequently analysed and re-issued to the relevant subcontractors. An extension of time was granted because of these amendments.

To conclude the tender process completed by Company A, a pre-tender management meeting was held. A number of days prior to the tender submission the managing director and the estimating team met to discuss the project and its estimated cost. Following this meeting, the BOQ rates were adjusted and a further two meetings were held to discuss other possible adjustments. The final adjustments were then made and the final BOQ was completed in soft copy format. An inked in version of the bill was required to be returned. However Company A's policy, shown in figure 4.5, was to

print a copy of the bill from their estimating software. This helped to reduce any time spent on the “inking in” process. The BOQ was subsequently printed twice and sorted into two large boxes. One was a copy for the courier to deliver to the PQS firm while the other was kept for record purposes. The author was informed that should the print version BOQ be accepted, Company A would complete any required inking in of BOQ.

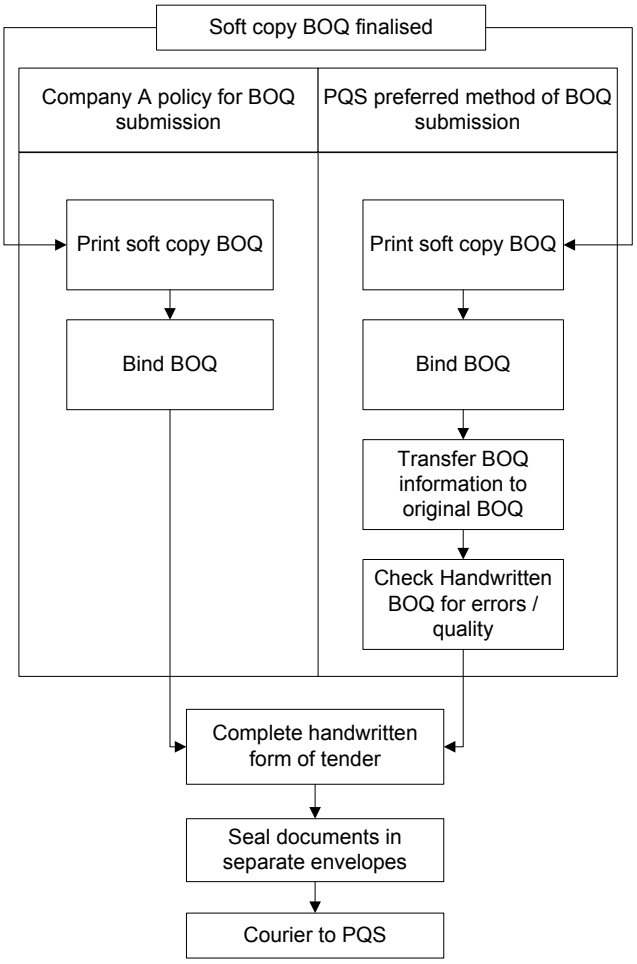

Figure 4.5 Company A Policy Compared with PQS Preferred Submission Method

Observation Findings

The author's goals when undertaking the initial observation was to establish a basis for an interview regarding the tender process. This was achieved. Furthermore the author gained an introduction to what tasks were completed during the tender process and by default what the tender process map actually looked like. Following the observation the author tentatively concluded that the process maps shown in chapter 2 (figures 2.3, 2.4, 2.5, 2.6) and additionally Company A's process map (figure 3.4), reflected the Irish

construction industry tendering process. Further research would be required to conclusively confirm this finding.

The process was seen to be heavily dependent on the labour intensive task of obtaining, inputting and assessing subcontractor quotations. However, the author noted that any tasks, specifically inking in, that were deemed to be inefficient had already been removed, in so far as possible, from the companies work practices.

4.4.2 Interview One

Following the initial observation, the author carried out a semi-structured interview with a senior estimator from Company A. This interview's transcript is included in appendix A.2.

It was confirmed in this interview that the tender process as shown by Company A's flowchart, (see figure 4.3), was indeed an accurate portrayal of the actual tender process. This was the main objective of this stage of the observation. It was also discussed that, on occasion, slightly different tasks maybe required to be completed during a tender process. In the majority of these cases, however, the small differences would be project specific tasks outlined prior to a tender being undertaken.

The interview revealed that tender information was increasingly being received in soft copy format. However, this had resulted in a perceived exponential increase in the quantity of documents and information transferred between the PQS and CQS. Indeed some of these documents were seen as irrelevant to Company A's staff.

Specifically, when questioned on the tender process itself and any inefficient practices that may be present, the interviewee responded that he believed the tender process was efficient in the tasks it undertook and that the individuals involved did not complete unnecessary tasks. However there were time consuming "*annoyances*" with the process. These included Bills of addenda, inking in of the BOQ – although not required as much in recent times – and the interoperability of BOQ production and estimating software.

Finally, when asked to discuss eTendering experiences the interviewee suggested that often the process led to more work in formatting and reformatting documents. This was due to the PQS requirement to have an identical copy of the received soft copy BOQ submitted to the PQS office. This he suggested was just, if not more, time consuming than the current paper based process.

4.4.3 Observation Two

Project Details

On the 8th of January 2007 Company A received a tender for a small project which was be due to be constructed over the summer months of that year. This tender was received following a phone conversation between the PQS firm and Company A. Company A was not required to complete a pre-qualification questionnaire for the project due to their prominent status within the Irish construction industry.

The project entailed the redevelopment of a university's rugby pitch spectator stand, a new spectator multi-purpose room, wc facilities, landscaping and the required enclosures to the pitch.

The tender documents were required to be completed and returned to the university on the 26th of the same month at 12:00 noon. The tender package was consisted of:

a) 1 page tender notification letter
b) 3 page form of tender
c) 31 pages of preliminary items
d) 80 BOQ pages
e) 5 page BOQ option two for site enclosures
f) Appendix containing a list of prime cost, provisional sums and tender documents
g) 21 no. A1 size drawings

Project Observations

The documents were received and checked that all items were present. They were then stamped and handed to the estimating department. The estimating department then faxed the PQS firm confirming receipt of the tender documents. Additionally the estimator included a request for the documents and, in particular, the BOQ to be supplied in soft copy. The soft copy documents were received by post on CD-Rom two days following the request.

A soft copy of the BOQ was received in a software format (EOX file) different to that used by Company A. Therefore, it was required for Company A to transfer the

document to their own software format. This was completed using the freeware software package CITE. Once the BOQ was transferred to Company A's estimating software, the lengthy process of reformatting the BOQ began. Without completing this task the BOQ would not be suitable for subsequent subcontract tender enquiries or for the final print version to be submitted to the PQS. The bill was then resourced and issued for pricing in the same fashion as observed in the pilot observation. As listed in appendices A.1, this project had 18 subcontract packages, which led to 68 individual subcontract enquires.

Once the subcontract packages were sent out, the estimating team turned to pricing the preliminaries section of the BOQ. They approached the contracts department to discuss the scope and extent of the works based on their knowledge of the BOQ and its subcontract packages. To assist both the estimators and contracts team with the tender, a site visit was undertaken. This enabled the project team to familiarise themselves with the site. Following this the contracts team outlined their specific requirements for the project and a projected project timescale, which they believed to be realistic for the proposed works. The estimating department used this information with their current in-house rates to confirm a preliminary cost to complete the works.

Amendments to the BOQ were made on two occasions (16/1/07 and 23/1/07). The first schedule of amendments contained 27 changes to the BOQ. This required two subcontract enquiry packages to be resent, as there were some small new work items introduced. The remaining amendments either altered the quantity of work for specific items or clarified an aspect of an item's description. These changes were seen as a clerical correction to the BOQ rather than a significant change, which would require an extension of time. The final changes saw two additional clerical errors being corrected.

A junior surveyor was tasked with assuring Company A received subcontractor quotations and reissuing of subcontract packages due to BOQ amendments. Quotations from sub contractors were received and reviewed up to the 25th of the month when the pre-tender management meeting was held. Any quotations that were received after this date were filed for reference purposes should the tender be successful.

At the pre-tender management meeting the estimating director and managing director reviewed the project scope, timescale and estimated cost of the works. It was decided to make a number of small adjustments to some of the BOQ rates and a further addition was made to the bill for Company A’s overheads and profit. These adjustments were subsequently completed and a final BOQ was printed on the morning of the 26th.

The author was again advised that Company A's policy was to submit a computer print out of similar format to the BOQ that was received. This they believed would be acceptable to the PQS firm even though the tender letter clearly requested inking the original BOQ. Should the PQS firm confirm Company A's BOQ as the winning tender, Company A would subsequently provide an inked in copy of the BOQ. The estimating director then completed the form of tender document, stating the tender sum and projected programme for the works. These documents were sealed in two separate envelopes, clearly stating the contents of each and couriered to the university for the deadline of 12:00 noon.

Observation Findings

This tender process closely followed the well defined tendering process that the author had previously outlined in the literature review. Further investigation by the author of the process map, its inefficiencies and the processes "*annoyances*" appeared to confirm that tendering was completed in Company A in an efficient manner. That is to say that when the processes are identified at a high level, all the completed tasks are a necessity to complete the process. However, with further investigation and dismantling of these tasks into smaller sub-tasks, certain aspects of the tendering process were questionable. Specifically the author identified the medium of communication between the tender participants. Frequently the author observed that communication was completed in hard copy format. This was still the case even when 100% of the documents originated in soft copy.

In relation to this the company staff had suggested (See Appendices A.2) that electronic transfer of documents to subcontractors would improve the process. However, while they had to a degree implemented this task by email, they found that some subcontractors did not have the IT to receive the information and, in particular, large A1 sized drawings. Furthermore, they suggested that PQS firms often do not think of supplying the information electronically even though Company A always request it in order to assist their estimating procedures.

Additionally the author observed the process when a BOQ of addenda was issued. This was specifically identified in an interview with the company's senior estimator as an *"annoyance"*. During this tender a small amount of work had to be completed to accommodate the addenda issued. The PQS did not grant an extension of

time for these adjustments to the BOQ. However, it must be considered that due to these errors on the original BOQ, all of the competing tender companies had to revise their work. Furthermore, a number of subcontractors also had to requote for Company A.

4.4.4 Observation Three

The final observation study was of a medium sized tender undertaken by Company A. This tender was valued at approximately €7.25milllion and was completed in the summer of 2007. There were fifty number drawings, a BOQ including a preliminaries section (190 pages), two specification documents and a health and safety plan couriered to Company A's head office. The practice of pricing the BOQ was then initiated in a similar fashion to that of the previous projects. The tender was completed within twenty working days.

At this point in the observation the author believed that he had reached Morse's (1994) point of saturation with regard to the actual tender process map. The author's beliefs were confirmed by the project's supervising estimator, once the project observation began. He stated that no additional tasks, other than those identified on Company A's flowchart, were required to be completed during the tender.

Therefore, for his final observation the author wished to establish a realistic cost for the tender process in Company A. Additionally by costing the process it would assist the author in further identifying any inefficient processes.

The author proceeded to review the time spent on the project by the individuals involved and materials they used for each specific stage of the process. This could then be used to identify a cost for the tender process for this project. The author compiled these findings in Table 4.1, which was modelled on each of the tender stages, as mapped in figure 4.3.

The author's findings on this project indicate that the company needs to include an overhead on the basic cost of completing the building works of 0.1% (Tender cost divided by Tender value = £6,930.12 / £7,250,000) for the tender process alone. While this percentage is not substantial, a number of items must be considered. The most obvious consideration is that not every tender is successful.

The figure of 0.1% is only a fraction of the real cost of tendering to Company A. However, the author's objective in this observation was to identify a cost of the inefficient processes undertaken in Company A's tender process. The inefficient

processes are highlighted in table 4.1 by means of referencing (i.e. R1, R2, R3, R4). The highlighted processes make up 15% of the tender cost. These processes and their cost impact on the tender process will be further discussed in the following section.

Tender stage	Person involved / Material used	Qty.	Unit	Rate / Item	Total
Receipt of Documents	1. Courier (R1)	1	No.	€60.00	€60.00
	2. Intermediate Level Estimator (ILE) (R1)	4	Hrs.	€33.00	€132.00
	3. Administration	1	Hrs.	€18.00	€18.00
	4. Copies of Documents	100	A1 pages	€0.25	€25.00
		250	A4 pages	€0.06	€15.00
Analyse Documents & Transfer to estimating software	1. ILE (R2)	8	Hrs.	€33.00	€264.00
Resourcing of BOQ	1. ILE	40	Hrs.	€33.00	€1,320.00
Subcontractor quotations (Sent out, returned and Assessed)	1. ILE	30	Hrs.	€33.00	€990.00
	2. Administration(R3)				
	- Posting Docs. (R3)	10.75	Hrs.	€18.00	€193.50
	- Materials(R3)	258	A4 pages	€0.06	€15.48
		84	A1 pages	€0.25	€21.00
	- Postage(R3)	43	Envelope &Postage	€1.40	€60.20
	- Faxing(R3)	9	Hrs.	€18.00	€162.00
	- Materials(R3)	324	A4 Pages	€0.06	€19.44
	- Fax(R3)	54	No.	€0.25	€13.50
	- Email	0	Hrs.	€18.00	€0.00
	- Materials	0	No.	€0.00	€0.00
	3. Junior level surveyor	24	Hrs.	€25.00	€600.00
Contracts Team Works	1. Project manager	24	Hrs.	€38.00	€912.00
	2. Planner	24	Hrs.	€33.00	€792.00
Final rating of BOQ	1. ILE	25	Hrs.	€33.00	€825.00
Pre-Tender Meeting	1. Managing Director	1	Hrs.	€75.00	€75.00
	2. Estimating Director	2	Hrs.	€50.00	€100.00
	3. ILE	2	Hrs.	€33.00	€66.00
Final Adjustments	1. ILE	2	Hrs.	€33.00	€66.00
Final Proposal Sent	1. ILE	1	Hrs.	€33.00	€33.00
	2. MD/Estimating director	11	Hrs.	€50.00	€50.00
	3. Administration (R4)	400	Hrs.	€18.00	€18.00
	- Materials (R4)	1	A4 pages	€0.06	€24.00
	4. Courier (R4)		No.	€60.00	€60.00
Total Cost					£6,930.12

Table 4.1 Company A Typical Cost of Tendering For Medium Sized Project

4.5 Observation Findings

Over the course of the observation, the author wished to develop his knowledge on the topic of eTendering to meet specific objectives. To paraphrase; the tender process, its inefficiencies and the scope for eliminating these inefficient processes. Furthermore, an introduction to the industries opinions on the topic was explored. Having completed

collecting the relevant data, the author has gained extensive knowledge of the actual process that is undertaken in pricing tender documents in the current Irish construction industry. The initial observation led the author to understand the work tasks involved in the tender process and, in particular, the tasks in preparing, sending, chasing, receiving and then analysing subcontractor tender packages. The second observation's process tasks were acknowledged by the author to be identical to those undertaken by Company A in the pilot observation. Indeed, the process also followed Company A's flowchart as shown in figure 4.3. This second observation also helped identify inefficient tasks within the process an objective of the initial research. For the most part, these were understood to be communication based inefficiencies. Finally, believing that over the course of the previous observations the saturation point had been reached with regard to mapping the tender process, the author wished to investigate the level of cost to Company A of undertaking the process. These costs also helped the author further identify the inefficient processes and their magnitude in comparison with the entire tender process. There now follows a more in-depth discussion on specific findings of the author’s research.

4.5.1 Communication Links

The author observed tendering as a process involving many communication links similar to that illustrated in figure 4.6. This figure shows how the PQS arranges and prepares tender packages. These are then communicated to the relevant number of main contractors. They, in turn, reduce the BOQ into trade packages for subcontractors. Once the subcontractors receive the information a price is produced. This information is then fed back up the chain to the PQS. It is within these links that the author’s observation findings are based.

4.5.2 PQS to Contractor Communication

The Building Centre Trust (2000) had suggested that the communication of tender documentation solely in hard copy was inefficient. Furthermore, they had completed a number of case studies to show this. In the projects the author observed, tender documents tended to be issued in hard copy and Company A was requested to return the documents in the same fashion. However, the question raised by this research was the

extent to which the construction industry had accepted these findings and implemented changes. An interview revealed that more recently Company A was receiving more electronic documents. Furthermore, should this not occur, Company A requested that they receive an electronic BOQ. The company's senior estimator confirmed that more often than not the soft copy documents were duly received. Yet, as observed, there was still an amount of formatting to be completed even with the introduction electronic BOQ. This was due to the many separate software systems in operation within the Irish construction industry. Also, the inking in of BOQ was observed to be undertaken less often than actually requested. However, the author will require further research among other Irish construction industry parties to confirm if Company A's policy of initially only returning a computer print out is widespread practice.

4.5.3 Main Contractor to Subcontractor Communication

The observational research undertaken confirmed the contention of Curtis (2006) that large quantities of photocopying and printing had to be undertaken in order to acquire subcontractor quotes. When the author both observed and partook in the production of subcontractor packages, the information was, in the majority of cases, posted or faxed depending on the need for drawings to accompany the information.

	Subcontract package	Qty Sent	Received on Time	BOQ Pages	Enquiry Page	Specification or Other Information	Drawings	Fax / Post / Email
Observation One	Groundworks	4	4	54	Yes	Yes	Yes	Post
	Drywall and Suspended Ceilings	6	4	64	Yes	No	Yes	Post
	Painting	7	5	15	Yes	Yes	No	Fax / Email
	Balustrade	5	4	15	Yes	No	Yes	Post
Observation Two	Groundworks	4	2	24	Yes	Yes	Yes	Post
	Ceilings	3	2	1	Yes	No	No	Fax
	Painting	4	2	4	Yes	No	No	Fax
	Misc. Metalwork	5	4	3	Yes	Yes	Yes	Post

Table 4.2: Sample Subcontract Enquiry Packages During Observations

On one of the observations, Company A produced 60 subcontract packages. On a number of occasions two or more packages were combined. This meant that the initial subcontractor enquiry list consisted of 227 separate enquiries. In addition to the 227 enquiries issued further enquires were sent. This was due to a number of subcontractors responded stating that they did not wish to price the work or in some cases where some subcontractors returned insufficient information. An example of the size of subcontract packages is given in table 4.2, as well as the preferred method of communication.

As shown in table 4.2 the majority of tender packages were issued by post or fax and therefore in hard copy. On a number of occasions when the enquiries consisted of a small number of BOQ pages, the enquiry was scanned and issued to the subcontractor in question by email. Upon querying the reason behind scanning the documents, the author was told that this was a security measure. With this security measure in place, the subcontractor could not easily change the details on the tender enquiry page or BOQ resulting in a qualification to the tender that may not be instantly recognisable to Company A's estimators. Furthermore, the subcontractor would definitely have the IT capability, a free generic picture viewer or adobe reader, to view the documents.

On occasion, the links as shown in figure 4.6 between contractors and subcontractors were observed to overlap. An example of an overlap can be explained using figure 4.6. The author observed a case where subcontractor B returned Contractor B's subcontract package to Company A. The subcontract package did not include the same items of work included in Company A's BOQ. This was due to the individual nature of how estimators in different companies can approach resourcing a BOQ. This meant that Company A did not have all the required cost information for the estimator to complete the BOQ. Furthermore, the identity of the competing main contractor was revealed due to a copy stamp on the returned document.

4.5.4 Other Inefficiencies

There were some other problematic issues raised by the individuals within Company A. The main issue was amendments made to the BOQ during the tender process. It was observed most prominently on the pilot project where both extensive additional and repetition of work occurred due to a bill of addenda being issued.

Figure 4.6 Tender Communication Process

4.6 Recommendations

The following recommendations are based on the author's overall findings of the observation process and, in particular, the communications between the parties involved. In the following section, these recommendations will then be reviewed by means of an interview with Company A's estimating director.

4.6.1 Reduction in the use of hard copy communication of documents from the PQS to main contractor

The communication process using hard copy was observed to be inefficient. Firstly, the tender received from the PQS firm was in paper format. This meant that the PQS firm must gather and distribute this information at their own cost. Furthermore, on all

occasions observed it was requested in soft copy format following the delivery of the hard copy. Therefore, the author recommends that, should pre-qualification take place, an option be included regarding whether the tender documents are to be forwarded in (preferably) soft copy or hard copy or both. This would reduce time wasted in the document checking process and in the compiling hard copy documents, as well as, cancelling the main contractor's need for a courier. It should, however, be noted that there are a range of options for the electronic transfer of information. These range from documents placed onto a CD-Rom to Trusted Third Party sites. As per the RICS eTendering practice notes (2006), the author would suggest that the most cost effective solution be used for soft copy transfer. Should a fully electronic form of communication be undertaken potential savings in the region of €192.00 or 2.7% (See Table 3.1 (R1)) of the tender process could be achieved by Company A.

4.6.2 Standardisation of Software / Interoperability

A further recommendation of the author would be that the initial communication of the BOQ is standardised to an agreed industry standard software format. Company A consistently had to transfer the received soft copy documents from the received format to their estimating software. Due to interoperability issues, transferred documents often required manual manipulation, so they could be viewed and printed as the PQS issued them. The cost of the manual manipulation process is shown as R2 in table 3.1. The author has not placed an estimated saving against this item of work as the estimator is also analysing the BOQ. The author was thus unable to establish what percentage of the total time could be allocated to each individual task.

An alternate route to solving this problem involved the software companies (Conquest, Buildsoft, Coins etc.) who produce the software. A program that would allow both easy and quick transfer of data between software packages that are regularly used within the industry could then be produced.

4.6.3 An increase in the use of electronic communications between the main contractor and the subcontractors

The numerous communication channels opened between different parties requires to be streamlined. Over the course of the author’s observations, it was observed that the

communication of documents was both quicker and more cost effective, when carried out in electronic format. The author would argue that, having observed email being used for this process, this medium would be the current best fit solution. Email is as secure as faxing documents, which is a trusted communication medium and it is also highly cost effective. Email is seen as being cost effective, due to the fact that Company A is required to use email regularly on a range of other practices within the company.

The increase in speed is illustrated, when issuing subcontractor tender packages in figure 4.7. The requirement for administrative staff to gather and send information is reduced due to the fact that the documents, already prepared by the estimators on their computers, can be emailed instantly to the subcontractor in question. The wholesale adoption of this system of communication, using table 4.1's cost analysis (items marked R3), could generate savings of up to €485.12 or 7% of the tender cost to Company A.

4.6.4 Removal of requirement for hard copy BOQ submission

Finally, the condition to ink in any BOQ should not be a requirement within the Irish construction industry. The Irish Electronic Commerce Act (2000) is in place so electronic communications and signatures are acceptable and legally binding in Ireland. Therefore communication in this fashion should not be encouraged. The items marked R4 in table 3.1 reflect the cost of this practice to Company A. Should the author's recommendation on this aspect be put in place savings of approximately €102.00 or 1.5% could be generated by Company A.

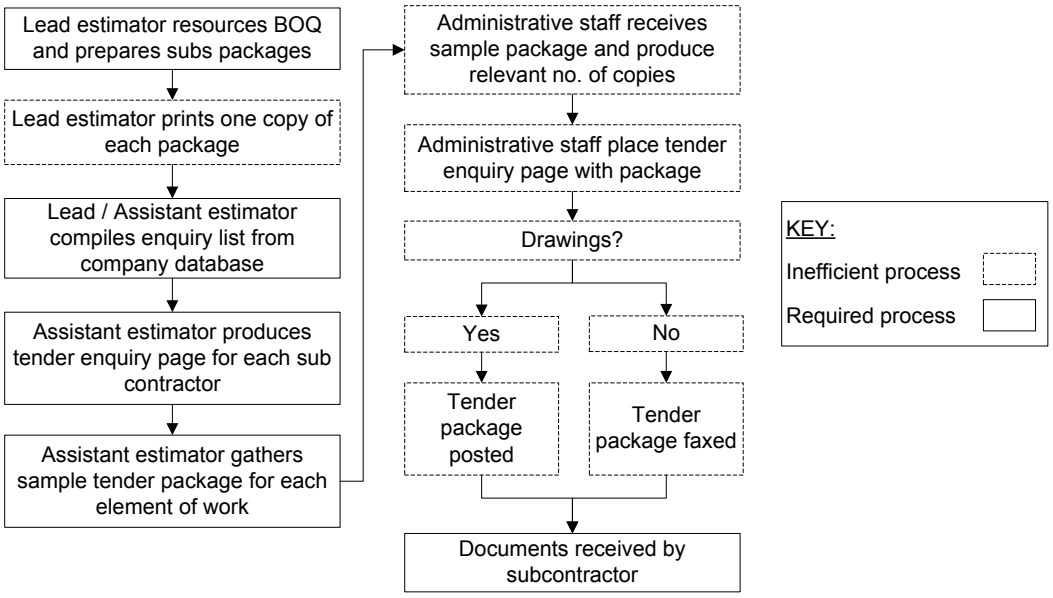

Figure 4.7 Inefficient Processes

4.6.5 Overall Recommendations

The above recommendations revolve around a change in the communication medium for the tender process. This change is from the paper based form of communication to an electronic form of communication. There are currently several media by which electronic communication is possible. However, if any of these forms were undertaken, the author would argue that they would have a significant impact on the traditional process as costed in table 4.1. Furthermore, it should be recognised that for each saving Company A generates, a similar saving could be achieved by the other competing tender companies.

The eTender process would include the removal of large quantities of administrative paperwork and courier costs. The author calculated these savings to be approximately 15% on the cost to produce a tender for Company A. There would also be a reduction in costs for the other competing companies in the tender process, the PQS and the numerous companies involved in subcontract activities. Consequently this could lead to significant savings across the industry a whole.

4.7 Contractor Feedback on Observation and Recommendations

An interviewee of Company A reviewed the information gathered by the author and confirmed that they believed that, in theory, there are cost savings to be achieved through increased electronic communication. An analysis of their specific views, (transcript of which is available in appendices A.3), regarding the above recommendations follows:

4.7.1 Reduction in the use of hard copy communication of documents from the PQS to main contractor

The author was informed that Company A would have no problem receiving information in soft copy format. The use of this method would remove or reduce the workload on a number of tasks completed in the current tender process. Specifically, these were the use of couriers, the printing of a large number of documents and the possible double take when issuing documents in hard and soft copy.

Yet further comments by the interviewee led the author to believe that the PQS may undertake the paper based process, in order, to ensure the tender was fair and open

to all contractors who may be interested. Specifically this related to how the tender process was undertaken with subcontractors by Company A. The paper format was used to ensure that all individuals are able to compete for the work. This is further discussed in recommendation 3.

4.7.2 Standardisation of Software / Interoperability

Company A believed that industry standardisation of documents was not a legitimate option. This was due to some software packages not having the capabilities that certain companies or individuals require. The author further interpreted the interviewees comments to conclude that any standardisation could result in a monopolistic force within the industry. This would potentially lead to higher prices and less affordability of the product. However, Company A did greet enthusiastically the possibility of software companies developing software that allowed efficient transfer of data between separate software programs. He said that the CITE program does not complete the transfer of information in a satisfactory fashion. When the author saw this program being used, it was noted that there was a substantial amount of reformatting required to the transferred document.

4.7.3 An increase in the use of electronic communications between the main contractor and the subcontractors

Company A stated their belief that, in Ireland, there are still a large number of subcontractors operating out of "*their living rooms*". This results in them not having email or sufficient high-speed Internet connections to access the information as quickly or as cost effectively as having it posted to their place of business. However, he agreed that in theory, the practice would be beneficial to the industry and would be embraced by Company A.

4.7.4 Removal of requirement for hard copy BOQ submission

With regard to inking in BOQ, Company A policy, as previously noted, was seen as the most cost effective solution they could apply. Additionally, they suggested that there were concerns with the legality, security and completeness of electronically transferred

documents.

However, on previous occasions the company had priced a number of projects using the Governments CONVAL system. This system allowed the estimators to use an electronic file saved to disk to be the form of tender submitted to the PQS firm. The staff at Company A believed that this system was the best operational system of eTendering they had encountered to date.

4.7.5 Further Recommendations Discussed

A final aspect that the contractor discussed was the issuing of amendments during the course of a tender. This is allowed for in the LCPN. However, the contractor believed that when extensive amendments were made, an exponential extra cost was forced upon all the contractors involved. Much of the BOQ may require reformatting and, in addition, some subcontractor quotes may require to be reissued. Company A would prefer that the process of amending the BOQ in such a fashion would only occur in negotiations with the successful bidder for the works. This would eliminate the need for several parties to undertake this work.

4.8 Conclusions

The overriding objective of this chapter was to confirm or refute a number of findings of the author's literature review. It has been confirmed in this observation study that the tender process was a relatively smooth process carried out on a large scale within the Irish construction industry. It was carried out in a structured fashion closely corresponding with the LCPN process. Establishing this information was the first objective of the research. However, the author's literature review found that the process of communications when tendering was inefficient. The author's observation reaffirmed those findings. The tender process relies heavily on the transfer of hard copy documents in lieu of soft copy. Furthermore this study has shed further light on the "annoyances" which are causing the process to become inefficient. This detail has allowed the author to establish an accurate cost assessment of the inefficient processes in the context of the Irish construction industry.

Following the study, it was discussed with Company A about the possible gains it could achieve by moving away from hard copy communication. Their response was to agree with this statement. However, they did have a number of concerns.

Firstly, Company A believed that the Irish construction industry and its SMEs

were not sufficiently ready to undertake this step. Furthermore, when Company A had experienced eTendering, they were of the opinion that it also contained inefficient processes. The eTendering process involved just as much work when it came to reformatting for both the issuing of subcontractor enquiries and Company A's tender submission. The BOQ was received in a different format to that used by Company A and, to compound matters, the subcontractor quotes were issued and received back, for the most part, in hard copy. Additionally, there were some concerns over the legality of electronic documents. However, the actual acquisition of the tender documents and the returning of them by Company A was seen as a simpler process.

Having undertaken a detailed in depth observational study and two qualitative interviews of the tendering process in one large construction company the author had identified the major processes and issues involved and was ready to undertake a broader survey of the practices in the Irish construction industry. This would help clarify some of the initial findings of the industries opinion on the topic of eTendering. This would further explore the authors findings that there are savings to be made with the use of eTendering. However, for the most part, due to a lack of I.T. among the Irish construction industry SMEs, interoperability issues and industry inertia due to legal concerns, these savings may not be realised.

Chapter 5

Irish Construction Industry Survey

5.1 Introduction

Chapter three documented an observation study that the author completed with a large construction company. This observation study let the author confirm the tender process, its inherent inefficiencies and the potential scope for process improvement in an Irish context. In concluding chapter four, recommendations were tabled and discussed with Company A, which were aimed at reducing or in some cases removing the process inefficiencies they encountered. This chapter will seek to explore in greater depth some of the opinions raised by Company A in the interviews they undertook. Furthermore the industries willingness to adopt the technology will be explored by an analysis of the industries current level of ICT uptake together with the drivers and barriers to eTendering in the Irish Construction Industry.

In this chapter, the author will be presenting the results of a questionnaire survey of the Irish construction industry relating to the rapid advancement of ICT in the area of tendering. The conclusions of the chapter are drawn from an analysis of the survey results and the knowledge acquired from the previous chapters' findings. Additionally the results are compared and contrasted to previous national and international surveys where relevant. This analysis will further strengthen the base of knowledge already established by the author and inform him of what directions a pilot project should take so that the industry can easily relate to and perhaps acknowledge as a safe efficient method of tendering.

5.2 The Survey

The overall aim of the survey was to investigate the construction industry's uptake of and opinion of eTendering. To establish this, it was necessary to seek further information from the industry on the areas of ICT and tendering practice. In addition, the author would seek to gather data on the drivers and barriers regarding the use of ICT to support the tendering process. Therefore a number of key research objectives/questions were established by the author.

The first research question the author sought to understand was whether or not the Irish construction industry believed that tendering was a costly process. If the industry responded that the process was expensive, this would indicate to the author the

possibility that the industry would be less hostile to the introduction of eTendering.

One of the inefficient tasks observed in Company A's revolved around BOQ manipulation. The author thus wished to collect data on whether there were any prominent software packages used within the industry for BOQ production and manipulation. The author also research the question of firms general ICT usage in the tender process.

Finally, the author was informed by staff at Company A that eTendering was undertaken by certain firms within the Irish construction industry. Therefore, the author aimed to establish what was the Irish construction industry's firms level of experience with the technology. With the Irish construction industry's views on all the above topics, a final range of questions were put to the respondents on the drivers and barriers for eTendering. The appropriate collection and analysis of these research questions would therefore lead the autho to meeting his aims 5 and 6 listed in table 1.1.

5.3 Methodology

5.3.1 Background

In 2006 CITA undertook a survey of the Irish construction industry to establish the overall views of the industry on the topic of eTendering. CITA (2006) outlined that the survey set out to establish a number of key research questions:

1. The current level of both take up of and interest in tendering present within the industry.
2. What the industry sees as both the drivers and barriers to its uptake?
3. Further developments that would assist in the uptake of tendering.

The survey was internet enabled and sent to 42 individuals in different areas of the construction industry. The survey established an overall response rate of 35% and included responses from building contractors (53% of responses), civil engineering firms (13%), general construction (20%), educational bodies (7%) and market service providers (7%). CITA’s report established that the industry did not feel its personnel were technologically up to speed with the new ICT. Furthermore, there were significant concerns about the security of information during an electronic communication and also the possibility that implementing the technology would not be cost effective.

Having reviewed CITA's findings, the author decided to further review CITA's

questionnaire and adapt and revise this questionnaire, as appropriate, to his own survey research. The logic behind this was that a number of both the surveys' goals were closely matched, as shown in table 5.1. With this in mind, it was seen as a good opportunity to complete a short to medium term longitudinal study of change over time. Longitudinal work like this would assist the author in establishing one of his core objectives: was the rapid advancement of ICT was being experienced and embraced by the construction industry. Furthermore, the initial CITA survey could be reviewed as a pilot survey. Any experiences gained from the CITA survey could be utilised by the author to help improve his own survey. It was important that the author would rework the CITA survey where appropriate. Overall the survey would lead to an updated Irish construction industry view on the topic and also be easily contrastable to the already canvassed views obtained by CITA in 2006.

