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A Contractual Framework for Two-Stage Early-Contractor Involvement (2S-ECI) in New Zealand Commercial Construction Projects

A thesis submitted in fulfilment of the requirements for the degree of

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Abstract

Two-stage early contractor involvement (2S-ECI) is a two-stage procurement process for firstly employing a contractor during the design stage, and then entering into a contract for construction. 2S-ECI contractual practices remain generally unknown in New Zealand despite the well-documented advantages of involving contractors in the design-stage planning. Clients, with the help of their consultants or lawyers, must draft their own, often bespoke contract to engage the contractor's services during the design stage because there are no standard forms of pre-construction services agreements (PCSAs) in New Zealand for employing contractors during the design stage. Some of these contracts, especially if done without professional advice, are drafted inadequately.

This study attempts to remove these ambiguities and explore the effect 2S-ECI has on contractual risks; the optimal contractual ingredients to consider at the pre-construction stage such as timing, obligations and liabilities; the effect of 2S-ECI on market pricing; and the overall benefits, challenges, and opportunities to improve the effective use and uptake of 2S-ECI in New Zealand.

A mixed-method research approach was adopted which comprised case law analysis, contract document analysis, and comparing these legal doctrines against industry perceptions which was obtained through conducting interviews and surveys. Three bespoke contract agreements used on 2S-ECI in New Zealand commercial construction projects were compared with two standard form PCSAs published in the UK. Perceptions of 2S-ECI use in New Zealand were explored through interviews of 21 senior construction practitioners. Interview findings were validated through surveying the interview sample

A contractual framework was developed to provide a clearer contractual process, identify contract ingredients for the pre-construction stage and establishing the effect of early involvement on the contractor's obligations during the construction stage. The framework helps clients and project managers to develop procurement strategies using 2S-ECI, including as a starting point, the type of project suited to 2S-ECI. It also helps decision makers like architects, engineers, and quantity surveyors, to make more informed decisions on who should pay for instructed drawing details that come after entering into a construction contract such as the New Zealand Standard NZS3910:2013 *Conditions of Contract for Building and Civil Engineering Construction*. The framework considers; (i) when to treat claims for drawing details as variations; (ii) the legal implications of a contractor's involvement in design development; and (iii) the legal implications on construction managers if there are claims from direct trade contractors against the client under a construction management procurement.

Findings from the survey analysis shows the majority of interviewees see value in early collaboration between designers and contractors, but qualify this in that the actual value depends on the extent of the contractor's contribution and that the tangible benefits are difficult to measure. Many felt that contractors had a moral duty to reduce their claims for design development during the construction. However, none was aware of the effect of early involvement on the contractor's contractual obligations during the construction stage. 2S-ECI may have the potential to reduce the cyclical boom bust nature of construction pricing and provide a more equitable risk distribution between the contracting parties. 2S-ECI is best suited for projects involving work to existing building operations where the cost of disruption outweighs any premium incurred with the contractor's early involvement in logistical planning; where the selection of preferred contractors through open-book negotiation is desirable; where securing resources in heated markets is otherwise difficult through competitive tender; and where designers want the contractor's input for more complex design solutions.

Challenges to the effective use and uptake of 2S-ECI in New Zealand were identified as part of the survey. The challenges include lack of clear 2S-ECI definition, unclear expectations and difficulty measuring the benefits, incomplete design documentation, and amendments made to standard contract terms transferring greater risks to contractors – without fully considering which party may be best able to manage the risk. The bespoke pre-construction contract documentation used often lacked scope of obligations and liabilities. Opportunities for improving the use and uptake of 2S-ECI in New Zealand include educating industry about 2S-ECI, developing a standard form of pre-construction services agreement (PCSA) for New Zealand, contractors developing specialist expertise in design coordination, buildability analysis and value management, and agreeing fixed-price construction contracts based on fully complete quality drawings. These findings also contribute to developing procurement policies that support transparency and appropriate risk equity and transfer toward the party who is best able to manage the risk within the New Zealand construction industry.

A pre-construction services agreement (PCSA) was drafted with ingredients based on the findings (appendix 4). The framework also includes a flowchart that guides claims entitlement and a table comparing head or main contractor and consultant construction manager obligations was developed. This provide a practical guide for contract administrators and includes a summary of interpretation of terms to inform contract drafters that can help reducing ambiguity for all construction contracts. This has the potential to help avoid unwarranted disputes.

It was also recommended that skills in construction law and buildability analysis within the construction industry be enhanced and for tertiary education institutions to play a greater role. These include skills in buildability-related claims-entitlement, the effect of early contractor involvement, the application of design buildability analysis, and design coordination and management within a building information model (BIM) system environment.

Background and acknowledgements

This research originates from questions arising from ethnographic industry observation and post-graduate study in construction law. Through studying a Bachelor of Construction (Quantity Surveying) at Massey University, I found a disconnect between how I, as a recent industry practitioner at the time, and many others, interpreted contractor entitlement to buildability related claims, versus the stricter legal position at common law. This led to my Master's research report exploring contractor buildability obligations, forming part of my Master's degree in Construction (Construction Law) of which I graduated in 2016 with distinction. Two dominant questions arose from observations when working as a Contracts Manager (estimator/ contract administrator/ project manager) for a large NZ construction company between 2003 - 2009: (i) project manager consultancies began securing projects before we could access them through the tender market. We questioned the true added value to clients of using these consultant project managers over us head contractors, and the effect on client risk when employing the trade packages directly with a consultant to manage them, and (ii) the two last major construction projects I worked on were procured through a two-stage process. We first bid a fixed price for P&G works and margins for subcontractors, and sometimes our rates for builder's work. Further stages were negotiated through open-book pricing, with our project managers working alongside the clients' design team to plan stage. These seemed like the best performing projects, yet the procurement agreements were often informal, based on verbal agreement or invitation letters.

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Acronyms

2S-ECI	Two-stage early-contractor involvement
CIOB	Chartered Institute of Building
CLT	Cross-Laminated Timber
CM	Construction management
CM@R	Construction Management at Risk (USA equivalent of the UK definition for MC)
DB	Design and build
DBH	Department of Building and Housing (now the Ministry of Building Innovation and Employment)
ECI	Early-contractor involvement
ITA	Industry transformation agenda
LBP	Licensed Building Practitioner scheme
LD	Liquidated damages
MBIE	Ministry of Building Innovation and Employment)
MC	Management contracting
MMC	Modern-Methods of Construction
NZIA	New Zealand Institute of Architects
NZIOB	New Zealand Institute of Building
NZIQS	New Zealand Institute of Quantity Surveying
NZCIC	New Zealand Construction Industry Council
NEDO	National Economic Development Office
Novated DB	Form of DB procurement where the client employs designers to develop the design. Employment of the designers is then novated to the contractor for the construction stage.
OSM	Off-site Manufacturing
P&G	Preliminary and General
PCSA	Pre-construction services agreement
PM	Project manager employed by the client
PPP	Public Private Partnership
PQS	Professional quantity surveyor (or quantity surveyor employed by the client as opposed to a contractor's quantity surveyor)
RAP	Risk adjusted price. The price of construction work developed during the pre-construction stage
RICS	Royal Institute of Chartered Surveyors
RFI	Request for Information
RFP	Request for Proposal
Traditional DB	Form of DB procurement where the contractor develops the design from the client brief
SOQ	Schedule of quantities, also known as bill of quantities
VM	Value management

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Chapter 1: Introduction

1.1 RATIONALE AND IMPORTANCE BEHIND THE RESEARCH

A key claimed advantage of 2S-ECI is that it reduces design risk by harnessing contractor input on buildability and as a result reducing the chances of claims and disputes on design buildability during the project implementation. Typically, construction professionals such as architects, engineers, and quantity surveyors make decisions on contractors' claims entitlement throughout a construction project. However, typically they are not legally trained to interpret contracts. Under common law, contractors legally warrant that they can build what the client's design team has designed, and do so for the fixed price they have offered. Despite this contractual commitment, contractors sometimes find they cannot build what has been designed, and are provided further detailed drawings by the client's design team. If the contractor has been involved in the design development, this becomes a more complex legal issue, which the architect, engineer, or quantity surveyor is expected to know how to resolve and make decisions on the contractor's entitlement to additional time and cost. Earlier studies and cases have addressed contractor's buildability obligations relating to ground conditions and foundations, but not on design development.

Standard textbook definitions of procurement systems complicate the definition of 2S-ECI. ECI as a concept includes any procurement system that involves contractors during design, including design and build (DB) and management contracting (MC). A variation of that includes the construction manager acting as a professional advising the client under the construction management (CM) procurement system where clients employ trade contractors directly and the construction manager managing them. 2S-ECI describes a procurement system in its own right. However, overlapping this with these other standard textbook procurement systems, 2S-ECI it could be considered a two-stage tender process for entering contracts under the standard textbook procurement systems. This ambiguity has sometimes led to earlier inconsistent research findings.

The use of early contractor involvement (ECI) appears to be growing in New Zealand (MinterEllisonRuddWatts, 2016; Cain, 2016). ECI was used by the Department of Corrections (Naylor Love, 2016) and Otago Polytechnic (Otago Daily Times, 2016) the Lincoln University/AgResearch Joint Facility (The Treasury, 2017) and the Christchurch Convention Centre (GETS.GOV.NZ, 2014). A regional manager for a national construction company estimates that approximately 30% of turnover in Otago is through two-stage ECI (Personal communication, Tutty, 5 August 2016).

The introduction of 2S-ECI follows a move toward management-based and contractor-led procurement pathways in order to improve project performance (Masterman, 2002). Various reports in the United Kingdom (Simon Committee Report, 1944; Latham Report 1994; Egan Report, 1998; Egan Report, 2002) steered the industry toward more relational procurement strategies such as partnering in order to improve productivity and reduce disputes. Similarly, in an attempt to improve productivity in the New Zealand construction sector, the Ministry of Business Innovation and Employment (MBIE, 2016) identified procurement as a key focus and in 2015 released; *Planning Construction Procurement: A Guide to developing your procurement strategy*. The guide includes alternative management-based procurement pathways such as management contracting (MC) and construction management (CM), and contractor led, design and build (DB). Means of improving procurement practices include; better advised clients; considering whole-life cost; more standardization; and collaboration and early-involvement in the construction process between clients, designers and contractors (MBIE, 2013).

However, 2S-ECI processes and user perceptions about its effectiveness remain largely unknown. This makes measuring the benefits of ECI difficult (Cheng and Li, 2004). Multiple studies support the need for research in this area. Turner and Riding (2015, p180) highlighted the lack of literature and clear definition of ECI and identify a badly structured processes that impacts on trust and collaboration as a common hindrance to ECI use. Mosey (2011, p2) relates problems with defining early-contractor partnering models and requirements of project team members with the slowed uptake of partnering within the industry. Song, Mohamed and AbouRizk (2009, p14) also argue that much of the resistance to ECI uptake is due to a lack of understanding of the concept and its benefits. Farooqui and Ahmed (2008) highlighted the bespoke nature of ECI as a challenge and recommend developing client attitudes in order to improve constructability through the input of construction knowledge. Pheng, Gao and Lin (2015, p831) concluded that ECI can improve productivity, but that this requires greater awareness from building professionals.

The benefits of 2S-ECI are generally associated with harnessing contractor's buildability input to de-risk the design and generally improve project planning and reduce claims and disputes (Mosey, 2011). However, there is scant research into the contractual provisions for 2S-ECI such as parties' obligations and the contractual effect of early involvement on the contractor's claim entitlement during the construction stage. There are no standard pre-construction services agreements (PCSA) support 2S-ECI in New Zealand leaving parties to draft their own bespoke agreements. Standard form PCSAs have only emerged from the United Kingdom since 2011 to support JCT and NEC contracts (see Chapters 5 and 6). Comparing these provisions with the bespoke practices and user perceptions could provide a value framework from which to develop a standard form PCSA for use in New Zealand to support NZS3910:2013 (SNZ, 2013).

Even 2S-ECI lacks clear definition in previous research and may be confused with ECI as a concept, which includes any procurement pathway that involves contractors before or during design. These pathways have been categorised into 'models' such as design and build, management contracting and construction management. Such attempts at categorising procurement into succinct 'models' has been criticised (Rowlinson and McDermott, 1999). 2S-ECI may be considered a two-stage tendering process to support these different models, or these models could be considered variations of the 2S-ECI pathway.

The New Zealand construction industry generates over NZ\$30 billion per annum and expected to grow to \$41b in 2023 (MBIE, 2018). Construction contributed over 6.1 percent of NZ's gross domestic product (GDP) in 2017 and the industry is expected to employ 571,300 employees by 2022 (MBIE, 2017). Being a significant industry in New Zealand, even a 1% saving in process efficiency could equate to a saving of up to NZ\$300 million per annum.

However, growth across the sector has seen contractors incurring greater risk. Contractors are entering fixed price contracts based on incomplete designs and amended contract terms (that were standard form) that transfer greater risk onto the contractor. Previous research has found incomplete drawings a dominant source of variations during construction and increased contractor tender risk amongst Australian contractors (Tower and Bacarini, 2008). The risk transfer onto both contractors and consultants in New Zealand has been described as reaching 'inequitable' levels (NZIQS, 2019) and there are calls for better risk equity and greater focus on risk training across the construction industry (Fleming, 2019). This follows major players exiting the sector, including Fletcher Construction, Mainzeal and Ebert Construction (Harris, 2018).

Construction professionals (quantity surveyors, project managers (PMs), architects and engineers) generally decide claim entitlement. However, until recently, tertiary-level construction qualifications have contained little or no content on contract interpretation, effectively reserving such content to university law programmes across New Zealand. Lay

readers may interpret written clauses (express terms) differently from those who have studied the influence of implied terms that exist through case law precedent or legislation. For example, general clause phrases, such as ‘anything reasonably unforeseeable by an experienced contractor’, may appear to provide grounds for extending time due to delay caused by the client. However, courts have found such clauses to be ineffective on that basis that changing from the common law position (in this case that an act of prevention would constitute a breach of contract not a variation to it) requires specific provisions to do so (Thomas and Wright, 2011).

Deciding whether drawings instructed during construction vary the contractor’s fixed-price contract is more complicated than when clients simply instruct scope changes. This is because the long-held common law position is that by offering a fixed-price contract based on drawings supplied by the client, the contractor legally warrants that they can build what has been designed and do so for the fixed price offered. Relevant principles of contract law include, including absolute liability, fitness for purpose and the inclusive-price principle. Yet when contractors request details during construction, they are effectively doing so on the very basis that they could not otherwise build what has been designed. Considerations include; whether the contract would be frustrated on the basis that the design problem was reasonably unforeseeable and performance would be impossible without doing the work; whether the detail corrects a design documentation error, and whether early warning by the contractor may have mitigated the costs. A further complication is designers found negligent for their drawings lacking ‘buildability’, in case law and under the New Zealand Licensed Building Practitioner (LBP) scheme.

The introduction of early contractor involvement (ECI) further complicates design obligations, when contractors or consultant managers provide early input into design buildability. The entity responsible for managing construction may be employed using a head construction contract or a contract for services. A contract for services is used where the client employs trade contractors directly. Alternatively, 2S-ECI uses a hybrid of first-stage services contract and second-stage head contract (2S-ECI) (Finnie et al., 2018; Whitehead, 2009).

In the absence of a clear contractual framework for 2S-ECI in New Zealand, clients and consultants are left to research procurement pathways and develop their own bespoke practices, potentially creating inconsistency and adding to transaction costs. This further risks sub-optimal process that in-turn negatively influence the perception of 2S-ECI and reduces overall uptake.

Figure 1 presents a process overview of 2S-ECI based on the author’s ethnographic experience working for a construction company in New Zealand and from initial scoping discussions with industry participants forming a basis of this study.

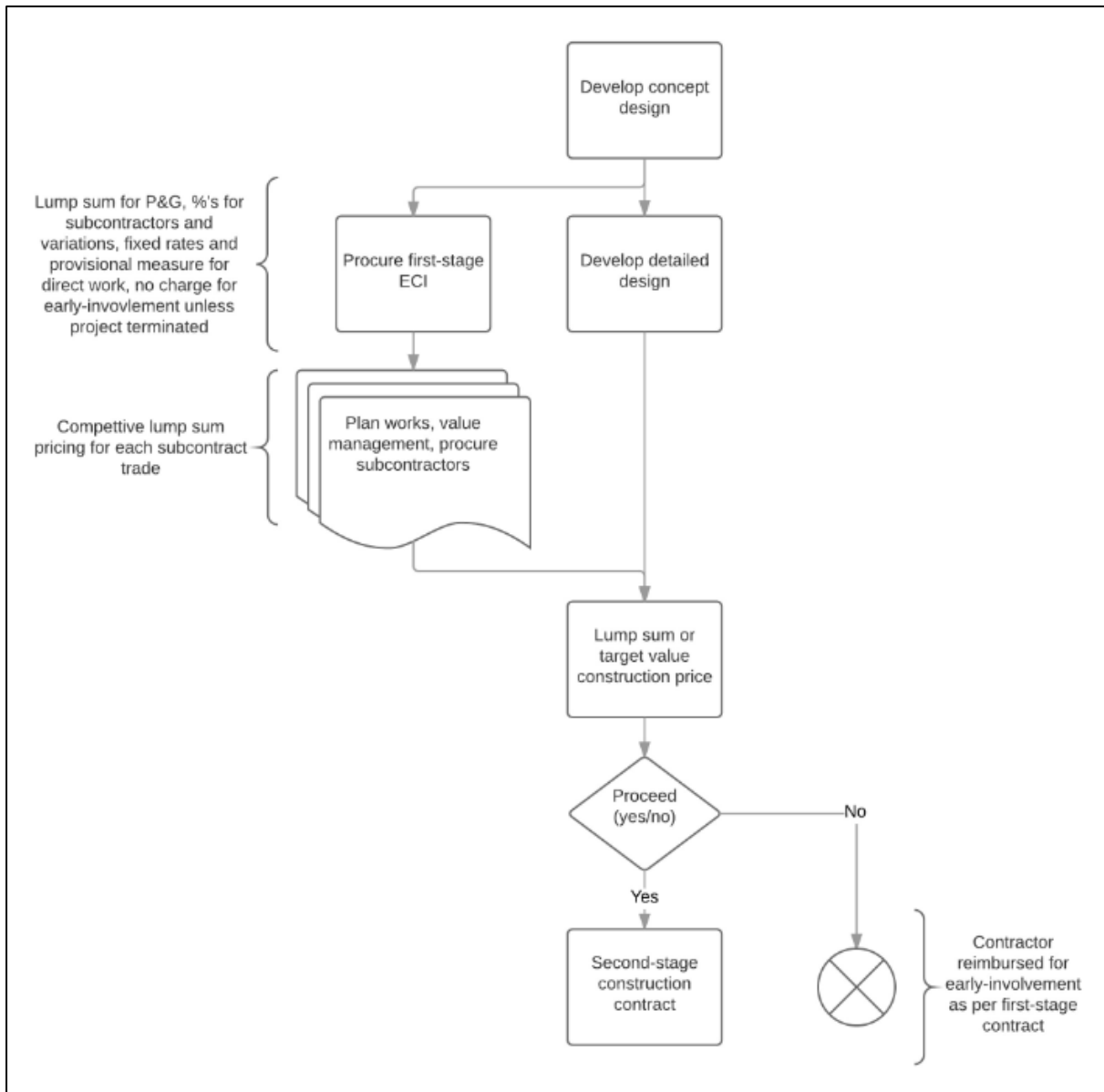


Figure 1: Flowchart of Two-stage ECI Procurement Process

1.2 AIM

The aim of the study is to develop a framework for two-stage early contractor involvement (2S ECI) in New Zealand commercial construction projects. The contractual framework will improve knowledge about procuring construction projects to improve the fulfilment of set targets, particularly time and cost, within minimal risk.

1.3 RESEARCH QUESTIONS

The research questions are:

1. What types of projects are best suited to 2S-ECI?

2. What effect does 2S-ECI have on contractual risks?
3. What are the optimal contractual ingredients to consider at the pre-construction stage, such as scope of services, timing, obligations and liabilities, i.e., for a pre-construction services agreement (PCSA)?
4. What are the overall benefits, challenges and opportunities to improve 2S-ECI, including the effect on market pricing?

The contractual framework will establish the contractual obligations of parties. Optimal contractual provisions are explored in terms of; timing of contractor involvement, scope of pre-construction services, pricing, liabilities, and the optimal project type suitable for 2S-EC. From this, 2S-ECI can be compared with the traditional procurement pathway in terms of the effect on market pricing, risk transfer, and overall benefits, challenges and opportunities to improve 2S-ECI.

1.4 CONTEXT

The study focuses on contractual obligations of construction contracts and the effect of 2S-ECI on entitlement for design buildability related claims. This evaluation includes interpretation through implied principles of contract law. This builds on the author's thesis on contractor buildability obligations forming part of a Master's degree in Construction (Construction Law) completed at Massey University in 2016. The Master's thesis explored contractor obligations pertaining to buildability and identified areas of contract terms that could be prone to legal interpretation, potentially varying claim decisions between construction professionals and lawyers.

The type of project is more relevant to 2S-ECI than the type of client. Clients may be procuring a one-time development, or have return business. They may be public or private. According to Turner and Riding (2015), ECI processes may be adapted to suite the type of client and their project, and on an ongoing or one-off basis. ECI processes share common principles with alliance contracts in terms of trust, partnership and often target value pricing and shared incentives. Ma and Xin (2011, p83) concluded that ECI is best suited to projects with high risk and uncertainty (where tender prices would otherwise be high to reflect the uncertainty), but smaller than a typical alliance project. The key distinctions between ECI and alliances is that ECI does not feature ongoing relationships or pain/gain share pricing. Traditional procurement remains more suitable for straightforward projects.

This study focuses 2S-ECI used on commercial construction projects of all size, whether public or private. Commercial projects include retail, health, large residential and industrial buildings, but does not include infrastructure works such as roading.

ECI describes any form of procurement that involves contractors during the design stage. ECI is generally associated with projects of high risk and uncertainty, rather than the type of client. Past research demonstrates that ECI is typically used for projects that benefit from contractor input around planning, risk mitigation, and design buildability, on large complex projects (Turner and Riding, 2015; Whitehead, 2009) and high-value long-term work (Turner and Riding, 2015). Although construction management (CM) procurement is generally aligned to clients who are experienced in construction on the basis that they can employ the trade packages directly and a consultant construction manager (CCM) to administer them without

the single-point accountability of a head contractor, as discussed in Chapter 5. On the other hand, 2S-ECI does involve a head construction contract. Client appetite for risk and relationships between parties influence the use of 2S-ECI. The distinguishing feature between 2S-ECI and design and build concerns who owns and controls the design, the client or contractor (rather than the type of client). Under design and build, the design and build contractor controls design decisions as far as they comply with the client's brief. In the pre-construction stage of 2S-ECI, the contractor only provides design input for the client's or their representative's approval. Then the construction contract may be construction—only or the design may be novated to the contractor (novated design and build) to become a design and build construction contract. For example, (regardless of client type), large and complex bespoke multi-million-dollar residential housing, designed by architects and engineers, involving complex buildability issues, may benefit from a two-stage procurement process to involve the contractor during the design-stage, whereas simple housing designs may not.

Standardisation provides advantages of tried and tested familiarity to both the less experienced, and the more experienced return clients. For example, all client types can use NZS3910:2013.

1.5 LIMITATIONS

The following are excluded from the scope of the study; public private partnerships (PPPs), small residential housing, and infrastructure works. Large government infrastructure projects sometimes use PPPs. PPPs involve a complex project governance group including government, banks, and contractors. Therefore, PPPs are not relative to mainstream commercial construction project in New Zealand. Franchise house builders use design and building contracts for the majority of residential housing in New Zealand. Again, this is not a feature of 2S-ECI. However, findings from this research may be generally applicable (external validity) to other types of construction such as architectural houses and large infrastructure works. The author is aware of 2S-ECI processes used in small residential works, such as alterations and extensions. However, this does not form part of the scope.

The interviews conducted were limited to clients, PMs, designers, PQSs, and head contractors. This is because the 2S-ECI process is a contractual agreement between the client and the head contractor. Typically, the head contractor then procures the subcontractors on an open-book basis. Further studies could explore perceptions of 2S-ECI among specialist subcontractors. Attempts were made to interview industry participants who worked on Christchurch projects procured through 2S-ECI that were reported in the media as disasters, after suffering major budget blow-outs, such as the Metro Sports Facility. However, government level investigations prevented those involved from commenting. Further research could more specifically explore 2S-ECI use during the earthquake rebuild. The absence of specific focus on the Christchurch rebuild does not distort the findings from the New Zealand construction industry. The 21 interviewees from across New Zealand had extensive experience, and many belonged to national firms and spoke regularly with other divisions adding to the robustness of the research. In any case, the Christchurch rebuild represented exceptional circumstances, and not the norm of construction practice.

1.6 STRUCTURE OF THE THESIS

This first chapter presents the overall research context, the research questions, and rationale and importance of this research.

In the second chapter, presents the applied research design and methods.

In chapter 3, presents a review of literature pertaining to early contractor involvement.

In chapter 4, presents an analysis of existing standard form contractual documentation and procedures the support forms of early contractor involvement.

In chapter 5, presents an evaluation of contractual design obligations for construction including the effect of 2S-ECI.

In Chapter 6, presents the use of 2S-ECI in New Zealand commercial construction in terms of the contractual documentation used and perceptions from users.

In Chapter 7, presents the analysis of survey data collected from the interview sample.

Chapter 8 discusses the 2S-ECI framework, providing guidance for users, key ingredients for pre-construction services agreements (PCSAs), and overall advantages, and opportunities for improvement and further research.

1.7 RESEARCH PUBLICATIONS

Following is a summary of the research publications from thesis:

Journal articles:

- Finnie D, Ameer Ali N and Park K (2021) Early contractor involvement: a review of pre-construction service agreements, *Procurement and Law*, 174(1):1-8 <https://doi.org/10.1680/jmapl.20.00038>

This article evaluates optimal contract provisions for 2S-ECI through comparing two standard form ECI agreements published in the United Kingdom with two bespoke agreements used in NZ and collating with industry perceptions through 21 interviews across NZ.

- Finnie D, Ameer Ali N and Park K (2019) Design development post contract signing: client's or contractor's cost New Zealand?. *Proceedings of the Institution of Civil Engineers – Management, Procurement and Law*. <https://doi.org/10.1680/jmapl.18.00044>

This article evaluates contractor entitlement to claim costs for detailed drawings instructed after entering a fixed price construction contract applying principles of contract law and considering the effect of 2S-ECI.