	M.Phil. Survey Research Goals	**Matching CITA Goal**	**Comments**
RESEARCH GOALS	Is tender process expensive?	No matching goal	Author questions required
	Current process software?	No matching goal	Author questions required
	Current communication practices?	Similar questions asked but not a specific research goal	Review CITA questions and broaden to complete authors goal
	Willingness to support?	Current level of interest	Review and rework as appropriate
	Current experiences?	Current eTender level of take up	Review and rework as appropriate
	Drivers and barriers	Drivers and barriers to eTendering	Review and rework as appropriate

Table 5.1 Survey Comparison

5.3.2 Planning and Implementation Phase

Question Selection

Naoum (2007) understood that the foundation of all questionnaires was the questions themselves. As discussed above, the author used the 2006 CITA eTendering survey as

the basis for a new survey. The author undertook a review of the 2006 CITA survey and its questions. It was found that some of the research areas in the surveys overlapped. However, the addition, removal and editing of a number of questions was required to establish factors not considered in the CITA survey, such as current ICT usage. This editing is clearly identified in table 4.1.

Description	**Qty**	**Question number**
CITA Survey Original Questions (=)	24	
Questions removed by Author (-)	9	1, 2, 5, 6, 7, 8, 9, 16, 20 * Relates to question number of CITA survey *
Questions added by Author (+)	12	a, d, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14 * Relates to question number of Author's survey *
Total questions in Author's survey (=)	27	
Questions edited by Author	5	17, 19, 20, 21, 22 * Relates to question number of Author's survey *
* A full copy of the Author's survey is included in Appendix C3 *		

Table 5.2 Adjustments to CITA Survey

A number of decisions needed to be made regarding the format of questions. One was whether open ended questions would be used or not. Open ended questions give the respondent the opportunity to offer a custom made response to those questions. Yet Salant and Dillman (1994) believed that open ended questions, when on a technical subject should be avoided. This was due to the possible difficultly for the respondent to complete the question and the time it could take them. Additionally, this question type is difficult to analyse. Therefore, these question types were not considered in this survey but were more appropriately dealt with in interviews completed by the author.

The questions selected by the author fell into two distinct categories. The first category was close ended questions. Close ended questions were used where specific “yes or no” information was required. The second category involves partially close ended questions which gives the respondent a choice in respect to their answer.

The author enlisted the assistance of a number of individuals to pilot the survey. Then any feedback received from the pilot survey allowed the author to make improvements to the final survey.

Sample

The author decided upon a sample size of one hundred companies. The sample was made up of three main categories namely; PQS firms, main contractors and subcontractors.

The author subsequently gathered the names of companies to partake in the survey using selected sampling. The author began by approaching the PQS firms. The firms were selected by searching the Society of Chartered Surveyors (SCS) website (www.scs.ie) for chartered surveying firms. From the author's knowledge of the industry, the market leading firms were extrapolated and targeted. A number of further firms were then randomly selected.

The process was then repeated with main contractors. Company selection began by obtaining access to the www.irishconstruction.com list of top construction companies for the previous years. As this list contains all types of firms involved in the construction industry, the author had to extract the main contracting firms as required. Again company websites were used to establish a member of staff that could assist in the survey. All companies were systematically contacted from the top companies on the top of the list to the firms toward the lower end of the list.

The subcontractors were the third set of participants and a selection of the larger subcontractors, who the author knew to have dedicated commercial staff, from across a range of Company A trade codes were chosen. The sample taken can be seen as a random sample due to the enormous quantity of subcontractors of varying size and type involved in the construction industry. Contact details for individuals involved in the tender process were included on Company A's list, allowing the author to directly contact the individual who was most involved in the tender process.

Should a negative response be received, from the firm during the contact stage, the author established a replacement firm who were agreeable to completing the survey. The complete list of agreeable companies can be seen in appendix B.2.

Distribution and Return of Survey

The potential respondents were sent an email. This email contained a web link to the survey and assured the respondents that all responses received would be confidential. To assist the author in issuing reminder emails to potential respondents,

question one of the survey asked for the respondent's company name. The author could then establish which of the companies had not completed the survey. These companies were then sent a reminder email one week after the initial mail.

After following the web link to the survey webpage, respondents could then complete the survey. The webpage listed the questions beside the choices that could be ticked or chosen as relevant. This had a number of benefits, which similarly reflect the benefits of eTendering over the traditional paper based process (i.e. instant response to author, guarantee of same information to each individual etc.). The author was hopeful that, as the survey was relatively easy to complete, a good response would be achieved.

Survey Analysis

After the website was closed, the results were extracted from the website and analysed by the author. Salant and Dillman (1994) pointed out that a sample survey, when completed, can only produce estimates of people's opinions on an individual topic. As the author's survey was such a survey it is important to note that, the following results are only an indication of the standing of the Irish construction industry and its opinions on the topic of eTendering.

The survey results are show in table form in appendix B.3. These tables were plotted for a clear presentation of the results and, where appropriate, are included throughout this chapter. A range of suitable charts were subsequently plotted to clearly show what Naoum (2007) discussed as the central tendency or most typical response value for the group of responses. With these charts the dispersion of the results was also assessed. Outliers, as discussed by Fellows and Liu (2008), were seen in several questions to be either evenly spaced around or stacked to one side of the mode of the survey results. Therefore the charts can show what tendency the remaining respondents have towards the mode.

Another method of data analysis was the use of the cross tabulation of the results from all the respondent groups. This was completed as reviewing the results, as a whole, could have skewed the research findings. To this end, each questions results were analysed in individual sections, i.e. PQS, CQS and subcontractor, before a broader industry wide analysis was undertaken. Also, where required, Spearman's Rank correlation analysis was completed. This is described by Naoum, (2007), as being a non parametric test which derives a value to show how closely matched the different

comparison groups are in their responses. These calculations, shown in detail in appendix B.4, were completed specifically for the drivers and barriers section of the survey to hone in on the key factors that link each group within the industry.

5.4 Findings

In this section the author will discuss the key survey findings. Individual questions are tabulated, graphed and analysed as required. Furthermore, a through discussion is progressed with consideration given to each participant group. Additionally, the tables of responses for each question, where not presented in this chapter, are included in appendix B.3.

5.4.1 Response Rate

The overall response rates are shown in table 5.2. All 33 of the PQS firms approached were listed on www.scs.ie. Of the 33 firms contacted and agreeable to completing the survey, a total of 23 firms responded. This resulted in a response rate of 70%, as shown in table 5.2 below. A total number of 27 main contracting firms were contacted. These firms were all in the top 200 Irish construction firms. Of these firms 17 responded giving a response rate of 63%. A total of 40 subcontractors were contacted and were agreeable to completing the survey. Twenty eight of the 40 firms returned the survey providing a response rate of 70%. Overall a relatively high response rate of 68% was achieved.

	Client's QS	Contractor's QS	Sub's QS	Total
Sent	33	27	40	100
Received back	23	17	28	68
Response rate	69.70%	62.96%	70.00%	68.00%

Table 5.3 Response to Survey

Additionally in the introductory section of the survey two other questions were asked of the respondents. These questions set out to establish the individual's level of experience and how many tenders they would complete per week. 90% of the respondents' replies stated they had over a minimum of 6 years experience within the Irish construction industry. In addition to this, the vast majority of PQS and CQS

responses, 78% and 82% respectively, showed that they completed from one to five tenders a week. However, this number of tenders significantly increased further along the supply chain with most (64%) of subcontractors completing more than 6 tenders a week.

5.4.2 The Cost of the Current Tendering Process

It was established in the literature review that the tendering process can cost up to 6% of a construction company's costs. Questions one to three were designed to gain the industry's current view on the tender process' cost. Furthermore the questions would gauge the industry's level of belief that an eTendering system could generate savings on the current costs.

Question one, as charted in figure 5.1, shows that the vast majority of firms (79%) believed that the tender process was expensive. However, the CITA survey in 2006 found that 93% agreed with this statement, indicating a decrease in the number of respondents who found the process expensive. The author has concluded that this decrease was due to the impact of a higher proportion of responses received from subcontractors and PQS firms in the author's survey. Both the subcontractors and PQS firms had a higher level of disagreement to this question. They respectively had an 11% and 22% level of disagreement with the proposal.

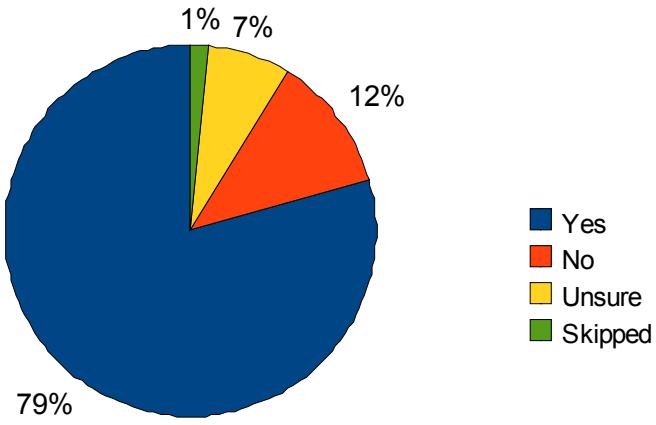

Figure 5.1 Question 1 Results

Furthermore, when asked in questions two and three, about possible savings that could be generated if eTendering was introduced, the respondents were broadly (78%)

in agreement that savings would be generated. The most negative grouping were the subcontractors of whom 29% did not feel that savings would be generated by this new system of tendering.

In question three the respondents were asked to rate the level of savings they would expect through the introduction of the technology. The results are ranked in table 5.4 and a distribution of the responses is then shown in figure 5.2. The rankings show that the respondents suggested that a saving of between 6 to 10% could be achieved through eTendering. However, it is important to note the multimodal distribution of responses seen in figure 5.2. It is shown that the PQS and CQS had their own mode, 6-10% and greater than 15% respectively, while the subcontractors QS responses show a bimodal curve with both "no savings" (N/a in table 4.3) and "6–10% savings" having a similar response rate.

	If "YES" to above please indicate what level of savings you would expect to see as being applicable?				
Q3 Ranking		PQS	CQS	Sub QS	Total Ranking points
	6 to 10 %	1.0	2.0	1.5	4.5
	Greater than 15%	3.0	1.0	3.0	7.0
	N/a	4.0	3.0	1.5	8.5
	11 to 15 %	2.0	4.0	4.5	10.5
	Less than 5%	5.0	5.0	4.5	14.5

Table 5.4 Ranking of Response to Q3

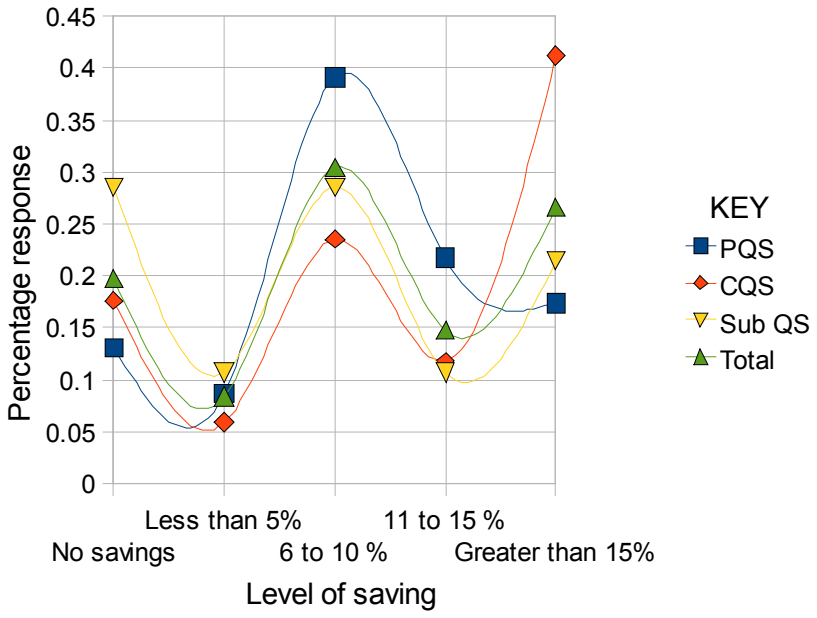

Figure 5.2 Distribution of Responses to Question 3

From these questions and results the author has come to some key conclusions. The sample did recognise the tendering process, as a procedure, that had a substantial cost to their companies. However, even when acknowledging the substantial cost of the tender process, the industry was split in its views on the possible savings eTendering could introduce. In general the industry did identify that savings could be generated, but the level of savings they believed could be achieved varied widely. There was no common consensus between the three groups on the level of savings that could be achieved. This leads the author to conclude that each group sees eTendering as having different effects on their tender process.

5.4.3 Construction Tendering Software

During the observation study it was established by the author that whilst the BOQ can be distributed in soft copy, there were interoperability issues. The following questions were asked of participants to establish whether there was any predominant software within the industry. Additionally, the author sought to establish if the multiple software licences, as seen in Company A, was a common occurrence in the industry. The overall results to the questions are shown below in figure 5.3 and table 5.5 respectively.

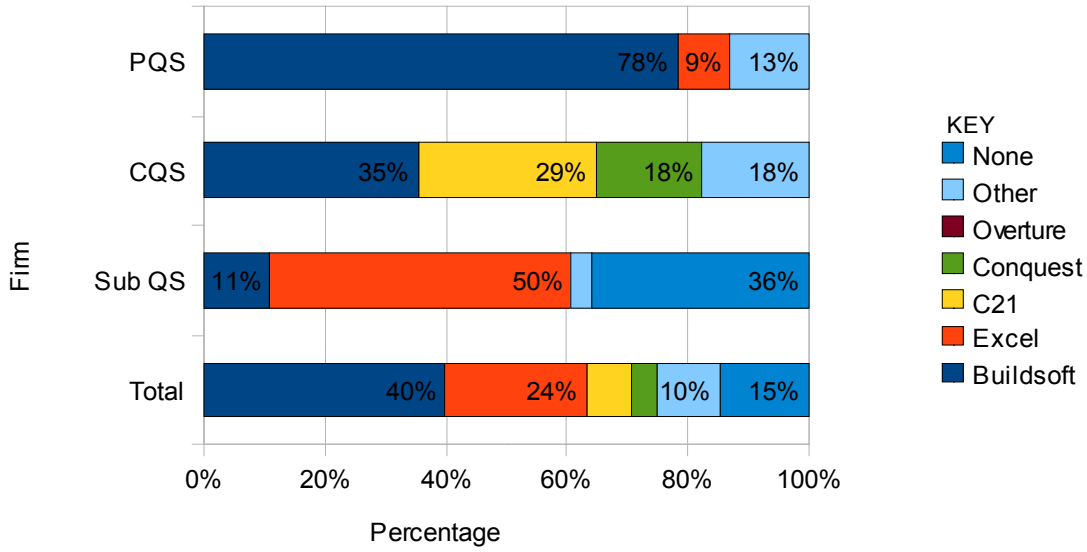

Figure 5.3 Q4: Primary Estimating Software Used

The responses revealed that the Buildsoft program is the dominant software in the PQS share of the market. In this sector, 78% of respondents suggested that this was their primary software package. The remaining 22% was shared among Excel (9%), and

an equal split between three other programmes CATO, RIPAC and Masterbill. Furthermore, as the author reviewed the findings of the firms further along the supply chain, it emerged that the percentage of Buildsoft usage as the predominant software package dramatically decreased. For the CQS section of the industry, the programs predominantly used were Buildsoft (35%), C21 (29%), Conquest (18%) and an additional three programmes (Estimate, Cost X and Causeway) equally divided the remaining 18% share. However, the most interesting finding was that 36% of subcontractors did not use any software to assist in estimating costs, with 50% using generic spreadsheet software as their primary software tool.

Progressing to question five's responses, shown in table 5.5, the author found a high degree of reliance by the PQS firms on Buildsoft (83% had access to Buildsoft). The CQS group had a significant spread of software programs, a slight majority of 58% of companies having access to three or more programs. Finally, of the subcontracting respondents, 21% claimed they had no access to any software program.

Quantity	Software program	PQS	CQS	Sub	Total
0	None	0 / 0%	0 / 0%	**6 / 21%**	6 / 9%
1	Buildsoft only	**3 / 13%**	**1 / 6%**	0 / 0%	4 / 6%
	Excel only	2 / 9%	0 / 0%	**15 / 54%**	17 / 25%
	One other only	1 / 4%	0 / 0%	0 / 0%	1 / 2%
2	Buildsoft and Excel	**14 / 61%**	**2 / 12%**	5 / 17%	21 / 30%
	Buildsoft and one other	0 / 0%	**4 / 24%**	0	4 / 6%
	Excel and one other	1 / 4%	0 / 0%	1 / 4%	2 / 3%
3	Buildsoft and excel and one other	2 / 9%	**6 / 34%**	1 / 4%	9 / 13%
4+	Buildsoft, Excel and two or more	0 / 0%	**4 / 24%**	0 / 0%	4 / 6%
	Totals	23 / 100%	17 / 100%	28 / 100%	68 / 100%

*Table 5.5 Q5: Use of Estimating Software (Key figures in **bold**)*

To conclude, the author found that the PQS firms within the Irish construction industry relied heavily on the Buildsoft program. Yet this programmes use was not replicated by the other groups in the industry. Contracting firms had access to Buildsoft and a range of other software, however, there was no clear preferred software in this sector. Additionally, the almost monopolistic use of Buildsoft by PQS firms, led to the 100% possession rate of Buildsoft by the CQS group within the industry. The

possession of this software helps alleviate the interoperability issues the author observed in chapter three. Interestingly, the subcontracting firms did not appear to have any software specific requirements during the tender process. This was indicated by both the widespread use of generic spreadsheet software and a sizable percentage of respondents not using any primary software.

5.4.4 Tendering Communication Practices

The next series of questions focused on the format of tender documents. The author sought to establish what level of electronic communication was taking place among the sample. Five possible answers were offered to the respondents from which to choose. The responses were established from all possible combinations of communicating information in hard or soft copy format. The responses can be seen in figure 5.4.

Figure 5.4 clearly shows that the majority (62%) of companies conform to the Liaison Committee practice notes, i.e., issuing paper documents with soft copy upon request. However, further along the supply chain it was more evident that companies were already using ICT as their sole communication medium. 4% of subcontractors replied that they received the majority of their tender packages in soft copy only. Also 11% of that group had also received soft copy tenders where hard copy documents were available upon request.

During the submittal stage of a tender there was also a strong trend among PQS and CQS samples to use paper based documents. This trend was not as evident in the subcontractor grouping, where only 21% of subcontractors returned a hard copy quotation for their works. The author expected prior to the survey that there would be a preference for the use of paper documents. To explore this further the author asked the respondents on their favoured method of this form of tender submission.

The results, shown in figure 5.5, show that no contractors preferred to ink in a BOQ at the submittal stage of a project. However, 52% of PQS firms still preferred this method. Indeed, a significant majority (78%) of PQS firms suggested that they required hard copy handwritten tender confirmation. To this end, 41% of contractors revealed that they facilitated this requirement by inking a BOQ for a contract award. Additionally the author, having reviewed the answers from previous sections, was not surprised at the level of positive response from subcontractors to returning a handwritten BOQ. 71% preferred this method of submittal.

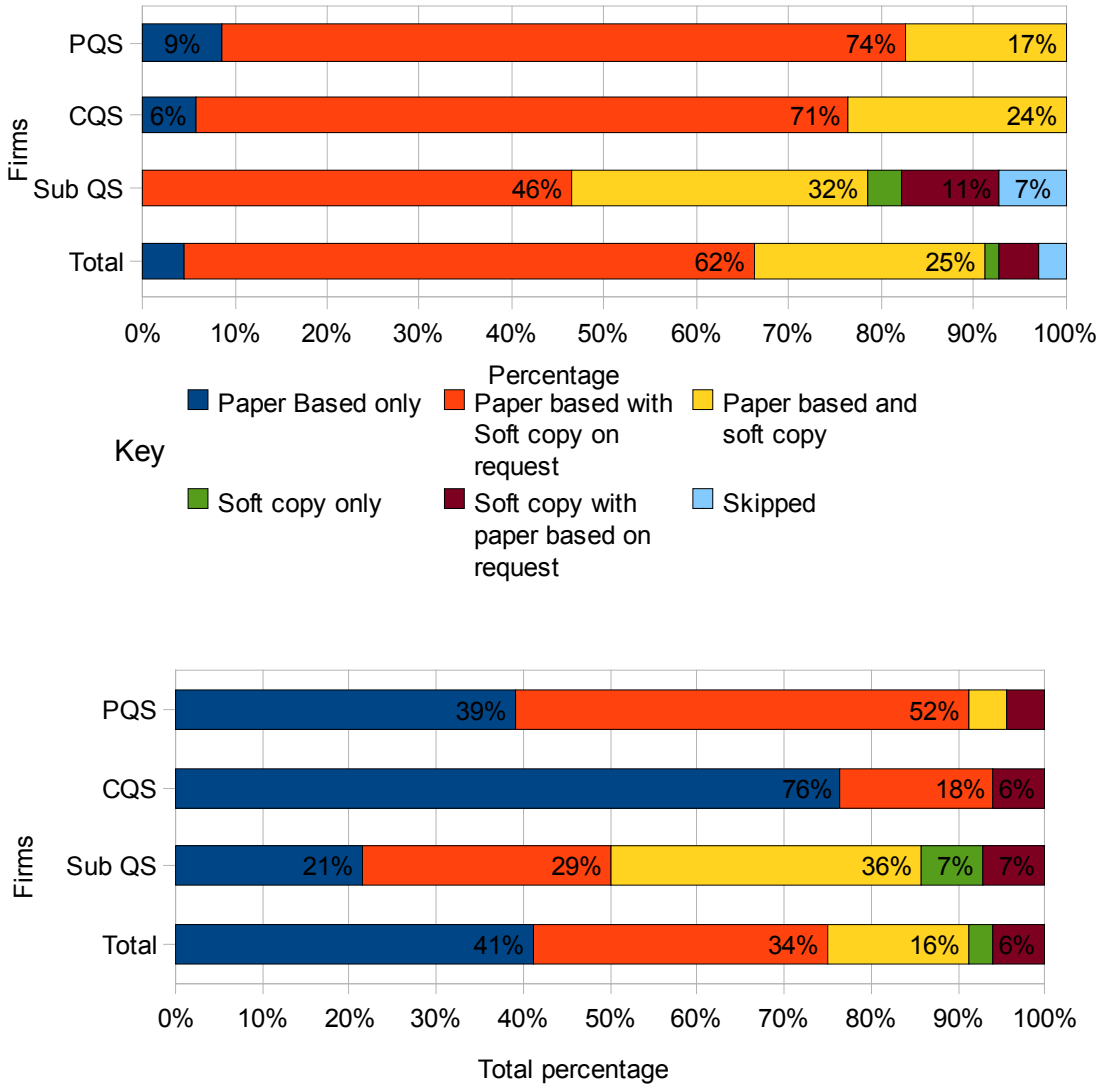

Figure 5.4 Medium of Tender Documents; Top Section for Issue Bottom Section for Submittal

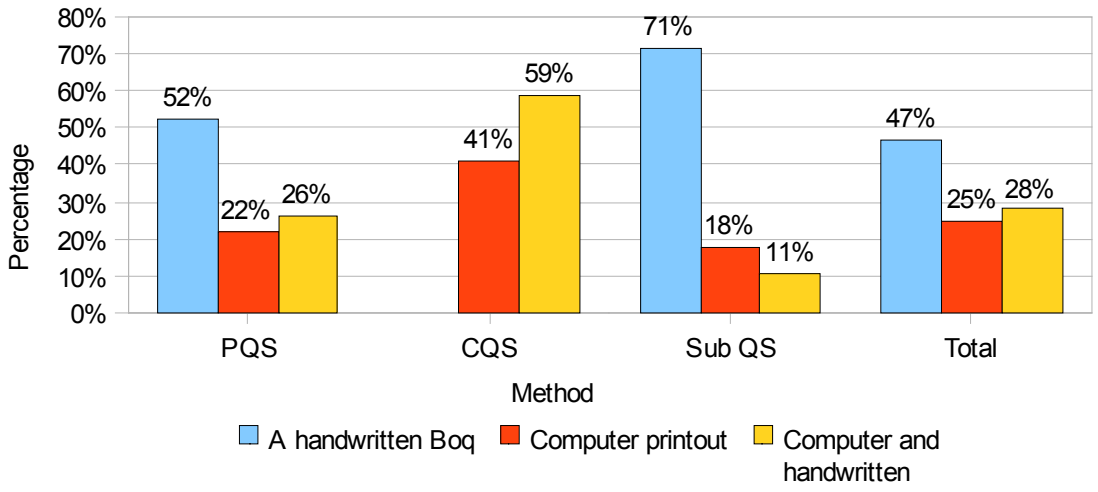

Figure 5.5 Method of BOQ Return

Finally in this section, a separate question was given to subcontractors when completing the survey. The results, shown in figure 5.6, revealed that 79% of subcontractors frequently obtained duplicate enquiries from multiple contractors. This meant that a significant amount of paperwork was being re-handled, printed and distributed to subcontractors who already have the information.

From the responses to these questions the author concluded that the preferred communication medium undertaken by the sample was the hard copy paper based form. The findings also pointed to ICT being utilised most frequently during the initial issuing of documentation.

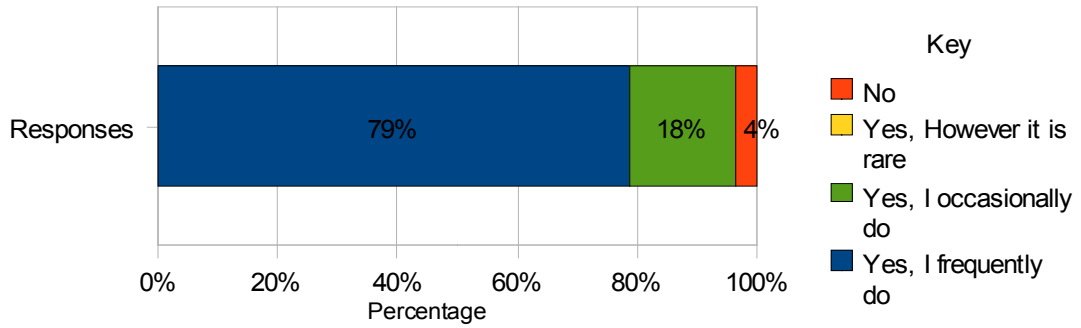

Figure 5.6 Incidence of Duplicate Enquiries

5.4.5 Willingness to Support Advancement of ICT

The next set of questions sought to establish the willingness of the sample to support the advancement of eTendering. Furthermore, the questions can be directly compared to the CITA survey of 2006.

The author asked a closed choice question to explore the level of awareness and knowledge the sample had about eTendering. The results are shown in figure 5.7. Choices ranged from the lowest option, of not aware through somewhat aware, aware and moderately aware to the highest option of very aware. Figure 5.7 shows that a majority of respondents were only somewhat aware of the technology. However, the effect of outliers from the "total" mode shown in the figure led the author to understand that there was a positive tendency towards a higher level of awareness of the eTender process in the Irish construction industry.

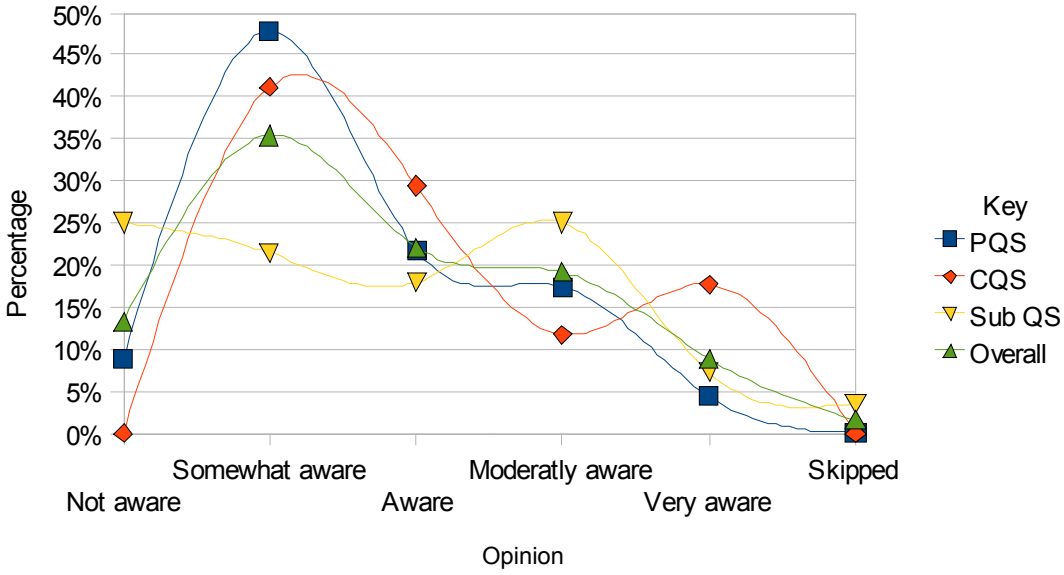

Figure 5.7 Level of eTendering Awareness

With most respondents having a general awareness of eTendering, the next questions aimed to establish if firms were positive about undertaking eTendering. The respondents view is illustrated below in figure 5.8. Overall the respondent's views were very positive, with 80% willing to consider applying the technology. This tallies with the same percentage of respondents to question one, who suggested eTendering could save on their company costs. Additionally, it was seen that a small percentage of companies were already undertaking the use of these technologies to assist them in their tendering process. These results when contrasted to the CITA findings (93% willing to apply) show that there was an increased level of uptake of ICT. However, there was also a larger percentage of respondents who stated an unwillingness to implement the technology. CITA recorded that only 7% of respondents were unwilling to consider the technology

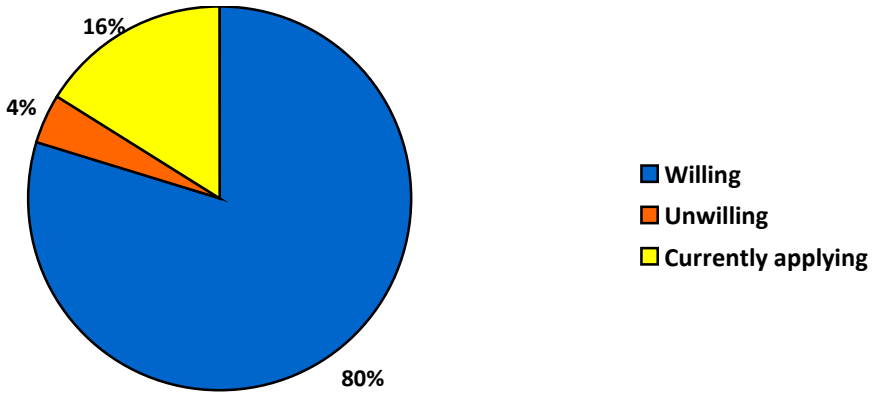

Figure 5.8 Willingness to Apply Technology

Question 17, asked respondents to indicate the extent to which they believed there would be an increased significance of eTendering. Responses to this question would enable the author to explore the extent to which there exists a strong inertia within the sample. Previously in 2006, CITA had found that the majority (92%) of respondents to their survey thought that tendering was between 2 – 5 years away from becoming increasingly important. The remaining 8 % believed that it was indeed nearer than that to becoming a reality. The author's results can be seen below in figure 5.9, along with comparitive findings from the CITA survey.

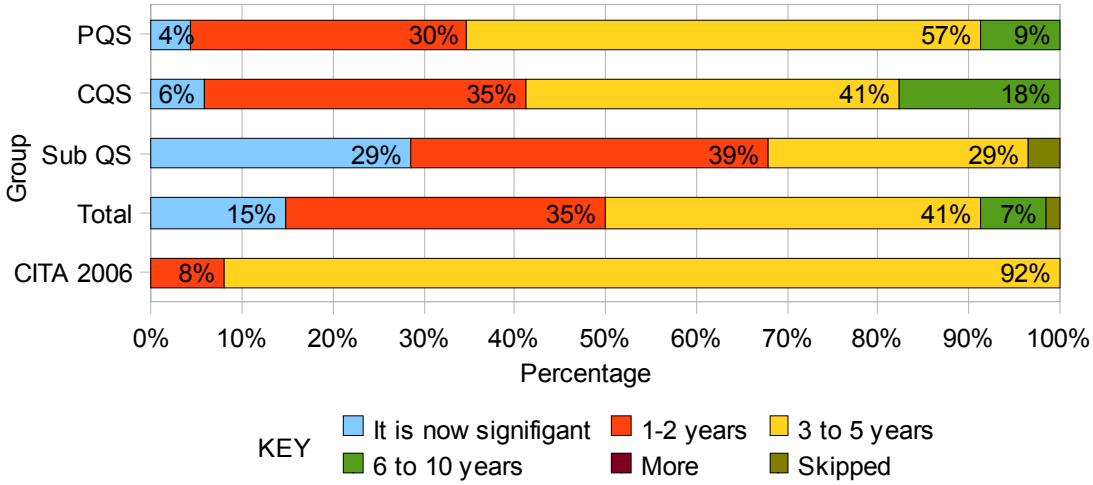

Figure 5.9 Future of eTendering

The responses to the above questions show that there was a significant degree of inertia in the sample with regard to eTendering. The author has shown that although there was an increased usage of the software since CITA's survey, that there was also an increased level of negative responses towards its uptake. The responses have led the author to conclude that the sample has a high percentage of people willing to partake in the use of such software, however, their interest has not lead them to actively pursue the implementation of the technology.