- Finnie, D, Ameer Ali N and Park K. (2018) Enhancing offsite manufacturing and prefabrication through early contractor involvement (ECI) in New Zealand. *Management Procurement and Law*, 171(4):1-35 <https://doi.org/10.1680/jmapl.17.00029>

This article evaluates how 2S-ECI contractual provisions help overcome key barriers to off-site manufacturers.

Conference proceedings:

- Finnie D, Ameer Ali N, and Park K (2019, August) Improving 2-stage early contractor involvement: lessons from New Zealand. Paper presented at the 22nd Pacific Association of Quantity Surveyors Congress, Kuching Sarawak, Malaysia.

This paper evaluates overall industry perceptions toward 2S-ECI in New Zealand through 21 interviews across New Zealand in terms of what is working well, and opportunities to improve 2S-ECI.

- Finnie, D. and Ameer Ali, N. (2016, December) *Enhancing offsite manufacturing and prefabrication through procurement practices*. Presentation at the New Zealand Modular Construction and Prefabrication Conference, Auckland, New Zealand.

This PowerPoint presentation evaluated how 2S-ECI contractual provisions work to overcome key barriers to off-site manufacturers. Audience feedback helped inform the journal article above.

Seminar proceedings:

- Finnie, D. (2011, 8th June) Design buildability Claim Entitlement under NZS3910:2013, Considering Early Contractor Involvement. Presentation to the Adjudicator's Association of New Zealand (AANZ) annual training day, Auckland New Zealand.
- Finnie, D. (2018, 28th March) *Employing a builder: when can they claim more time or money?*. Presentation at Otago Polytechnic, Dunedin, New Zealand.

These were local PowerPoint presentations sharing findings into when contractors can claim costs after entering a fixed price construction contract for drawings supplied by

Chapter 2: Research Methodology

2.1 RESEARCH DESIGN

This study adopts an exploratory approach to identify the relationships between process variables (Fellows and Liu, 2015 p91) such as scope, obligations, timing, pricing, risk, and project governance structure to develop a framework for 2S-ECI.

2S-ECI procurement is an emerging area of procurement research. The first definitive work specifically addressing 2S-ECI was by Mosey (2011). There are plausible reasons for this. First, previous literature has described the challenges in defining construction procurement processes and into systems or models (Rawlinson, 2013). Second, construction procurement processes are often complex and complicated by a large range of factors, such as the influence people in the project and their relationships (Mastermind, 2002; Dissanayaka, 1998; Walker, 1995) and the form of contract used which, in New Zealand, is likely to have amended terms (NZIQS, 2019). Previous research into ECI has found that procedures vary across countries including the United Kingdom, USA, Australia, and New Zealand (Turner and Riding, 2015). In the United Kingdom, ECI is typically considered a form of partnering (Rahman and Alhassan 2012; Mosey, 2011) while in Australia ECI has been associated with hybrid models developed for infrastructure projects where the first-stage is a form of partnering and the second-stage is often a design and build contract (Whitehead, 2009). While prior studies have considered the relational aspects of ECI (Strahorn, Gajendran and Brewer, 2015; Menches and Chen, 2012; Ross, 2011; Lee, Seo, Park, Ryu and Kwon, 2009; Song, Mohamed and AbouRizk, 2009; Zuo and Zilante, 2006) there is little known about the contractual liabilities associated with ECI. In comparing whether the entity employed to plan and manage construction should be employed through a contract for works or a construction contract, again relational aspects have been studied, (Jergeas and Put, 2001; Tenah, 2001) but the first reported court case involving a construction management agreement (CMA) was in 2001, *Great Eastern Hotel v John Laing Construction Management Ltd* (2005). This makes establishing any absolute cause and effect of relationships difficult.

An exploratory systems approach to research is therefore preferable over an analytical approach of existing systems. The systems approach assumes that reality is the sum of components that often have indicative relationships, but that in which reality differs from the sum of its components. Rowlinson and McDermott (1999, p12) described how attempts to define procurement pathways have been called 'virtually meaningless', and that such systems may actually share more commonality than differences. They argue (on p35) the need for a set of key variables to define the contract strategy. In comparing the pros and cons of traditional versus alternative procurement pathways, Ashworth (2012, p94) concluded that 'if a single method was able to be devised which addressed all of the problems then the remaining methods would quickly fall into disuse.' Therefore exploring the systems used to procure 2S-ECI is preferable to analysing any one prescribed textbook procurement 'model.'

A quantitative approach would fail to represent 2S-ECI in New Zealand construction because surveying industry, asking them to rate and rank based on textbook procurement definitions (design and build, management contracting and construction management) would fail to explore the 2S-ECI process when those textbook definitions are problematic. This is supported by Kashiwagi, Kashiwagi and Savicky (2009)'s argument that the construction industry is fundamentally misunderstood by academics whose attempts at improvement have focused on technical expertise over systems. They argue that continually surveying pre-set questions based on prior literature contributes to the stability when a systems overhaul is required.

This research uses a qualitative strategy. This is supported by Fellows and Liu (2015 p71) who describe a 'paradigm shift' towards the more qualitative, interpretive approach in construction management research. A soft systems methodology is appropriate for social problems and tackling ill-structured problems such as value management (Fellows and Liu, 2015 p49). Construction management researchers often view the temporary project organisation as a social-technical system and, in the study of the relationships between project participants, taking the social constructivist's approach (Fellows and Liu, 2015 p74). This is where knowledge is constructed based on experience and social interaction. This supports qualitative approaches such as interviews.

Legal scholarship research methods established the contractual obligations of the entity employed to plan and manage construction, and the influence of 2S-ECI on those obligations. Construction procurement involves both inter-personal and definitive contractual relationships. Toolanen (2008) described a procurement *system* as the process of engaging the various parties to the project and establishing the temporary project organisation and setting out each parties' responsibilities obligations and liabilities and how they are compensated (see Toolanen, 2008. According to Chynoweth (2008, p29-30) legal doctrines analysis, such as dealing with the law of contract, is largely concerned with the interpretation of legal texts (such as contracts) and can often be better understood when combined with industry perceptions. The evaluation of obligations based on recognised legal doctrines ('black letter law') and developing legal doctrines in the context of 2S-ECI falls under the expository and legal theory research as defined by (Arthurs (1983) taxonomy of legal research in Knight and Ruddock, p29). The doctrinal research analyses legal texts such as court reports and legal commentary to establish contractual obligations. For example, the legal term 'reasonable skill and care' defines the legal duty required of a professional consultant such as a PM, architect or PQS. Legal theory also considers the context of the legal institution. For example, the Common law of England is important in the New Zealand legal system. Originally, New Zealand shared its statutes with England. Now only a few British Statutes apply here, like Magna Carta and the Great Bill of Rights, however, according to the Imperial Laws Application Act 1989 the Common law of England remains New Zealand's Common Law until changed by our courts. This is why many New Zealand contract cases are English cases, which are binding, not just persuasive, once our courts have adopted them.

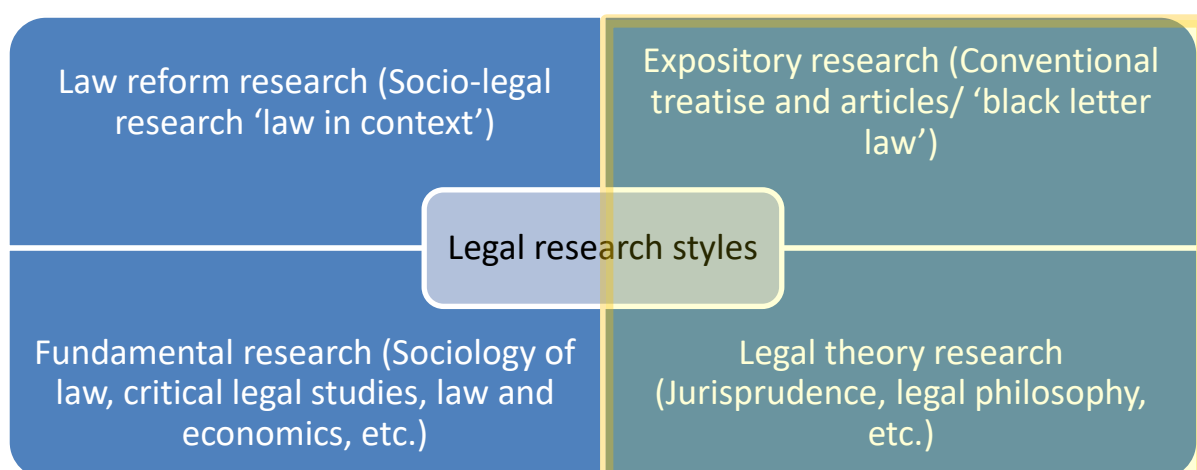


Figure 2: Doctrinal methodology (Arthurs (1983) taxonomy of legal research in Knight and Ruddock, p29)

It is important to evaluate the contractual obligations required of parties when comparing procurement pathways. Contractual risk transfer is a major problem in New Zealand

construction (NZIQS) with calls for more contractual risk training in the sector (NZIOB, 2019). Yet, contractual legal research appears largely separated from construction management research despite construction professionals administering construction projects, not lawyers. Knight and Ruddock (2008, p1) describe the philosophical debate that emerged in the 1990's about the dominance of positivism and the role of theory in the journal of *Construction Management and Economics*. Over a decade later, Knight and Ruddock (2008, p6) found that positivism and quantitative research approaches still appear to dominate, with almost all of the 107 papers published in the *Journal of Construction Management and Economics* volume 24 in 2006, being based on surveys or interviews. In preparation for this study, research methods were studied from the following three texts on the topic of research methods in the built environment:

- Fellows, R. and Liu, A. (2015) *Research methods for construction* (4th ed.). Wiley Blackwell.
- Knight, A. and Ruddock, L. (2008) *Advanced research methods in the built environment*. Wiley-Blackwell.
- Naoum, S.G. (2013) *Dissertation research & writing for construction students* (3rd ed.). Routledge.

In addition, a fourth on more general 'real world' research:

- Robson, C. (2002) *Real world research* (2nd, ed.) Oxford, UK: Blackwell Publishing.

All four books compare qualitative and quantitative research methodologies, and the use of surveys and questionnaires. Only Knight and Ruddock (2008) mention legal research methods or 'legal scholarship'. Knight and Ruddock (2008, p28) provide that 'legal researchers have always struggled to explain the nature of their activities in other disciplines' and may often be viewed as not truly academic. With such a cynosure of empirical data based on surveys and questionnaires it is easy to see the potential for friction between the scientific (natural and social science) researchers and those legal scholars who, rather than relying on empirical data, focus on developing a more theoretical debate to answer the question; 'what is the law?' in particular contexts. Knight and Ruddock (2008, p33) provide that:

Scientific research in both natural and social sciences, relies on the collection of empirical data, either as a basis for its theories, or as a means of testing them. In either case, therefore, the validity of the research findings is determined by a process of empirical investigation. In contrast, the validity of doctrinal research findings is unaffected by the empirical world.

Scientific research places a strong focus on the establishment of a 'research methodology', which aligns the selected research tools with the philosophical viewpoint (ontological and epistemological positions) of the researcher, considering for example whether reality is absolute (positivism) or subjective (interpretivism). In contrast, legal scholars focus on developing legal doctrine through logical deduction, reasoning, and applying legal principles to hypothetical classes of situations. 'The most widely used technique is undoubtedly the process of analogical reasoning' (Knight and Ruddock, 2008, p30). As such, there is no such focus on the development of a 'research methodology' in legal scholarship. As described by Knight and Ruddock (2008, p32):

Its [legal scholarship] approach involves the development of scholastic arguments for subsequent criticism and reworking by other scholars, rather than any attempt to deliver results which purport to be definitive and final. Any 'methodologies' in this type

of research are therefore employed subconsciously by scholars (and practicing lawyers) who would most usually consider themselves to be involved in an exercise in logic and common sense than in the formal application of a methodology understood by researchers in the scientific disciplines.

Scientific researchers may consider research that bases its conclusions on theoretical arguments without any empirical data (such as surveys or questionnaires) as a mere 'literature review.' However, it is difficult to see how surveying construction professionals (who are unlikely to be legally trained) about contractual legalities is going to develop the law in the field of construction procurement. The law is the law, regardless of individual's perceptions of what it should be. This demonstrates a philosophical flaw in any assumption that construction research should solely focus on empirical evidence in the form of surveys and questionnaires. The New Zealand construction industry can clearly benefit from research that integrates construction management with legal analysis.

2.2 APPLIED RESEARCH METHODS

The following mixed research methods were used to address the questions of this study (see figure 3):

- Literature review within the field of construction procurement to obtain knowledge of prior and ongoing research on procurement pathways that involve contractors during the design stage. This examination included mainly journal and conference articles, textbooks and reports.

This helped toward establishing the key process parameters for 2S-ECI, research question 2: What are the optimal contractual ingredients to consider at the pre-construction stage, such as timing, obligations and liabilities. It also helped to establish what is already known about 2S-ECI in terms of risk and market pricing (research questions 1 and 3) and about previously identified challenges to using 2S-ECI and opportunities for improvement (research question 4).

- Legal scholarship to establish the contractual obligations of parties to construction contracts and the effect of early involvement on those obligations. Legal scholarship includes the interpretation of contractual obligations in terms of both the express contract terms (those written in the contract) and terms implied through case law precedent and legislation.

This helped to answer research question 2: What effect does 2S-ECI have on contractual risks?

- Document analysis to compare contractual documentation used in 2S-ECI and the efficacy and efficiency of how contractual obligations particularly in terms of ability to add value and reduce risk.

This helped answer research questions 1 and 2: Risk and optimal contract ingredients.

- Interviews to establish how 2S-ECI is conducted in New Zealand construction and to explore user perceptions about how the different process components affect project performance through 2S-ECI and gauge the overall effect on risk, pricing, benefits, challenges and opportunities for improvement.

This helped answer research questions 1 – 4. Risk and optimal contract ingredients, and the effect of 2S-ECI on market pricing and the overall benefits, challenges and opportunities to improve 2S-ECI

- Survey questionnaire in the forms of a single-stage Delphi method sent to all interviewees (as an expert sample) to help validate the interview findings by capturing the views of expert sample population of all ideas raised within the interview sample.

This also helped answer research questions 1 – 4.

Further details of each research method and its application are provided in the respective chapters of this thesis.

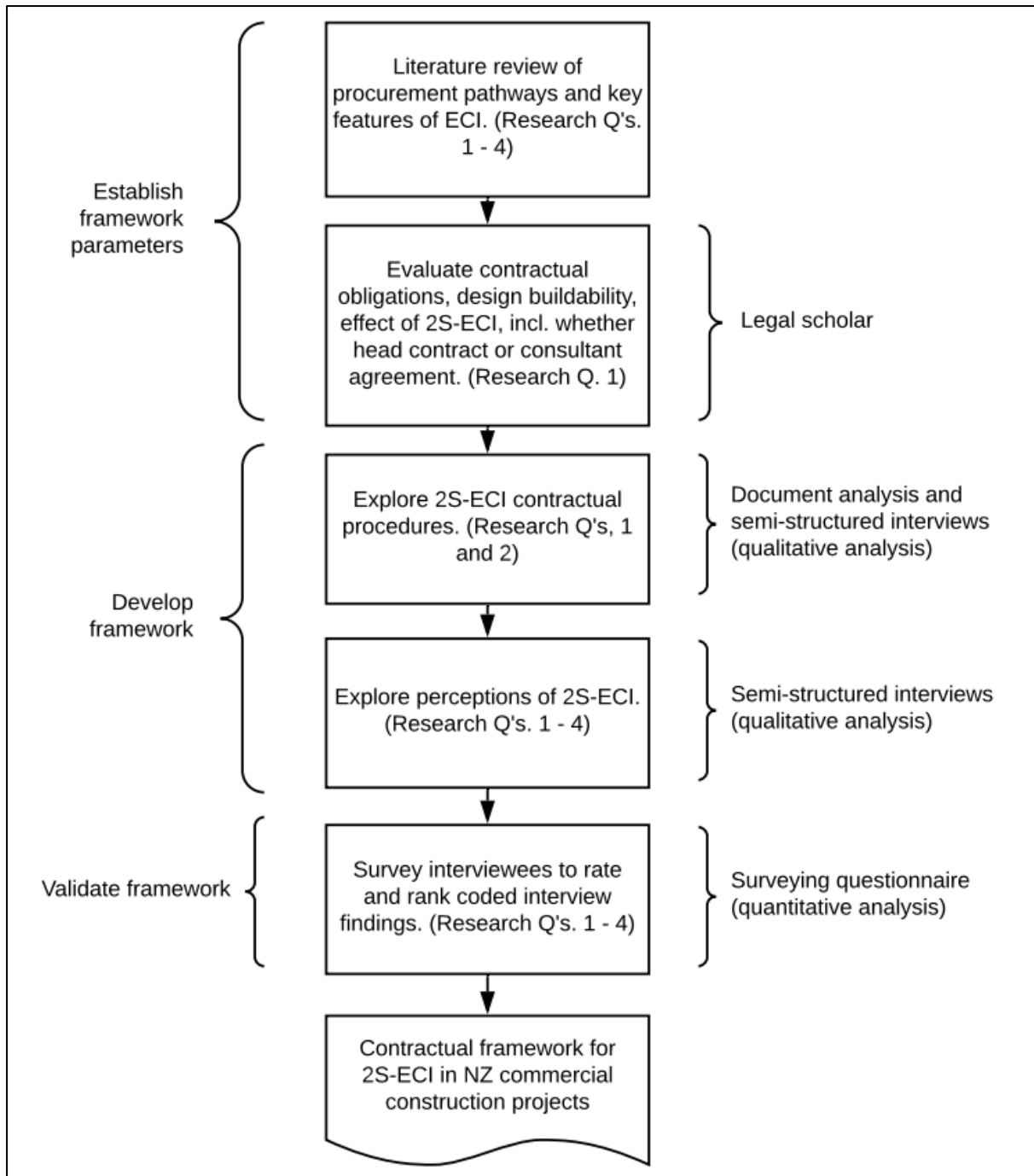


Figure 3: Research framework

2.3 VALIDITY AND RELIABILITY

Reliability and validity are important in research studies in order to produce accurate results, using a clear research methodology so that others may repeat the study, and so that findings may be used in other research and application in practice (Fellows and Liu, 2015). Validity for exploratory studies can be subdivided into construct validity, internal validity, external validity and reliability (Yin, 1994). Construct validity is a measure of how well the study reflects the area of interest in question, internal validity is used to measure causalities in an explanatory

study and external validity is a measure of how general the results of the study can be regarded. Reliability is a measure of the reproducibility of the study.

A key focus of validity is how well the questions asked in interviews or surveys address the research topic. The semi-structured interview questionnaire was adapted from a questionnaire used by Gameson and Sher (2009) to study perceptions of procurement. The questionnaire was trialled with interviews and refined before continuing. Interviews also provided the opportunity to more deeply explore the respondent's views. This is supported by Robson (2002, p271) who recommends interviews for exploring perceptions of new organisational processes. Robson (2002, p272) describes how 'face-to-face interviews offer the possibility of modifying one's line of enquiry, following up interesting responses and investigating underlying motives in a way that postal and other self-administered questionnaires cannot.' However, interviews can create practical challenges. For example, throughout the process, some interviewees would raise valuable points that might have been applicable to earlier interviewees, however, re-interviewing the sample to gain their views each time a new point is raised was impracticable. Therefore, a survey questionnaire based on coded interview findings provided a reliable way to test ideas amongst the expert sample. The survey enables all of the interviewees (in the form of an expert panel) to rate all ideas raised from the sample, such as the challenges of using 2S-EI and the opportunities to improve it.

Surveying the interview sample provided a mixed-method research approach, in that, the interview findings (a quantitative approach), were tested through the survey (a qualitative approach). This can help counter the threats to validity, although practical difficulties can still arise when different sources yield conflicting results (Robson, 2002, p174). The mixed-method approach is supported by Knight and Ruddock (2008, p8) who describe how quantitative methods can be used to corroborate qualitative data (or vice versa) through providing *methodology triangulation*. Mixed-method approaches also feature in previous research into construction procurement (Edkins and Hedley, 2006; Rahman and Kumaraswamy, 2005 etc.). Edkins and Hedley (2006) used a two-stage qualitative then quantitative research methodology to explore the extent to which effective relationships and legal factors determine PPP performance outcomes in United Kingdom construction. The first stage involved ethnographic case studies and the second stage used survey questionnaire. Rahman and Kumaraswamy (2005, p366) used multiple research methods to develop a framework for building relational project teams comprising 'literature review, two questionnaire surveys, one case study and one interview-based survey of local industry experts'. Document analysis and case studies also feature as prominent research methods for exploring construction procurement practices (Jergeas and Put, 2001; Larsen, Kao, Soentanto and Goodier, 2006; Song, Mohamed and AbouRizk, 2009, p14).

2.4 ETHICAL PROCEDURES: INTERVIEWING AND DATA COLLECTION

The main risk of harm to participants is the sharing of commercially sensitive views or information, including commercially sensitive project data. Participants risk facing employment disciplinary procedures or embarrassment. At an organisational level, firms risk losing commercial advantage. Ethical considerations are particularly important when conducting interviews. A risk is that the interviewer may manipulate the data collected. It is crucial that all views expressed are those of the interviewee and not the interviewer. Robson (2002, p273) warns that 'the lack of standardisation that it implies inevitably raises concerns about reliability, Biases are difficult to rule out.' This study was conducted in accordance with *Massey University Ethical Conduct for Research*. The research method was submitted to the Massey University Human Ethics Committee (MUHEC) using the online process for full ethics approval. An ethical analysis of the research methodology was conducted after reading the *Massey University Ethical Conduct for Research*. This was then discussed with the research

supervisors. These principles were applied in the interviews. The ethics application was approved under NOR 17/48. The following strategies were used to minimise harm:

2.5 MINIMIZATION OF HARM

Conflict of interest:

Some interviewees in this research worked on projects for the tertiary institution where the researcher is an employee. Other interviewees had working relationships with the researcher when he worked for a construction company (2002 – 2009). Therefore, the researcher knew some interviewees.

Extra care was taken with questioning and interpreting participants' comments to adopt a scholarly stance. It was made clear to participants (through the Information Sheet and interview introductions) that the researcher role is separate from any previous roles.

Interviewees were offered written transcripts of their interviews and the opportunity to edit for correctness.

Informed consent:

Participants were introduced to the research aims and objectives before volunteering to participate.

Anonymity:

Sensitive comments were described in a generic manner to avoid potential identification. For example, a rebuild of a hospital in Dunedin could easily be linked to the parties involved. Such a project could be described as a 'large, complex and highly serviced project' in Dunedin. Identifying codes will be assigned to names of people and projects (e.g., respondent a, respondent b, project a, project b etc.).

Data management

Recorded consents were stored in a safe and secure manner under the control of the research supervisors. This facilitates future reference to these forms if necessary.

Interviews were recorded using an audio device or written notes, then transcribed. Transcriptions were provided to the respondent to edit for accuracy. All written transcripts are submitted through the student's supervisor before going to any other party.

Data was stored on secure computers or networks.

Respondents were given the option to receive a summary of key findings upon completion.

Raw data is archived for three years from the completion of the thesis to enable future publishing before being destroyed by the supervisor.

Chapter 3: Literature Review

This section critically analyses knowledge relating to ECI from literature, and identifies gaps in knowledge. This chapter is structured as follows:

- Literature relating to procurement definitions and the main different procurement models;
- Market pricing in terms of traditional versus relational procurement and price-based versus value based procurement;
- Advantages of ECI;
- Considerations such as project suitability, pricing provisions, and scope of pre-construction services;
- Potential challenges of ECI and comparisons between head contract versus consultancy contract;
- Challenges on procurement decision-making and the advantages of standard form contracts.

3.1 PROCUREMENT DEFINITIONS

Previous studies have sometimes attempted to gauge the advantages and disadvantages of ECI, without first establishing any clear contractual framework. For example, Francis and Kiroff (2015) surveyed the perceptions of ECI based on their assertion (based on 'personal communication') that design and build is the most commonly used form of ECI in Auckland commercial construction market. Therefore, their findings could be considered the perceptions of design and build, and not ECI, which, as a concept, includes any procurement pathway that enables contractor involvement in design (Rahman and Alhassan, 2012), nor ECI as its own procurement system, generally referred to a 2S-ECI (Mosey, 2011). This blurring of ECI definition potentially confuses research findings. The contractual obligations required of contractors in a design and build contract are quite different to a 2-stage construction-only contract, or where clients employ trade contractors directly and a consultant to manage them, under the CM pathway (also a form of ECI). Worse, previous studies have failed to agree on what even constitutes a procurement pathway, with attempts to prescribe procurement into a 'system', or 'model'.

Construction procurement is the acquisition of resources required to realise a construction project across all stages of the procurement process (NZCIC, 2006). There exists a multitude of variables to consider in terms of the possible pathways to acquiring such resources over the project lifecycle. A procurement *system* or *model* describes the process of engaging the various parties to the project and establishing the temporary project organisation and setting out each parties' responsibilities obligations and liabilities and mechanism for compensation (Toolanen, 2008). Systems or models are not contracts. A useful distinction is drawn by Murdoch and Hughes (2008, p19) who distinguish between a standard form of contract as a document which should rarely, if ever, be amended, versus a model which only provides a starting point for more detailed negotiations. Attempts to categorise procurement pathways into 'systems' or 'models' have been criticised. The National Economic Development Office's NEDO (1983) categorised procurement into *traditional*, *design and build*, *design and manage*, *management contracting*, and *construction management*. Franks (1990) later categorised procurement into *designer-led competitive tender*, *designer-led construction works managed for a fee*, *package deal*, and *project manager/client's representative led*, have subsequently

been criticized. Hibberd (1991) argued that the term 'model' or 'system' is inappropriate because there exists no formal structure or even general agreement in terminology and that the terms procurement 'paths' or approaches' are more appropriate. Rowlinson and McDermott (1999, p12) described how such attempts have been referred to as 'virtually meaningless', and that the pathways that have been categorised into different systems may actually be more similar than they are different. They argued (on p35) the need for a set of key variables to define the contract strategy. In comparing the pros and cons of traditional versus alternative procurement pathways, Ashworth (2012, p94) concluded that 'if a single method was able to be devised which addressed all of the problems then the remaining methods would quickly fall into disuse.'