5.4.6 Current eTendering Experiences

The first set of questions on this topic asked the respondents whether or not they had experienced electronic communications in the tender process. An initial basic trend is obvious in figure 5.10. The trend, also identified in the CITA report, shows a higher level of electronic document issue when compared to submittal. Furthermore, the

author's survey shows a level of further uptake of the technology. Yet the response to the questions asking the respondents if they had experienced the entire process over an electronic medium shows a marked decrease in positive responses. Again, the author found that subcontracting firms had the most experience of using the technology to communicate information.

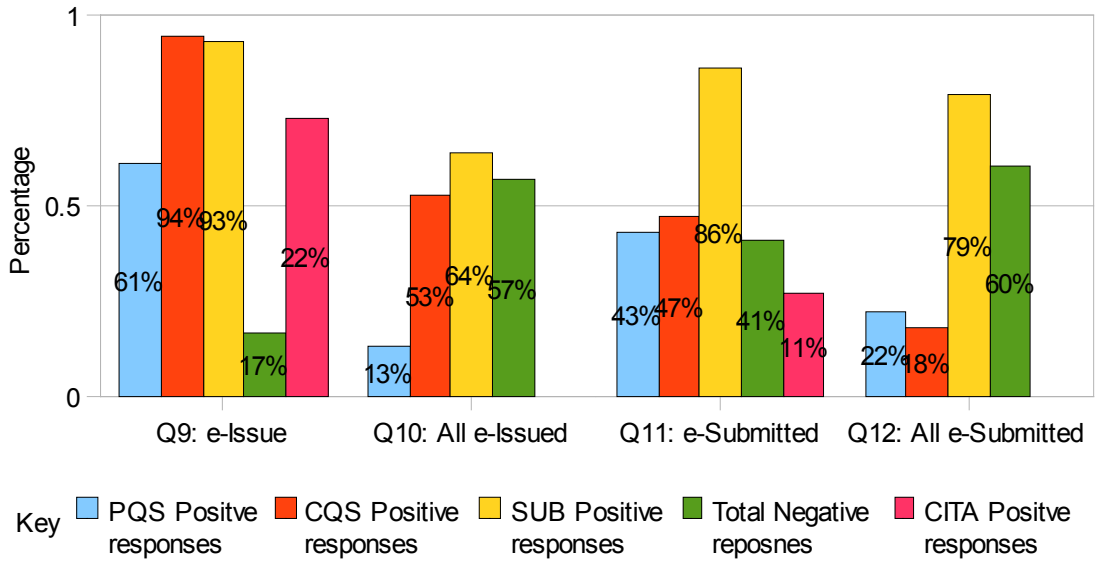

Figure 5.10 Experiences with eTendering

A further two questions were then asked of only the PQS to CQS firms. These questions considered how they dealt with their subcontract enquiries. These questions were not asked of subcontractors, as the author felt that they do not extensively partake in further subcontracting of works. The results, as shown in figure 5.11, found that a significant majority, 88% of contractors, had used ICT for subcontract tendering. This percentage was not as high in PQS firms. In the PQS group, only a slight majority of 57% of PQS firms undertook this practice.

To further explore this question respondents were asked about the percentage of times they would utilise the technology. Responses are shown in figure 5.12. It can be seen that of the PQS firms that had used the technology, there was still only a low uptake of using electronic means to communicate the tender documents, with 56% of firms who use the technology, using it up to a maximum of 1 in every 2 tender packages. It was further shown, that contractors were again more open to utilising the available technology. From an analysis of responses to these questions a number of conclusions can be drawn. Firstly, a significant majority of subcontractors have been

involved in the issue and submittal of tender documents using electronic communications. However, when the author examined the responses of the firms that are above the subcontractor in the supply chain, it was revealed that even though the CQS was undertaking a level of electronic communication with the PQS firms, there was a significant drop in the level of all documents being sent in this fashion. With the PQS in charge of the submittal method, it is interesting to note that only 47% of the PQS sample had experienced some form of submittal of electronic documents, with a further reduced percentage experiencing a fully electronic tender submittal system.

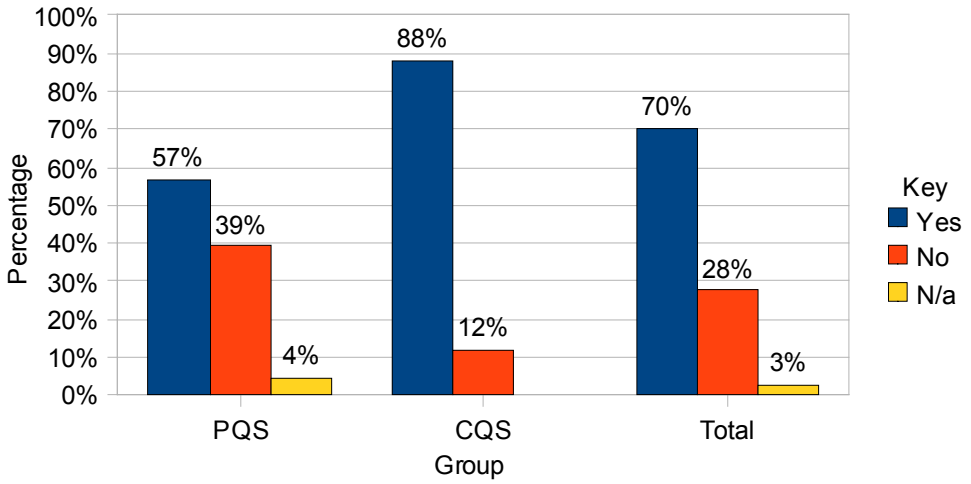

Figure 5.11 Use of eTendering in Sourcing Subcontractors

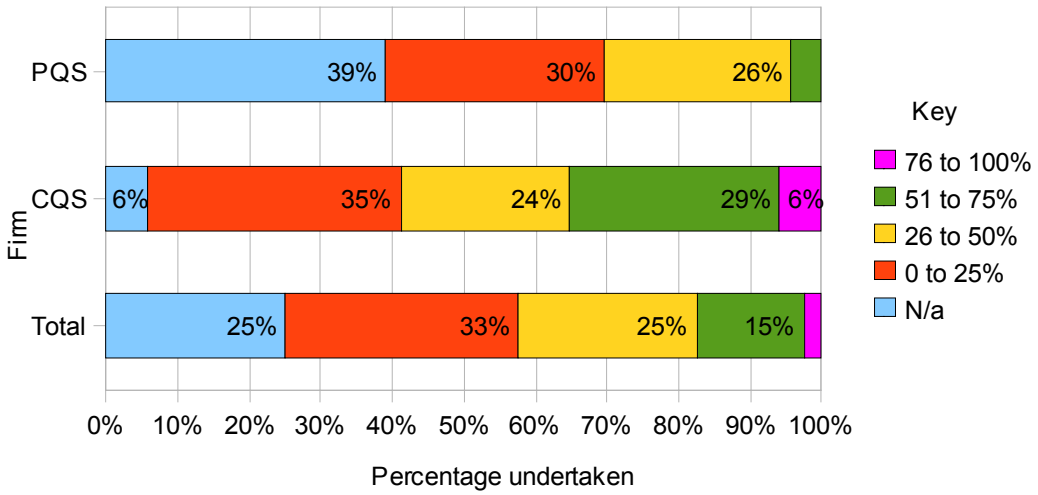

Figure 5.12 Level of Use of eTendering in Subcontracting

5.4.7 eTendering: Drivers and Barriers

CITA had established that there were significant concerns in the Irish construction industry with regard to eTendering. In the next section of the questionnaire the author reissued CITA's survey questions on the drivers of and barriers of eTendering, with a view to establishing whether these views had changed over the intervening two years.

The author asked if the respondent's company had concerns over adopting a web-based strategy for construction tendering communications. The results, shown in figure 5.13, show that the CQS and subcontractors were the most comfortable with the idea of using web based technologies. Both groups' results revealed that a slight majority did not have overriding concerns. This is in contrast to CITA's 2006 findings where a majority held concerns over using the technology. However, the authors findings showed an increased level of similarity to the CITA survey in the PQS grouping. Here a majority of PQS firms had concerns with the utilisation of the technology.

The next question was asked to further clarify the views of the respondents who had replied in a negative fashion to the previous question. A number of issues were supplied to the respondents and they were asked to identify their level of apprehension on each concern. These results were then ranked, by number of responses received for each option. These rankings and other calculations are shown in appendix B4.

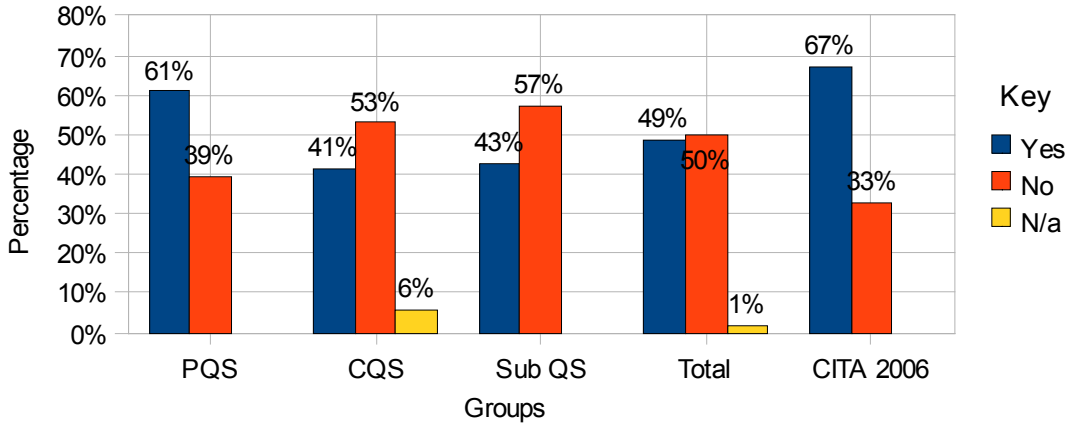

Figure 5.13 Level of Concern with Technology

The author established that the top ranking concerns in order were: Security of sensitive data, other parties ICT capabilities and legal implications. To examine how closely the author results matched the CITA findings, Spearman's coefficient of rank

correlation (r = .786, See appendix B4) and a graph, see figure 4.14, of the results were completed. The results show a strong linkage between the results of the surveys. Thus it would appear that the industry in general continued to be apprehensive on a number of key aspects of eTendering and that these have yet to be addressed within the industry. However, to clarify and confirm any concerns, a further two questions on the barriers that prohibit the uptake of eTendering in both the industry and individual firms were asked.

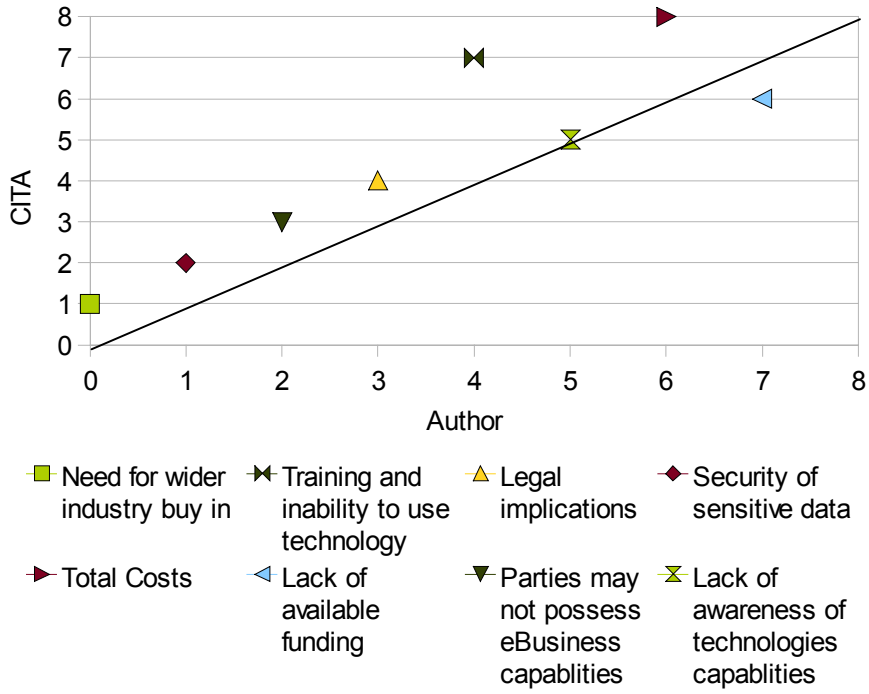

Figure 5.14 Correlation of Survey Results

Figure 5.15 shows the six items identified by CITA and the author, as aspects which undermine the uptake of the technology within the industry's firms. Again, there were seen to be a very close correlation of the results of the author's survey and the CITA survey (Spearman's result was r = .829). In this question security of data was again the key issue. Furthermore, it was established that the cost of implementing the process was not seen as a major barrier. Indeed the option of stating that "the investment will not match the return" was ranked in a low position on the table reflecting the positive response received in section 5.3.2 about whether or nor eTendering would generate savings.

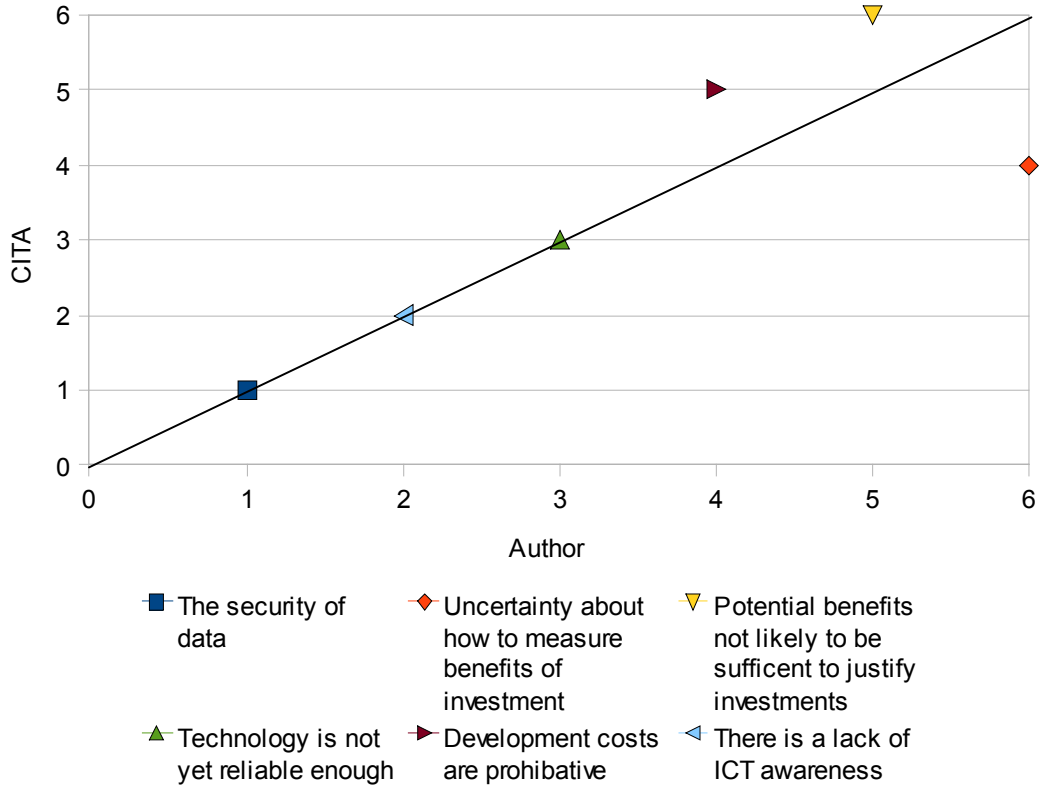

Figure 5.15 Barriers to Uptake of Technology

Finally the respondents were requested to address the drivers behind the implementation of eTendering in the Irish construction industry. The key attraction in the author's survey, as shown in figure 5.16, for firms to undertake eTendering was listed as reduced photocopying and printing costs. However, this was marked of least importance in the CITA survey, leading to a very poor rank correlation score of r = .214. Yet a number of the drivers were closely linked. Saving manpower was marked as the significant driver of the technology. Saving manpower was then closely followed by the three options which reflected that choice: fewer errors, improved accessibility and the avoidance of re keying data.

From these questions on the drivers and barriers to eTendering and the use of ICT, the author has come to some significant conclusions. The author is encouraged that during the time between the CITA and his own survey, there was a reduced level of concern about the uptake of the technology. However, it was established that even though this level of concern had fallen, there were still some aspects of the technology that had not been significantly dealt with. The most important area of concern was that of security of information. Furthermore, the areas of ICT and, in particular, the awareness of its capabilities within the industry were seen as a factor

which was holding back the implementation of the technology. Legal issues and the lack of government support were also found to be significant factors. At the time of the survey it was also interesting to note that costs to implement the technology were not seen as a strong barrier. Furthermore, the author found that there was a change in opinion on the drivers to the implementation of the technology. Reduced photocopying and printing costs were now the key driver to its uptake, while savings on manpower were also seen as important.

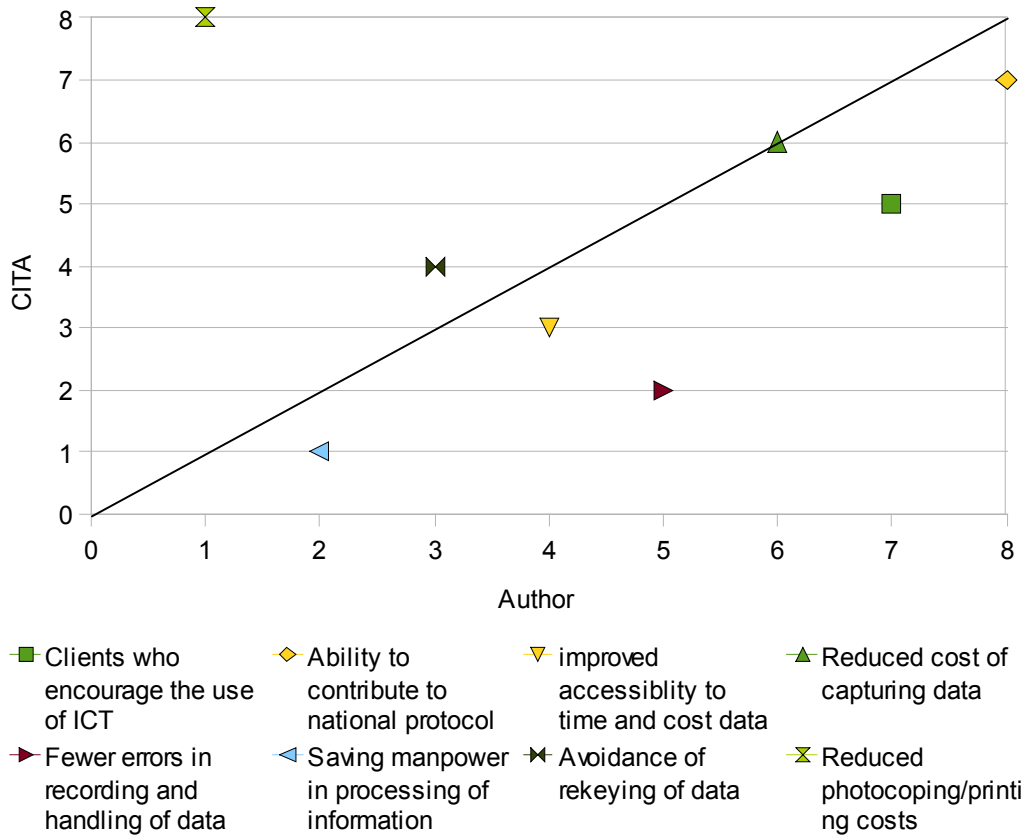

Figure 5.16 Drivers to Uptake of Technology

5.5 Survey Comparison

The author has completed a review of similar survey findings in appendix B5. For the purposes of brevity a concentrated overall comparison of all the surveys and the author's survey is included in this section.

The author found that there were a range of similarities and differences between the survey results. To begin with, the results of the Omani (Al-Lawati and Aibinu, 2008), UK (Martin, 2008) and the author's survey suggest that parties within their

respective industries were willing to apply ICT usage to assist in their tendering process. Furthermore, this is supported by the evidence that there was increased transfer of electronic documents between the construction industries firms. This was illustrated comparing Martin's two UK based surveys, the author's comparison with the CITA 2006 survey findings and Samuelson's findings in Sweden. With this in mind the author wished to compare what factors were attracting the firms to using this technology.

A comparison of all the survey findings of attractions, as well as barriers, can be seen in table 5.5. This comparison shows that the attractions were balanced between cost reduction incentives and ICT's ability to gain additional value from staff members. However, even with a number of key attractions identified, there was still seen to be a level of inertia. This is based on a comparison between the CITA and authors findings and also Martin's (2008, 2003) papers. This inertia is undoubtedly linked to the barriers associated with the uptake of ICT within the construction industry.

		Author (2008)	**Cita (2006)**	**Northern Ireland (2007)**	**Oman (2008)**	**Sweden (2008)**	**UK (2003) *Not ranked***
DRIVERS	1	Reduced photocopying	Reduced manpower required	Improved communication	Potential for time savings	Better access to information	Reduces risks
	2	Reduced manpower required	Fewer errors in recording and handling of information	Reduced administrative costs		Better financial control	Better information to all parties
	3	Reduction in rekeying of information	Improved accessibility to time and cost data	Price reduction in tendering		Sharing of information	Reduces resource input and remaining time means an increase in output quality
BARRIERS	1	Security	Security	Security	Internet threats / security	Continuous demand for upgrading of hard/software	Costs of printing shifted down supply chain
	2	Awareness of ICT	Awareness of ICT	Legal	Ease of use / Clarity of systems	Overabundance of information	IT infrastructure
	3	Legal aspects	Government leadership	Lack of business relationship	Efficiently designed websites	Old systems work fine. "If it ain't broke don't fix it"	ICT access can be unachievable in some areas

Table 5.6 eTendering Drivers and Barriers

Comparisons show there is a considerable concern regarding the security of any possible system over 4 of the 6 surveys. Interestingly, the Swedish survey ranked this item as least important. However, it is important to note that this survey was not centred on the topic of eTendering, but rather on the communication of the respondent's everyday type of document. There were then a wide range of other concerns. This was also represented in the author's surveys findings.

The author also noted that Irish construction industry, when compared to their UK counterparts (Martin, 2003) appeared to have a far greater percentage of specialised tendering software. This difference could however, be related to the time lapse between the surveys.

The author's findings, when compared to similar surveys of construction industries, do reveal a trend. This trend is for the continued uptake of ICT within the construction industry. However, this uptake was not identified as a rapid one due to widespread concerns over a range of issues and a general level of industry inertia.

5.6 Conclusions

The author had observed little in the way of eTendering in Company A. A small fraction of the communications undertaken were based around email, but the vast majority of communication was paper based. Consequently, the author wished to investigate the sample's uptake of rapidly changing ICT in relation to current tender practices. Furthermore, the author wanted to consider the drivers and barriers that affect the uptake of the technology. However, before any conclusions could be made on these items, the author had to understand a number of smaller individual aspects of the current Irish construction industry. The author had to understand whether or not the Irish construction industry believed that tendering was a costly process. Subsequently, and with the additional knowledge of individual firms ICT usage, the Irish construction industries views on eTendering could be established and interpreted to develop an acceptable pilot project.

An overall response rate of 68% was achieved across the three main groups that are involved in the tender process; the clients QS, the contractors QS and the subcontractors QS. These three groups were surveyed to give the author a representative sample of the Irish construction industry. From an analysis of the responses the author established that the sample believed they were undertaking an expensive process when

completing tender documentation. During this process they used software programmes to create and manipulate documents. Specifically, the author found that the PQS firms had a high level of dependence on the Buildsoft program. However the information was often communicated in hard copy even though it had been created in a soft copy format.

On further analysis of the respondents' eTendering experiences, there appeared to be a far greater level of eTendering taking place further down the supply chain, the majority of companies surveyed believed that eTendering could establish a level of cost savings. However, there was a degree of inertia identified by the author in his analysis of the survey results regarding the uptake of the technology. This inertia was examined through comparisons with other studies. It emerged that there was a wide range of concerns with regard to the application of the technology. Security was seen as the most common and, therefore, key barrier to its introduction. The other aspect clearly identified by the author was the lack of awareness that respondents perceive there is in the industry with regard to ICT and eTendering. This was particularly conveyed in the response to the final question of the survey (Shown in appendix B3, Q23). The respondents were asked to agree or disagree to a number of statements. The author found that the highest level of disagreement was to the statement relating to the Irish construction industry's awareness and familiarity of it's respondents to eTendering, where 34% of respondents did not believe there was a general awareness of the benefits of the technology.

The author would thus contend that the construction industry would welcome a process that would reduce the expensive nature of tendering regardless of the perceived barriers. Therefore, any electronic solution developed would be required to identify and address the industries concerns to its uptake which were identified in figure 5.15. These findings were of fundamental importance as they would allow the author to progress a considered pilot project in relation to his thesis aims and objectives.

Chapter 6

Pilot Project

6.1 Introduction

The author's literature review and observational research have documented the tendering process and its inherent inefficiencies. Furthermore, the author's survey concluded that there was a general belief among the sample chosen that eTendering would bring significant business benefits to the Irish construction industry. The purpose of this chapter is to test the author's hypothesis with a view to validating the benefits of an eTendering solution deployed by an industry alliance known as the Construction IT Alliance (CITA).

The group responsible for the research consisted of industry individuals with experience of current tendering practices. The author actively partook in the group's research, as an academic representative, and assisted the group as required by the module leader. As discussed in chapter three, the reasoning for undertaking this form of research was that it would allow the author to directly compare and contrast the separate tender processes. Thus clearly identifying the benefits of undertaking an eTender in lieu of the traditional paper based format.

6.2 Construction IT Alliance

CITA originated as a research project in the Dublin Institute of Technology in 2002. The goal of the organisation is to encourage participants in the Irish construction industry to take greater advantage of current and emerging IT (Thomas and Hore, 2003). The organisation's members comprise a large number of corporations drawn from a broad cross-section of the Irish construction industry, including architects, engineers, contractors, suppliers, clients, IT companies, government departments, state agencies and third level institutions. The main source of funding originates from membership subscriptions, with other income sourced from training courses and sponsorship of events. The main activities involve organising bi-annual member meetings, training courses, information dissemination through the organisation's website and online newsletters and promoting the work of its Special Interest Group (SIG) network (O'Connell et. al., 2007).

6.2.1 CITA Special Interest Group

The author was fortunate to work with a special interest group focused on eTendering. Prior to the author's involvement the group established practice guidelines and protocols for eTendering within the Irish construction industry. A requirement of the protocol was that eTendering should seek to minimise errors, speed up the tender process and create overall efficiencies in the preparation and submission of tenders. The group's work involved carrying out two tasks, namely:

1. Reviewing the policy of the Liaison Committee Practice Notes (LCPN).
2. Conducting a mock tender exercise to examine the practicability of carrying out a fully electronic tender.

The group carried out a number of mock tenders electronically utilising the Buildsoft Online Tendering System (BOLTS). However, they experienced major difficulties in converting the data between different software packages. This involved a great deal of time and effort, and they concluded that, whilst the technology was available and successful, it was not commercially viable at that time to be widely deployed in the industry.

6.2.2 Construction IT Alliance eXchange (CITAX)

In 2005, CITA obtained funding for the CITAX project under an Industry Led Network initiative funded by Enterprise Ireland (West and Hore, 2007). The overall aim of the project was to facilitate more efficient business transactions between companies in the Irish construction sector by the deployment of readily available ICT tools. The longer term objective of the network was to develop a platform for the design and development of open standards that would be promoted and implemented within the construction supply chain. The CITAX project focused on five module areas:

1. Module 1 - Production and exchange of CAD drawings.
2. Module 2 - Production and exchange of trading documentation, such as purchase orders, proof of delivery and invoices.

3. Module 3 - The pricing of tender documentation electronically and the recommending of a preferred tender for selection.
4. Module 4 - The storage, retrieval and general dissemination of project information on construction projects.
5. Module 5 - The use of CAD software in the production of bills of quantities.

The management structure, as shown in figure 6.1, for the five modules was identical, with only the participants of the actual group and also the module's project leader differing. These roles were filled by individuals closely related to the specific area of research.

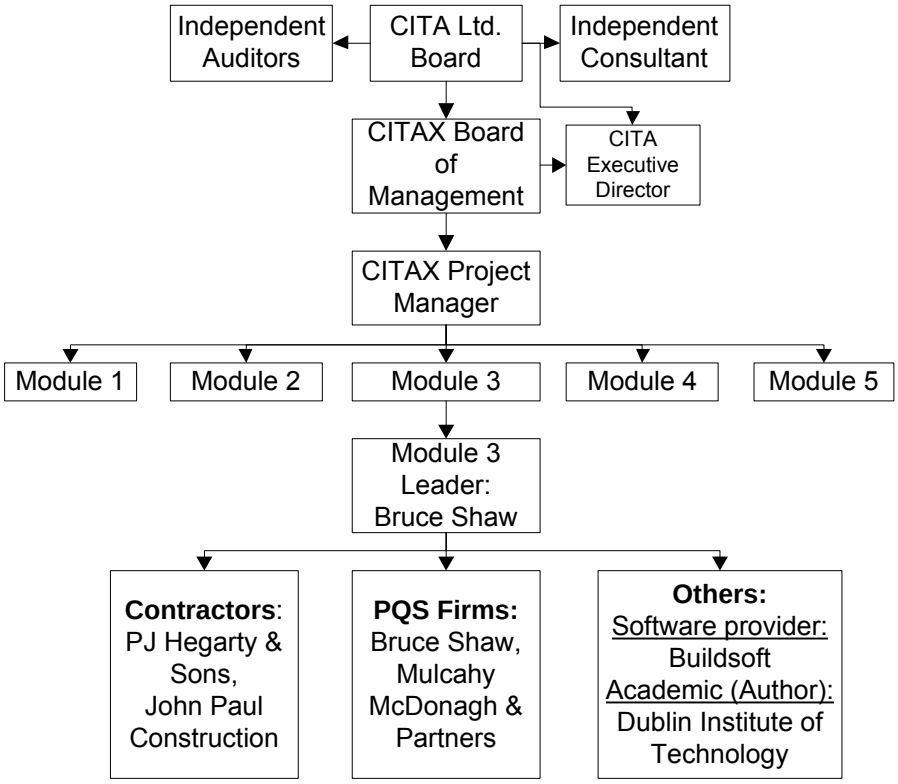

Figure 6.1: Pilot Team

6.3 eTendering pilot group

6.3.1 Formation of eTendering Group

The momentum for the foundation of the eTendering module emanated from the previous Special Interest Group with a number of the SIG members joining module 3.

This meant that module 3's team had a good understanding of both the traditional tendering process and the potential electronic systems which were available for deployment in the Irish construction industry. The author was fortunate to be invited to join module 3 to assist with the research. Within the module, the module leader was responsible for the group's co-ordination and guidance. Furthermore, this individual would report to the CITAX main board on a regular basis. The remaining group members are shown in figure 6.1. This figure includes the author as the academic participant of the module. The author agreed to undertake the required tasks, as requested by the module leader, to ensure a successful pilot. All members would add their experience and expertise to the group. In particular, the author used the research he had completed at each stage of his work to further inform and assist the group. Additionally a member of the CITAX board could attend any meetings should the group require their assistance or knowledge over the project's duration.

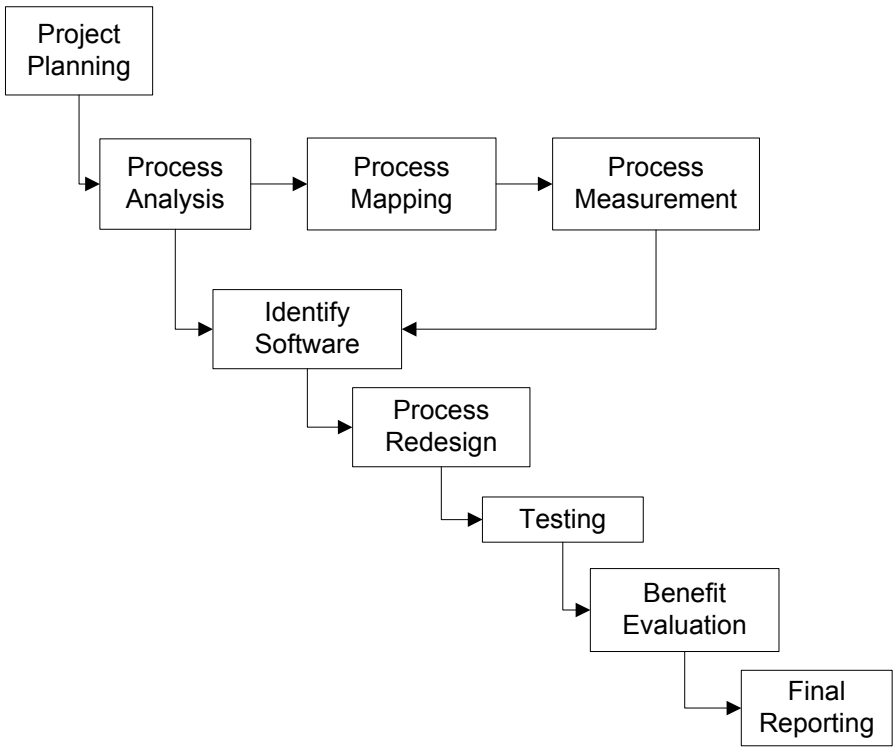

Figure 6.2 Module 3 Methodology (Hore et al., 2007)

The inaugural module meeting, which took place on the 29th September 2006 (A full summary of the group meeting dates can be seen in Appendix C.1), involved the CITAX board members discussing their outlook and proposed methodology for the pilot project. The agreed methodology, shown in figure 6.2, was based on a two year cycle of

work. The pilot methodology led the group from analysing, mapping and measuring the initial tender process, to identifying the software that would facilitate a redesigned process which would be suitable to be piloted, mapped and measured for a final benefit evaluation. This work was facilitated through the use of regular and frequent module meetings in conjunction with eight CITAX symposia. The symposia were based on the eight key steps, following the project planning stage, identified in figure 6.2 giving all the modules milestones to obtain, as well as helping them identify the key requirements of the study.