Despite the growth of 2S-ECI the optimal contract provisions remain largely unknown. The ECI pathway is generally referred to as a 'two-stage' procurement processes, often referred to as 'two-stage tendering' or 'fast-tracking' in reference to the ability to over-lap design and construction activities when contractors are employed during the design stage. The most focused and comprehensive research into ECI as a system was by Mosey (2011). Mosey proposed a two-stage procurement process where a head contractor is first employed during the design stage under what he describes as a 'conditional' construction contract. The contractor then works with the client's design team, providing planning and design buildability advice, and works toward establishing a construction budget, typically in the form of a target value. If the developed design and budget price are to the client's satisfaction, the contractor secures the unconditional construction contract. This provided a starting point for 2S-ECI. Subsequently, standard form contract documentation has evolved to support 2S-ECI, such as the launch of the first edition of the JCT Pre-Construction Services Agreement (PCSA) in 2011. These PCSAs still leave parties to decide a number of key variables. These include the timing of contractor involvement, scope of pre-construction services, whether or how the contractor is paid for early involvement, whether the construction stage contract is construction-only or design and build, whether the contractor subcontracts all trade packages or carries out carpentry and concrete works using their own employees and if so how this work is priced. Turner and Riding (2015) explored ECI processes of a large Australian operations and maintenance contractor, Transfield Services. They found that, in public sector procurement, procedures vary across countries including the United Kingdom, USA, Australia, and New Zealand. In the United Kingdom, ECI is typically considered a form of partnering (Rahman and Alhassan 2012; Mosey, 2011). In Australia, hybrid models have been developed for infrastructure projects where the first-stage is a form of partnering and the second-stage is often a design and build contract (Whitehead, 2009). Examples include; South Australia's Department for Transport Energy and Infrastructure (DTEI) and Queensland's Department of Transport and Main Roads (TMR). To date, there appears to be little or no research into the optimal contractual provisions for 2S-ECI, i.e., a lack of contractual framework.

Only the word 'procurement' appears clearly defined. Construction procurement is the acquisition of resources required to realise a construction project across all stages of the procurement process (NZCIC, 2006). The procurement strategy sets out how parties employed, their responsibilities, and the structure of the temporary project organisation, typically comprising a project manager (PM), designers and contractors (Toolanen, 2008). Thomas, Luu and Chen (2002, p79) describe the selection and use of an appropriate procurement system as 'crucial to project success'. The effectiveness of procurement strategies and contractual arrangements have been linked to productivity (Durdyev and Mbach, 2011; Wilkinson and Scofield, 2010; The Building and Construction Productivity Partnership, 2012), levels of innovation (Loosemore, 2014; de Valence, 2010), and have been found to influence the potential for conflict and disputes (Jelodar, Yiu and Wilkinson, 2015; Heaphy, 2011a; Mosey, 2011).

To begin establishing a contractual framework for 2S-ECI evaluate the key components of textbook procurement models, from what is considered 'traditional' contracting to the 'alternative' procurement pathways such as design and build, management contracting, and construction management. In terms of ECI, these models may be categorised into those that involve a head contractor (design and build, management contracting, 2-stage traditional) versus those where the client employs the separate trade packages directly and a consultant to manage them (CM).

3.2 ALTERNATIVE PROCUREMENT PATHWAYS

Literature has generally distinguished procurement *traditional* and *alternative* pathways. The traditional pathway features single-stage tender process. Where head contracts tender based for fully complete designs (Murdoch and Hughes, 2008; Kirkham, 2007). Alternative pathways originated when governments began encouraging to help address projects often being completed late and over budget, particularly on large and complex projects, both the United Kingdom (Franks, 1999) and in the US (Edward, 1997). These alternative pathways feature more management-based and contractor design and build procurement. However, here again, there exists a lack of clear definition of procurement terminology. Kong and Gray (2006) define traditional procurement as where design is completely separate from construction, and the contractor has no input into the design. However, design and build f in the United Kingdom before traditional design-bid-build (Murdoch and Hughes, 2008). Perhaps this is why some authors consider design and build a traditional pathway (Strahorn, Gajendran and Brewer, 2015; Jaafar and Radzi, 2013), while others such as (Tenah, 2001) categorise design and build under as an alternative.

Alternative management-based procurement pathways see managers or contractors moving closer to the client (Rowlinson and McDermott, 1999) and the ability to overlap design development with construction, typically referred to as 'fast-tracking' (Franks, 1998). For clients and consultants to make informed design decisions on projects involving OSM, Elnaas, Ashton and Gidado (2009) recommend procurement practices should facilitate the sharing of cost and buildability knowledge among manufacturers, constructors and designers. Previous studies have reported the savings of fast-tracking. A case study by Franks (1998, p38) documented that in a project completed over two-years through fast-tracking, while an additional cost of \$0.5 million was estimated for earlier involvement, a total saving of \$2 million was achieved over the two-year period compared with traditional procurement. Gil, Tommelein and Ballard, (2004) found that through ECI, shop drawings may be produced earlier and faster by reducing the time required for freshly appointed contractors to familiarise themselves with the project. However, not all research into alternative procurement pathways has produced positive findings. Jaafar and Radzi (2013) found that, while alternative procurement pathways, such as *project management consultancy* (PMC), *build operate and transfer* (BOT), and *design and construct* (D&C) began to feature in Malaysia in the 1990s due to the large volume of construction work, subsequent reports eventuated of projects being over budget, completed late, and incurring significant defects.

ECI falls under the alternative classification based on previous research. Contractors move closer to their clients through their involvement in the design stage planning, rather than competitively tendering for fully complete designs, largely eliminating the opportunity for input. The key features of individual procurement systems are now explored.

3.3 TRADITIONAL (GENERAL) CONTRACTING

As already stated, under traditional contracting construction, head contracts are tendered, generally on a lump sum basis, once the design is fully developed (design-bid-build). The head contractor may use employees for the carpentry and concrete work and subcontract the remaining trade packages, typically in the order of around 80%.

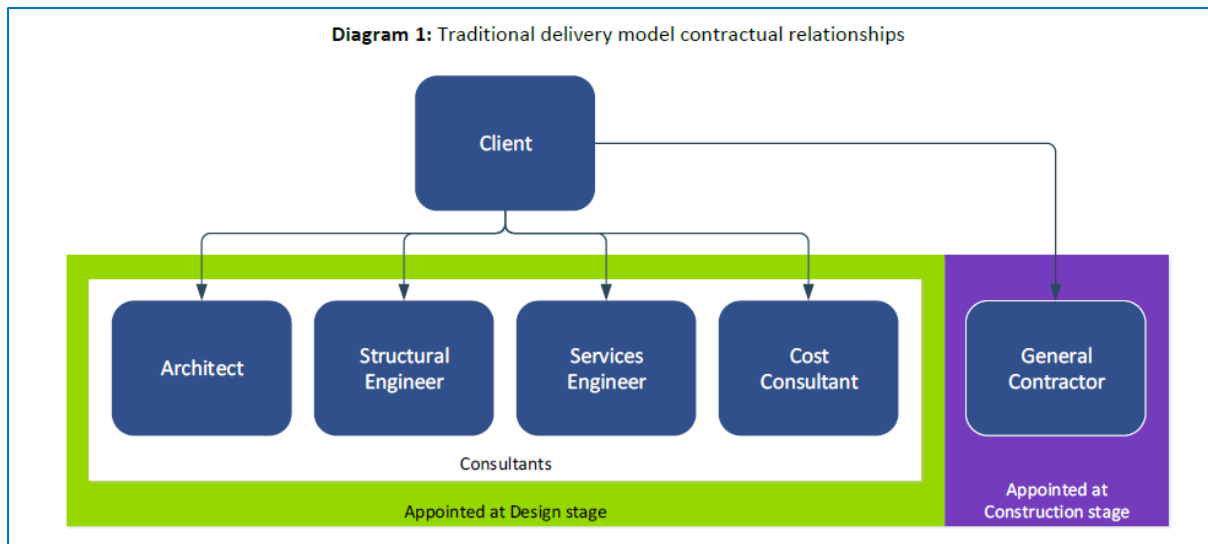


Figure 4: Contractual relationships in traditional contracting (MBIE, 2016)

The advantages of this procurement system include; the client enjoys single-point accountability for construction work, as the head contractor takes full responsibility for the performance of their subcontractors. If the head contractor is late in achieving practical completion, the client may claim general or liquidated damages, and the contractor must remedy any quality defects at their cost.

However, the client generally pays for the design before receiving the price surety of lump sum bids for construction (unlike design and build). There is no opportunity for the contractor or construction manager to provide input during design, such as around buildability, risk mitigation, or value management (unlike forms of ECI such as management contracting or construction management or design and build). Because the contractor competitively bids against a design provided by the client, if the design is not fully complete, the contractor may look for opportunities to claim variations, and given the short timeframe for contractors to become familiar with the design, additional demand is placed on management and coordination and on specialist subcontractors associated with complex technologies (Kirkham, 2007). General contracting is suitable where:

- The construction work is fairly straight forward
- Design is fully complete
- The client wants price certainty before construction work commences
- There is time to fully develop the design, then procure, before construction work starts
- E.g. a new classroom for a school

Since its introduction in the early 19th century, the traditional procurement route remains very popular, accounting for the majority of construction work in the United Kingdom (RICS, 2010; Murdoch and Hughes, 2008; Gruneberg and Hughes, 2004) and in New Zealand (Cain, 2016). This is despite the arrival of alternative procurement methods, such as construction management and management contracting. Murdoch and Hughes (2008, p27) provide an historic overview of its introduction. Interestingly, before traditional contracting, procurement

was often in the form of design and build or a series of direct contracts between the client and the various trade contractors (historic equivalent of today's CM pathway). Traditional contracting evolved in response to the increasing sophisticated of construction technology during the Industrial Revolution which saw complex construction sites and coordination issues, and more formalised trade contractors, all fuelling the desire for construction companies to shoulder the full responsibility for building the project (or buildability risk) and leave architects and engineers to focus on designing. ECI processes emerged where a head contractor adopts singular responsibility for all construction work such as management contracting, versus construction management where the client employs the trade contractors directly and a consultant to manage them. This period also saw the introduction of the quantity surveyor to produce schedules of quantities (SOQs) to provide consistency across tender bids and control costs during the financial contract administration.

The continued dominance of traditional procurement based on competitive lump sum pricing, indicates the industries' risk aversion and preference for singular accountability, competitive pricing, and the surety of fixed-price contracts prior to construction work commencing. All of these features are available through design and build procurement. Design and build also offers the advantages of enabling ECI (with the contractor responsible for both design and construction), and providing the client with a price for design and construction before paying for design.

3.4 DESIGN AND BUILD

Under design and build the head contractor, is responsible for both design and construction. The contractor's scope of design liability and payment procedures define the form of design and build contract. The design and build contractor may either (i) be responsible for fully developing the design from the client's brief; (ii) develop the design from a preliminary design already developed by the client's design team; or (iii) adopt responsibility for a design which is already developed either fully or in part which is then contractually *novated* to them. Here again, previous research demonstrates varying terminology. Where the contractor develops the design from the client brief has been called 'pure DB' (Turner, 1995; Jansens, 1991), 'traditional DB form' (Akintoye, 1994; Bennet et al, 1996), 'true DB' (Counce, 1995), or 'complete DB' (Turner, 1995). This study will adopt the term 'traditional DB'. Payment maybe through regular monthly payment claims or in *package deals* or *turnkey* arrangements (see Ling and Leong, 2012) where the contractor finances the project until completion when they claim for the works in full.

Design and build continues to prove popular, and research (RICS, 2010; Bennet, et al, 1996) shows this continues to accounts for up to around 20 percent of construction work in the United Kingdom. Ling and Leong (2012) reported a growing trend towards the use of design and build in Singapore and Cain (2016, p30) found through surveying the viewpoint of contractors that New Zealand clients tend to favour design and build behind sequential traditional procurement.

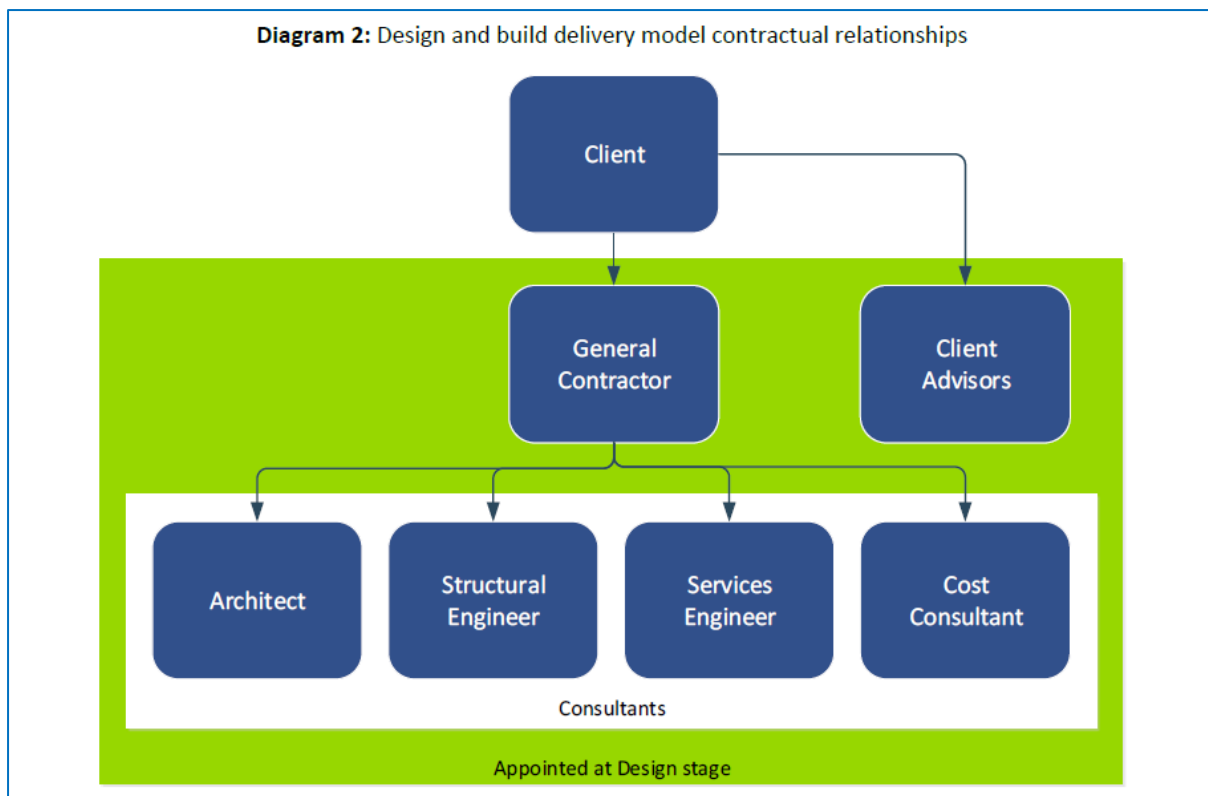


Figure 5: Contractual relationships in design and build (MBIE, 2016)

Key advantages to the client include the single-point accountability for both design and construction (Murdoch and Hughes, 2008; Kirkham, 2007; Katsanis and Davidson, 1998) unlike traditional contracting where the contractor is only responsible for construction. Kirkham (2007, p128) called this a “significant shift in risk to the contractor compared with the traditional route”. The client can also obtain a single lump sum price for design and construction before investing in a design. This mitigates the risk of paying for receiving tender bids that are over budget, after already paying for the design. Beyond these advantages, it becomes difficult to verify research into advantages and disadvantages of design and build again due to problematic definitions. For example, Ling and Leong (2012, p43) found that parties perceived design and build project costs to be lower noting a likely reason to be the contractor’s ability to conduct value engineering. However, this is a feature of any procurement pathway that enables ECI (including management contracting, construction management and traditional with a two-stage tender), regardless of whether the contractor is responsible for construction only or design and build. It is equally difficult to distinguish findings by Ming (2005) - that the main predictor of design and build project success is the quality of project management, with other predictors including the client’s input in the project, working relationships among project team, project attractiveness and the use of innovative management approaches – with other forms of ECI, if not all forms of procurement.

The advantages of design and build could question the need for other forms of ECI. Previous research has identified challenges when the contractor employs the architect, rather than the client. The design and build contractor relies on clearly stated client requirements (client brief) on which to formulate their design (According to Ling and Leong (2012, p41; Kirkham, 2007, p127). As the project complexity increases, so too does the need for sophisticated briefs and performance-based specifications, for which the client remains responsible. Converting the client’s requirements into legally binding terms can be challenging, and performance-based specifications are more difficult to produce than technical specifications (Katsanis and Davidson, 1998). Ibbs, *et al.* (2003) analysed 67 construction projects and found that design and build may not provide all the expected benefits to project performance. While time savings

were definitive, cost and productivity changes were not convincing. They concluded that the contractor's experience and project management expertise might affect project performance outcomes more than solely the project delivery strategy. Interestingly, they found that overall (design and construction stages) more construction-only projects incurred cost changes than design and build projects, but that the cost changes on traditional projects were more likely to be savings while design and build projects incurred more cost increases (p385). Further, 'projects that used a combination of two delivery methods had the least cost change' (p384). Traditional projects experienced a higher percentage of cost changes during the construction stage, though the real value of cost change was less than that of design and build projects. Ibbs, et al. (2003, p385) suggested a possible reason for design and build projects having the lowest percentage of changes 'the contractor has more opportunity to use innovative procedures to construct the facility that could result in cost savings for the contractor. Also, the improved communication between the contractor and designer allowed for a better and positive constructability review that reduced the need for revisions and changes during the construction stage.' They concluded (p387) that design and build projects can result in poor performance depending on the time given to the design phase, and that 'the owner needs to be educated and informed about conveying ideas to the contractor in preparing the design specifications to ensure success when adopting the DB approach.' This aligns with other literature identifying the need for educated clients when using design and build (Murdoch and Hughes, 2008; Kirkham, 2007). It also supports Kings College (2016) findings that alliance contracts and ECI require active client involvement.

Another key debate raised across previous studies is the extent that design and build contractors may drive cost and time saving at the expense of aesthetic design quality. Whitehead (2009) identified the risk of too many 'chiefs in the kitchen' in Australian infrastructure projects using 2S-ECI (with the second stage typically design and build), where designers pull back as contractors drive buildability efficiencies, and potential problems arising from contractors being involved too early. Findings by Ling and Leong (2012) particularly highlight the issue. Contractors were more enthusiastic about design and build than clients and architects. Contractors felt that workmanship quality is better under design and build, it maximises overall client satisfaction, and that design and build projects are aesthetically pleasing. While all parties felt that design and build projects are more likely to achieve cost and time targets, architects felt that design and build projects may concentrate on time and cost at the expense of aesthetics, and clients and architects both felt the reason design and build project costs may be lower is because "contractors pursue cheaper design solutions all the time." Fixed price design and build contract incentivise contractors to maximise profits through achieving time and cost savings and not to produce an outstanding piece of architectural creation at the expense of cost and time, as an architect might. Therefore, for large, complex, innovative or creative projects, the client's desire for single-point accountability should be balanced with the potential for contractors to drive cost savings at the expense of design. Furthermore, the ability to obtain price surety before paying for design does not apply to large complex projects in which case the client still requires separate consultants to develop their design brief and to represent their interest in administering the contract and supervising the work.

Novated design and build is comparable with 2S-ECI where the contractor adopts responsibility for design. Doloi (2008) defines novated design and construct (ND&C) as a process where the client first employs a design team to prepare a design to approximately 30-40%, then contractors bid for the project, and responsibility for the full detailed design is novated to the successful contractor. This is similar to 2S-ECI (see figure 1 (2S-DB)) where contractors bid a fixed price for P&G and declared margins based on concept design. However, under 2S-ECI, the successful contractor then works with the design team toward agreeing a fixed price construction contract, which may be construction-only or novated design and build. The collaborative involvement toward agreeing a fixed price construction contract under 2S-ECI avoids contractors bidding for ND&C projects and making 'a series of

assumptions, allowances or contingencies' ... which 'often leads to misinterpretation of the design specifications without appropriate input from design consultants in fulfilling both client's and design team's anticipations' (p1182). Doloi (2008) identified the following critical attributes of novated design and build from surveying 46 respondents (comprising architects, engineers, project managers, design managers, and site managers); quality of pre-novation documentation, contractor's responsibility for accepting design errors, contractor's motivation to reduce costs, loyalty of the design team to the contractor post-novation. Doloi (2008, p1194) concluded that 'clear definition of the design brief and early engagement of contractors in the novation process are important attributes for driving the contractor's motive to lower construction costs.' In discussing the critical attributes Doloi (2008, p1191) states that 'if the design is agreed by the client and most of the technical issues are clarified at this stage from the constructability perspective, the chances for change of project scope at the post novation phase and subsequent design variation greatly reduce' and that this in-turn reduces the likelihood of disputes. This again highlights the advantage of 2S-ECI where contractors provide buildability input, rather than competitively bidding for a 30-40% complete design, requiring pricing assumptions about the design in a competitive bidding environment.

Design and build can be appropriate for novice clients requiring simple projects (Murdoch and Hughes, 2008) and is used extensively in the New Zealand residential sector where building companies offer design and build packages. However, as design complexity increases, so does the need for client sophistication, a detailed design brief and the input of specialist consultants. Design and build is suitable for the following:

- The client wants a clear path for resolving contractual remedies: The head contractor is fully responsible for both the design and the construction.
- The client wants price surety for design and construction before paying for the design. This applies for simple projects on the basis that the client can obtain a fixed price for say a house without first paying a separate designer to develop a design.
- The client does not intend to alter the specification during construction.
- Where the design is straight forward, such as large farm buildings or straightforward houses.

If the amount of input and responsibility for accurate and sophisticated design briefs increases as project complexity increases, employing a design team separately may become a more attractive option. For example, findings by Ling and Leong (2012, p41) that quality is likely to be good when the schematic design is developed to an advanced stage before tendering, indicate that performance of more complex projects likely depends on greater input and control by a client-employed design team. Another consideration is that as project complexity increases so too does the likely amount of contractual administration. There are likely to be more instructions and variations dealings with unforeseen circumstances. A challenge with design and build procurement is that variations can include costs for both construction and design changes. For this reason, Murdoch and Hughes (2008, p51) recommend that 'a client who wishes to reserve the right to alter requirements during the fabrication process should not use design and build.' Therefore, lay-clients of complex builds may require specialist consultants to prepare their design brief, and independently administer the contract and supervise the quality. Ling and Leong (2012) found participants perceive the overall administrative burden of design and build to be about the same as other procurement pathways. A form of ECI where contractors provide planning and buildability input during the design stage, but client control over the design may be preferable for large, complex, innovative or creative design solutions. This may reduce the risk and resource incurred by the client to develop sophisticated brief and performance-based specifications and ensure that any proposed efficiencies by the contractor do not sacrifice design quality. Furthermore, the administrative burden for such projects may be comparable between design and build and other forms of ECI.

3.5 MANAGEMENT CONTRACTING

Traditionally head contractor employees tendered fixed price bids for completed designs and carried out carpentry and concrete works, subcontracting the remainder. In management contracting (MC), the head contractor subcontracts all of the works packages. In practice, head contractors subcontracting all packages has become such a regular feature in the industry that it is 'not easily to discern much real difference in practice' Kirkham (2007, p131).

However, subcontracting all trade packages enables the head contractor employment earlier (during the design stage) based on a management fee, thus a form of ECI. This brings the advantages of ECI. The head contractor can provide input around buildability, risk management, and value management. They can also evaluate subcontractor quotes with the client consultants to iron out any issues earlier thus reducing variations (Mosey, 2011). According to Ashworth (2012, p114) this 'should result in the least expensive cost for each of the trades and thus for the construction works as a whole.'

The distinction between management contracting and construction management (CM) is that under management contracting a head contractor takes single-point accountability for construction, whereas under CM, the client employs all the trade packages directly and a consultant to manage them (Ashworth, 2012; Donohoe and Brooks, 2007; Turner, 1997; Male, 2003; Cox and Champ, 2003). The absolute *fitness for purpose* duty of a head contractor is a higher duty than the *reasonable skill and care duty* required of a consultant manager. Therefore, if the pricing is the same, the reduced risk exposure of MC makes it preferable over CM. According to Male (2003, p205):

Management contracting (MC) and Construction Management (CM) are attempts at increasing the level of integration within the project delivery process. The allocation of risk differs between the two, with the client picking up the work package risks with CM whereas they are allocated to the management contractor under MC.

However, under CM the consultant construction manager (CCM) is not without liability. Standard forms of CM contracts set out express obligations and responsibilities and the Courts have recognised responsibilities such as for; planning, monitoring and controlling activities and procuring construction work, including the responsibility for demarcation between trade packages (*Great Eastern Hotel Company v. John Laing Construction Management*, 2005). The CCM's *reasonable skill and care* obligation is measured what any other reasonably competent professional would have done given similar circumstances and taking into account required standards of practice. Reasonable skill and care is therefore less strict than the commercial liability adopted by head contractors entering fixed price contracts. See Chapter 5. Both management contracting and CM may increase the client's risk exposure by commencing work with an estimated budget rather than a lump sum price. The 1995 version of *Hudson's Building and Engineering* (Wallace, 1995, p434) describe the client's risk exposure under management contracting and CM as follows:

Increased exposure to complex disturbance and delay claims brought by numerous potential plaintiffs and frequently, under modern contribution legislation involving claims between a multiplicity of parties ... The budgetary uncertainty of final cost, and the lack of control over price which tendering procedures would provide, seems to render the arrangements on offer doubly unattractive.