6.3.2 Project Planning Phase

Following the inaugural meeting, the members of module 3 had a number of months to prepare a project plan report for the first CITAX symposium. During this time the group met monthly and discussed the key items for the module's plan of action. These items included broad agreement of the projects aim, objectives, scope etc.

The module's specific aim was to complete a pilot that would prove that significant measurable economic benefits can be achieved by collaborating network members through the adoption of an online tendering system. Furthermore, if possible, it was seen as important to secure the agreement of a suitable client who would allow the pilot to take place on a live construction project.

To achieve this aim the module had a number of objectives, as shown in figure 6.2. First, the group would be required to reach a consensus on the existing tender process map. Subsequent analysis of this process map, in terms of time and resources, would result in a calculation of the tender process cost. The costing of the tender process' tasks would also assist the module 3 in identifying the inefficient processes undertaken during the existing process. The group then prepared an estimate of the cost savings that could potentially be achieved through the introduction of an eTendering system. Following this, module 3 wished to pilot a suitable eTender process. This process sought to demonstrate that it was possible to remove the identified inefficient processes.

The module 3 team began by agreeing on its aims and objectives, the scope, assumptions required and limitations of the pilot. The agreements made with regard to the scope included:

- It was agreed to include the main stages of the tender process, as shown in figure 6.3,
- The tasks undertaken during the preparation of tender documentation would be excluded from the research.
- It was agreed that the pre-qualification tender process was to be omitted from the scope of this study.
- The group would not complete a review of tender document assessment procedures

With the module members coming to an agreement on the aims, objectives and scope of the research, an agreed timescale for the overall project was also produced. This is shown in table 6.1. The timetable identified the date each methodology task was required to be completed by along with the individuals involved in completing the task.

6.3.3 Process Analysis and Mapping

Following an agreement on the module plan, an analysis of the existing business processes was conducted. The methodology adopted by the project team involved:

a) The identification of the activities to be included or excluded, as decided in the planning phase.
b) The formalisation of the process into flow-chart form, including the activities of all likely participants.
c) A top-down approach was adopted in analysing the process, breaking the process down, from higher to lower levels.

To assist in the production of the flowchart the group was advised by the CITAX project manager to, at first, map the process very simply, i.e. by identifying the major processes (as shown in figure 6.3) of the mega process that is tendering. As these were agreed upon, discussions were held on identifying the sub-processes below the major processes. In general terms, to avoid unmanageable detail, the analysis did not go below task level, that is, a job which can be carried out by one person in one phase of work (see figure 6.4).

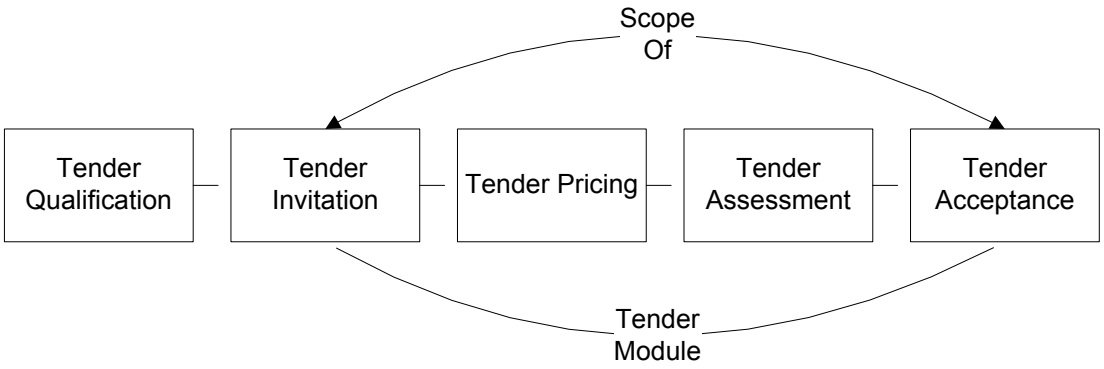

Figure 6.3 Scope of Tendering Module (Major Processes)

Tasks	**Responsibility**	**Time allowance to complete tasks (Months)**	**Date to be completed by:**
Prepare Draft module plan	Module leader	2	November '06
Sign off module plan	All members	2	November '06
Check Historic data	All members	3	December '06
Assessment of Current Practice	All members	4	January '07
Summary of report on current practice	Module leader	5	February '07
Assessment of inefficiencies	All members	6	March '07
Summary of report on current inefficiencies	Module leader	7	April '07
Completion of software registrar / standards	All members	6	March '07
Check on functions of software	All members	7	April '07
Identify Pilot	All members	8	May '07
Prepare pilot documentation	All members	9	June '07
Issue pilot documentation	All members	9	June '07
Completion of pilot study	All members	14	December '07
Internal module report on resources	All members	15	January '08
Audit on accuracy	All members	16	February '08
Audit on records	All members	17	March '08
Comparison of resources expanded	All members	18	April '08
Issue draft report	All members	20	June '08
Issue closing report	Module leader	21	July '08

Table 6.1 CITAX Project Timescale

The module's discussions regarding the process mapping revolved around the many processes each participant would undertake when they were completing a tender package. Additionally, this meant that the tender process was also broken down into company specific tender tasks. After a number of meetings discussing the same, a table of steps was finalised for the commencement of a drafting phase to visualise the 'as-is' process.

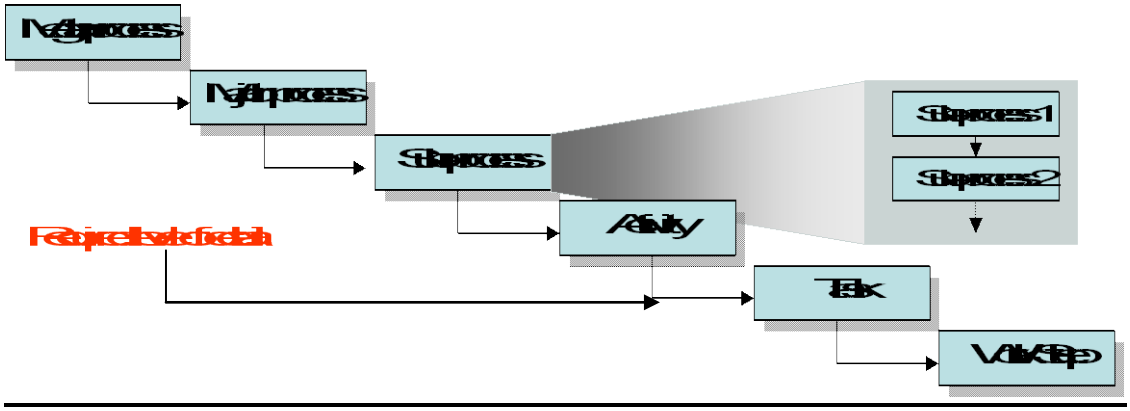

Figure 6.4 Breaking Down Tasks (West and Hore, 2007)

This visualisation, prepared by the author, is shown in figure 6.5 and constitutes what the group agreed upon being the most accurate current tender process diagram. Figure 6.5 contains 38 tasks that were required to be completed over the process of a tender. Steps one to three outline the tasks that the PQS firm completes prior to sending out a tender. This includes printing, collating and then issuing the tender documents to a number of main contracting firms. It is at this point that the contractor engages in the tendering process. This commences with the CQS receiving and checking the document for completeness. Should any issues or queries arise from these checks, as shown in step 9 of figure 6.5, the PQS will be informed. Any PQS responses are then sent to all the contractors involved in the tender.

When the initial checks were complete, the CQS inputted the BOQ into the in-house estimating software. This was be done by either manually imputing the items or, as in the majority of cases, an electronic form of data transfer between computer programmes (i.e. Builsoft to Conquest) takes place. When the entire BOQ was inputted correctly, complete with formatting and page numbering, the contractor set about preparing individual trade packages. These packages corresponded to sub-contractor/suppliers quotes for materials and were subsequently issued to the subcontractors (Step 11 in figure 6.5).

The subcontractors then decided whether or not they wished to bid for the project and, following any clarification or queries raised through the main contractor to the PQS, they then returned a quotation for the works to the main contractor. In step 21, the main contractor contacted the subcontractors to confirm whether or not they intended to issue a quote. The relevant returned quotes were then inputted into the estimator's in-house estimating system.

Figure 6.5 Observed Tender Process

Following these tasks, the contractors' final BOQ was then prepared, adjusted and submitted to the PQS firm. The documents received by the PQS firm were submitted in two separate envelopes. One included the form of tender and one included the priced BOQ. Firstly, the forms of tender were opened. These forms list the specific bid amount of the contractor. Steps 31 to 34 identify the tasks completed following the opening of the winning contractor's BOQ. The PQS then completed an examination of the BOQ's contents for computational errors and any clarifications. Errors identified were queried with the contractor in question. Subject to a positive review of any possible errors or clarifications, a contract for the work was awarded to the contractor. Further information, regarding the individual process tasks, is supplied in appendix C.2.

6.3.4 Process Measurement

With the completion of the “as-is” process map, the group established the associated costs for each of the identified tasks (These costs are further discussed in Section 6.4.1). The module established that this objective was theoretical and subjective and that any resultant costs would only be a representative average estimate. However, having each step identified individually meant that each of the module's participants were able to draw on their many years of experience within the industry, to establish, as accurate a cost model, as possible.

Each module participant agreed that the average tender would incorporate the following items: a form of tender document, a 250 page BOQ (including specification and preliminaries) and a small number of standard drawings and details. Each participant then began to identify the individuals and resources required for the completion of each process. These resources were subsequently allocated a responding cost. Staff costs were calculated on a rate per hour basis, whilst items, such as, couriers were given the standard cost that would usually be paid for the service. The results of each individual's cost analysis were subsequently shared between corresponding members (i.e. PQS to PQS).

When the next meeting was held, the costs were discussed by all members. In particular, unit rates were agreed for staff and resource costs. In the intervening month, further consultation took place between the module members and indeed the staff within the respective module members' companies. At the next meeting, the revised costs were

agreed and signed off by the module team. As there were no subcontractors within the module, their costs were based on an estimated figure. This estimated figure accounted for the fact that some subcontractors would have many items to price, while other prices for specific items can be acquired over the phone. Therefore, widely different quote preparation costs could be generated by different subcontractors. The high level cost analysis results can be seen later in this chapter (Section 6.4.1). Furthermore, an itemised breakdown is provided in appendix C.3.

A number of inefficient processes were identified by the author. These were seen to revolve around the following items:

1. Administrative processes within the PQS organisation involved collating/packaging/checking and distributing multiple copies of the tender packages by post.
2. Main contractor receiving BOQ in hard copy format and, in many instances, manually inputting the data into estimating software (if it is not available in soft copy).
3. Requirement of main contractor to “ink-in” BOQ due to legal constraints.
4. Main contractor facing delay of having to forward information to the sub-contractor in hard copy (fax/postage).

6.3.5 Process Redesign

Over several meetings, the group had many discussions about how they saw the redesigned tender process. It was agreed that the current tendering process was as efficient, as possible, as the contractors firmly believed they did not undertake any activity that was not deemed essential. Additionally, the PQS firms also agreed that their activities were essential. However, it was strongly argued that the tasks could be improved and complemented through the appropriate use of ICT.

At this stage of the module's work, the author prepared a redesigned process map and the responding process costs were agreed Figure 6.6 shows the group's predicted future process work flow.

The predicted process began with the PQS posting the tender documents online (Step 3a). The estimators were then notified that the documents were available for download. The task of sourcing subcontractors quotations was initiated and involved

further communication between the three parties involved. The communication tasks in the predicted system allowed the posting of any required information online for retrieval by the appropriate group. As in the instance of the main contractor an email was sent to the subcontractors to notify them of the availability of the information. The subcontractors then submitted their quotation online as per step 27 of figure 6.6. The estimator retrieved the quotations and uploaded the tender on or before the tender deadline.

Of the 38 steps identified in the current tender process (figure 6.5), 19 were removed or gained efficiencies from the redesigned tender process. These 19 efficiencies are summarised and categorised in table 6.2.

Preparation Stage	Estimation Stage	Evaluation Stage
Paper eliminated as documents no longer required to be printed.	If the tender data can be provided in an electronic format it avoids the need to re-key in data.	No necessity to record tender sums on forms of tenders.
The labour effort involved in preparing paper copies of tender documents can be eliminated.	Savings acquired in terms of paper and the time required to prepare packs for subcontractors.	No necessity to carry out computational checks as BOQ completed in computer checked document.
The distribution costs associated with delivering the tenders to bidders can be removed.	The tender system should provide validation to ensure that all information is supplied. This ensures the completeness of tenders and minimizes the number of queries that have to be raised.	Receive and review tender queries in an online or offline environment as preferred.
Errors in version numbers, missing paperwork etc. will be reduced as a single version of the tender is posted on line to which all bidders have access.	The validation of tenders should also provide basic checks on calculations to minimize the risk of errors.	Tenders easily updated with notification to clients and cost consultant.

Table 6.2 Efficiencies Due to Redesigned Tender Process (CITA, 2008)

6.3.6 Identify Software

In an attempt to establish the identified process gains, the group contacted a number of software companies involved in the construction industry who were actively promoting their own collaboration/eTendering products. A number of these companies were present at various CITAX symposia. Contact details were subsequently gathered and issued to all module participants.

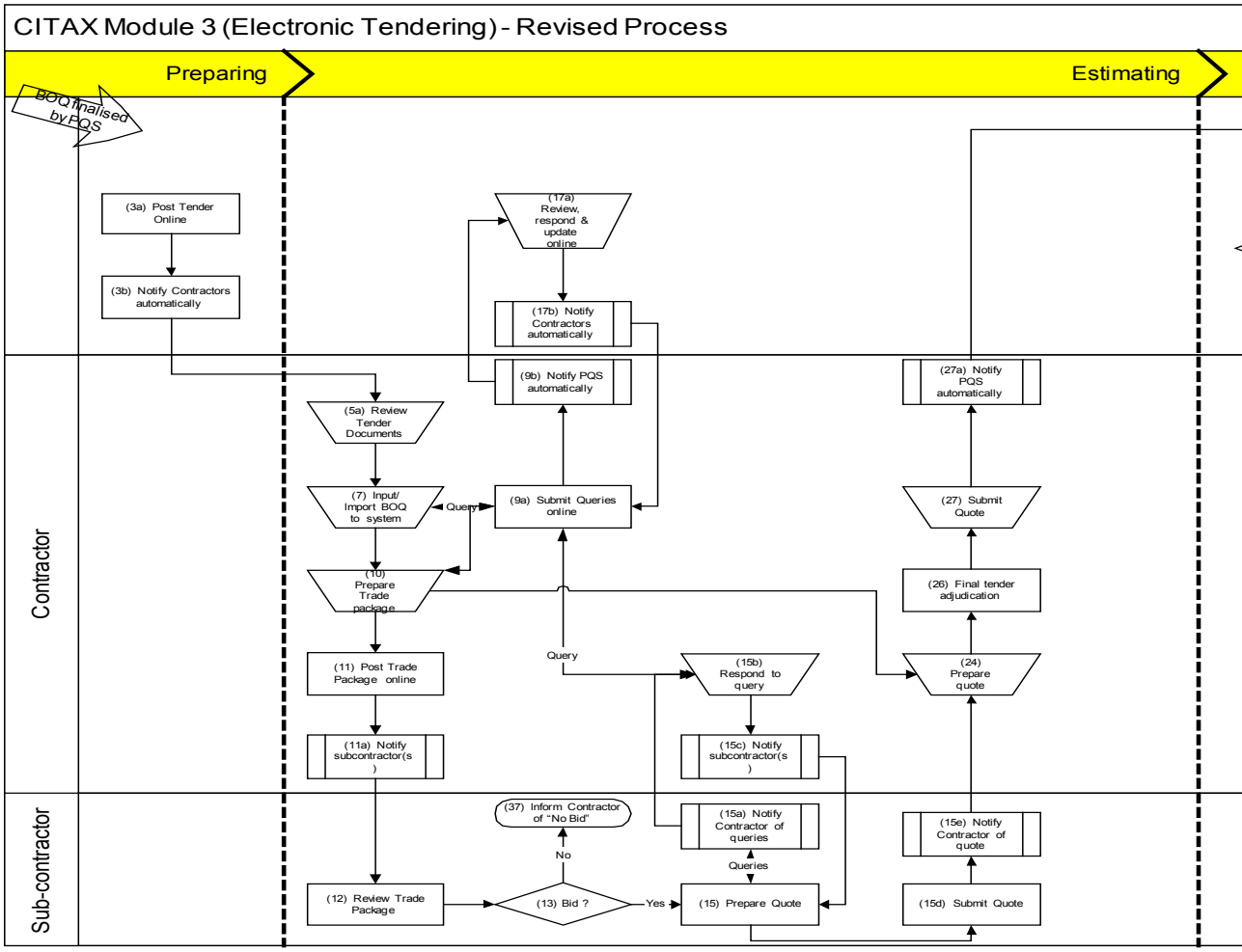

Figure 6.6 Redesigned Tender Process (O'Connell et al, 2008)

The group was also actively establishing, through their own work, a profile of software used within the industry. These actions lead to the completion of an extensive list of software service providers currently active in the Irish market place. These are shown in table 6.3.

Further to this, the group then sent a formal letter of invitation to the software service providers outlining the group's expectations and strategy. This letter also requested their potential involvement with the module and the pilot. Many of the groups were UK based, which lead to a lack of response from these organisations. With a largely uncooperative response and with a number of small project timescale overruns, the group were under considerable pressure to complete a viable pilot solution. In these difficult conditions a group member suggested the use of FTP (File Transfer Protocol) to assist in the simulation of a live construction project.

PQS: BOQ Production Software	**Possible eTendering Solutions**	**CQS: Estimating software**
Company: CSSP Product: RIPAC	Company: ASITE solutions Ltd. Product: Various	Company: CIT Product: C21
Company: MasterBill Micro Systems Ltd. Product: Masterbill	Company: Sarcophagus Ltd Product: eTenderer	Company: Crest Software Ltd. Product: Valesco
Company: Building Software Services Ltd. Product: Buildsoft	Company: Buildsoft software Services Ltd. Product: BOLTS	Company: Buildsoft software Services Ltd. Product: Buildsoft
Company: Elstree computing Product: CATO	Company: 4Projects Ltd. Product: 4Projects Tendering	Company: TJK software services Product: TJK Estimate
Company: Microsoft Product: Various	Company: BiP Solutions Limited Product: Delta eTendering suite	Company: Conquest Ltd. Product: Conquest
	Company: Build online & Citadon (now CTSpace) Product: AEC collaboration tool	Company: Construction Computer Software Product: CCS
		Company: Overture Product: Overture Bid Tool
		Company: Microsoft Product: Various

Table 6.3 Software Register (CITA, 2008)

6.3.7 File Transfer Protocol (FTP)

File transfer protocol's primary function is defined, as transferring files efficiently and reliably among hosts and allowing the convenient use of remote file storage capabilities (Postel J. and Reynolds J., 1985). Since this definition, ICT has advanced considerably,

however, the application of the technology remains the same. Now standard web browsers give individuals access to FTP sites, where information can be uploaded or downloaded, similar to that of file manipulation on individual's PCs.

6.3.8 Testing Phase

The module leader's company took ownership of the FTP site solution. Both PJ Hegartys (PJH) and John Paul Construction acted as main contractors and additionally, as subcontractors to each other. Therefore, the pilot eTender system could be fully tested across all participants of a tender process.

The remaining PQS firm (Mulcahy McDonagh) prepared a complete set of tender documents for the process. These included drawings, BOQ and a form of tender. As these documents were prepared the module leader (Bruce Shaw), John Paul Construction and PJH established their own FTP sites. The author observed this task in PJH where IT staff set up the relevant site within a short space of time and instructed the author on how the site would be administered. To summarise, the administration would be completed by the PJH module representative, who could simply allocate and administer the availability of files, from initial access to read or write authorisation, through password control.

The tender went live on April 1st 2008. An email was sent from the PQS firm to the competing contractors. This email confirmed the companies' acceptance to complete a live tender project and additionally gave the contractors a web address to access the documents and a further web address for their return. The documents were filed as shown in figure 6.7 below. At this stage, the documents were downloaded by the main contractors. Each contractor manipulated the BOQ and then prepared the relevant number of subcontract packages in electronic form. They subsequently sent their subcontractors details, by email, for download on a specific FTP password protected site. As the main contractors were less concerned about the submittal method of subcontract BOQ, it was suggested in the email that the completed tender be returned by email to the CQS involved.

With subcontract quotes returned and analysed, the main contractor adjusted their BOQ as required and uploaded both the final rated BOQ and completed form of tender to the FTP website. When the tender deadline was reached the PQS firm logged into his FTP administration window and closed the website for external use. The

module leader subsequently checked for the receipt of documents from the contractors. The documents and their filing in their respective folders was shown at the monthly meeting to all of the module members. Additionally, a time check was conducted on the uploaded files. It was established that all documents uploaded were received on time.

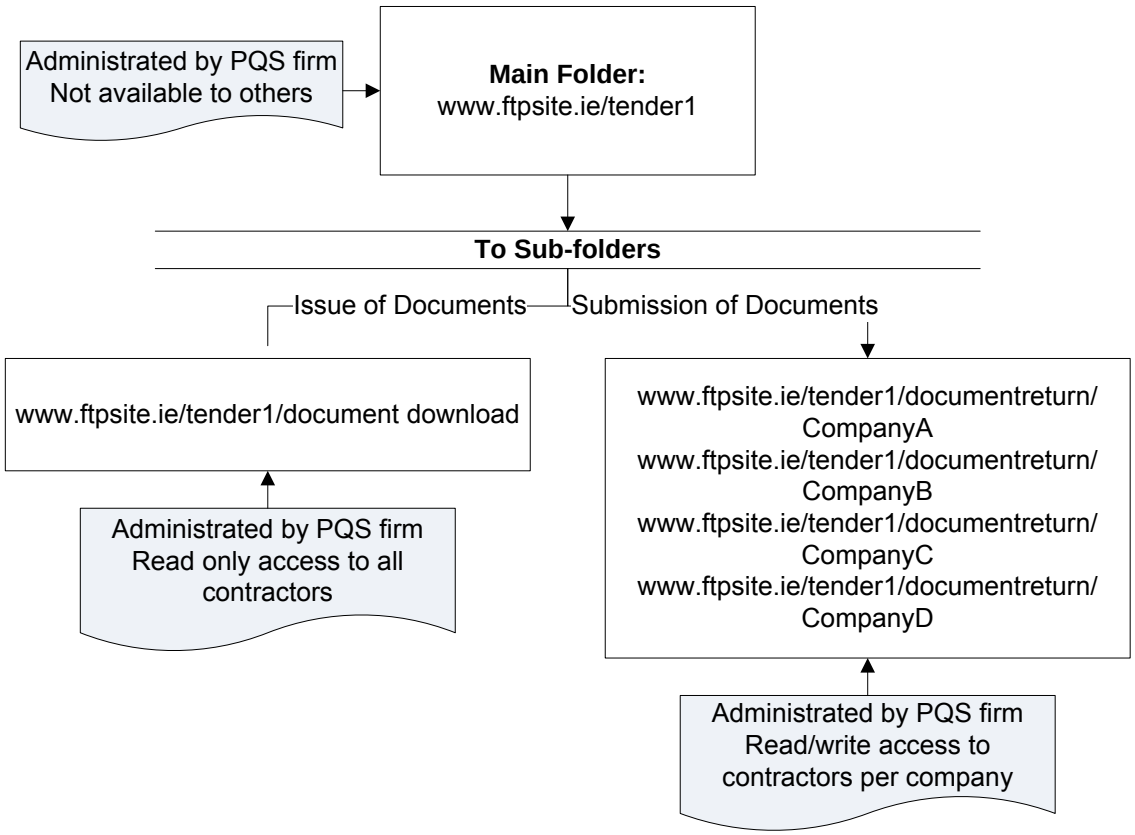

Figure 6.7 FTP Folder Outline

The PQS then proceeded to open the CQS forms of tender. It was revealed that one firm was more cost efficient than the other. This company's BOQ was subsequently opened for computational analysis. Due to the file types agreed upon and transmitted by module 3, this check was completed quickly by means of a cut and paste operation of the BOQ rates to the PQS BOQ production software. No errors were present and therefore the company was in the position to be awarded the tender and contract documents could subsequently be exchanged.

6.4 Cost Analysis

Both the agreed initial tender process cost and future tender process cost are summarised in tables 6.4 and 6.5 respectively. A breakdown of both tables' key figures

is provided in appendix C3. Table 6.4 shows the cost per participant to partake in the tender process for an average tender. It is important to note that the cost for the CQS can be replicated a number of times in the basic tender process depending on the number of competing bidders. In both table 6.4 and table 6.5's instance this is indicated by the multiplier figure. Additionally, as shown previously in the author's observational study (figure 3.6) this multiple further increases for the subcontractor section of the tender. These multiplications were additionally estimated by module 3 and the results are included on the final line as a complete cost of an average tendering process.

		Participants Costs			
		PQS	CQS	Subcontractor	Total
Stages:	Preparation	803.75	0.00	0.00	803.75
	Estimating	1,091.25	8,075.00	225.00	9,391.25
	Evaluation	4,837.50	1,500.00	0.00	6,337.50
	Individual Total	6,732.50	9,575.00	225.00	16,532.50
	Multiplier	X 1	X 5	X 30 / CQS	N/a
	Total tender costs	6,732.50	47,875.00	33,750.00	88,357.50

Table 6.4 Estimated Current Cost of Tender Process Per Individual

A comparison of tables 6.5 and 6.6 shows that there were savings observed by the group. These were, for the PQS, CQS and subcontractor groupings, 22%, 14% and 11% respectively. These savings were adjudged to be somewhat conservative. As can be seen in the appendix C.3, where a further breakdown of the costs is available, certain participant task's costs remain unadjusted, although these tasks were seen to have a number of advantages when compared to the current tender system.

The subcontractors' costs are indicative only and actual subcontractors' costs can vary widely depending on the size of their individual tender packages.

The main costs savings were seen in the reduction in paper work and the administration that is included with that work. Printing costs were effectively greatly reduced or removed from the process for both the PQS and CQS.

It is important to note that there are some cost increases involved in this tender process. However, none of these were encountered by the companies involved over the tender pilot. These include adequate access to high speed broadband connections for the individuals involved. Specifically, in the case of PQS to CQS and CQS to subcontractor,

download speed would need to be of an adequate quality so that accessing documents would be efficient for the end user. Furthermore, as the participants involved already maintained their own website and by default their own FTP site no additional setup costs were required. There would be a once off setup cost to companies who did not have this facility.

		Participants Costs			
		PQS	CQS	Subcontractor	Total
Stages:	Preparation	197.50	0.00	0.00	197.50
	Estimating	1000.00	6,762.50	200.00	7,962.50
	Evaluation	4,040.00	1,500.00	0.00	5,540.00
	Total	5,237.50	8,262.50	200.00	13,700.00
	Multiplier	X 1	X 5	X 30 / CQS	N/a
	Total tender costs	5,237.50	41,312.50	30,000.00	76.550.00

Table 6.5 Estimated Future Cost of Redesigned Tender Process Per Individual

6.5 Participant Feedback

The author has provided the feedback received from the participants in appendix C4. The following is a summary of the key points raised by the contractors:

- In most cases, the potential savings which were identified in the process model were verified by the contracting participants.
- In some instances the level of saving could not be quantified accurately. However, the selection of items for potential savings was relatively conservative
- It is possible that exponential increased savings could be generated with an increase in the size of a tender project.
- In some cases, where administrative savings were identified, there would be a resultant saving in estimator's and manager's time due to the efficiencies introduced. These can not easily be quantified and therefore was not included in the model. Similarly, there would be resultant time savings which have not been included.
- There are other types of eTendering (mainly TTP sites) which were not considered in the pilot which could realise further savings.

In the case of the PQS firms it was concluded that the potential savings found were achievable for the industry and that those savings established by module 3 were reasonably accurate. It was also suggested that with regular and more frequent use, an eTendering system, such as, the one piloted, would have an exponential learning curve and by default the savings generated could also experience a level of exponential growth. The PQS firm believed it was a technology the industry should be taking notice of.

However, this optimism was still tempered by a number of concerns. Firstly the interviewee contended that a proprietary in-house system may not be the best method for the Irish construction firms utilise. This method was established to be effective yet a similar FTP site on a larger scale would result in the reliance of the firm on in-house IT support to resolve any technical errors. The technical errors could be generated from a range of items such as the complex folder structure that would be required and also the large numbers of people accessing the site through login and password. Therefore, the in-house eTender option would result in an additional cost to the process, in terms of hardware and skilled labour time, not included in the module's calculations. It is important to note however that there is also a cost to the use of a TTP eTendering site, (From £325 to £500 per tender on RICS eTender service, 18/3/09).

Further concerns were again raised by the interviewee. These mirrored the barriers identified by the author in his previous research. The PQS firm cited his belief that the construction industry was quite conservative by nature and that any change in processes would be slow. Furthermore, the individual discussed the interoperability barrier to the introduction of the technology. With electronic documents, the interviewee had experienced that the transfer of information from Buildsoft to excel was difficult and therefore he predominantly provided electronic documents in PDF format. Nonetheless, the PQS firm' conclusion was that although there were some specific concerns with the technology, it was a technology that would assert further influence in the industry over the coming years.

6.6 Review of Research Aims and Objectives

Over the course of the pilot project the author established the validation of the thesis hypothesis. This stated that undertaking an eTender process in lieu of the traditional method generates cost savings to the parties involved. This key aim of the author was

also the key goal of the CITAX module in which the author completed his research. Table 6.2 details the modules' aims, objectives and accomplishments of the research. The table also details the author's concurrent aims or objectives that were further progressed by his involvement with CITAX.

	Description	**Author objective**	**Not achieved**	**Partially achieved**	**Fully achieved**
AIM	(a) a demonstration, by means of a pilot project, that significant measurable economic benefits can be achieved through the adoption of an online tendering system	Hypothesis Validation			X
	(b) on a live construction project		X		
OBJECTIVES	Visualise current tender process	Objective 1 & 4			X
	Establish a realistic cost against the current tender process	Objective 4			X
	Identify and cost inefficient processes	Objective 2 & 4		X	
	Establish a redesigned tender process utilising ICT	Objective 7			X
	The identification of a suitable software for industry use	Objective 5			X
	Establish an estimate revised cost based on redesigned tender process	Objective 7			X
	Assist the Irish construction industry to keep apace with ICT			X	
	Prepare a set outline standards and protocols for the Irish construction industry		X		
	The exercise was as realistic as possible and based on current industry standard procurement procedures	Objective 7			X

Table 6.6 CITAX and Author's Aims and objectives

6.7 Conclusions

In this chapter the author has detailed the research that was undertaken in order to

validate the thesis hypothesis. The research involved piloting a tender process in an electronic fashion and subsequently directly comparing the measured cost of completing the project to the cost of a traditional paper based tender method. CITAX module 3, a group of industry experts who were completing this research, kindly invited the author to assist and partake in this research with them.

The author actively participated within module 3. To begin with, the author informed the group on the research completed on the topic during the thesis. This knowledge was incorporated into the module's work most often where the module's objectives matched those of the author's (table 6.6). Furthermore any tasks that were required to be completed to achieve the project's milestones, as shown in table 6.1, were undertaken both individually and collectively by all module members including the author.

Collectively the module validated that there were cost savings of between 11% and 22% were achievable for the three main participants of the tender process. These cost savings shown in detail in appendix C3 and discussed in section 6.4, were spread across the time and material cost savings previously identified by the author's literature review. These areas of time and material cost savings were also identified in the author's survey as the key drivers to the uptake of the technology. Furthermore, although the complete process percentage savings were not as high as those established by Woking Borough Council (2003) or the Building Centre Trust (2000), on a similar scope of work the percentages do compare favourably.

Chapter 7

Conclusions and Recommendations

7.1 Introduction

Over the course of this thesis the author has utilised a wide range of research methods. This chapter will review the research the author has completed with the key research findings identified and discussed. Furthermore, a final section is included where the reader can be advised of areas where the author believes there is sufficient merit for further research.

7.2 Review of Research Aims and Objectives.

The author began his research with a specific set of research aims and objectives. Following an in-depth literature review, the author analysed these aims and objectives once more to reaffirm their appropriateness and method of research. Table 7.1 shows the authors achievements in respect to these aims.

Title	**Research Method**	**Comments**
Aims		
Examine tendering inefficiencies	This was clarified through all the research methodologies; literature review, observation study, survey and pilot project.	By piloting an eTendering process the reported inefficient practices were reduced.
Can eTendering reduce inefficiencies		
Objectives		
1. Critically examine tender process	Literature review, Observation & Pilot	Each chapter was seen to continuously build on the previous chapters' research. This lead the author towards achieving an in depth understanding of the topic in relation to the project specific aims. An overall triangulation method of research was used to bring all the research to the point of publishing.
2.Identify process inefficiencies	Literature review, Observation & Pilot	
3.Examine existing ICT support	Literature review, Observation, Survey & Pilot	
4. Effectiveness of process in action	Literature review, Observation& Pilot	
5. Examine eTendering uptake	Literature review, Observation, Survey	
6. Drivers and Barriers of eTendering	Literature review, Observation, Survey	
7.Comparison of methods	Pilot	

Table 7.1Review of Thesis Aims and Objectives

As shown in table 7.1 all of the researcher's aims and objectives were achieved. The authors hypothesis "If you undertake the tendering process in an electronic fashion then you reduce its inherent inefficiencies and save money" was also seen to be proved correct in the pilot study chapter.

7.3 The Research Approach and General Findings

The author's literature review in chapter two established a number of findings regarding the tender process in the Irish construction industry. It was found that tendering was required to obtain a firm price from a suitable contractor to complete the works the client requires (Aqua Group, 2006). Furthermore, there were found to be several methods under which a tender can be carried out, each differing, in order, to suit the client and his/her requirements. These methods, which range from open tendering to selective tendering, were fully described in chapter two with further information presented in the author's appendices.

The author found that the tender process was well documented and that many publications had broken down the process into a number of key stages. The stages identified at a high level were pre-qualification, tender invitation and submission; tender assessment and contract award (CIB, 1997). Further to this, the LCPN (2006) defined their preferred selective tender process in explicit detail and, in particular, the protocol one should follow when completing a tender. Following an understanding of the tender process, the author went on to establish that there were still areas where inefficient processes had been identified. These inefficient processes were linked to the communication practices of the industry (CITE, 2000, Curtis, 2006, Hore et. al., 2007).

The identified inefficiencies were highlighted by the rapid expansion and growth of ICT within the construction industry (CSO, 2008, Martin 2003, 2008). This rapid growth had led to the establishment of TTP web-enabled tendering systems. The research also showed that these systems could significantly reduce labour intensive and costly tasks within the tender guidelines (Woking Borough Council, 2004). This can result in cost savings to both the client and the contractor.

Having established that cost savings could be generated with the introduction of an electronic tender forum, the author wished to objectively observe and partake in the existing process to confirm the extent of any of the researched inefficiencies.

By completing an in-depth observational study and two qualitative interviews, the author confirmed that the tender process was a relatively smooth process carried out on a large scale within the Irish construction industry. The process itself was structured in a fashion closely corresponding to the LCPN. The author examined in detail, the process of communicating a tender package. It was observed to rely heavily on the transfer of hard copy documents in lieu of soft copy. This communication medium

meant that aspects of the process were inefficient.

When the author interviewed staff at Company A on the topic of tendering and eTendering a mixed response was received. Firstly, Company A believed that the Irish construction industry and its SMEs were not sufficiently I.T. literate to undertake this step. Secondly, when Company A had experienced eTendering, they believed that it was as inefficient in nature, as that of hard copy tendering. This was due to the requirement to reformat electronic documents due to the lack of interoperability between tendering software. The legality of electronic documents was also identified as a major concern in Company A. However, the actual acquisition of the tender documents in electronic format and the returning of the same by Company A was acknowledged as a more efficient process. Yet Company A staff still believed that, due to a lack of I.T. among the Irish construction industry SMEs, interoperability issues and industry inertia due to legal concerns, these savings may not be realised.

With possible efficiencies identified by the author, through two research methods, the realisation that there were significant concerns within the industry prompted the author to investigate, by means of a survey questionnaire, the construction industries willingness to partake in the rapid advancement of ICT to support current tender practices.

The author enquired about a number of areas on the topic of tendering within the industry. Initially the author established that the respondents to his questionnaire believed they were undertaking an expensive process when completing tender documentation. During this process a high percentage (85%) used software programs to create and manipulate documents. Of these programs one grouping, the PQS firms, had a high level (78%) of dependence on the Buildsoft program. As a number of the PQS firms disseminated the information in this format, the author concludes that it led to the multiple licensing of software that was recorded among CQS firms. These multiple licences helped to alleviate interoperability issues when data was communicated in electronic form. Furthermore it was noted that the CQS was more open to the use of technology which enabled eTendering.

The subcontractors' group recorded the highest percentage of the tender communications using electronic medium. However this group also held the lowest percentage of firms who did not use software or used only generic software for their estimating and tendering business processes. This is an area which could be explored in further studies of the topic.

However, of paramount importance was the author's finding that the industry recognised that there was a level of cost savings to be gained through the implementation of the available technology. Yet inertia and general industry malaise to the introduction of the technology was identified by the author in his analysis of the survey results. Comparisons with other studies indicated that there were a number of key concerns regarding the application of the technology. Security was seen as the most common and, therefore, a key barrier to eTendering's introduction. Additionally, the lack of awareness that respondents felt existed in the industry with regard to ICT, eTendering and its legality were also established as key barriers.

The final research method, a pilot project, aimed to confirm if there were sufficient business benefits to support the uptake of ICT and move from the paper based tender process to an electronic forum. The pilot was completed by visualising the current tender process and establishing the associated costs of the individual tasks within it. With this completed an eTender solution based on FTP technology was proceeded with. The costs of this process were recorded and compared to the existing process.

The pilot methodology identified that significant cost savings, from 11% to 22%, were achievable when the group undertook the tender process electronically. Although these figures did not include a number of discussed costs of implementing the technology, the participants in their feedback maintained that the savings identified could also increase over the duration of a number of tenders as the participants' knowledge and use of the eTender system improved. Furthermore, it was suggested that a higher specification eTendering system that allowed for the online input and manipulation of data would again generate further cost savings.

Along with the discussion of the savings established by the pilot, the author also discussed the key drivers and barriers to the pilot system of eTendering being undertaken by the Irish construction industry. It was the author's contention that the pilot met and in some cases exceeded the survey identified drivers and barriers to the technologies uptake. The author thus concludes that he has successfully both achieved his initial research aims and proved his initial hypothesis correct by completing a realistic and effective method of eTender communication subsequent to his initial research findings.

7.4 Key Conclusions and Recommendations

There are several key findings of the author's study which will now be further discussed. These findings are areas where further research by the author would bring this work to a higher standard or similarly there are areas of research for potential students. The author firmly contends that the main tender processes, as shown in figure 2.1, when undertaken correctly in their current form are not inefficient. This was observed by the author in his observational study. Here the staff at Company A completed only the processes that were required of them, however, they did complete a number of tasks, which make up the main tender processes, in an inefficient manner. This was particularly evident in the transfer of information between separate parties. Acknowledging this the author investigated eTendering technologies and piloted one possible eTender solution. This resulted in inefficient processes being reduced and in some cases removed from the tender process and thereby resulting in a cost saving to the companies involved.

Recommendation 1

Further research should be completed on differing eTendering systems. This can range from the simple email of documents to the full scale online only tender. A comparison of the systems, their benefits to the end user, their associated cost and the drivers towards using the various systems would be beneficial to the industry.

Recommendation 2

The tender process is an expensive process (Module 3 predicted a cost of €88.36m for the tender process over the course of 1000 average tenders). The author's survey respondents also confirmed the high cost of tendering. Therefore, the question the author has raised is whether the tender process, while efficient in its main processes, is the most efficient manner for clients and indeed contractors to obtain a reputable firm to complete a proposed piece of work? The author would advise that further research be undertaken to explore what is the most efficient way of obtaining a competitive quotation for the completion of building works.

Recommendation 3

There are significant barriers to the uptake of the technology within the industry. These concerns were recorded in all of the research methods completed by the author. The literature review, observation study, survey and also feedback from the pilot project participants all pointed to areas where the industry is worried or scared, and indeed sceptical about any undertaking to implement the available technology. The overriding concern was due to a number of factors. However, all of these concerns, beginning with the barriers identified in the survey, warrant further research to assist in alleviating the fears of the industry.

Recommendation 4

The area in which the most beneficial research, on the barriers to the uptake of the technology, could be completed is the area of software system interoperability. This is due to the author's findings that a significant percentage of documents are currently being communicated in an electronic forum. However, this forum is severely limited and inefficient due to the fact that not all companies require software to complete tender documents and therefore they do not have access to the specialised tender software. This leads to two occurrences. First, the document can be issued electronically, however, it is in a generic (i.e. PDF) format that can only be properly utilised following a computer print out, or, secondly the document is sent electronically for transfer from one software package to another. This is either completed through the use of the inefficient CITE programme or by some extensive cut, paste and reformatting of the data. Therefore, research could be conducted on the need for standardised file formats.

Recommendation 5

It is the contention of the author that the other barriers identified, including but not limited to security, legality and awareness can all be combated though increased knowledge and experience sharing within the Irish construction industry. This is being undertaken with the guidance of CITA. However further active involvement by the other regulatory bodies would greatly aid in the expunging of the evident inertia within the industry due to a lack of available information and direction. This would be aided by

undertaking further research on industry standards and protocols, which could then be put in place. It is very possible that, in the current economic climate, this cost saving technology would be more than welcome.

Recommendation 6

A final area where research could be undertaken is in the area of individuals' consistent requirement or preference for the use of paper based documents. This is an area of research not simply confined to the construction based work of this thesis. The author, since his research began, has experienced how people, including staff at Company A, DIT and indeed the author prefer to review electronic based documents in paper format. The question may be raised whether the advancement of new video output technologies (of particular note the recently heavily advertised Sony electronic book reader) will ever replace the ease of viewing and therefore the use of paper documents.

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Appendix A

Observation Study appendices

A.1 Pilot and Second observation Subcontractor enquiry list

A.2 Semi structured interview, Tender process

A.3 Semi structured interview, Process Cost and Inefficient practices

A1: Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Excavation & Drainage	Subcontractor	1) 2) 3) 4)	Shannon Valley Barnmore Hegarty Demolition Euromist
Sheet Piling	Subcontractor	1) 2) 3) 4) 5)	TRENCH CONTROL LTD. Murphy International Cain White P.j Edwards Sheet Piling U.K
Concrete Cutting	Subcontractor	1) 2) 3)	Kavnagh Mc Corrmack Hole Masters Core Drilling Services
Post Tensioning	Subcontractor		N.A
Concrete/ Formwork	Subcontractor		N.A
Metal Deck	Subcontractor	1) 2) 3) 4)	Composite Design Fitzharris Construction H.E Costello Ballykine Structural Engineering
P.C Floors	Subcontractor	1) 2) 3) 4)	Eden Precast Flood Flooring Concast Oran Precast
Mastic Sealent	Subcontractor	1) 2)	Kerrigan Mastic Lexslip Construction
Damproofing	Subcontractor	1) 2) 3)	Ostmark Quigley Preservation Protim Services
Flexible Sheet Covering	Subcontractor	1) 2) 3) 4) 5)	May Roofing Lynch Buildcon Costello Corlin Developments
Fire Protection	Subcontractor	1) 2) 3)	FIRESEAL LTD MULTIFIRE PROTECTION LTD MCLOUGHLIN PAINTING
Structural Steel	Subcontractor	1) 2)	Tolka Engineering Shirley Engineering
Metal Work M.S	Subcontractor	1) 2) 3) 4) 5)	Balzar/ B.S Engineering Ark Stainless Steel Thomas David O.M.C Longford Architectural Metal
Plumbing	Subcontractor	1) 2) 3)	Harris Heating & Plumbing Patrick Engineering Haugghton & Young

Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Vinyl Flooring	Subcontractor	1) 2) 3) 4) 5) 6) 7)	D.D O Brien Crean Mosaics Floor Form Bridge Flooring Floorstyle Midland Tile PEK
Ceramic Tiling	Subcontractor	1) 2) 3) 4) 5) 6)	D.D O Brien Crean Mosaics Bridge Flooring Midland Tile Grange Tiling PEK
Hardwood Flooring	Subcontractor	1) 2) 3) 4)	Floor Form D.D O Brien Crean Mosaics Keen -m - Imports
Carpet	Subcontractor		As Vinyl
Raised Access Floors	Subcontractor	1) 2) 3) 4)	Jan Janseen Cross Flow System Floors Allied Ireland
Plastering	Subcontractor	1) 2) 3) 4) 5) 6) 7)	Kilbride Plastering Platt & Reilly Oakleaf Dolmen Construction Errigal Contracts Asgard S.K Drylining
Patent Render Plastering	Subcontractor	1) 2) 3) 4)	Telling Stanta A.G.P Kevin Gallogly & Sons
Decorative Plaster	Subcontractor	1)	Classic Walls
W.C Cubicles	Subcontractor	1) 2) 3) 4)	Petal Post Form Western Post Form Carella Laminate G.T Office Design
Suspended Ceilings	Subcontractor	1) 2) 3) 4) 5) 6) 7)	Platt & Reilly Kehoe Oakleaf Dolmen Construction Errigal Contracts Asgard S.K Drylining
Glazing	Subcontractor	1) 2) 3)	Glass Centre Mira Glass Tipperary Glass

Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Roof Vents	Subcontractor	1) 2) 3)	Surespan ASVS Coxes Domes
Louvres	Subcontractor	1) 2) 3) 4)	QEF Fin Heat ASVS Colt Ventilation
Painting	Subcontractor	1) 2) 3) 4) 5)	Allied Colours Highfeild Decorators Mc loughlin M.V O Halloran Sean Doyle
Landscaping	Subcontractor	1) 2) 3)	Redlough Peter O Brien FEENEY, SAM
Tarmac	Subcontractor	1) 2) 3) 4)	Road stone Lagan Asphalt Stanley Macadam S.M Morris
Roadlines	Subcontractor	1) 2) 3)	Kelly Brothers Markaline Highway Marking
Paving	Subcontractor	1) 2) 3) 4)	Gibson Paving Premier Paving C&M Construction Seamus Murphy
Safety Fences	Subcontractor	1) 2)	Highway Safety Developments Holgate
Stud Partitions	Subcontractor	1) 2) 3) 4) 5) 6)	Platt & Reilly Hillcrest Oakleaf Dolmen Construction Errigal Contracts S.K Drylining
Glazed Partition Systems	Subcontractor	1) 2) 3) 4) 5)	M.J Flood Allied Ireland Systems Interiors Well Plan Asgard
Hygenic Wall Cladding	Subcontractor	1) 2) 3)	Asgard Fireseal Cleantech
Stone Flooring	Subcontractor	1) 2) 3) 4)	Stone Systems Eiregramco Stone Developments Taranto De Poll
Timber Decking	Subcontractor	1)	Wood Lands Decking Co.

Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Acoustic Underlay	Subcontractor	1) 2) 3)	Qualtile T.C Insulation D.D o Brien
Stone Cladding	Subcontractor	1) 2) 3) 4)	Stone Systems Eiregramco Stone Developments Taranto De Poll
Tile Cladding	Subcontractor	1) 2) 3)	Bridge Flooring Mc Auley Bespoke Stone Solutions Crean mosaics
Car Park Surfacing	Subcontractor	1) 2) 3)	S.M.C Specialist Surfaces Kelly Brothers Sika Ireland
Bauder Roof System	Subcontractor	1) 2) 3) 4)	May Roofing Lynch Buildcon Costello
Metal Flashing/ Capping	Subcontractor	1) 2) 3) 4) 5)	Ace Tool May Roofing Lynch Buildcon Costello
Blinds	Subcontractor	1) 2) 3) 4)	Paddy Rogers Ringsun Blinds Acme Blinds Blinds Of Ireland
Timber Panelling	Subcontractor	1) 2) 3)	Mc Cue Interiors M.J Flood Andrew Culligan Carpentry
Stainless Steel Wall Cladding	Subcontractor	1) 2) 3) 4) 5)	Ace Tool Manufacturing Ark Stainless Steel Thomas David O.M.C Longford Architectural Metal
Stainless Steel Skirting	Subcontractor		AS ABOVE
Balustrading	Subcontractor		AS ABOVE
Insulation	Subcontractor	1)	Energy Savers
Metal Doors	Subcontractor	1) 2) 3) 4) 5) 6)	Fortress Ellikson Doors Skelly Doors Ring Guard Ope -Tech Dimension Engineering

Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Dock Levellers	Subcontractor	1) 2) 3) 4) 5) 6)	Ellikson Engineering Fortress Skelly Doors Ring Guard Ope -Tech Dimension Engineering
Rubber Protection Strip	Subcontractor		N.A
Timber Door Sets	Material	1) 2) 3) 4) 5) 6)	Burke Joinery Diamand Furniture Carroll Architectural Doors Essexford Joinery Bonmahon Joinery Fire Doors & Joinery
Skirtings	Material		AS ABOVE
Screens	Material		AS ABOVE
General Hardwood	Material	1)	Abbey Woods
Insulation	Material	1)	Kingspan
Steel Door Frames	Material	1) 2) 3) 4) 5) 6)	Fortress Ellikson Doors Skelly Doors Ring Guard Ope -Tech Dimension Engineering
Metal Access Hatches	Material	1) 2) 3)	Surespan ASVS Coxes Domes
Granite Counter Top	Material	1) 2) 3)	Well Granite & Marble Marble & Granite Supplies Stone Finishes
Aluminium Angle	Material	1) 2) 3) 4) 5)	Ace Tool Manufacturing Ark Stainless Steel Thomas David O.M.C Longford Architectural Metal
Sanitary	Material	1) 2)	Heitons Davies
Hand Dryer	Material		N.A
Mats	Material	1) 2)	Mats & Frames Talamat

Observation Project 1: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Precast Concete Paving Slabs	Material	1) 2) 3)	Roadstone Paving Ancheonson & Glover Tobermore
Stone Paving	Material	1) 2) 3) 4)	Stone Systems Eiregramco Stone Developments Taranto De Poll
Concrete Paviors	Material		N.A
Tree Grills	Material	1) 2) 3) 4) 5) 6)	Emtek Products Osmos Larkin Street Products Minsters Stone SES Street & Parking Eqpt.
Street Furniture	Material		As Above
External Lighting Columns	Material		As Above

Total Packages	227
Total Enquires sent	60

Observation Project 2: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Scaffolding	Subcontractor	1) 2) 3)	Advance Scaffolding Dolan scaffolding Donohue scaffolding
Formwork	Subcontractor	1) 2) 3) 4)	Bonar Kellform Ltd Tricastle Tor Mor Construction
Plastering	Subcontractor	1) 2) 3) 4)	DB Plastering Romac SK Drylining Oakleaf contracts
Mastic works	Subcontractor	1) 2) 3)	Dolan Mastics Kerrigan Mastic Lexslip construction
Piling	Subcontractor	1) 2) 3) 4)	Edwards Cain White Trench Control FK Lowry Piling
Joinery	Materials	1) 2) 3) 4)	Essexford Joinery Burke Joinery Fire doors and joinery Carrol Joinery
Concrete sundries	Subcontractor	1) 2) 3)	EZ Drill Hole Master Core Drilling services
Mechanical works	Nominated		N.A
Rebar steel	Materials	1) 2)	Heitons James St Steel

Observation Project 2: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor		Contractor name
Carpentry labour only	Subcontractor	1) 2) 3) 4)	Millbrook South Eastern builders JK Carpentry Nolan Carpentry
Roofing	Subcontractor	1) 2) 3) 4)	Howfar Shamrock asphalt Gerard May Roofing Systems Costello Roofing
Glazing	Subcontractor	1) 2) 3) 4) 5)	Munster Joinery Burke Joinery Glass Centre Ltd. Mira Glazing Fire doors and joinery
Wall finishes	Subcontractor	1) 2) 3)	New Look Décor Grat Ryan painting Sean Doyle Group
On-Site Labour	Subcontractor	1) 2)	O'Neill and Brennan MCR
Outdoor Seating	Nominated		N.A
Ironmongery Supply	Subcontractor	1) 2) 3)	Perrum Design Interlock Architectural Hardware
Groundworks	Subcontractor	1) 2) 3) 4)	PMB Eftim Hurley plant Hire Cafferkys Barnmore
Tarmac	Subcontractor	1) 2) 3) 4)	SM Morris Lagan Asphalt Roadstone Stanley Macadam

Observation Project 2: Subcontractor and Materials suppliers enquiry list

Subcontract package	Materials or subcontractor	No.	Contractor name
Metalwork	Subcontractor	1) 2) 3) 4) 5)	Stanley TLM Hentech Ltd. Tolka Structural Steel OMC
Electrical works	Nominated		N.A
Site enclosures	Subcontractor	1) 2) 3) 4)	Capital Fencing Irish Fencing and railings Ltd. Fendec Ltd. Fast Fence Ltd.
Toilet fit out	Subcontractor	1) 2) 3)	GT Office Designs Western Post form Area plan Ltd.

Total Packages	18
Total Enquires	68

Appendix A2: Semi-structured interview: The general tender process; Outline questions

1. Does flowchart accurately portray process?
2. Majority of tender sources? Invited or sought by PJH?
3. Prequalification stage?
4. Do other parties get involved in estimating practice?
5. Receipt of documents? Checked for all info on list? Qty of information received?
6. Tender List; Example? How many tenders on list at any one time?
7. Decision to Tender? Whose decision?
8. What makes level of interest high?
9. What are the strategies that could be undertaken?
10. Example of abnormalities?
11. Standard documents?
12. Tender programme example?
13. Site visit; Why/Why not required for works?
14. How many subcontractors involved in average job?
15. How many subcontractors price per (e.g. ground works) package?
16. How are they Analysed?
17. How is bill rated?
18. Pre tender management meeting?
19. Adjustments?
20. Copies made of full BOQ or all documents?
21. Additional Inefficiencies?
22. E-tendering; ever used; experiences; process gains?

Semi-structured Interview Transcript:

Participants:
Joe Mullen (JM) , Senior Estimator Company A
Larry O'Connell (LOC), Author

Date: 11/1/2007
Location: Company A head office

LOC: You have a copy of Company A's Tendering process flowchart. Does that accurately portray the process?

JM: Yes it does.

LOC: Are there any differences between the diagram and what you experience when completing a tender?

JM: If there are any differences to the chart and I cannot think of any at the moment, they would be would be job specific differences.

LOC: Can you think of any examples?

JM: Basically all the processes listed here are undertaken to a greater or lesser extent.

LOC: All the boxes are ticked?

JM: Yes, all the boxes are ticked. Generally speaking everything on the diagram would be done. The degree to which it would be completed depends on the job. Level of interest etc. When we are tendering for a project no shortcuts are taken. For instance, sending out enquiries to subbies, depending on the job, there maybe packages in the job that you will not send out enquiries. This is either due to a gut feeling that the level of interest will be very low and issuing information will be a waste of time or you already have suitable information from a previous job. However, in a strict interpretation of the process flowchart all sections would be completed.

LOC: Where do the majority of tender sources come?

JM: The majority are competitive tenders and they do tend to be run through a prequalification process. Government funded projects all end up on the OJEC journal. Due to the size and reputation of Company A in the industry other work does come from PQS firms enquiring whether or not we would we be interested in prequalifying for a prospective project. Also on other occasions a tender may even just land on your desk. However of the work we tender for 90-95% of work is competitive.

LOC: Prequalification is also a tender process. How is that completed?

JM: Prequalification is not dealt with by the estimating department. Usually it is compiled of standard questions which Paul Maher (Quality Manager) deals with.

LOC: How many people are involved in estimating in the Dublin major projects office?

JM: Four are directly involved in the actual estimating process; Myself, Donal, Paddy and Liam. Joe is junior estimator and is only beginning to price small jobs himself. Also Breeda does as many of our administrative tasks as possible. The Small works department price and then run their own projects.

LOC: Tendering involves the transfer of information to and from different parties. How are the PQS documents received by Company A?

JM: It depends and it is a bit of a mixture lately. Specifically, on Lansdowne road nothing came in paper format, everything was received on 6 Cds. The only information provide outside of the Cds was a cover letter and a document with a full list of all the information provided and where it was on each CD. That was it. We then must print a full copy of the documents.

LOC: On other occasions what hard copy documents will you receive?

JM: You can get everything in hard copy but what tends to happen now is that you will get the Boq and specification in hard copy while increasingly the drawings are coming on CD. Then, from our standpoint, if it is possible we request as much of the information again in electronic form. The most important piece from our perspective is the bill.

LOC: Could you give an indication of the Quantity of information that is now received with a tender package?

JM: Since things have become digital the quantity of documents has significantly grown. I believe this is because it is so easy to send information on CD or DVD that individuals tend to send and bombard you with everything. Every little bit of information.

LOC: Physically could you describe what amount of information would you receive?

JM: You can get 2 or 3 boxes. The last job we got was for an estimated €10million and there were 3 boxes (bank boxes) of documents.

LOC: The project flow chart suggests that there is a tender list. What is that?

That has changed to become the project database. When a job comes in we input the information into the database. In the estimating folder on the K drive. General information regarding what the job is and consultant and client details. Then there is other information that would be inputted into the system such as amount of provisional sums and prime cost sums, defects liability period, professional fees and certs etc. Another section is linked to the commercial department if we get the job.

This results in a database where a full list of current and past tenders can be printed off along with any relevant information about them. Previously, the tender list was in the possession of the estimating director. This was a simple excel spreadsheet, which he

kept up to date with any new projects etc.

LOC: Their is a stage labelled decision to tender. Could you further explain this stage of the process?

JM: In essence that is the managing directors decision on whether or not to tender. However the majority of jobs that come in will be tendered unless we are completely swamped under. The jobs will come in and be costed and then the decision is made on the level of interest. Personally I think that the decision to tender is not made early enough during the entire process. A lot of work can be put into obtaining accurate costs for the project and then the decision is made that the company is not really that interested in the job.

LOC: How is the level of interested decided?

JM: I am not party to what the company strategy is so I cannot really say. However, i would presume it is pretty simple and that if the company needs work the level of interest is high and its is then low when we are busy.

LOC: There is a suggestion that strategies can be used for tendering projects. Does this happen and what are they?

Generally what happens is the estimator will examine the documents. As he does this he would make notes as to what items he had queries about. For example he may come to some conclusion over the quality and accuracy of the Boq, he might understand that measurements are taken a certain way and that it may not occur in that way on site.
This stage tends to occur when there is a slight lull in the process between where the subbies enquires have gone out and you are waiting on a response. This can effect how the final “cost” Boq is adjusted.

LOC: The process flow chart identifies that abnormalities should be identified and acted on. Could you explain and possible give an example of this?

JM: You go through the bill and check that all the documentation goes together and there are no discrepancies. Sometimes what happens is that a job is under the GDLA form of contract with amendments and then when you check the contract form there are no amendments.

LOC: There are a wide range of standard documents identified on the flow chart. Why are these used?

JM: The standard documents are all available through the Quality Management System. They are used to give pointers on what should and should not be included in a specific item of work. They also assist the company in that all documents sent and or received from the company have a standardised look and it is easier to identify the information you need off each document.

LOC: Why are tender programmes prepared?

JM: These don’t really exist. We tend to price the project as quickly as we possibly can,

knowing what the deadline time is. For example if we know the deadline date is 12o'clock on a Friday then we will aim to have the bill and all other items priced a number of days before hand. This will then be reviewed before it is finally printed out and sent to the PQS or architects or who ever it maybe. However on Lansdowne road we do have a specific tender programme, as we are involved in a joint venture with another company. This is so it is clear to both parties the goals and objectives that must be met by certain deadlines.

LOC: Site visits appear as a separate task to be completed during the tender process. Do they occur and what is their importance?

JM: Site visits are not always a necessity if you have knowledge of the site and its location. They are usually carried out more often that not to get an idea of the location of the site and any access problems there maybe.

LOC: How is the tender information processed?

JM: Firstly after the tender information is received and checked we input the Boq into our estimating programme; conquest. This can take a number of days even when it is received in electronic format. The electronic format tends to have to be adjusted and edited a number of times to make sure the bill is an accurate reproduction of what was received. Formatting pages and the like. However at the same time you would also be resourcing the bill (Assigning each item of work to a specific sub contract package). When this is completed the estimator will be able to break the bill into individual subcontract packages, which he will be able to send out.

LOC: What is the scale or quantity of subcontract packages per job?

JM: It really does depend on the job but you are going to have at least one package per the major items of work. For example groundwork through to electrical and mechanical fix. Possibly 20 or more it really does depend on the project.

LOC: If there are approximately 20 subcontracts in a project how many times would these be issued to actual subcontractors?

JM: Well this depends on the size of the job. If I were looking at it in ranges to get average figures I would say that for jobs up to €6m around 3-4 subbies should be ok. Usually for the smaller jobs you would be able to manipulate information you have from previous jobs prices if the information is not received back. On a job of up to €30m then 6 to 8 subbies would be required. This means you would always get a number of hits. Finally on jobs larger than this again which we would almost always be interested in we can send it out to up to 20 people. This means we are covering anyone we would consider using for the project. Of course a number of things can influence the numbers you send it out to. On occasions there may only be a select number of subbies able to carry out the works.

LOC: How are the documents sent out/returned?

JM: By and large it is still mainly in hard copy. There are a lot of smaller companies who do not have access to other sources of communications. Drawings cannot be

printed or even viewed on occasion. So it is just easier for all involved to send either by fax or post. Also not all people have conquest and so viewing the bill in that form may not be possible. They are also returned in the same way. More recently we have been receiving some quotes back by email in excel format or whatever program the company maybe using.

LOC: How are the Boq analysed?

JM: You invariably don't get back all the bills you send out but when they are returned you simply input the rates manually into conquest under separate subbie headings. Formatting the bill received in an electronic form to place into the bill can be just as time consuming as the manual input. Each bill can then be compared and with the click of a button the most cost effective quote is imputed into the tender bill. When qualifications are made there can be further correspondence to clarify what is the most accurate price to the match the bill description. Also on occasion you can be returned with a competing companies Boq. This might not always have the same split as you have decided is relevant to the specific contractor. Here you input whatever you can and make your best guess at what the missing rates are.

LOC: How is the final BOQ completed?

JM: It is done as I just said and an inked bill if that's what your asking is not a necessity on all jobs anymore. On government contracts it is a requirement however most PQS and clients will accept a printed bill. This has to be confirmed to be correct by them as on a small no. of occasions that I have heard that descriptions were adjusted and this is not acceptable. Anyone who undertakes this process should stick to it and if they do not then their tender should be rejected.

LOC: What is the Pre-tender management meeting?

JM: This is where the managing director, myself and the estimating director sit down and discuss the pricing of the bill and the conclusions I would have come to during the pricing process. Then the managing director would decide if any adjustments should be made to the bill based on your list of additional queries and suspected errors or areas where they maybe scope to use your initiative. Finally the estimating director and managing director will decide on the level of overheads and profit to be used and these will lead to any adjustments that may required to be done to the bill.

LOC: What adjustments are made and how are they completed?

JM: There are two ways we basically do it. One is we take a lump adjustment to the end of the bill which naturally enough will be just spread over the rates by the PQS. We can take a lump off the preliminary items, which we would be very reluctant to do. This opens up a major can of worms should any claims occur. It puts you in a weaker position and although you can argue it just leaves you in a weaker position to negotiate. If we have enough time we can adjust the bill ourselves. This is not a difficult thing to do it simply depends on whether you have the time to do it.

LOC: So when the adjustments are complete is the BOQ ready to send?

JM: Yes. The final bill is printed (one copy) and a summary page is hand written. So if there is a 12o'clock deadline in the city we look to have it ready for 11 to be sent by courier.

LOC: Are there any further copies made of the documents at this stage?

JM: It is not really needed as if it is priced in conquest we just make one copy to be sent and we can lock the file on conquest so it cannot be changed. A copy of the summary page would be made for our records this would include items such as the prelims as well and the form of tender.

LOC: Do you see there being any inefficiencies in the process?

JM: The biggest problem without a shadow of a doubt and which causes more hassle to the tendering process is late amendments from the QS. For instance on the Curragh which we are tendering at the moment, we got a bill of addenda yesterday. And it is not actually a bill of addenda he has actually changed the bill. He reissued the bill. If it occurs on a big bill it effectively shortens the tender period. It makes late adjustments almost impossible. The joke about it really is that when the hard copy is delivered you then get additional bill addenda. You have to manually change the bill putting in and out pages it is an absolute mess.

LOC: Does the entire project then have to be resourced again?

JM: You have to manually change the bill again because you cannot lay one over the other. The easiest way would be to actually issue a bill of addenda that can be added on to the end of the bill.

LOC: Are there any other recurring problems?

JM: The other problem would be the requirement to have an inked in bill. It tends to happen on government contracts more than anything else. Not exclusively though. It is a pure waste of time. I understand that the QS say that the hard copy is a legal document and that it is too easy to change the electronic bill. The only way to stop this is that anyone who has done this is to have his or her tender rejected. We have heard rumours of it happening. However in all reality I think that there is not really a lot wrong with the actual tendering process. A lot of the annoying things are inconveniences that eat up time. There are no major problems with the actual process itself. With respect to getting out enquires I cannot think of a more efficient method. A lot of the subbies are small and unable to price electronically or are not using certain technology.

LOC: Have you experienced eTendering?

JM: Yes a number of occasions for Intel and Wyeth and the Ulster bank jobs. If you were to ask me is there anything to recommend them? I would say that the etenders that we have done to date have been more inefficient than the normal tender process. Because the clients imposes additional restrictions upon you. It makes life more difficult.

LOC: Could you explain or give an examples of the restrictions?

That the method for uploading the information and format must be identical to what you originally received. A lot of the etenders that we have done have been semi design and build so a bill is received that will not accurately reflect the extent of the project. So items must be added and changed. However the document must remain identical so you must add on items, which makes it very difficult.

LOC: Was the tender carried out online or was information just uploaded?
JM: The documents were downloaded. You generally got it in excel format. That was then imported to conquest. Price it then export the conquest to excel and format all the information again to make it back in to the exact same file. It was a laborious task.

JM: Did it add to or improve the tendering process?