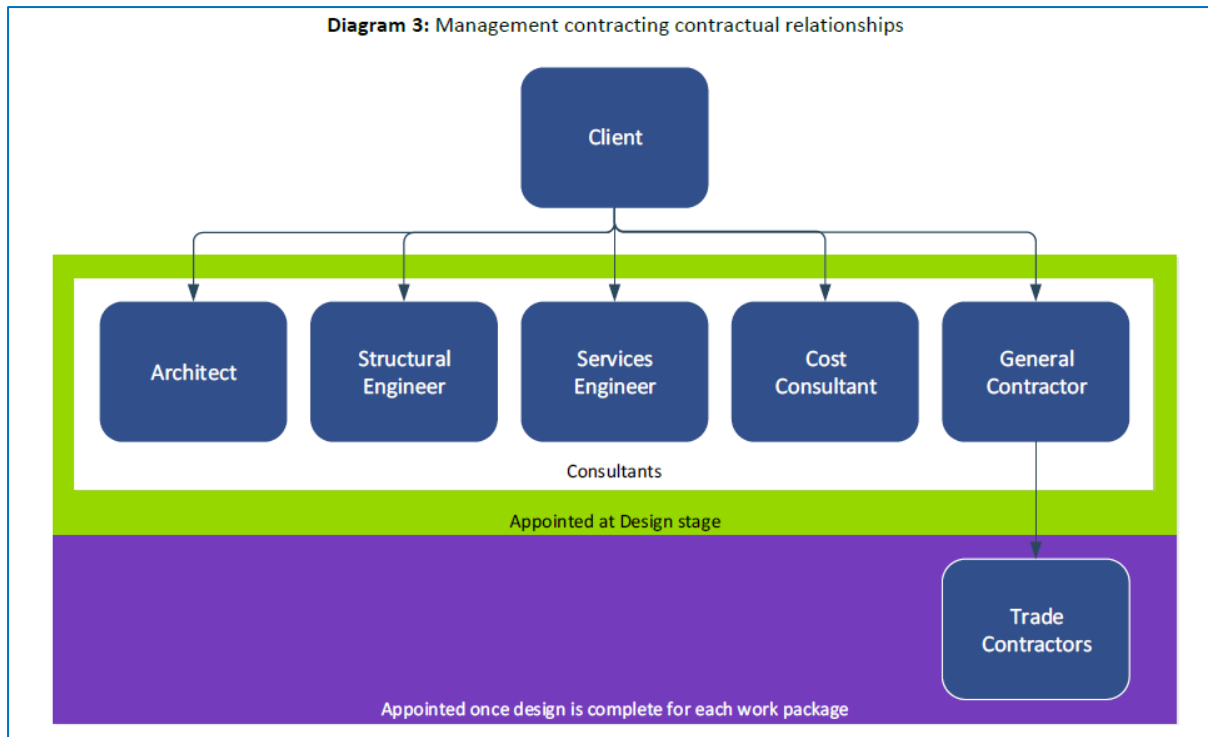


Figure 6: Contractual relationships in management contracting (MC) (MBIE, 2016)

The form of management contracting pricing may be similar with 2S-ECI or CM procurement. Management contracting and 2S-ECI are the same if the head contractor's fee comprises fixed-price P&G and margins, and then a construction contract is agreed. However, the Joint Contracts Tribunal (JCT, 2019) provides a single standard form contract, the *MC Management Building Contract 2011*, which covers both the pre-construction and construction stages (see Chapter 4.3.2). Clients may perceive that under CM they save paying a head contractor profit margin on their subcontractors. However, Ashworth (2012, p114) describes how under MC, the contractor is appointed in a professional capacity for a fee to cover overheads and profit, and that 'the contractor does not, in theory, participate in the profitability of the construction work.' Therefore, the management fee structure of management contracting and construction management may be similar. For example, both fees may incorporate a percentage of the estimated total project cost. Management contracting is suitable for the following:

- Large or complex projects, such as staged alterations to a hospital
- Where the design is to be separated from management
- The client wants the ability to alter the specification during construction
- Speed from conception to completion is a priority
- The client does not require price certainty

The use of management contracting fluctuated, after being introduced in the 1980s, to between around 5 and 15% and by the early 1990s and remained slightly ahead of CM. Ashworth (2012, p87) provides that MC was a procurement method which showed real promise in the 1980's, but peaked in 1989 and has declined ever since. Statistics recorded by RICS (2010) found management contracting to account for approximately 1% of projects procured in the United Kingdom in 2007 and did not feature at all in 2010.

3.6 CONSTRUCTION MANAGEMENT

Unlike, traditional contracting, design and build, and management contracting, there is no head contractor. The client employs the trade contractors directly and a consultant construction manager (CCM) to manage them. The consultant price is a management consultancy fee. This may avoid paying a head contractor profit margin on their subcontractors. However, if the consultant's fee comprises a percentage of the total works, the effect would be the same. It is difficult to compare consultant fees with head contractor pricing. Head contractors seldom declare their profit margins in traditional tenders and market conditions influence their margins. For example, contractors may bid below cost during recessionary markets to maintain resources.

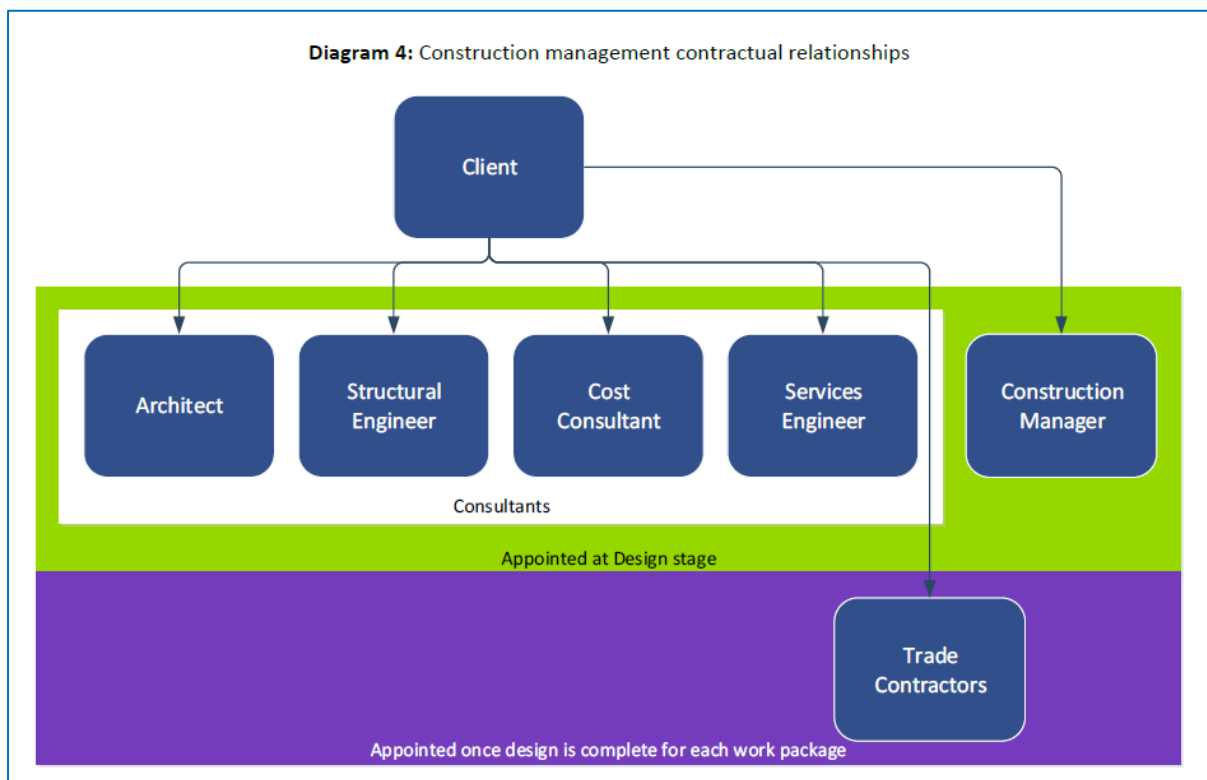


Figure 7: Contractual relationships in construction management (CM) (MBIE, 2016)

CM procurement requires client involvement from clients who are experienced in construction and is not suitable for those clients who are naïve and inexperienced in construction processes (Murdoch and Hughes, 2008; Kirkham, 2007) or where the client is ambiguous, such as comprising multiple stakeholders (Kirkham, 2007). Murdoch and Hughes (2008, p71) warn that for the CM pathway to operate properly, the client must 'take an active role in the management of the process' and have familiarity with both the *product* and the *process* of construction. Construction management is suitable for the following:

- Large complex projects, such as apartment buildings for an experienced developer
- The client has a good knowledge of the construction process
- The design is to be separated from management
- The client wants the ability to alter the specification during construction
- Speed from conception to completion is a priority
- The client does not require price certainty of construction work

Use of CM procurement increased to almost 20% by 1991 in the United Kingdom after its introduction in 1985, before declining to less than 5% by 1993 and now only features on larger

complex projects (Ashworth, 2012). The CM pathway accounted for only 0.3% of contracts by number in 2010 in the United Kingdom or 0.1% project value (RICS 2010).

Previous literature has identified challenges with CM procurement. Kirkham (2007, p132-133) argued that many of the perceived advantages of CM procurement have not been realised and highlights the following difficulties. First CM procurement is only suitable for large complicated projects. Second, traditional standard form contracts are well understood and tried in case law, unlike the more bespoke forms used in CM. Third, CM procurement still relies on satisfactory performance by architects, consulting engineers and the PQS, none of whom are under the CCM's control. Fourth, employment of the specialist contractors remains on a lowest price basis, so usual confrontations apply. Loosemore (2014) found such confrontations to be worse through CM procurement than traditional contracting when trade contractors feel the head contractor, who was a fellow sufferer, becomes isolated from adversarial contract tactics. Newcombe (1994) describes how CM provides a more equitable 'power paradigm' than traditional contracting because the specialist trade contractors (who would otherwise be subcontractors) are moved closer to the client, and the project manager tends to employ charisma and persuasion through modern management concepts to bridge the 'power gap.' However, Newcombe focused only on theoretical concepts from literature on organisational power and ignored the *contractual* power paradigm. In contrast, Mosey (2011) argued that those who portray partnership arrangements as solely requiring a set of values and no formal contract fail to recognise the legitimacy of each party's commercial interests in the project. Furthermore, soft skills, persuasion and charisma may improve relationships regardless of the procurement pathway. Indeed previous research has suggested that team performance and communication can influence project performance more than any particular procurement or contractual system (Dissanayaka, 1998; Walker, 1995). Kirkham argued that total CM project costs are likely to be higher than for traditional contracting due of the added layer of project management. However, this assumes two tiers of manager under CM and one under traditional. CM procurement may simply transfer the construction management functions from a head contract to a contract for services. In any case, Kirkham (2007, p133) concluded that 'it is probably a mistake to employ management methods on moderately sized straightforward jobs which are in no particular hurry.' Nevertheless, CM procurement seems well suited to large developers who have no need to employ a head contractor because their core business is designing and constructing buildings. Calder Stewart may be a good example in New Zealand.

3.7 PUBLIC PRIVATE PARTNERSHIPS

The primary objective of public private partnerships (PPPs) (also known as private finance initiatives (PFIs)) is to encourage private sector investment into major public projects, such as hospitals, prisons, schools, and roads. The provider designs, constructions, and provides services over a predetermined period (design, construct, manage and finance is a variant) (Kirkham, 2007). Procurement procedures are long and complex and contractual relationships are complicated. Kirkham (2007, p137) provides a typical example for where a new hospital building for public health trust;

- A private consortium pays for a new hospital, where the consortium usually consists of a construction company, a bank or financier, a facilities management contractor and consultants.
- The trust then pays the consortium a regular fee for the use of the hospital, which covers construction costs, the rent of the building, the cost of support services and the risks transferred to the private sector.
- Thus in essence, most new NHS hospitals will be designed, built, owned and run by a consortium or grouping of companies.

- The trust will employ some of the staff, mainly doctors and nurses, and will rent the building and other facilities from the consortium for at least 25 years.
- The deal is constructed in such a way that the consortium is guaranteed a full return on costs, including interest on the capital borrowed, plus an element of profit.

While PPPs are advocated for reducing government debt and transferring risk to the private sector, Kirkham (2007, p135) highlights significant debate around the concept of risk transfer. After conducting interviews from two case studies in the US, Jacobson and Choi (2008) found ten success factors relating PPPs: specific plan/vision, commitment, open communication and trust, willingness to compromise/collaborate, respect, community outreach, political support, expert advice and review, risk awareness, and clear roles and responsibilities. Important aspects for construction success included: shared vision between the client, architect, and contractor, open communication and trust, and high levels of compromise or collaboration.

PPPs feature large complex projects by governments wanting to transfer initial investment to the private sector. Only very large projects can accommodate the costly and highly complex contractual arrangements. Therefore, they are not suitable for typical commercial construction projects for infrequent clients.

This section has evaluated the key features of traditional and alternative procurement systems generally defined in literature. The following sections explore theories relating to construction procurement including traditional and relational systems, price-based and value-based systems and transaction cost theory, before exploring the specific advantages and challenges associated with ECI.

3.8 TRADITIONAL VERSUS RELATIONAL PROCUREMENT PATHWAYS

Research has categorised procurement relationships into competitive or relational. Traditional procurement involves competitive relationships (also called distributive, win-lose, or adversarial), parties act in self-interest to maximise profit and secure a larger project share (Lee, Seo, Park, Ryu and Kwon, 2009). Relational procurement pathways focus more on aligning the right contractor with the right client and their project in order to maximise value and reduce conflicts and disputes (Heaphy, 2011a; Heaphy, 2011b; Jelodar, Yiu and Wilkinson, 2016; Mosey, 2011).

Traditional procurement based on competitive tender has long been considered adversarial in nature (Strahorn, Gajendran and Brewer, 2015; Mosey, 2011; Zuo and Zilante, 2006) and criticised for emphasizing cost at the expense of value (Ciobe and Saha, 2009). Based on principles of best practice procurement, the NZCIC (2006, p8) provides that, parties should 'negotiate the fee on a mutually agreed scope of services with the selected firm' and avoid adversarial selection methods that force fees down to the point where providers 'cannot afford to assign properly qualified staff or for sufficient periods' should be avoided. They promote positive relationships, such as partnering philosophies where parties work together in a team environment.

The problems associated with traditional procurement have driven change toward relational procurement pathways. Walker and Vines (1997) found the procurement model and relationships between contracting parties to influence project time performance. Case study research by Eriksson (2010) found partnering strategies with common objectives and target value contracts to improve project success. Strahorn, Gajendran and Brewer (2015) recommend increased trust; a greater emphasis on project team selection in the initial project stages, careful allocation of risks, and clear communication including that of an informal nature

to improve project success. They recommend distribution of authority, mutual objectives, and individual competence and trust to cultivate collaborative environments.