No. It didn't make any influence in the process. However we have also used the conval system on a number of projects. I would have no real problems with that system. However like inking a bill you must renter the conval system to renter all the rates again. It is far less time consuming that inking a bill and if I were to say at the moment what is the best road to go down, I would say that if people were thinking about it I would go with conval. It is not 100 percent perfect but at the moment it is probably the best half way house. However it would need to be developed further. If somebody could right a programme to transfer your rates into the system. It is a simple and quick system to use. Rates inputted to the file and the file is saved to disk and returned.

LOC: Are there any other systems you would approve of?

JM: To the best of my knowledge I am not aware of any other system in use at this time.

LOC: Is interoperability a concern?

Yes. I find it difficult to see how all the systems in use can be made compatible. I think somebody needs to grasp the nettle between conquest and buildsoft and the rest of the systems. Perhaps Conval at the minute has the track record, it is a government sponsored so security aspect of people using it should be more than adequate for all parties.

Appendix A3: Semi-structured interview: The authors suggestions and contractors response; Outline questions

1. Estimated cost of Company A Tender process?
2. Communications between the Parties involved?
    a. PQS to Contractors
    b. Contractor to Subcontractor
    c. Subcontractor to CQS
    d. CQS to PQS
3. Interoperability of IT systems
4. Other issues

Semi-structured Interview Transcript:

Participants:
Dave Gilligan (DG), Company A Estimating Director
Larry O'Connell (LOC), Author

Date: 23/4/2007
Location: Company A head office

LOC: Having completed a number of observations of the companies tender process it is obvious that your company flowchart accurately represents the actions of the companies staff. However does the cost estimate of the process appear to be in line with your own experiences?

DG: Yes appears to be reasonably accurate. It does fall below the company standard % yearly cost for the estimating department by means of turnover. This is probably because it was undertaken by both a junior estimator and was relatively straight forward tender package. Also the company is experiencing an increase in the numbers of design and build tender packages which add significantly to our tender costs.

LOC: It was previously said by Joe Mullen that there are no real inefficient processes in the tender process, only annoyances that take up certain amounts of time. Do you agree with this statement?

DG: I would have to agree with Joe on that one. There are many stages to be completed during a tender but most are necessary for us to complete. The most difficult aspect is trying to commit to the most cost effective way of completing them. If that means eTendering or not I am not sure at this stage. But it does seem increasingly likely.

LOC: With eTendering in mind I have noticed a number of inefficient tasks that are completed during the tender process within the company. I suspect the corresponding tasks in similar companies are completed in the same way. For the most part the communications between parties is old fashioned.

DG: If the sending of tender documentation in paper format is required it is something we have to do. We are a company in a competitive market and sometimes the companies who can complete the work to our standards and with the most cost effective price are not an IT literate company. We accept that but we would embrace the change to electronic communication.

LOC: Do you feel that the majority of PQS firms are IT literate?

DG: They most certainly are. I can not remember a Bill that has not been received into our offices in any form other than a computer print out for a long time. The same goes for the drawings and specifications. Occasionally there maybe hand drawn sketches and hand written amendments to contracts but these are not big problems.

LOC: Would the hand written amendments be extensive?

DG: No. They would usually involve certain clauses being crossed out from the standard forms of contract. Also some of the detailed items on the documents would be hand written for example the project details.

LOC: With most PQS firms being IT literate do you think that hard copy transfer of documents is a cost effective method of communication?

DG: Well I would believe that for the PQS that forwarding the documents on a CD is presumably easier and takes out the need for the printing of reams of paperwork and the couriers we use regularly. For some firms there is a concern over the security of the documents given out in electronic form. Having said that the majority of firms, having supplied us with a hard copy tender, forward us electronic copies of the tender when we request it. It seems to be a bit of a double take on their part to send out the hard and soft copy.

LOC: Would you be happy to only receive the soft copy documents from the PQS? Do others within the industry feel the same on the issue?

DG: It would not bother us to receive only soft copy documents. It has happened on a number of projects for us. With the hard copy documents though, I personally find it easier to run my eye over them. Yet we still price the final BOQ in our estimating software. I cannot definitively talk for others within the industry on this topic but I do suspect that the majority and more than likely all of the major firms that we would regularly compete with price BOQ in a similar fashion to us. Therefore soft copy communication would not be a problem. Again it could come down to IT literate companies and having a process that is open to all parties.

LOC: From both Joe Mullens and your earlier comments, I suspect that there are a large number of non IT literate subcontracting companies. Also the observations showed this to be the case. This results in the majority of tender packages being sent in hard copy.

DG: Yes a lot of packages are sent this way.

LOC: Wouldn't it be more efficient to send these documents in soft copy?

DG: Again I agree with you but it is not possible at the moment. If it were we would be doing it. The main problem with subcontractors at the moment though is the ability and reluctance in some cases to print off large scale drawings.

LOC: What could help the industry change?

DG: I don’t know if it will change in the short term. Some of the guys that complete the work for us really do operate out of their own living rooms. If it does we will try to take advantage of it. Increased training and availability of the hardware at a reduced cost would obviously help.

LOC: There appears to be a range of software available for BOQ production and manipulation. Would an industry standard software format help to reduce the problems that are encountered when you doe receive a soft copy BOQ?

DG: Yes and no. People like to use their own software. An industry change to a specific software like buildsoft for example would not offer us the flexibility that our current software does. In theory it would be a good thing but the software would have to meet all the parties needs and be accessible and affordable to all.

LOC: What about standard file types meaning all BOQ could be used in a range of BOQ software?

DG: This would the best solution to the problem. The CITE program attempts this but it does not really do a satisfactory job.

LOC: Also at the final stage of the tender process the BOQ can be required to be inked in. This seems to be a highly inefficient process after all the BOQ has been completed electronically and can be printed out. What's your take on this process?

DG: We do check with the firm and try for the most of the projects we tender to submit an electronic BOQ. Should a written version be required we will also complete that as necessary. You know by now that I do not approve of inking a BOQ. It is an onerous task from which we do not benefit and I doubt that the PQS firms gain anything from us completing this. The only time I have heard of them having any gain in it is when a contractor supposedly changed the BOQ descriptions and their tender was accepted. However arguments were then had over whether the BOQ rates related to the original or contractor modified BOQ description. We do not make any amendments to a BOQ like this as they are not supposed to be made to a BOQ in any circumstances.

LOC: Are there any other comments you would like to make on the process?

DG: I do firmly believe that the industry is lacking direction on this whole area. On Legal and security issues in particular. On this front I believe that the government as the industries largest client should be undertaking a greater proactive role in the whole area.

Appendix B

Irish construction Industry Survey appendices

B.1 The Online survey

B.2 Survey Sample

B.3 Analysis of results

B.4 Spearman’s Rank Correlation Calculations

B.5 Survey comparisons

Appendix B1; Replication of eTender survey accessible on http://cita.ie/SurveyeTendering.asp

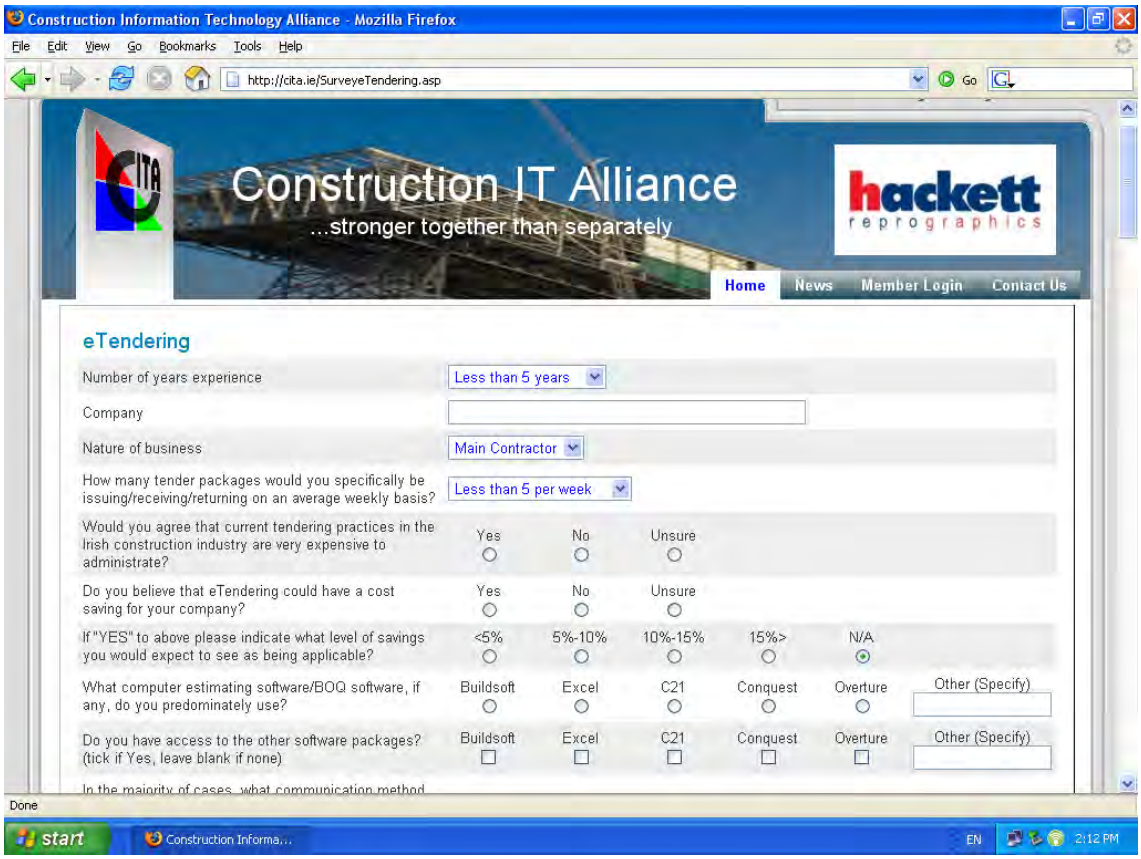

Figure B.1.1 A screenshot of the view a survey respondent would have of the online survey

Note: A Full list of questions and the Reponses received are given in Appendix B.3

Appendix B2; Survey respondent list

No.	Company	PQS / CQS / Sub	Email Address	Contact	Role	Responded
1	ABP-TBS (IRELAND) LTD	Sub	chrisadams@abp-tbs.com	CHRIS ADAMS	Estimator	Yes
2	Allen & Smyth Constructions Ltd	CQS	paulmangan@allenandsmyth.ie	Paul Mangen	Senior Estimator	Yes
3	ANDREW P NUGENT & ASOCIATES	PQS	andrew@apna.ie	Andrew Nugent	Owner	Yes
4	Ardmac	CQS	ruth.savage@ardmac.com	Ruth Savage	Senior Estimator	No
5	ASGARD INTERIORS LTD	Sub	dbannon@asgard.ie	DARREN BANNON	Estimator / Surveyor	No
6	Austin Reddy & Company	PQS	goneill@areddy.ie	Gavin O'Neill	Senior PQS	Yes
7	Basil Conroy & Co.	PQS	niallm@basilconroy.com	Niall McAree	Chartered PQS	Yes
8	BECKETT & CO	Sub	beckettandco@eircom.net	ERIC BECKETT	MD	Yes
9	Bennett Construction	CQS	stephenmccloughlin@bennettconstruction.ie	Stephen McLoughlin	Senior Estimator	Yes
10	Bowen Construction Ltd	CQS	fanahan.colbert@bowengroup.ien	Fanahan Colbert	Estimating Director	Yes
11	Boyd Creed Sweett	PQS	garry.waldron@boydcreedsweett.com	Gary Waldron	Senior PQS	Yes
12	Brendan Merry & Partners	PQS	mmulryan@bmp.ie	Michael Mulryan	PQS	Yes
13	Brian McCarthy Contractors Ltd	CQS	alangorman@bmcc.ie	Alan Gorman	Senior Estimator	Yes
14	Bruce Shaw Partnership	PQS	Steven.Cooke@bruceshaw.ie	Steven Cooke	Associate	Yes
15	C & S SHUTTERS	Sub	frank.markey@cs-shutters.ie	FRANK MARKEY	Estimator	Yes
16	CARELLA LAMINATE SYSTEMS LTD	Sub	kerry@carella.com	KERRY MCSHANE	Estimator	Yes
17	Cedar Building Company	CQS	cedarrockbrook@gmail.com	Paul Tiernan	Estimator / Surveyor	Yes
18	Chartered Lands	PQS	ewilcox@charteredland.ie	Eoin Wilcox	Senior PQS	No
19	Cleary Doyle Contracting	CQS	jmcnabb@clearydoyle.com	Joe McNabb	Senior Estimator	Yes
20	Concast	Sub	tony@concast.ie	Tony O'Reilly	Senior Estimator	No
21	CQS (Creagh QS)	PQS	darren@cqs.ie	Darren McRinn	PQS	Yes
22	Crampton	CQS	rryan@gtcrampton.ie	Richie Ryan	Estimator / Surveyor	No
23	D. O'Brien Developments	Sub	Brendan@dobdevs.ie	Brendan	Estimator / Surveyor	No
24	Daughton + Associates	PQS	emer.coonan@daughtonassociates.ie	Emer Coonan	PQS	Yes
25	David Mcloughlin Chartered QS	PQS	info@davidmcloughlin-cqs.com	David McLoughlin	Owner	No
26	Doyle Quantity Surveying	PQS	sean@doylesurveying.ie	Sean Doyle	Owner	Yes
27	Duggan Brothers LTD.	CQS	pspillane@duggan-brothers.ie	Pat Spillane	Senior Estimator	Yes
28	E.Z. Drill	Sub	justin@ezdrill.ie	Justin Kennedy	Owner	Yes
29	EC Harris	PQS	richard.fitzpatrick@echarris.com	Richard Fitzpatrick	Senior PQS	Yes
30	Edward Cotter Partnership	PQS	martin.odonovan@ecp.ie	Martin O'Donovan	Senior PQS	Yes
31	Eftim Hurley	Sub	john@hurleygroundworks.ie	John Lawlor	Senior Estimator	Yes
32	ELLICKSON ENGINEERING LTD	Sub	emoriaty@dublin.ellickson.ie	Eoin	Estimator	No
33	Engineering Cost Management	PQS	sodoherty@ecml.ie	Seamus O'Doherty	Senior PQS	Yes
34	Eoin Stack & Associates	PQS	info@esaqs.ie	Eoin Stack	Owner	Yes
35	ERRIGAL CONTRACTS LIMITED	Sub	dtreanor@errigalcontracts.com	DAMIEN TREANOR	Director	Yes
36	FIREBLOCK	Sub	apeacham@eircom.net	AARON PEACHAM	Estimator	No
37	Freeman Keane Associates	PQS	johnkeane@fka.ie	John Keane	Partner	Yes
38	Gardiner & Theobald Ireland	PQS	k.havemann@gardiner.com	Kevin James	Senior PQS	No
39	GEM MANUFACTURING COMPANY LTD	Sub	kieran.rigney@gemgroup.ie	KIERAN RIGNEY	Senior Estimator	Yes
40	Gerard May Roofing Ltd T/A GFM Systems	Sub	edwina@gfmsystems.com	EDWINA HEGARTY	Senior Estimator	Yes
41	Graham	CQS	john-paul.halton@graham.co.uk	John Paul Halton	Senior Estimator	No
42	GRAT-RYAN PAINTERS & DECORATORS LTD	Sub	gratryan@hotmail.com	ELIZABETH BANKS	Director	No
43	Grogan surveyors	PQS	frank@grogansurveyors.com	Frank Grogan	Owner	Yes
44	hardy partnership	PQS	alanhardy@hardy.ie	Alan Hardy	Owner	Yes
45	Hentech	Sub	eamonn@hentech.ie	Eamonn whealan	Senior Estimator	Yes
46	HILLCREST METAL PARTITIONS LIMITED	Sub	freda@hillcrestgroup.co.uk	Frieda	Estimator	Yes
47	HKT&T	PQS	mark.kelly@hktt.ie	Mark Kelly	Partner	Yes
48	Hmg Associates	PQS	michael@hmg.ie	Michael	Senior PQS	No
49	James Sheehan Associates	PQS	declan@jsaqs.com	Declan Cronin	Senior PQS	No
50	JJ rhatigan	CQS	dwilliams@rhagtigan.ie	Declan Williams	Senior Estimator	Yes

No.	Company	PQS / CQS / Sub	Email Address	Contact	Role	Responded
51	John Cuddy & Partners	PQS	limerick@johncuddy.com	Andrew	Senior PQS	No
52	John Fleming Construction Co	CQS	mmccarthy@fleminggroup.ie	Michael McCarthy	Senior Estimator	Yes
53	John Paul Construction	CQS	paitken@johnpaulconstruction.com	Paul aitken	Estimating Director	Yes
54	John Sisk & Son Ltd.	CQS	d.gormley@sisk.ie	Derek Gormley	Senior Estimator	Yes
55	Joseph Coyne & Associates	PQS	charteredsurveyor@eircom.net	Joseph C. Coyne	Owner	No
56	Kane Crowe Kavanagh	PQS	kentobin@kck.ie	Kenneth Tobin	Partner	No
57	Karl Slyne Quantity Surveyors Ltd.	PQS	Karl@ksqs.ie	Karl Slyne	Partner	No
58	Kehoe Acoustic Ceilings & Partitions	Sub	kacp@eircom.net	Paul Crampton	Estimator	Yes
59	Kellform	Sub	kellformltd@eircom.net	Michael Leavy	Senior Estimator	Yes
60	Keogh McConnell Spence	PQS	keogh.barry@kmcs.ie	Barry Keogh	Senior PQS	Yes
61	Kerrigan Sheanon Newman	PQS	gmitchell@ksn.ie	Gavin Mitchell	Senior PQS	Yes
62	Lagan Group	CQS	padraicblack@lagandublin.com	Padraic Black	Estimator / Surveyor	Yes
63	Laing O'Rourke	CQS	pmurphy@laingorouirke.com	Paddy Murphy	Senior Estimator	No
64	Leonard & Williams	PQS	gordon.place@landw.ie	Gordon place	PQS	Yes
65	Levins Associates	PQS	conall@levins.ie	Conall	PQS	Yes
66	Lynch Roofing Systems (Ballaghaderreen) Ltd	Sub	colman@lynchroofing.ie	Colman Lynch (JNR)	Estimator	Yes
67	Macminn | O'Reilly | Mahon Partnership	PQS	qs@mcminn.ie	Stewart MacMinn	Partner	No
68	MANNIN IRL T/A MANNING FURNITURE	Sub	justin@manningfurniture.ie	JOE MANNING	Estimator	No
69	McCabe	CQS	asia.kozula@mccabebuilders.ie	Asia Kozula	Senior Estimator	No
70	MCCauls	PQS	info@mccauls.ie	Alan Brindley	PQS	Yes
71	McCUE INTERIOR FIT-OUT SOLUTIONS	Sub	Gary@mccuefit.com	Alan McCloud / Gary	Estimator	No
72	MCGRATH BROS (IRELAND) LTD	Sub	pharkin@mcgrath-group.com	Paul harkin	Senior Estimator	Yes
73	McInerney Contracting	CQS	pcummins@waterford.mcinerney.ie	Paul Cummins	Senior Estimator	Yes
74	McLoughlin painting contractors Ltd	Sub	noelgoss@mcloughlinltd.ie	NOEL GOSS - QS	Senior Estimator	Yes
75	Michael McNamara & Company	CQS	mdavidson@mcnamaraconstruction.com	Martin Davidson	Estimating Director	Yes
76	MIDLAND PROFIX LTD	Sub	midlandprofix@eircom.net	JOHN DUIGNAN / Justin McKenna	Owner / Estimator	No
77	Mulchay McDonagh	PQS	jdaly@mmp.ie	John Daly	Partner	Yes
78	N. Kennelly Holdings T/A Dimension Engineering	Sub	s.colgan@dimensioneng.ie	NIALL KENELLEY	Senior Estimator	Yes
79	O Flynn Construction	CQS	fiachra@akc.ie	Fiachra Mac Aogain	Estimator / Surveyor	No
80	OAKLEAF CONTRACTS (EUROPE) LTD	Sub	pat.scullion@oakleafcontracts.com	PATRICK SCULLION	Director	Yes
81	OPE-TECH LIMITED	Sub	paul@ope-tech.ie	Paul McDermott	Project manager	Yes
82	P Elliot	CQS	M.clerkin@pelliott.com	Martin Clerkin	Senior Estimator	No
83	P.J. Hegarty & Sons	CQS	david.gilligan@pjhegarty.com	Dave Gilligan	Estimating Director	Yes
84	Pierse	CQS	ericg@pierse.ie	Eric golden	Senior Estimator	Yes
85	PJ walls	CQS	Sean.oconnor@walls.ie	Sean O'Connor	Senior Estimator	No
86	PLATT & REILLY DRYWALL LTD	Sub	chris@plattreillydrywall.ie	CHRIS REILLY	Director	Yes
87	PMB	Sub	pmbltd@eircom.net	Patrick McBride	Owner	Yes
88	POWERSHIELD DOORS LTD	Sub	s.wilkinson@powershield.co.uk	STEPHEN WILKINSON	Estimator	No
89	QUAYSIDE INTERIORS LTD	Sub	rob@quaysideinteriors.com	ROB O'BYRNE	Contracts Manager	Yes
90	Roadbridge	CQS	eamonn.odowd@roadbridge.ie	Eamon O Dowd	Estimating Director	No
91	Rohcon	CQS	tmccabe@rohcon.ie	Terry McCabe	Estimating Director	Yes
92	Sammon contracting	Sub	johnrossbowler@sammon.ie	John Ross Bowler	Senior Estimator	Yes
93	SHAMROCK ASPHALT LTD	Sub	stephen@theroofcentre.com	Steven Kennedy	Estimator	Yes
94	Siac	CQS	noel.casey@siac.ie	Noel Casey	Senior Estimator	No
95	SIAC Construction	Sub	donal.mangan@siac.ie	DONAL MANGAN	Estimator	Yes
96	SKELLY OPENING SOLUTIONS LTD	Sub	dkellett@skellyopeningsolutions.ie	Basil / Derek	Estimator	Yes
97	SVPH	Sub	kevinmchugh@shannonvalley.ie	Kevin McHugh	Senior Estimator	Yes
98	TAFFETSAUFFER & JONES LTD	Sub	taffetjones@eircom.net	ALAN JONES	MD	No
99	TARA STAINLESS STEEL	Sub	ciaran@tarastain.ie	CIARAN O'REILLY	Estimator	Yes
100	WOODFIT LTD	Sub	vmurray@woodfit.ie	Vinny Murray	Estimator	No

Appendix B3: Survey Response Analysis

	Response rate			
	PQS	CQS	Sub QS	Total
Sent	33	27	40	100
Received back	23	17	28	68
Response rate	69.70%	62.96%	70.00%	67.55%

Table B3.1 Survey Response rate

	Experience profile			
	Less than 5	6 – 10 years	11 – 15 years	16 + years
PQS	3	6	5	9
CQS	3	5	2	7
Sub QS	1	5	10	12
Totals	10.29%	23.53%	25.00%	41.18%

Table B3.2a experience profile of the respondents

	Tenders per week (number of responses / % per respondent section)			
	1 – 5	6 – 10	11 – 15	16 +
PQS	18 / 78%	4 / 17%	1 / 5%	0
CQS	14 / 82%	1 / 6%	1 / 6%	1 / 6%
Sub QS	10 / 36%	10 / 36%	4 / 14%	4 / 14%
Totals	61.76%	22.06%	8.82%	7.35%

Table B3.2b Level of tenders completed per week by respondents

	Would you agree that current tendering practices in the Irish construction industry are very expensive to administrate?			
	PQS	CQS	Sub QS	Total
Q1 Yes	78.26%	100.00%	67.86%	79.41%
No	21.74%	0.00%	10.71%	11.76%
Unsure	0.00%	0.00%	17.86%	7.35%
Skipped	0.00%	0.00%	3.57%	1.47%
Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.3 Opinion on the cost of the current tender process

	Do you believe that eTendering could have a cost saving for your company?			
	PQS	CQS	Sub QS	Total
Q2 Yes	86.96%	82.35%	67.86%	77.94%
No	4.35%	11.76%	28.57%	16.18%
Unsure	8.70%	5.88%	0.00%	4.41%
Skipped	0.00%	0.00%	3.57%	1.47%
Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.4 Opinion on the possible cost benefit of eTendering

	If “YES” to above please indicate what level of savings you would expect to see as being applicable?				
		PQS	CQS	Sub QS	Total
Q3	Less than 5%	8.70%	5.88%	10.71%	8.82%
	6 to 10 %	39.13%	23.53%	28.57%	30.88%
	11 to 15 %	21.74%	11.76%	10.71%	14.71%
	Greater than 15%	17.39%	41.18%	21.43%	25.00%
	N/a	13.04%	17.65%	28.57%	20.59%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.5 Positive respondents opinions on the level of expected savings if eTendering was used

	What computer estimating software/BOQ software, if any, do you predominately use?				
		PQS	CQS	Sub QS	Total
Q4	Buildsoft	78.26%	35.29%	10.71%	39.71%
	Excel	8.70%	0.00%	50.00%	23.53%
	C21	0.00%	29.41%	0.00%	7.35%
	Conquest	0.00%	17.65%	0.00%	4.41%
	Overture	0.00%	0.00%	0.00%	0.00%
	Other	13.04%	17.65%	3.57%	10.29%
	None	0.00%	0.00%	35.71%	14.71%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.6 Respondents preferred estimating and tendering software

	Do you have access to the other software packages? (tick if Yes, leave blank if none)				
		PQS	CQS	Sub QS	Total
Q5	Buildsoft	48.72%	35.42%	12.50%	33.61%
	Excel	41.03%	25.00%	43.75%	35.29%
	C21	0.00%	10.42%	0.00%	4.20%
	Conquest	0.00%	12.50%	0.00%	5.04%
	Overture	0.00%	6.25%	0.00%	2.52%
	Other	0.00%	8.33%	3.13%	4.20%
	None	10.26%	2.08%	40.63%	15.13%

Table B3.7 Respondents access to other estimating and tendering software

	In the majority of cases, what communication method is undertaken when you are issuing/receiving tender documents?				
		PQS	CQS	Sub QS	Total
Q6	Paper Based only	8.70%	5.88%	0.00%	4.41%
	Paper based with Soft copy on request	73.91%	70.59%	46.43%	61.76%
	Paper based and soft copy	17.39%	23.53%	32.14%	25.00%
	Soft copy only	0.00%	0.00%	3.57%	1.47%
	Soft copy with paper based on request	0.00%	0.00%	10.71%	4.41%
	Skipped	0.00%	0.00%	7.14%	2.94%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.8 Communication medium when issuing / receiving tender documents

	In the majority of cases, what communication method is undertaken when you are returning tender documents?				
		PQS	CQS	Sub QS	Total
Q7	Paper Based only	39.13%	76.47%	21.43%	41.18%
	Paper based with Soft copy on request	52.17%	17.65%	28.57%	33.82%
	Paper based and soft copy	4.35%	0.00%	35.71%	16.18%
	Soft copy only	0.00%	0.00%	7.14%	2.94%
	Soft copy with paper based on request	4.35%	5.88%	7.14%	5.88%
	Skipped	0.00%	0.00%	0.00%	0.00%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.9 Communication medium when returning tender documents

	Whether requesting the return of a Bill of Quantities or actually returning the BoQ, which of the following ways does your organisation wish to see the completed BoQ or complete the BoQ?				
Q8		PQS	CQS	Sub QS	Total
	A handwritten Boq	52.17%	0.00%	71.43%	47.06%
	Computer printout	21.74%	41.18%	17.86%	25.00%
	Computer and handwritten	26.09%	58.82%	10.71%	27.94%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.10 Preferred method of BOQ submittal

	Has your organisation issued/received tender documents electronically?				
Q9		PQS	CQS	Sub QS	Total
	Yes	60.87%	94.12%	92.86%	82.35%
	No	39.13%	5.88%	7.14%	17.65%
	Skipped	0.00%	0.00%	0.00%	0.00%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.11 Organizations experience of issued and receipt of electronic tender documents

	If 'YES' to above, has it been the case, on any projects, that all the documents issued/received were only in electronic format?				
Q10		PQS	CQS	Sub QS	Total
	Yes	13.04%	52.94%	64.29%	44.12%
	No	52.17%	35.29%	28.57%	38.24%
	N/a	34.78%	11.76%	7.14%	17.65%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.12 Q9 Positive respondents level of usage of electronic means for all tender documents

	Has your organisation been returned or submitted tender documents electronically?				
Q11		PQS	CQS	Sub QS	Total
	Yes	43.48%	47.06%	85.71%	61.76%
	No	52.17%	52.94%	14.29%	36.76%
	N/a	4.35%	0.00%	0.00%	1.47%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.13 Organisations experience of submitting electronic tender documents

	If 'YES' to above has it been the case, on any projects, that all the documents returned or submitted were only in electronic format?				
		PQS	CQS	Sub QS	Total
Q12	Yes	21.74%	17.65%	78.57%	44.12%
	No	26.09%	41.18%	7.14%	22.06%
	N/a	52.17%	41.18%	14.29%	33.82%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.14 Q11 Positive respondents level of usage of electronic means for all tender documents

	Have you ever recieved tender documentation from a number of main contractors for the same construction project?				
		PQS	CQS	Sub QS	Total
Q12a	Yes, I frequently do	N/a	N/a	78.57%	78.57%
	Yes, I occasionally do	N/a	N/a	17.86%	17.86%
	Yes, However it is rare	N/a	N/a	0.00%	0.00%
	No	N/a	N/a	3.57%	3.57%
	Response rate	0.00%	0.00%	100.00%	100.00%

Table B3.15 Subcontractors experiences of repeat information being issued by separate main contractors

	Has your organisation sought sub-contract package prices electronically?				
		PQS	CQS	Sub QS	Total
Q13	Yes	56.52%	88.24%	N/a	70.00%
	No	39.13%	11.76%	N/a	27.50%
	N/a	4.35%	0.00%	N/a	2.50%
	Response rate	100.00%	100.00%	N/a	100.00%

Table B3.16 % of subcontract packages that have been sought electronically

	If 'YES' to above what percentage of your overall subcontract tenders would be sent electronically?				
		PQS	CQS	Sub QS	Total
Q14	0 to 25%	30.43%	35.29%	N/a	32.50%
	26 to 50%	26.09%	23.53%	N/a	25.00%
	51 to 75%	4.35%	29.41%	N/a	15.00%
	76 to 100%	0.00%	5.88%	N/a	2.50%
	N/a	39.13%	5.88%	N/a	25.00%
	Response rate	100.00%	100.00%	N/a	100.00%

Table B3.17 Q13 Positive respondents percentage of subcontracts sought electronically

	Please indicate your current state of awareness of the opportunities for eTendering in the construction industry.				
		PQS	CQS	Sub QS	Total
Q15	Not aware	8.70%	0.00%	25.00%	13.24%
	Somewhat aware	47.83%	41.18%	21.43%	35.29%
	Aware	21.74%	29.41%	17.86%	22.06%
	Moderatly aware	17.39%	11.76%	25.00%	19.12%
	Very aware	4.35%	17.65%	7.14%	8.82%
	Skipped	0.00%	0.00%	3.57%	1.47%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.18 Respondents opinions on the Irish construction industries awareness of eTendering

Q16	Please indicate your willingness to consider applying secure web-based technologies in construction tendering. (For the purposes of this question "web-based technologies" does NOT include electronic auctions)				
		PQS	CQS	Sub QS	Total
	Willing	86.96%	76.47%	75.00%	79.41%
	Unwilling	13.04%	11.76%	21.43%	16.18%
	Currently applying	0.00%	11.76%	3.57%	4.41%
	Skipped	0.00%	0.00%	0.00%	0.00%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.19 Industry's willingness to apply web based technologies to eTendering

Q17	Please indicate the extent to which you believe there will be an increasing significance of eTendering in the Irish construction industry				
		PQS	CQS	Sub QS	Total
	It is now signifigant	4.35%	5.88%	28.57%	14.71%
	1-2 years	30.43%	35.29%	39.29%	35.29%
	3 to 5 years	56.52%	41.18%	28.57%	41.18%
	6 to 10 years	8.70%	17.65%	0.00%	7.35%
	More	0.00%	0.00%	0.00%	0.00%
	Skipped	0.00%	0.00%	3.57%	1.47%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.20 Industry's opinion on significance of eTendering in coming years

Q18	Does your company have concerns over adopting a web-based strategy for construction tendering communications?				
		PQS	CQS	Sub QS	Total
	Yes	60.87%	41.18%	42.86%	48.53%
	No	39.13%	52.94%	57.14%	50.00%
	N/a	0.00%	5.88%	0.00%	1.47%
	Response rate	100.00%	100.00%	100.00%	100.00%

Table B3.21 Percentage of companies with concerns over adoption of web based strategy

Q19	If Yes, to above what are / have been your company's concerns with regard to adopting a web-based strategy for construction tendering communications?				
		PQS			
		Level of concern / Number of responses			
		Very	Moderately	Less	Not
	Lack of awareness or knowledge of technology capabilities	1	4	8	1
	Other parties may not possess adequate eBusiness capabilities	7	7	0	0
	Lack of available funding	1	3	6	4
	Total costs	1	4	7	2
	Security of sensitive data	10	4	0	0
	Legal implications	7	6	1	0
	Training and inability to use technology	0	8	6	0

Table B3.22 PQS responses to concerns with regard to adopting a web based strategy for construction tendering

Q19	If Yes, to above what are / have been your company's concerns with regard to adopting a web-based strategy for construction tendering communications?				
		CQS			
		Level of concern / Number of responses			
		Very	Moderately	Less	Not
	Lack of awareness or knowledge of technology capabilities	2	5	0	2
	Other parties may not possess adequate eBusiness capabilities	6	3	0	0
	Lack of available funding	0	3	4	2
	Total costs	0	5	1	3
	Security of sensitive data	4	3	2	0
	Legal implications	4	3	2	0
	Training and inability to use technology	2	5	0	2

Table B3.23 CQS ranking of concerns with regard to adopting a web based strategy for construction tendering

Q19	If Yes, to above what are / have been your company's concerns with regard to adopting a web-based strategy for construction tendering communications?				
		PQS			
		Level of concern / Number of responses			
		Very	Moderately	Less	Not
	Lack of awareness or knowledge of technology capabilities	3	5	6	0
	Other parties may not possess adequate eBusiness capabilities	3	7	3	1
	Lack of available funding	0	7	2	5
	Total costs	1	6	3	4
	Security of sensitive data	7	6	1	0
	Legal implications	4	7	2	1
	Training and inability to use technology	4	5	4	1

Table B3.24 Subcontractor QS ranking of concerns with regard to adopting a web based strategy for construction tendering

Q19	If Yes, to above what are / have been your company's concerns with regard to adopting a web-based strategy for construction tendering communications?				
		Ranking			
		PQS	CQS	Sub QS	Overall
	Lack of awareness or knowledge of technology capabilities	6	4.5	5	5
	Other parties may not possess adequate eBusiness capabilities	2	1	4	2
	Lack of available funding	5	7	7	7
	Total costs	4	6	6	6
	Security of sensitive data	1	2.5	1	1
	Legal implications	3	2.5	2	3
	Training and inability to use technology	7	4.5	3	4

Table B3.25 Ranking of respondents concerns with regard to adopting a web based strategy for construction tendering

Q20	Please rate (from 1 to 6) the following factors, which attract or are likely to attract your organisations to apply web-based construction tendering communications						
		PQS					
		Level of attraction (1 = strong decresing in strength to 6 = weak)					
	Factors	1	2	3	4	5	6
	Reduced photocopying/printing costs	14	7	1	1	0	0
	Avoidance of re-keying information into computer systems	10	5	5	2	1	0
	Saving manpower in processing information	10	5	7	1	0	0
	Fewer errors in recording and handling information	7	10	2	3	1	0
	Reduced cost of capturing data	4	11	6	2	0	0
	Improved accessibility to time and cost data: providing real time information	8	8	6	1	0	0
	Ability to contribute to national protocol/standard	3	7	8	5	0	0
	Clients who may encourage or stipulate the use of Information Communications Technologies	3	11	5	2	2	0

Table B3.26 PQS levels of response to Q20

Q20	Please rate (from 1 to 6) the following factors, which attract or are likely to attract your organisations to apply web-based construction tendering communications						
		CQS					
		Level of attraction (1 = strong decresing in strength to 6 = weak)					
	Factors	1	2	3	4	5	6
	Reduced photocopying/printing costs	12	0	3	1	1	0
	Avoidance of re-keying information into computer systems	9	2	3	2	1	0
	Saving manpower in processing information	9	5	1	2	0	0
	Fewer errors in recording and handling information	4	8	0	3	2	0
	Reduced cost of capturing data	6	6	3	1	1	0
	Improved accessibility to time and cost data: providing real time information	4	9	2	1	1	0
	Ability to contribute to national protocol/standard	1	4	6	5	1	0
	Clients who may encourage or stipulate the use of Information Communications Technologies	3	4	3	4	2	1

Table B3.27 CQS levels of response to Q20

Q20	Please rate (from 1 to 6) the following factors, which attract or are likely to attract your organisations to apply web-based construction tendering communications						
		CQS					
		Level of attraction (1 = strong decresing in strength to 6 = weak)					
	Factors	1	2	3	4	5	6
	Reduced photocopying/printing costs	17	4	4	2	0	1
	Avoidance of re-keying information into computer systems	17	3	7	0	1	0
	Saving manpower in processing information	17	4	6	0	0	1
	Fewer errors in recording and handling information	16	5	5	1	0	1
	Reduced cost of capturing data	16	4	7	0	0	0
	Improved accessibility to time and cost data: providing real time information	17	5	5	0	0	1
	Ability to contribute to national protocol/standard	6	4	8	3	5	2
	Clients who may encourage or stipulate the use of Information Communications Technologies	7	6	8	4	2	1

Table B3.28 Sub QS levels of response to Q20

Q20	Please rate (from 1 to 6) the following factors, which attract or are likely to attract your organisations to apply web-based construction tendering communications				
		Ranking			
		PQS	CQS	Sub QS	Overall
	Reduced photocopying/printing costs	1	1	3	1
	Avoidance of re-keying information into computer systems	3	3	4	3
	Saving manpower in processing information	2	2	2	2
	Fewer errors in recording and handling information	5	6	5	5
	Reduced cost of capturing data	6	4	6	6
	Improved accessibility to time and cost data: providing real time information	4	5	1	4
	Ability to contribute to national protocol/standard	8	8	8	8
	Clients who may encourage or stipulate the use of Information Communications Technologies	7	7	7	7

Table B3.29 Ranking of responses to Q20

Q21	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation						
		PQS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	A lack of awareness of Information Communications Technologies deployed in construction tendering	3	13	3	3	1	0
	Development costs are prohibitive (hardware, software and training)	3	8	7	4	1	0
	Technology is not yet reliable enough for use in construction tendering	4	11	3	2	3	0
	Potential benefits of eTendering are not likely to be sufficient to justify investments	2	5	8	4	4	0
	Uncertainty about how to measure the costs and benefits of such investments	0	8	4	5	5	1
	The security and sensitivity of the data	10	6	4	1	2	0

Table B3.30 PQS levels of response to Q21

Q21	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation						
		CQS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	A lack of awareness of Information Communications Technologies deployed in construction tendering	7	2	1	3	2	1
	Development costs are prohibitive (hardware, software and training)	2	2	5	3	2	2
	Technology is not yet reliable enough for use in construction tendering	1	5	6	0	2	2
	Potential benefits of eTendering are not likely to be sufficient to justify investments	2	3	3	3	3	2
	Uncertainty about how to measure the costs and benefits of such investments	1	2	6	3	1	3
	The security and sensitivity of the data	4	1	4	3	3	1

Table B3.31 CQS levels of response to Q21

Q21	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation						
		Sub QS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	A lack of awareness of Information Communications Technologies deployed in construction tendering	9	8	6	0	1	4
	Development costs are prohibitive (hardware, software and training)	1	7	14	1	3	2
	Technology is not yet reliable enough for use in construction tendering	2	2	11	5	3	5
	Potential benefits of eTendering are not likely to be sufficient to justify investments	1	5	8	4	5	5
	Uncertainty about how to measure the costs and benefits of such investments	1	5	9	3	4	6
	The security and sensitivity of the data	7	7	7	3	1	3

Table B3.32 Sub QS levels of response to Q21

Q21	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation				
		Ranking			
		PQS	CQS	Sub QS	Overall
	A lack of awareness of Information Communications Technologies deployed in construction tendering	3	1	1	2
	Development costs are prohibitive (hardware, software and training)	4	4	4	4
	Technology is not yet reliable enough for use in construction tendering	2	5	3	3
	Potential benefits of eTendering are not likely to be sufficient to justify investments	5	3	6	5
	Uncertainty about how to measure the costs and benefits of such investments	6	6	5	6
	The security and sensitivity of the data	1	2	2	1

Table B3.33 Ranking of responses to Q21

Q22	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within the ICI.						
		PQS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	There is a general lack of awareness of Information Communications Technologies (ICT) capabilities in construction tendering and its potential benefits to the Irish construction supply chain	4	10	7	1	1	0
	There is a high incidence of technologically conservative organisations in the Irish construction industry	5	10	4	3	1	0
	The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived	1	13	4	4	1	0
	There is no motivation for organisations to apply ICT when other parties will benefit	2	5	8	7	1	0
	There are too many construction professionals and contractors to make the adoption of ICT in construction tendering widespread	1	1	7	8	5	1

Table B3.34 PQS levels of response to Q22

Q22	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within the ICI.						
		CQS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	There is a general lack of awareness of Information Communications Technologies (ICT) capabilities in construction tendering and its potential benefits to the Irish construction supply chain	5	7	4	0	0	0
	There is a high incidence of technologically conservative organisations in the Irish construction industry	3	8	5	0	0	0
	The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived	3	4	8	0	1	0
	There is no motivation for organisations to apply ICT when other parties will benefit	4	3	4	4	1	0
	There are too many construction professionals and contractors to make the adoption of ICT in construction tendering widespread	2	6	4	1	3	0

Table B3.35 CQS levels of response to Q22

Q22	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within the ICI.						
		Sub QS					
		Level of attraction (1 is strong to 6 being weak)					
	Factors	1	2	3	4	5	6
	There is a general lack of awareness of Information Communications Technologies (ICT) capabilities in construction tendering and its potential benefits to the Irish construction supply chain	6	11	7	2	1	1
	There is a high incidence of technologically conservative organisations in the Irish construction industry	3	6	13	3	1	2
	The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived	1	10	10	2	3	2
	There is no motivation for organisations to apply ICT when other parties will benefit	4	7	6	5	4	2
	There are too many construction professionals and contractors to make the adoption of ICT in construction tendering widespread	3	9	8	2	3	3

Table B3.36 Sub QS levels of response to Q22

Q22	Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within the ICI.				
		Ranking			
		PQS	CQS	Sub QS	Overall
	A lack of awareness of Information Communications Technologies deployed in construction tendering	2	1	2	2
	Development costs are prohibitive (hardware, software and training)	1	4	5	3
	Technology is not yet reliable enough for use in construction tendering	5	5	6	6
	Potential benefits of eTendering are not likely to be sufficient to justify investments	4	3	3	4
	Uncertainty about how to measure the costs and benefits of such investments	6	6	4	5
	The security and sensitivity of the data	3	2	1	1

Table B3.37 Ranking of responses to Q22

Q23	Please indicate your position on the following statements						
			Combined levels				
			Level of Agreement				
	Factors	Statement	Strongly Agree	Agree	No opinion	Disagree	Strongly disagree
	There is a general awareness of the benefits of deploying web-based technologies in construction tendering practice	No. 1	5.88%	50.00%	10.29%	29.41%	4.41%
	A construction industry standard should be introduced for electronic data interchange in construction tendering transactions	No. 2	39.39%	43.94%	6.06%	9.09%	1.52%
	There is an increase in familiarity of the capabilities of eTendering in construction	No. 3	5.88%	54.41%	17.65%	22.06%	0.00%
	Longer term relationships between supply chain organisations, allow development costs and on-going advantages to be shared	No. 4	16.18%	55.88%	14.71%	11.76%	1.47%
	Employers should stipulate the use of eTendering in future construction tendering communications	No. 5	17.65%	45.59%	16.18%	14.71%	5.88%
	Involvement in e-business is of vital importance for improving efficiency and effectiveness of the construction supply chain	No. 6	26.47%	52.94%	10.29%	5.88%	4.41%

Table B3.38 level of responses received for Q23

Appendix B4: Spearman's Coefficient Rank correlation equations.

Spearman's coefficient rank correlation allows for the user to identify how closely matched a series of results are. The result ranges from 0 to 1, with 1 being identical and 0 meaning there is no match. The equation is as follows:

$$r = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Equation B4.1 Spearman's Coefficient of Rank Correlation

In the equation C4.1 d is the difference between the rankings of the same item and n is the number of choices that were available to the respondent in the question.

The areas where this calculation were used are now shown below with question 19 being used illustrated as a worked example. Relevant results are discussed in chapter 4.

Question 19: If Yes, to above what are / have been your company's concerns with regard to adopting a web-based strategy for construction tendering communications?

Ranking	PQS	CQS	Sub QS	Overall	CITA 2006
Lack of awareness or knowledge of technology capabilities	6	4.5	5	5	5
Other parties may not possess adequate eBusiness capabilities	2	1	4	2	3
Lack of available funding	5	7	7	7	6
Total costs	4	6	6	6	8
Security of sensitive data	1	2.5	1	1	2
Legal implications	3	2.5	2	3	4
Training and inability to use technology	7	4.5	3	4	7
Need for wider industry buy in	n/a See Appendices				1

Table B4.1 Ranking of question 19 responses

	PQS to CQS		CQS to Sub		PQS to Sub		Overall to CITA	
Answer Choice	D	D2	D	D2	D	D2	D	D2
Lack of awareness or knowledge of technology capabilities	1.5	2.25	-0.5	0.25	1	1	0	0
Other parties may not possess adequate eBusiness capabilities	1	1	-3	9	-2	4	-1	1
Lack of available funding	-2	4	0	0	-2	4	1	1
Total costs	-2	4	0	0	-2	4	-2	4
Security of sensitive data	-1.5	2.25	1.5	2.25	0	0	-1	1
Legal implications	0.5	0.25	0.5	0.25	1	1	-1	1
Training and inability to use technology	2.5	6.25	1.5	2.25	4	16	-3	9
Need for wider industry buy in	0	0	0	0	0	0	-1	1
	Sum	20		14		30		18

Table B4.2 D calculation of question 19 responses

$$r = 1 - \frac{6\,x\,20}{7\,[7^2 - 1\,[} \quad r = 1 - .357 \quad r = .643$$

Equation B4.2 Calculation of Spearman's coefficient of rank correlation for PQS to CQS Question 19

	PQS	CQS	Sub QS
PQS	1.000		
CQS	0.643	1.000	
Sub QS	0.464	0.750	1.000
Overall result to CITA 2006	0.786		

Table B4.3 Spearman's coefficient of rank correlation for Question 19

Question 20 Please rate (from 1 to 6) the following factors, which attract or are likely to attract your organisations to apply web-based construction tendering communications.

Ranking	PQS	CQS	Sub QS	Overall	Cita 2006
Reduced photocopying/printing costs	1	1	3	1	8
Avoidance of re-keying information into computer systems	3	3	4	3	4
Saving manpower in processing information	2	2	2	2	1
Fewer errors in recording and handling information	5	6	5	5	2
Reduced cost of capturing data	6	4	6	6	6
Improved accessibility to time and cost data: providing real time information	4	5	1	4	3
Ability to contribute to national protocol/standard	8	8	8	8	7
Clients who may encourage or stipulate the use of Information Communications Technologies	7	7	7	7	5

Table B4.4 Ranking of responses to question 20

	PQS to CQS		CQS to Sub		PQS to Sub		Overall to CITA	
Answer Choice	D	D2	D	D2	D	D2	D	D2
Reduced photocopying/printing costs	0	0	-2	4	-2	4	7	49
Avoidance of re-keying information into computer systems	0	0	-1	1	-1	1	1	1
Saving manpower in processing information	0	0	0	0	0	0	-1	1
Fewer errors in recording and handling information	-1	1	1	1	0	0	-3	9
Reduced cost of capturing data	2	4	-2	4	0	0	0	0
Improved accessibility to time and cost data: providing real time information	-1	1	4	16	3	9	-1	1
Ability to contribute to national protocol/standard	0	0	0	0	0	0	-1	1
Clients who may encourage or stipulate the use of Information Communications Technologies	0	0	0	0	0	0	-2	4

Table B4.5 Ranking of question 20 responses

	PQS	CQS	Sub QS
PQS	1.000		
CQS	0.929	1.000	
Sub QS	0.833	0.690	1.000
Overall result to CITA 2006	0.214		

Table B4.6 Spearman's coefficient of rank correlation for Question 20

Question 21 Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation

Ranking	PQS	CQS	Sub QS	Overall	Cita 2006
A lack of awareness of Information Communications Technologies deployed in construction tendering	3	1	1	2	2
Development costs are prohibitive (hardware, software and training)	4	4	4	4	5
Technology is not yet reliable enough for use in construction tendering	2	5	3	3	3
Potential benefits of eTendering are not likely to be sufficient to justify investments	5	3	6	5	6
Uncertainty about how to measure the costs and benefits of such investments	6	6	5	6	4
The security and sensitivity of the data	1	2	2	1	1

Table B4.7 Ranking of responses to question 21

	PQS to CQS		CQS to Sub		PQS to Sub		Overall to CITA	
Answer Choice	D	D2	D	D2	D	D2	D	D2
A lack of awareness of Information Communications Technologies deployed in construction tendering	2	4	0	0	2	4	0	0
Development costs are prohibitive (hardware, software and training)	0	0	0	0	0	0	1	1
Technology is not yet reliable enough for use in construction tendering	-3	9	2	4	-1	1	0	0
Potential benefits of eTendering are not likely to be sufficient to justify investments	2	4	-3	9	-1	1	1	1
Uncertainty about how to measure the costs and benefits of such investments	0	0	1	1	1	1	-2	4
The security and sensitivity of the data	-1	1	0	0	-1	1	0	0

Table B4.8 d Calculations of responses to question 21

	PQS	CQS	Sub QS
PQS	1.000		
CQS	0.486	1.000	
Sub QS	0.771	0.600	1.000
Overall result to CITA 2006	0.829		

Table B4.9 Spearman's coefficient of rank correlation for Question 21

Question 22 Please rate (From 1-6) the barriers which undermine the use of a web-based strategy in construction tendering within your organisation

Ranking	PQS	CQS	Sub QS	Overall	Cita 2006
There is a general lack of awareness of Information Communications Technologies (ICT) capabilities in construction tendering and its potential benefits to the Irish construction supply chain	2	1	2	2	1
There is a high incidence of technologically conservative organisations in the Irish construction industry	1	4	5	3	4
The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived	5	5	6	6	6
There is no motivation for organisations to apply ICT when other parties will benefit	4	3	3	4	5
There are too many construction professionals and contractors to make the adoption of ICT in construction tendering widespread	6	6	4	5	3
There is a general lack of leadership from the government to actively promote the use of ICT in construction tendering	3	2	1	1	2

Table B4.10 Ranking of responses to question 22

	PQS to CQS		CQS to Sub		PQS to Sub		Overall to CITA	
Answer Choice	D	D2	D	D2	D	D2	D	D2
There is a general lack of awareness of Information Communications Technologies (ICT) capabilities in construction tendering and its potential benefits to the Irish construction supply chain	1	1	-1	1	0	0	-1	1
There is a high incidence of technologically conservative organisations in the Irish construction industry	-3	9	-1	1	-4	16	1	1
The temporary nature of relationships between organisations results in an unwillingness to invest in ICT which may only be short lived	0	0	-1	1	-1	1	0	0
There is no motivation for organisations to apply ICT when other parties will benefit	1	1	0	0	1	1	1	1
There are too many construction professionals and contractors to make the adoption of ICT in construction tendering widespread	0	0	2	4	2	4	-2	4
There is a general lack of leadership from the government to actively promote the use of ICT in construction tendering	1	1	1	1	2	4	1	1

Table B4.11 d Calculations for question 22

	PQS	CQS	Sub QS
PQS	1.000		
CQS	0.657	1.000	
Sub QS	0.257	0.771	1.000
Overall result to CITA 2006	0.771		

Table B4.12 Spearman's coefficient of rank correlation for Question 22

B.5: Detailed Survey Results Comparison

There are a number of other similar surveys, that have been completed on both, the specific topic of eTendering and also on areas relating to ICT usage in construction companies. In this section, the author will highlight any relevant surveys he has found, their specific findings and finally compare and contrast all of the separate researchers relevant findings.

CITA, 2006

This survey was completed in 2006 and was the basis for the author's survey. A large number of questions were re-used to establish a short to medium term longitudinal study of the Irish construction industry. The author has drawn a number of specific conclusions from the comparison of this survey with his own. These conclusions are identified in the main body of text in this document.

For the purposes of clarity the CITA survey and subsequent report concluded that:

- Industry inertia with regard to BOQ submittal was seen as a factor to delaying its implementation.
- Additionally government support was seen as lacking by respondents, both for industry standards and as the industries largest client.
- Information regarding the security of systems was required to quell the Irish construction industries' concerns on this specific barrier

Martin J., 2008

This survey was carried out in 2006 by BCIS in the UK. The survey was sent to 4,000 members of the RICS and a response rate 7.4% was achieved. A respondent profile was not given in the study. However, the respondents had been involved in approximately 25 tenders in the previous year.

When asked if the respondents would utilise a web based portal system, all costs being equal, over one third responded negatively to the idea of utilizing the technology. Additionally, 90% of clients either rarely or did not encourage the use of the technology during a tender request.

However, the industry was completing some level of electronic communication.

The exchange of tender documents in electronic format, was seen to be at 35% for the issue of documents, while a lower percentage of 26% was seen for the submittal stage of a project. When asked about, how the respondents electronically transferred the documents, the following results were obtained: 29% use a physical methods (e.g. CD-Rom) to transport the electronic data, 64% used email to communicate the documents and only 7% had utilized a web based portal.

A number of drivers were subsequently put to the respondents. A majority of respondents agreed that lower administrative costs, better access to information, reduction in effort to analyze tender documentation and a deduction in tender timescale were all drivers to the introduction of eTendering. The paper did not disclose any survey results on barriers to eTenderings adoption. Finally, a majority of 63% of respondents had failed to read their own societies guidelines on the topic. From this the author concluded that while UK companies accept eTendering has possible benefits and cost savings to their company, that it has yet to be taken seriously by the UK construction industry.

Martin J., (2003)

Prior to the above research, Martin (2003) had completed a survey on eProcurement and extranets in the UK construction industry. In this survey both consultants and contractors were surveyed. He found that a slight majority of BOQ were prepared on word processors or spreadsheets in the UK. Additionally, four proprietary systems (CATO, Masterbill, RIPAC and Snape) dominated the remainder of the market. However Martin found that, as Brooks (2008) suggested, only 29% of the electronically prepared documents were then exchanged electronically. The electronic transfer of these documents was broken down as being: 45% being sent on disk, 52% being emailed and the remaining 3% being sent using a web portal. Additionally, when the documents were sent electronically, one particularly large PQS firm responded that 65% of documents were sent in PDF format to avoid tampering. Martin subsequently established, but did not rank, a large number of both attractions and barriers to potential users of project extranets. These can be seen in table C5.1.

Eadie et. al., (2007)

Eadie et al (2007), completed research on the drivers and barriers to eProcurement in Northern Ireland. This survey used contractors responses for data analysis. The main

Project Extranets	
Attractions	**Barriers**
Instant availability of information	Costs of printing shifted down supply chain
Reduces risks	Copyright issues
Better information to all parties	CAD training
Reduces resource input and remaining time means an increase in output quality	IT infrastructure
Transparency of process	ICT access can be unachievable in some areas
Improved communication	Inflexible system
Increased accessibility	Lack of indexing
Audit Trails available if required	
Reduced risk of using out of date data	

Table B5.1 Project extranet attractions and barriers

drivers and barriers can be seen below in table C5.2 and C5.3 respectively. The survey analyzed the drivers and barriers based on a CD-Rom method of communication, which was applied by the Road Service Northern Ireland (RSNI), and a web based portal method of procurement. The main attractions and barriers established by the survey, were subsequently examined against those found in other studies. The main conclusions of the research led the author to conclude that, eProcurement in construction is very different to what is established in other industries. This conclusion was established due to the marked differences in the driver and barrier rankings by the Northern Ireland construction industry.

Driver	Rank CDR-Based eProcurement	Rank Web-based eProcurement	Overall Rank eProcurement
Improving communication	1	1	1
Reduced Administration Costs	1	3	2
Price reduction in Tendering	3	4	3
Gaining competitive advantage	6	2	4
Reduction in time to source materials	3	6	5
Reduced operating and inventory costs	5	4	5
Reduced staffing levels in procurement	7	7	6
Enhanced decision making and market intelligence	8	8	7

Table B5.2 Drivers to contractor for eProcurement in Northern Ireland

This survey was sent to 100 potential respondents chosen at random from the Omani government tender board listings. Four groups were represented within this survey: consultants, contractors, suppliers and clients, each group being sent 25 surveys by post. A high response rate of 64% was established with the majority of individuals being previously involved in over thirty tenders. Initially the respondents were questioned on their satisfaction of the current tender process in Oman. A majority of 53% of respondents were satisfied with the procedure, while only 20% of respondents were dissatisfied. The remaining percentage had no significant feeling of either satisfaction or dissatisfaction towards the process.

Barrier	Rank CDR-Based eProcurement	Rank Web-based eProcurement	Overall Rank eProcurement
Security of transaction	1	2	1
Unsure of Legal position	2	1	1
Lack of a business relationship with suppliers providing eTendering	3	3	3
Lack of eProcurement knowledge/personnel	4	4	4
Interoperability concerns	5	6	5
Lack of technical expertise	6	5	5
No business benefit realised	7	7	7
Company culture	8	8	8
Upper management support	9	9	9
IT systems too costly	10	10	10
Do not have the IT infrastructure	11	11	11

Table B5.3 Barriers to contractor for eProcurement in Northern Ireland

The survey proceeded to ascertain the separate groups' willingness to undertake eTendering. All groups, with the exception of the consultants, were willing to undertake the proposed Omani eTendering system. Additionally, the survey asked respondents to indicate what items would either encourage or discourage their willingness to implement the technology. From 17 literature reviewed possible items, it was found that; internet threats, clarity and simplicity of an eTendering systems, efficiently designed websites and the potential for time savings were likely to have highest influence on organizations willingness to participate in eTendering.

Finally, it was established that increased awareness of eTendering and its

benefits, would be the best route for the Omani government to undertake, when attempting to promote the use of such technology in future years.

Samuelson O., 2008

In 2008, Samuelson published the findings of a longitudinal survey study, which was completed by respondents in 2007, 2000 and 1998. The 180 respondents, to the 2008 survey, resulted in a 13% response rate and they were drawn from all areas of the Swedish construction industry. The survey sought to establish the Swedish construction industries level of ICT usage.

From this paper, the author gathered the following particularly relevant information. Over 80% of office workers had access to their own PC, with a slight drop to just under 80% having their own internet access. This percentage was seen as a significant increase from the previous years (2000, 1998) studies. Additionally, the study asked respondents about their usage of ICT in the communication of tender documents. It was shown that, there were substantial increases in the use of electronic communication of these documents, over the three surveys discussed. The most recent survey suggested, that almost 60% of the sample population, send documents in an electronic fashion over 60% of the time.

Finally, Samuelson also completed a ranked list of both attractions and barriers to ICT in the Swedish construction industry. The results are show in tables C5.4 and C5.5 respectively. Of most interest to the author, was the ranking of the factor “security of information” as the least important barrier. Furthermore, Samuelson illustrated the trends of certain attractions (E.g. Sharing of information) and barriers (E.g. Too much information, Systems work fine in their current form) to having increased leverage on the Swedish construction industries thoughts.

Attractions	**2007**	**2000**	**1998**	**Trend**
Better access to information	1	2	1	
Better financial control	2	1	5	
Sharing of information	3	4	6	Upward
Work completed quicker	4	6	3	
Possibility of teleworking	5	9	9	Upward
Better quality work	6	7	2	
Better communications	7	3	4	Downward
Easier to handle large amounts of data	8	5	7	
Greater flexibility to satisfy customers	9	8	8	
Makes company more attractive to potential staff	10	10	10	
Possibility to reduce staff numbers	11	12	11	
Possibility to develop new products	12	11	n/a	

Table B5.4 Swedish Attractions to IT

Barriers	**2007**	**2000**	**1998**	**Trend**
Continuous demand for upgrading of hard/software	1	1	2	
Overabundance of information	2	4	7	Upward
Old systems work fine. “If it ain't broke don’t fix it”	3	5	5	Upward
Greater know-how required from staff	4	3	3	
Investment cost too high	5	2	1	Downward
Risk that IT leads to inefficiency	6	9	12	Upward
Non-compatible software	7	6	N/a	
Insufficient interest/commitment from management	7	12	9	
Decision makers lack of time to acknowledge IT	9	7	6	
Difficulty in measuring return on investment	10	10	4	Downward
Prefer manual work due to lack of standards	11	11	8	
Reduced Security				

Table B5.5Swedish Barriers to IT

Appendix C

Pilot Project Appendices

C.1 Schedule of Module meetings

C.2 Breakdown of Figures 5.5 and 5.6

C.3 Detailed cost breakdown of Tables 5.4 and 5.5

C.4 Participant feedback

(a) CQS feedback

(b) PQS feedback

Appendix C.1: Schedule of CITAX Module 3 meetings

The pilot project team discussed in Chapter 5 met regularly throughout the course of the project. The schedule of meetings is as follows:

Module 3 Meetings	CITAX Steering Group Meetings
• 29th September 2006 • 7th November 2006 • 5th December 2006 • 9th January 2007 • 6th February 2007 • 5th March 2007 • 3rd April 2007 • 8th May 2007 • 25th May 2007 • 5th June 2007 • 3rd July 2007 • 4th September 2007 • 6th November 2007 • 29th January 2008 • 27th February 2008 • 4th March 2008 • 1st April 2008 • 21st April 2008 • 7th May 2008 • 26th August 2008	• 26th May 2006 • 14th August 2006 • 20th September 2006 • 1st November 2006 • 12th January 2007 • 26th January 2007 • 16th May 2007 • 4th July 2007 • 22nd August 2007 • 10th September 2007 • 24th October 2007 • 13th February 2008 • 26th June 2008

Additionally, CITA arranged a number of symposia. These normally involved workshops where the teams prepared for the next phase of their work. This feedback was then used in subsequent team meetings. The dates of the CITAX Symposia were:

- 8th September 2006
- 24th November 2006
- 28th February 2007
- 25th May 2007
- 20th September 2007
- 7th December 2007
- 27th February 2008
- 30th May 2008

Appendix C.2

(a) The existing tender process; Task outlines

(b) The redesigned tender process; Task outlines

(c) Process differences

All as final CITAX Report

C.2.(a):The existing tender process; Task outlines

Preparation stage of existing tender process

Ref	Owner	Activity	Explanation
1	PQS	Print & bind multiples of BOQ	Multiple copies of the Bill of Quantities are assembled as part of the preparation of the tender.
2	PQS	Collate & copy all other documents	The tender documents are gathered together and multiple copies are prepared for dispatch to contractors.
3	PQS	Issue tender to contractors	Once collated, the tenders are issued to appropriate contractors.

Estimating stage of existing tender process

Ref	Owner	Activity	Explanation
4	Contractor	Receive tender	The contractor receives the tender and it has to be issued to the bid team.
5	Contractor	Check tender documents	The bid team goes through the documents on a first pass to agree the way in which the tender will be addressed, and to see if there are any queries.
6	Contractor	Any queries raised?	Any queries in the documentation are noted.
7	Contractor	Input BOQ to system	The BOQ issued in the tender documents has to be input on the contractor's system.
8	Contractor	Contractor carries out own analysis	The contractor analyses the details of the BOQ and this may lead to further queries being raised.
9	Contractor	Issue queries to PQS	Any queries raised during the initial review of the tender documents, or after the BOQ has been input on the contractor's system are raised with the PQS. This is a process that may occur a number of times during the tender process.
16	PQS	Log queries and evaluate	All queries received by the PQS are logged and evaluated.
17	PQS	Issue clarification to contractors	All queries are addressed and responses issued to contractors.
18	Contractor	Receive clarifications	The contractor receives responses to queries raised and incorporates these into the tender process. Further clarification may be required and this can continue throughout the tender process.

Ref	Owner	Activity	Explanation
10	Contractor	Prepare trade package	The contractor will compile components of the tender into a series of trade packages for individual subcontractors.
11	Contractor	Issue to subcontractors	The trade packages will then be issued to subcontractors.
12	Sub-contractor	Receive trade package	Each subcontractor will receive a pack of information, which will form the basis of the quote they prepare for their area of responsibility.
13	Sub-contractor	Bid?	Each subcontractor has to decide whether or not to bid for the business.
37	Sub-contractor	Inform contractor of 'No Bid'	If the subcontractor is not going to bid for the work, they have to inform the main contractor.
14	Sub-contractor	Any queries raised?	Just as the main contractor reviews the tender documents and raises queries, subcontractors may raise queries following their review of the documentation. These queries may be addressed by the contractor directly, or they may have to be referred back to the PQS.
15	Sub-contractor	Prepare quote	The subcontractor prepares a written quotation that is issued back to the main contractor, again in paper format.
19	Contractor	Receive back subcontractor quote	Quotes are received from subcontractors.
20	Contractor	Has subcontractor returned quote?	The contractor has to check if quotes have been received from each subcontractor.
21	Contractor	Chase subcontractor for response	If subcontractors have not returned their quotes, the contractor has to chase them for a response.
22	Contractor	Does quote comply with requirements?	The contractor has to check if each subcontractor quote complies with the tender requirements.
23	Contractor	Return to subcontractor for clarification	If a subcontractor's quote does not comply with the tender requirements, or there are any other queries on it, it has to be returned to the subcontractor for clarification.
24	Contractor	Manual input to estimating system and select quote	The contractor inputs all quotes received from subcontractors into the estimating system and selects the most appropriate one.
25	Contractor	Prepare BOQ	The contractor prepares its own BOQ based on the information it has input along with information input from subcontractor quotes.
26	Contractor	Final tender adjudication	The contractor review its tender to ensure completeness and accuracy.

Ref	Owner	Activity	Explanation
27	Contractor	Submit tender proposal	The tender is then submitted to the PQS for evaluation.

Evaluation stage of existing tender process

Ref	Owner	Activity	Explanation
28	PQS	Receive completed tenders	The date and time that tenders are received is noted and any that have not been submitted in time may be excluded.
29	PQS	Open forms of tenders	The covering documentation with each tender is opened and is reviewed.
30	PQS	Record amounts on forms of tenders	The amounts quoted on the tenders are recorded.
31	PQS	Identify lowest (winning) bid	Based on the information supplied by the contractors, the lowest bid is selected.
32	PQS	Carry out computational check	The calculations used in the winning bid are checked for accuracy to eliminate any issues with transcribing figures or calculations used.
33	PQS	Review tender for clarifications	There may be queries on aspects of the tender that need further clarification from the contractor.
34	PQS	Any errors identified	If there are any errors in the tender, these need to be raised with the contractor.
35	Contractor	Receive queries on (winning) proposal	The contractor receives queries from the PQS and decides who should respond.
36	Contractor	Review queries and evaluate	The contractor review and responds to each query raised.
37	Contractor	Issue updated proposal to PQS	A response to all of the queries raised is issued back to the PQS.
38	PQS	Award contract	Having received all necessary clarifications, and provided that they are satisfactory, the contract is awarded to the winning bidder.

C.2.(b) The redesigned tender process; Task outlines

Preparation stage of redesigned tender process

Ref	Owner	Activity	Explanation
3a	PQS	Post tender on line	The entire tender is posted on line which eliminates the need to print, bind and distribute documents.
3b	PQS	Notify contractors automatically	The act of posting the tender on line should notify interested bidders automatically. This is likely to be in the form of an email that will be sent to designated recipients.

Estimating stage of redesigned tender process

Ref	Owner	Activity	Explanation
5a	Contractor	Review tender documents	The contractor reviews the tender and decides how best to submit a bid.
7	Contractor	Input/Import BOQ to system	Ideally, the electronic tender process should provide data in a format that can easily be imported into the Contractor's back office system. This helps to ensure that all information is imported and that reduces the effort involved in re-keying information.
9a	Contractor	Issue queries to PQS	If the Contractor has any queries when reviewing the tender information, they can be input on line.
9b	Contractor	Notify PQS automatically	Whenever new queries are logged on the tendering system, they are automatically notified by email to the PQS.
17a	PQS	Review, respond and update on line	The PQS reviews the query and responds on line If this is a general response that should be made available to all bidders, this can be specified at the time of posting the response.
17b	PQS	Notify contractors automatically	The Contractor that raised the query is notified that a response has been posted on line If the response needs to be made available to all other bidders, they will also receive a notification that a query has been raised and a response provided.
10	Contractor	Prepare trade package	The Contractor will compile components of the tender into a series of trade packages for individual subcontractors.
11	Contractor	Post trade package on line	The Contractor should be able to post its trade package on line and invite submissions from Subcontractors.
11a	Contractor	Notify subcontractors	When the trade package is posted on line, appropriate subcontractors should be notified automatically.

Ref	Owner	Activity	Explanation
12	Sub-contractor	Review trade package	Each subcontractor should be able to review the trade packages on line
13	Sub-contractor	Bid?	Each subcontractor has to decide whether or not to bid for the business.
37	Sub-contractor	Inform contractor of 'No Bid'	If a subcontractor is not going to bid for the business, they log this on line and the main Contractor is notified automatically.
15	Sub-contractor	Prepare quote	The Subcontractor prepares a quotation.
15a	Sub-contractor	Notify Contractor of queries	If the Subcontractor has any queries when preparing the quote, they are logged on line and the Contractor is notified automatically.
15b	Contractor	Respond to query	The Contractor may be able to respond to the query directly, or may have to raise it with the PQS. If it has to be raised with the PQS, the process for raising queries with the PQS as outlined above applies. In either case, the Contractor will post the response to the query on line
15c	Contractor	Notify subcontractor(s)	The subcontractor that raised the query is notified automatically about the response. This response may also be notified to other subcontractors that have expressed an interest in responding to the tender.
15d	Sub-contractor	Submit quote	The Subcontractor submits the quote on line when it is ready.
15e	Sub-contractor	Notify Contractor	The Contractor is notified automatically when the quote has been submitted.
24	Contractor	Prepare Quote	The Contractor assembles the quote from its own information as well as from the information supplied by the subcontractors.
26	Contractor	Final tender adjudication	The Contractor reviews its tender to ensure completeness and accuracy.
27	Contractor	Submit Quote	The tender is posted on line by the Contractor.
27a	Contractor	Notify PQS automatically	The PQS is notified automatically when a tender is submitted.

Evaluation stage of redesigned tender process

Ref	Owner	Activity	Explanation
28	PQS	Receive completed tenders	The date and time that tenders are received is noted and any that have not been submitted in time may be excluded.

Ref	Owner	Activity	Explanation
29	PQS	Open forms of tenders	Each tender is opened and is reviewed.
30	PQS	Record amounts on forms of tenders	The amounts quoted on the tenders are recorded.
31	PQS	Identify lowest (winning) bid	Based on the information supplied by the contractors, the lowest bid is selected.
32	PQS	Carry out computational check	The calculations used in the winning bid are checked electronically for accuracy to eliminate any issues with transcribing figures or calculations used.
33	PQS	Review tender for clarifications	There may be queries on aspects of the tender that need further clarification from the contractor.
34	PQS	Any errors identified	If there are any errors in the tender, these need to be raised with the contractor.
35	Contractor	Receive queries on (winning) proposal	The contractor receives queries from the PQS and decides on how who should respond.
36	Contractor	Review queries and evaluate	The contractor review and responds to each query raised.
37	Contractor	Issue updated proposal to PQS	A response to all of the queries raised is issued back to the PQS.
38	PQS	Award contract	Having received all necessary clarifications, and provided that they are satisfactory, the contract is awarded to the winning bidder.

C.2.(c) Process differences

Preparation stage

Ref	Owner	Activity	Explanation
1	PQS	Print & bind multiples of BOQ	Multiple copies of the Bill of Quantities are assembled as part of the preparation of the tender.
2	PQS	Collate & copy all other documents	The tender documents are gathered together and multiple copies are prepared for dispatch to contractors.

Estimating stage

Ref	Owner	Activity	Explanation
4	Contractor	Receive tender	The contractor receives the tender and it has to be issued to the bid team.
19	Contractor	Receive back subcontractor quote	Quotes are received from subcontractors.
20	Contractor	Has subcontractor returned quote?	The contractor has to check if quotes have been received from each subcontractor.
21	Contractor	Chase subcontractor for response	If subcontractors have not returned their quotes, the contractor has to chase them for a response.
22	Contractor	Does quote comply with requirements?	The contractor has to check if each subcontractor quote complies with the tender requirements.
23	Contractor	Return to subcontractor for clarification	If a subcontractor's quote does not comply with the tender requirements, or there are any other queries on it, it has to be returned to the subcontractor for clarification.
25	Contractor	Prepare BOQ	The contractor prepares its own BOQ based on the information it has input along with information input from subcontractor quotes.

Evaluation stage

Ref	Owner	Activity	Explanation
28	PQS	Receive completed tenders	The date and time that tenders are received is noted and any that have not been submitted in time may be excluded.
29	PQS	Open forms of tenders	The covering documentation with each tender is opened and is reviewed.
32	PQS	Carry out computational check	The calculations used in the winning bid are checked for accuracy to eliminate any issues with transcribing figures or calculations used.
34	PQS	Any errors identified	If there are any errors in the tender, these need to be raised with the contractor.
35	Contractor	Receive queries on (winning) proposal	The contractor receives queries from the PQS and decides on how who should respond.

Appendix C.3.(a): CITAX current tender cost breakdown

CITAX

Module 3 - eTendering

Costing of Current Process

ID	Process (refer to Procedures flow chart)	Responsibility	Notes	Qty	Unit	Rate	Current Cost Sub-Total	Current Cost / Tender (PQS,design team)	Current Cost / Tender (contractor)	Current Cost / Tender (subcontractors)
1	Print & Bind multiple copies of BOQ	PQS								
	Assumes 350 pg Tender Document		Document printed	3,500	pages	€0.02	€70.00			
		QS	Document checked	0.25	day	€790.00	€197.50			
		QS Admin	Documents bound	1.00	day	€300.00	€300.00			
							€567.50	€567.50		
2	Collate and Copy all other documents	PQS								
	Assumes misc. Tender Docs / Dwgs	Arch, M+E, Eng, PM ?	DT print documents / dwgs				*excl. - assume saving elsewhere Module ???*			
		QS	Documents prepared and boxed	0.13	day	€790.00	€98.75			
		QS Admin	Documents prepared and boxed	0.13	day	€300.00	€37.50			
							€136.25	€136.25		
3	Issue Tender to Contractors	PQS								
	Assumes 5 Contractors copies		Document couriered to Cons.	0	Docs	€35.00	€-			
	Assumes 5 copies for Client & DT		Document couriered to DT / Client	5	Docs	€20.00	€100.00			
	Assumes city centre delivery				Section Total / Tender		€100.00	€100.00		
4	Receive Tender	Contractor	int or ext courier + vehicle	0.25	day	175.00	€43.75			
5	Check Tender Documents	Contractor	manager	0.25	day	€750.00	€187.50			
			estimator	0.25	day	€500.00	€125.00			
6	Any queries raised ?	Contractor	estimator	0.25	day	€500.00	€125.00			
7	Input BOQ to system	Contractor	administative assistant	1.00	day	€175.00	€175.00			
8	Contractor carries out own analysis	Contractor	manager	0.50	day	€750.00	€375.00			
			estimator	1.00	day	€500.00	€500.00			
9	Issue Queries to PQS	Contractor	estimator	0.50	day	€500.00	€250.00			
10	Prepare Trade package	Contractor	estimator	2.00	day	€500.00	€1,000.00			
11	Issue to Sub-contractors	Contractor	administative assistant	2.00	day	€175.00	€350.00			
					Section Total / Tender		€3,131.25		€3,131.25	
12	Receive Trade package	Sub-contractor	included				€-			
13	Bid?	Sub-contractor	included				€-			
14	Any queries raised ?	Sub-contractor	included				€-			
15	Prepare Quote	Sub-contractor	say				€225.00			
					Section Total / Tender		€225.00			€225.00
16	Log queries and evaluate	PQS								
	Assumes average qty of queries									
	Assumes Admin Daily Salary	QS Admin	Queries logged	0.50	day	€300.00	€150.00			
	Assumes PQS Daily Salary	QS	Queries reviewed	0.50	day	€790.00	€395.00			
					Section Total / Tender		€545.00	€545.00		
17	Issue clarification(s) to Contractors	PQS								
	Assumes Admin Daily Salary	QS Admin	Response finalised / issued	0.50	day	€300.00	€150.00			
	Assumes PQS Daily Salary	QS	Response drafted / checked	0.50	day	€790.00	€395.00			
			Faxing costs - 5Nr x 5mins ?	25	Mins	€0.05	€1.25			
					Section Total / Tender		€546.25	€546.25		

Costing of Current Process

18	Receive Clarifications	Contractor	estimator	0.25	day	€500.00	€125.00			
			administative assistant	0.50	day	€175.00	€87.50			
19	Receive back Sub-contractor quote	Contractor	estimator	0.25	day	€500.00	€125.00			
			administative assistant	1.00	day	€175.00	€175.00			
20	Has SC returned quote ?	Contractor	estimator	0.25	day	€500.00	€125.00			
21	Chase SC for response	Contractor	administative assistant	2.00	day	€175.00	€350.00			
22	Does quote comply with requirements ?	Contractor	estimator	0.25	day	€500.00	€125.00			
23	Return to sub-contractor for clarification	Contractor	estimator	0.25	day	€500.00	€125.00			
			administative assistant	1.00	day	€175.00	€175.00			
24	Manual input to Estimating system and select quote	Contractor	estimator	0.50	day	€500.00	€250.00			
			administative assistant	1.00	day	€175.00	€175.00			
25	Prepare BOQ	Contractor	estimator	3.00	day	€500.00	€1,500.00			
26	Final Tender adjudication	Contractor	manager	1.00	day	€750.00	€750.00			
			estimator	1.00	day	€500.00	€500.00			
27	Submit Tender proposal	Contractor	manager	0.25	day	€750.00	€187.50			
			estimator	0.25	day	€500.00	€125.00			
		Contractor	int or ext courier + vehicle	0.25	day	175.00	€43.75			
						Section Total / Tender	**€4,943.75**			€4,943.75
28	Receive completed Tenders	PQS								
	Assumes Admin Daily Salary	QS Admin	Sign off in reception	0.25	day	€300.00	€75.00			
						Section Total / Tender	**€75.00**	€75.00		
29	Open forms of Tenders	PQS								
	Assumes PQS Daily Salary	QS	Prepare Receipt Form	0.25	day	€790.00	€197.50			
						Section Total / Tender	**€197.50**	€197.50		
30	Record amounts on forms of Tenders	PQS								
	Assumes PQS Daily Salary	QS	Receipt Form finalised / issued	0.25	day	€790.00	€197.50			
						Section Total / Tender	**€197.50**	€197.50		
31	Identify lowest (winning) bid	PQS								
	Assumes PQS Daily Salary	QS	Receipt Form finalised / issued	0.25	day	€790.00	€197.50			
						Section Total / Tender	**€197.50**	€197.50		
32	Carry out computational check	PQS								
	Assumes Admin Daily Salary	QS Admin	Check lowest with calculator	2.00	days	€300.00	€600.00			
	Assumes PQS Daily Salary	QS	Cross check	0.50	day	€790.00	€395.00			
						Section Total / Tender	**€995.00**	€995.00		
33	Review Tender for clarifications	PQS								
	Assumes Admin Daily Salary	QS Admin	Response drafted / checked	2.00	days	€300.00	€600.00			
	Assumes PQS Daily Salary	QS	Response finalised / issued	0.50	day	€790.00	€395.00			
						Section Total / Tender	**€995.00**	€995.00		
34	Any errors identified ?	PQS								
	Assumes Admin Daily Salary	QS Admin	QS Admin	2.00	days	€300.00	€600.00			
	Assumes PQS Daily Salary	QS	QS	2.00	day	€790.00	€1,580.00			
						Section Total / Tender	**€2,180.00**	€2,180.00		
35	Receive queries on (winning) proposal	Contractor	manager	0.25	day	€750.00	€187.50			
			estimator	0.50	day	€500.00	€250.00			
36	Review queries and evaluate	Contractor	manager	0.50	day	€750.00	€375.00			
			estimator	0.50	day	€500.00	€250.00			
37	Issue updated proposal to PQS	Contractor	manager	0.25	day	€750.00	€187.50			
			estimator	0.50	day	€500.00	€250.00			
						Section Total / Tender	€1,500.00			€1,500.00
	Total / Tender							**€6,732.50**	**€9,575.00**	**€225.00**
						Assumed Average No. of Tenderers / per year		1,000	5,000	150,000
						Total Cost of Current Process to the Industry / per year		**€6,732,500**	**€47,875,000**	**€33,750,000**

Appendix D.3.(b): CITAX future/eTender cost breakdown

CITAX

Module 3 - eTendering

Costing of Future Process

ID	Process (refer to Procedures flow chart)	Responsibility	Notes	Qty	Unit	Rate	Current Cost Sub-Total	Current Cost / Tender (PQS,design team)	Current Cost / Tender (contractor)	Current Cost / Tender (subcontractors)
1	Print & Bind multiple copies of BOQ	PQS								
	Assumes 350 pg Tender Document		Document printed	0	pages	€0.02	€-			
		QS	Document checked	0.25	day	€790.00	€197.50			
		QS Admin	Documents bound	0.00	day	€300.00	€-			
							€197.50	€197.50		
2	Collate and Copy all other documents	PQS								
	Assumes misc. Tender Docs / Dwgs	Arch, M+E, Eng, PM ?	DT print documents / dwgs				*excl. - assume saving elsewhere Module ???*			
		QS	Documents prepared and boxed	0.00	day	€790.00	€-			
		QS Admin	Documents prepared and boxed	0.00	day	€300.00	€-			
							€-	€-		
3	Issue Tender to Contractors	PQS								
	Assumes 5 Contractors copies		Document couriered to Cons.	0	Docs	€35.00	€-			
	Assumes 5 copies for Client & DT		Document couriered to DT / Client	0	Docs	€20.00	€-			
	Assumes city centre delivery				Section Total / Tender		€-	€-		
4	Receive Tender	Contractor	int or ext courier + vehicle	0.00	day	175.00	€-			
5	Check Tender Documents	Contractor	manager	0.13	day	€750.00	€93.75			
			estimator	0.13	day	€500.00	€62.50			
6	Any queries raised ?	Contractor	estimator	0.25	day	€500.00	€125.00			
7	Input BOQ to system	Contractor	administative assistant	0.00	day	€175.00	€-			
8	Contractor carries out own analysis	Contractor	manager	0.50	day	€750.00	€375.00			
			estimator	1.00	day	€500.00	€500.00			
9	Issue Queries to PQS	Contractor	estimator	0.50	day	€500.00	€250.00			
10	Prepare Trade package	Contractor	estimator	1.00	day	€500.00	€500.00			
11	Issue to Sub-contractors	Contractor	administative assistant	2.00	day	€175.00	€350.00			
						Section Total / Tender	€2,256.25		€2,256.25	
12	Receive Trade package	Sub-contractor	included				€-			
13	Bid?	Sub-contractor	included				€-			
14	Any queries raised ?	Sub-contractor	included				€-			
15	Prepare Quote	Sub-contractor	say				€200.00			
						Section Total / Tender	€200.00			€200.00
16	Log queries and evaluate	PQS								
	Assumes average qty of queries									
	Assumes Admin Daily Salary	QS Admin	Queries logged	0.25	day	€300.00	€75.00			
	Assumes PQS Daily Salary	QS	Queries reviewed	0.50	day	€790.00	€395.00			
						Section Total / Tender	€470.00	€470.00		
17	Issue clarification(s) to Contractors	PQS								
	Assumes Admin Daily Salary	QS Admin	Response finalised / issued	0.45	day	€300.00	€135.00			
	Assumes PQS Daily Salary	QS	Response drafted / checked	0.50	day	€790.00	€395.00			
			Faxing costs - 5Nr x 5mins ?	0	Mins	€0.05	€-			
						Section Total / Tender	€530.00	€530.00		

Costing of Future Process

18	Receive Clarifications	Contractor	estimator		0.25	day	€500.00	€125.00		
			administative assistant		0.00	day	€175.00	€-		
19	Receive back Sub-contractor quote	Contractor	estimator		0.25	day	€500.00	€125.00		
			administative assistant		0.75	day	€175.00	€131.25		
20	Has SC returned quote ?	Contractor	estimator		0.25	day	€500.00	€125.00		
21	Chase SC for response	Contractor	administative assistant		2.00	day	€175.00	€350.00		
22	Does quote comply with requirements ?	Contractor	estimator		0.25	day	€500.00	€125.00		
23	Return to sub-contractor for clarification	Contractor	estimator		0.25	day	€500.00	€125.00		
			administative assistant		0.00	day	€175.00	€-		
24	Manual input to Estimating system and select quote	Contractor	estimator		0.50	day	€500.00	€250.00		
			administative assistant		0.50	day	€175.00	€87.50		
25	Prepare BOQ	Contractor	estimator		3.00	day	€500.00	€1,500.00		
26	Final Tender adjudication	Contractor	manager		1.00	day	€750.00	€750.00		
			estimator		1.00	day	€500.00	€500.00		
27	Submit Tender proposal	Contractor	manager		0.25	day	€750.00	€187.50		
			estimator		0.25	day	€500.00	€125.00		
		Contractor	int or ext courier + vehicle		0.00	day	175.00	€-		
							Section Total / Tender	**€4,506.25**		€4,506.25
28	Receive completed Tenders	PQS								
	Assumes Admin Daily Salary	QS Admin		0.25	0.25	day	€300.00	€75.00		
							Section Total / Tender	**€75.00**	€75.00	
29	Open forms of Tenders	PQS								
	Assumes PQS Daily Salary	QS	Prepare Receipt Form		0.25	day	€790.00	€197.50		
							Section Total / Tender	**€197.50**	€197.50	
30	Record amounts on forms of Tenders	PQS								
	Assumes PQS Daily Salary	QS	Receipt Form finalised / issued		0.25	day	€790.00	€197.50		
							Section Total / Tender	**€197.50**	€197.50	
31	Identify lowest (winning) bid	PQS								
	Assumes PQS Daily Salary	QS	Receipt Form finalised / issued		0.25	day	€790.00	€197.50		
							Section Total / Tender	**€197.50**	€197.50	
32	Carry out computational check	PQS								
	Assumes Admin Daily Salary	QS Admin	Check lowest with calculator		0.00	days	€300.00	€-		
	Assumes PQS Daily Salary	QS	Cross Check		0.25	day	€790.00	€197.50		
							Section Total / Tender	**€197.50**	€197.50	
33	Review Tender for clarifications	PQS								
	Assumes Admin Daily Salary	QS Admin	Response drafted / checked		2.00	days	€300.00	€600.00		
	Assumes PQS Daily Salary	QS	Response finalised / issued		0.50	day	€790.00	€395.00		
							Section Total / Tender	**€995.00**	€995.00	
34	Any errors identified ?	PQS								
	Assumes Admin Daily Salary	QS Admin			2.00	days	€300.00	€600.00		
	Assumes PQS Daily Salary	QS			2.00	day	€790.00	€1,580.00		
							Section Total / Tender	**€2,180.00**	€2,180.00	
35	Receive queries on (winning) proposal	Contractor	manager		0.25	day	€750.00	€187.50		
			estimator		0.50	day	€500.00	€250.00		
36	Review queries and evaluate	Contractor	manager		0.50	day	€750.00	€375.00		
			estimator		0.50	day	€500.00	€250.00		
37	Issue updated proposal to PQS	Contractor	manager		0.25	day	€750.00	€187.50		
			estimator		0.50	day	€500.00	€250.00		
							Section Total / Tender	€1,500.00		€1,500.00
	Total / Tender							**€5,237.50**	**€8,262.50**	**€200.00**
							Assumed Average No. of Tenderers / per year	1,000	5,000	150,000
							Total Cost of Future Process to the Industry / per year	**€5,237,500**	**€41,312,500**	**€30,000,000**
							Total Cost of Current Process to the Industry / per year	**€6,732,500**	**€47,875,000**	**€33,750,000**
							Saving Total (€)	€1,495,000	€6,562,500	€3,750,000
							Total (%)	22.21%	13.71%	11.11%

Appendix C.4 Participant feedback

C.4.(a) CQS Feedback on pilot project:

C.4.(b) PQS Feedback on pilot project:

C.4.(a) CQS Feedback on pilot project:

Views of John Paul Construction.

Procedure outline:

An e-mail notification of the availability of the tender was received from the PQS, together with a link to the FTP site hosting the tender documents and a password for accessing the site.

The documents consisted of drawings, Bill of Quantities, and Form of Tender.

The documents were successfully down-loaded from the site, checked and stored in the tendering system for pricing.

The Bill of Quantities was priced and the Form of Tender was completed, and the priced documents were successfully uploaded to the PQS' FTP site.

As part of the process, a copy of the tender documents was placed on a JPC FTP site. As agreed, PJH, acted as a subcontractor for the purposes of the trial, accessed this site using a password provided and downloaded one trade package, which they priced and uploaded successfully. This 'subcontractor quotation' was available for incorporation in the JPC tender above.

Some of the documentation and security controls which would be needed in a live electronic tendering situation were not in place but these are available as part of commercial software systems and would have minimal impact on the evaluation of the pilot process.

While the scale of the pilot was not comparable to a full size tender, it was possible to draw valid conclusions for most items where a saving was expected.

Evaluation:

The contractor-related items on the Costed Process Summary are as follows:

Items 4-11: covering from receipt of documents and preliminary work.
Items 12-15A: covering the subcontractor input.
Items 18-24: covering subcontractor quotation process (main contractor input).
Items 25-27: covering preparation and submission of tender.
Items 35-37: covering the post-tender period.

Savings in each section are identified below.

Items 4-11:

Savings had been anticipated on items 4, 5, and 10 only.

Item 4 – 'receive documents / receive invitation to tender': The documents were circulated without use of a courier and therefore this saving was achieved.

Item 5 – ‘download and check tender documents’: The current system involves physically opening up, sorting and filing each document, and recording details. Much of this work is eliminated in the electronic process. The saving was demonstrated in the pilot process, and, if anything, a greater and increasing proportion of the cost of the current process would be saved the larger the project.

Item 10 – ‘prepare trade package’: This saving was tested only in a basic fashion. However it was clear that selection of documents and sorting them into trade packages was much quicker than physically selecting, photo-copying, assembling, and despatching hard copy documents. The comment in Item 5, regarding savings increasing with scale, would apply to this item.

Items 12-15A:

This refers to the sub-contractors input to the process. This was tested only in a rudimentary way. This process mirrors the main contractor’s process and therefore a similar level of saving would be expected. The saving assumed in this section – taken in item 15 – was in any case proportionately very small.

Items 18-24:

Potential savings had been identified for items 19, 23 and 24 only.

Item 19 – ‘receive back subcontractors quotation’: Again the savings associated with electronic rather than physical handling of documents was demonstrated. The saving assumed in this case was relatively small and was achieved.

Item 23 - : ‘return to subcontractor for clarification’: This item was not tested due to time constraints. However the process is similar to Item 10 above and savings of a similar type could be anticipated. Note that the projected saving on this item was taken at 15% of the current process, as against 50% in Item 10. This was because the process for Item 23 is more intermittent and piecemeal than Item 10 but the assessment of saving appears to be conservative.

Item 24 – ‘input to estimating system and select quote’. The saving assumed was 20% on the existing process and arises for the use of a combination of electronic and manual input methods as against manual methods alone. Some saving was evident but the sample was too small to quantify it.

Items 25-27:

Potential savings had been identified for item 27 only.

Item 27 – ‘submit tender proposal’: Area of saving was similar to item 4 above and the saving was achieved.

Items 35-37:

No savings had been identified in this section.

Items not identified for potential savings in the costed process summary:

The selection of items for potential savings in the process model was relatively conservative. For example, no savings were identified Items 35-37 above and these items were therefore not tested, particularly in view of the time constraints. However, the processes involved in these items are similar to other processes for which savings were identified. Similar comments would apply to other items, for example, items 6, 9, and 11.

Conclusions:

In most cases, the potential savings which had been identified in the process model were verified by the pilot process.

In some instances the level of saving could not be quantified accurately.

There were indications that the savings for some procedures could be larger than indicated, and would increase at an accelerating rate with increasing size of project.

The selection of items for potential savings was relatively conservative as indicated above.

In some cases, where administrative savings were identified, there would be a resultant saving in estimator's and manager's time due to the efficiencies introduced. These can not easily be quantified and therefore have not been included in the model.

Similarly, there would be resultant time savings which have not been included.

There are other types of electronic tendering which were not considered in the pilot which could realise further savings.

The foregoing would suggest that the pilot project successfully demonstrated that the potential savings, arising from electronic tendering of the type outlined, could be realised in the industry.

C.4.(b) PQS Feedback on pilot project:

Views of Bruce Shaw.

LOC (Author): Could we begin with you giving a brief description of the eTender process as the Pqs firm experienced it?

Steven Cooke (SC): I suppose from our point of view the etendering process was to try and eliminate as much, essentially I suppose, paper production and binding as possible so we were aiming to change the existing transfer of that information from paper to etendering. And essentially what we did was we “Pdf”ed any documents we would normally issue to a contractor for tender purposes and we made them available on an FTP site for their transfer. And this saved a significant amount of time and money.

LOC: You said you PDF all the documents and then placed them on the FTP site. Why was this?

SC: Well we did that in this because not all contractors or subcontractors have access to the program buildsoft that we use. This even applies to different PQS firms who may use different software. So by using Pdf the documents were made as generic as possible for their initial transfer. And thereafter should any of the companies come back and ask us for it in EOX format that is something which we are willing to do or we do export the document into excel for their use. CITE as a tool we use over the last couple of years has not really worked as an exporting factor so we don’t currently use that in the industry. That is purely because we don’t believe the software that is out there is capable of talking to each other.

LOC: Could you give me a run through of how the FTP site was set up by Bruce Shaw and also were there any costs associated with this?

SC: The main cost of setting up our FTP site was the time from our in house IT guy. I will actually get him to answer that if you don’t mind.

Keith (IT): First the hardware we used was all our own servers and broadband connections that were required for the pilot but if you were to start from fresh and put an FTP site live on the internet for lets say 100 customers use you would have to buy the internet connections, web space or a web server yourself and those couple of things would run into a few hundred euro.

SC: It was never the intention of the pilot to do that. The pilot was undertaken to see if it could be done. So as a company we decided that we could put in Keith's time, pro bono, and the use of our web space which was free as well but trying to quantify that going forward on large scale projects would be very difficult but the pilot in terms of time took how long? Taking into regard the queries you got and any other pieces that went with it.

Keith: It probably took a day or close to that but if you think that that was for one or two customers and a very simple structure and that a system could involve many customers, detailed folder structures, files and passwords then you would probably require someone possibly full time but definitely on call as they would be needed. The pilot did take me a bit longer with the one or two queries than I had hoped.

SC: It did and it was not as simple as we had all hoped but as this was the first occasion that we had undertaken something like this and we would hope that the learning curve on something like this would be exponential. And to get back to the question for the pilot side of things it didn't cost an awful lot of money to do but thats qualified by the small size of the pilot and the small number of people getting access to the site. Therefore it was not big money but it could be if it was implemented wide scale.

LOC: Ok. With that in mind there were savings that were possible to established for the PQS during the eTender project. Could you give a brief outline of the savings acquired over the course of the PQS tasks?

SC: What we tried to do with the revised cost model was maintain the same sort of analysis as before meaning we reused the steps from 1 to 37 that it takes to get the information to and from. Specifically myself and Eoin, the other PQS, looked at where time might be saved or administration costs might be saved and we looked at it and if you take for example the first process id reference, number one printing and binding multiple copies of BOQ, here we agreed that there would now be no documentation printed off or therefore bound so although in the current process we would have had 3,500 pages copied assuming it was an average 350 page tender, there is a straight saving on every tender of that money and that was €70 each time we go out ot tender and then the administration of binding that was a further €300 so in terms of how we assessed the savings using that as an example there was a 100% reduction in those costs and we worked our way methodically through the 1 to 37 odd steps and just purely evaluated it again using our kind of experience, you know 2 people with a good degree of experience, to establish what the savings in costs and time maybe and in certain instances it is certainly subjective but with me and Eoin bouncing ideas off each other it certainly made it more accurate.

LOC: Just with regard to the savings established what is your take on them? Would you say they are impressive, something to take note of or are they ok and something which you may look further into?

SC: I think that the final analysis shows from the PQS' side of things that there’s a saving of 22% or approx €1,500 per tender and we assumed an average of about 1000 tenders per year collectively as a group. That in the first instance is a substantial saving on anyone’s cost overheads. It is a 20% reduction or in excess of 20% is a good saving. Im sure you know with experience of doing these things more than once that saving could be increased. As you know we only did the one pilot and if additional examples were undertaken you might be able to hone the actual levels of savings that were achieved but I think in the first instance a 20% saving on anyone’s business is a good saving

LOC: Slightly skipping back to some of your comments from the previous questions, how would you assess the accuracy of the savings identified by the group?

SC: I suppose like I just said there is an element of subjectiveness in terms of how we did it but I think that we were accurate. It was a session that we had over the course of a day where we agreed whether or not there was a 100%, 0% or somewhere in between saving on one thing or another. It was a long and interesting debate that we had and in

terms of accuracy I would be nervous enough to put a percentage on it as it was only one pilot but I would say that the figures could be honed.

LOC: So you suggest it is not 100% accurate but would you see the savings increasing or decreasing from the figures given.

SC: Its very difficult to say but like I said earlier on one pilot achieving over 20% savings is a good thing. The accuracy of the figures and whether or not it would increase to 25% or even decrease would really need another pilot to clarify the figures.

LOC: So would you be reasonably happy with where it is at?

SC: I don't think we would be too far off the mark. And your pushing me for an answer so I would say that we are within plus or minus 5%. In terms of the costs for the current process there was a major thought process put into establishing them and similar effort was put into the reworking of the figures for the eTender process. And I think that the principles were sound and I would say that we are within 5% of probably where we should be but I also think that there would be further savings to come through the use of this kind of process.

LOC: So having completed the pilot would you be encouraged to undertake an eTender process in future?

SC: Absolutely. It is certainly the way to go even with the accuracy of plus or minus 5% on a 22% saving from a business standpoint you cannot ignore that. And there was alot of work put into the project over the 18 or so months and I think it does show that money can be saved. Particularly in the current climate that is very important and I think that this thought process and use of the technology should be encouraged and shown to as many of our colleagues within the industry as possible.

LOC: Have you used or seen any examples or uses eTender software or similar processes since the pilot?

SC: Well is suppose you could say that we do a large amount of electronic communication and that would include tender documentation. Whether or not you could call it eTendering would be debateable.

LOC: Would that be by email or on CD or any other method?

SC: It would be both the methods you mentioned for example on a current large scale project that we are working on we Pdf documents put them on a disk and contractors can pick them up is they wish and we also email them Pdf and if contractors want the EOX file or other forms we may have we also will supply them. That use of the technology saves us time and it saves the contractors time and by default saves us all money.

LOC: Would you have any overriding concerns with the use of any kind of eTendering system? Or even any specific concerns that you would have with the pilot?

SC: I do think that there are certain barriers to the whole eTendering thing. I think we

documented it and first I think the construction industry by its nature is quite conservative and can be quite slow to change I think that the numbers shown in terms of savings should make people stand up and take notice but like I said it is a conservative industry by its very nature and that is one particular barrier. I think that the lack of IT capabilities of some PQS firms main contractors and subcontractors would be a cause for concern although I have to say that over the course of the last few years people are beginning to use the whole IT side of things a lot more and that it is not as big a barrier as it once was. And also another barrier we noted was that estimating systems used by the parties are not good at communicating with each other. And they would be the three main barriers I would see to the use of this technology. But through collective discussion and projects like CITAX there will be a greater level of awareness and that eTendering will certainly be the way of the future.

Appendix D

Internationally Refereed Papers

D.1 CIB W092, 2007, Hunter Valley, Australia

D.2 CIB W102, 2007, Stuttgart, Germany

D.3 CIB W078, 2008, Santiago, Chile