Relational procurement pathways may improve planning and reduce claims and disputes. In traditional procurement, approximately 80-90% of construction work is subcontracted by the head contractor (Hinze and Tracy, 1994) and clients attempt to leverage savings through acquiring competitive pricing from head contractors who in-turn acquire competitive pricing from subcontractors. However, the construction sector is project-based. Each project comprises its own unique goals, objectives, and constraints and requires far more planning and management than manufacturing processes (Pinto, 2015). Schmid (2010) categorized four main types of project risk, (i) performance risk, (ii) default risk, (iii) delay in permits and approvals and (iv) environmental and unforeseen conditions. Pursuing the lowest price over the best quality planning and management may negatively affect project performance. Contractors running at a loss may take shortcuts, or worse, exit the market without completing the project. Reasons for payment problems may arise through ability (cannot pay) or attitudinal (would not pay) (Hughes, Hillebrant and Murdoch, 1998). The increased trust and collaboration of relational procurement pathways should therefore help reduce attitudinal payment problems. However, this relies on parties clearly understanding of their contractual obligations.

The open-book pricing used in 2S-ECI can provide a contractual framework to support supply chain integration (Kings College, 2016). However, researchers have not focused on the contractual and pricing mechanisms to support relational procurement, instead focusing on relationships. Supply chain integration features parties working together on repeat projects. Parties develop better understanding of each other's operations. This improves trust, reduces the distance between organisations and improves communication, and providing early collaborative involvement (Ross, 2011). Interest in supply chain integration arose around the same time as the Latham Report (Latham, 1994). Multiple government reports in the United Kingdom, including the Latham Report, followed by the Egan Report (1998) and restated by Egan (2002) recommended more relational approaches such as supply chain integration and serial tendering. Strategic partnerships feature common goal setting and longer-term relationships. Advantages of relational procurement include; better planning and coordination; economies of scale, reducing unit prices; and improving quality through head contractors partnering with subcontractors and including them in their employee training workshops (Lee, Seo, Park, Ryu and Kwon, 2009). Effective project team relationships is prerequisite to meeting client requirements, while industry fragmentation is one of the most cited reasons for barriers to performance improvements (Ross, 2011). Through supply chain integration, contractors can close the loop on continuous improvement by collecting lessons learnt from project to project, enabling them to plan projects in a more meaningful way and add greater value (Song, Mohamed and AbouRizk, 2009). Therefore, long-term relationships improve project-to-project efficiencies, over appointing a new contractor each time. Song, Mohamed and AbouRizk (2009, p14) defined value-based supplier integration as delivering 'continuous value improvement and cost reduction for both the owner and its suppliers.' Continuous improvement is an iterative process, which is only possible when the same parties are involved in repeating the process. Contractors can benefit from long term relationships through a 'relatively constant' workload and a reduced learning curve (Song, Mohamed and AbouRizk (2009) thus improving certainty of forward work and reducing business risk. They also avoid the cost and uncertainty of pricing work on the tender market.

Despite the advantages relational procurement, there are challenges to its use. Menches and Chen (2012) provide that while integrated project delivery (IPD) systems may improve collaboration and early decision-making, their implementation may not be as effective as envisioned. Barriers may include public bodies statutorily prohibited from entering into such risk-sharing agreements, and countless others remaining sceptical of their practicality.

Building inter-organisational long-term relationships may be time-consuming and costly and may not actually ensure better project performance. Lee, Seo, Park, Ryu and Kwon (2009) challenged the assumed advantages of strategic partnership arrangements between head contractors and subcontractors using theoretical transaction cost modelling. They found that partnership relations are only superior when head contractors incur a low 'shirking' cost of subcontractor opportunistic behaviour, the advantages of partnerships decrease as the proportion of labour increases because partnerships require more head contractor effort to manage subcontracted work; and in partnerships the higher the coordination costs, the lower the transaction costs incurred by the head contractor. However, their modelling was based on artificial cost values, the assumption that head contractors are able to choose the subcontractor's performance level in competitive relationships, and that head contractors prefer competitive relationships over relational. Clients not contractors (Ross, 2011) generally drive strategic partnerships. It is therefore difficult to see how head contractors are able to choose their subcontractor's performance level when driven to accept the lowest prices in competitive tender situations. In negotiated procurement, head contractors have more ability to select reliable subcontractors (thus subcontractor performance is not a constant variable across traditional and relational procurement). Moreover, supply chain integration can incentivise parties through long-term relationships over short-term opportunism. Improved reliability should theoretically reduce the amount of effort involved in managing subcontractor work.

Some research has found that the quality of relationships (particularly the relationship with client representative) can influence project success more than the particular procurement model or form of contract (Masterman, 2002; Dissanayaka, 1998; Walker, 1995). Menches and Chen (2012, p1044) argue that collaborative principles may be introduced into traditional contracting 'and thus harness the strength of teamwork and collaboration to produce a positive outcome.' Toolanen (2008) found trust to be the basic pillar of any procurement model and governance structure and Strahorn, Brewer and Gajendran (2015) found that individual personalities and risk apportionment influenced trust more than the degree of relational versus transactional procurement. Bresnen (1991) found that parties' aims and incentives could have a greater impact on project success than the procurement and contractual framework. In a case study of an early construction management at risk (CM@R) project (US equivalent of management contracting), despite late budget cuts, late appointment of the head contractor, design management problems, and lack of familiarity with a new procurement process, project completion was within time and budget. Bresnen (1991) concluded that CM@R might have been the best strategy for the project, but that the contractor's late involvement in the design process meant the procurement system was not the sole reason for project success. Rather, the shared incentives between the contractor and design team were greater influences. The designers and contractor were both eager to please the client with the lure of forward working and formation of long-term client relationships. Bresnen (1991, p261) argued that 'the organization which is able to use dependant suppliers, present a united front and clearly specify contractual terms and conditions is more likely to be at an advantage when it comes to controlling work on a large-scale, complex project.' However, not all clients can offer the incentive of large volumes of return work. It is however important to align each party's roles with their respective interests and liabilities. An example of a potential misalignment between parties' incentives is budget advice. A consultant may provide an intentionally high budget so that the project finishes within budget, making themselves look good without actually improving efficiencies (Kirkham, 2007). According to Sidwell (1983), 'even cost and time are not totally reliable indicators since expression in terms of cost and time over-run must be weighed against the accuracy and robustness of the forecast.' Again, it is difficult to evaluate the effect of procurement pathways on project success without clearly understanding the contractual framework through which the parties engage.

Studies show the importance of client involvement and common objectives in relational procurement. Ma and Xin (2011) case studied a \$100 million complex project involving a new

tram system and associated roading and bridge works, by interviewing the project manager, and found a key feature was client commitment toward establishing cooperative relationships, and involving members of their own staff in project leadership team. Rahman and Kumaraswamy (2005, p370) found interviewees strongly recommended that clients should lead relational contracting through teamwork, but that this requires all the contracting parties to share the same perceptions and attitudes. This aligns with other assertions that relational contracting requires active client leadership (Kings College, 2016; Ibbs, *et al.*, 2003). Specific recommendations for integrated project teams from interviewees about contracting practices (Rahman and Kumaraswamy, 2005, p370) included 'knowledgeable clients, fairer risk allocation, risk sharing, [and] whether the parties are properly paid'. Research has not focused on the contractual provisions for managing risk or pricing and payment.

It seems generally agreed that different procurement strategies may provide successful outcomes so long as all other aspects of the project have been handled correctly and the project team performs well (Masterman, 2002, p186) (the contingency theory). Therefore, if levels of trust and communication are equal, then the procurement strategy should influence project success. If the choice of procurement strategy is not important, then all construction work could simply be performed using one strategy, such as design and build. Ultimately, the procurement strategy establishes project team appointment, parties' responsibilities, and the allocation of risks and incentives. Rahman and Kumaraswamy (2005, p368) found the top 13 (of 25) ranked items for successful relational contracting were:

1. Mutual trust
2. Open communication among parties
3. Understanding each other's objectives
4. Equitable and clear allocation of foreseeable and quantifiable risks
5. Attitude of the project participants
6. Readiness to compromise on unclear issues
7. Awareness of risks and rewards
8. Effective co-ordination
9. Collective responsibility instead of individual responsibility
10. Alignment of objectives
11. Professional ethics
12. Agreed process for dispute resolution
13. Frequent and informal meetings

What is not yet clear is the contractual framework to support 2S-ECI procurement in NZ. Previous research has studied the perceptive effects of relational approaches to project success, largely without considering the contractual systems used to employ the consultants and contractors. For example, whether competitive fixed pricing or negotiated open-book. Cost reimbursement contracts enable negotiated agreement prior to full design and may be preferable for dealing with uncertainty, however more auditing work is required and there is less cost certainty than lump sum contracts (Bajari and Tadelis, 2001). A procurement pathway that combines partnering collaboration and transparency of cost reimbursement with competitive fixed-pricing across the supply chain and avoid time-consuming auditing seems optimal.

3.9 PRICE-BASED VERSUS VALUE-BASED ENVIRONMENT

A classic problem in construction is the adversarial environment and extensive use of lowest price tendering. In recessionary markets, contractors may price below costs to remain in business. Low prices may seem attractive. However, appointing a contractor at a loss can have disastrous consequences if they become insolvent midway through the project (Heaphy,

2011a). The construction sector is sensitive to boom-bust cycles and economic recessions (Allan and Yin, 2010) and features high rates of business failure (MBIE, 2015; Dikmen and Birgonul, 2010) particularly amongst smaller enterprises (Caulfield; 2008). Low entry barriers add to industry competitiveness (Ramachandra and Rotimi, 2015), and procurement is highly fragmented (Dikmen and Birgonul, 2010), typically employing five times more independent contractors than other industries (Loosemore, 2014).

Researchers, industry bodies, and government reports (NZIA, 2013; Kashiwagi, Kashiwagi, Savicky, 2009; NZCIC, 2006; Latham, 1994) have proposed moving toward value-based procurement. In their 2013 response to the New Zealand Ministry of Business Innovation and Employment (MBIE) (2013b) about government procurement practices, the New Zealand Institute of Architects (NZIA) (2013) called for 'best value to be the goal when procuring consultancy services.' The NZIA defined best value as; purchasing a service that delivers the optimal outcome, and is cost-efficient, after taking in to account the following non-financial attributes:

- Quality
- Impact on communities and the environment
- Design integrity
- Innovation
- Whole-of-life considerations such as maintenance
- Training and development opportunities
- Excellent health and safety practices, and
- Capital invested

This appears to have been taken from the NZCIC (2006, p2) definition of 'best value', which adds an equitable focus; 'it provides a fair return on capital and efforts for all parties, and is the result of a process that is mutually satisfying to all parties involved.' Kashiwagi, Kashiwagi, Savicky (2009) argue that lowest price procurement forces providers to allocate their cheapest staff on projects, because they cannot compete based on value services. In contrast, negotiating fair and reasonable profits enables contractors to invest in resource and reduces their exposure to the boom-bust cycles of the sector (Zuo, Wilkinson and Seadon, 2013). The NZCIC (2006, p7) recommend that selection processes:

do not force fees down to the point where service providers cannot afford to assign properly qualified staff for sufficient periods of time. Inadequate fees can lead to the reduction of the scope and quality of the work, by spending less time on the project, assigning sub-standard materials, or assigning lower paid (usually less qualified) personnel.

Recent studies have demonstrated a move toward value-based procurement. Zuo, Wilkinson and Seadon (2013) found that procurement practices between clients and contractors in post-earthquake Christchurch had largely u-turned from selecting lowest price conforming bids to more relational negotiated procurement strategies. Demand exceeding supply was a main driver, meaning competitive pricing would no longer provide best value for money. Whitehead (2009) described the same driver for two-stage ECI in Australian infrastructure.

Value-based criteria can form the basis of contractor selection in any procurement pathway. Research has struggled to establish the optimal pricing procedures to support value-based procurement. Edward (1997) describes how enabling US authorities to procure on quality attributes enabled designers and contractors to work as a single entity in design and build projects, encouraging innovation and avoiding conflict. Contractors were short-listed through a two-stage tender. After shortlisting, the contractors' detailed proposals were evaluated against weighted criteria for 'best value' not just lowest price. Alternatively, tenderers bid on

performance based specifications. However, Edward (1997) acknowledges that evaluating value-based proposals is not as simple as lowest price selection and that value-based procurement is as much an art as a science, as suggested by the term used to describe the approach 'competitive negotiation.' Contractor experience and expertise is clearly important for providing planning input during the design stage. 2S-ECI may provide the balance between competitive fixed-pricing and relational collaboration through competitive fixed-price P&G and margins, and then a fixed-price construction contract.

3.10 TRANSACTION COST THEORY

Williamson (1981) who applied economic theory to the structure of firms introduced transaction cost economics (TCE). Transaction costs are based on; bounded rationality, opportunism, uncertainty, frequency of transactions, and asset specificity (Lee, Seo, Park, Ryu and Kwon, 2009). Bounded rationality refers to people's limitations in memory and cognitive processing and inability to consider all possible alternatives. Opportunism recognises people acting with self-interest and their potential to exploit another party by taking advantage of unforeseen circumstances. Frequency refers to the frequency of transactions. Firms who use services frequently may decide to perform them in-house. Uncertainty recognises the difficulty in forecasting possibilities during the transaction. Bounded rationality and opportunism can influence uncertainty. Asset specificity refers to investments in transaction specific assets that may improve efficiency, but that the other party may jeopardise value by threatening to walk away from the relationship. When outsourcing goods, transaction costs include the costs of procuring contractors, contract management, performance measurement and dispute resolution, including variables that result in unexpected cost overruns (Lee, Seo, Park, Ryu and Kwon, 2009). Standardising procurement systems should reduce the people's limitations in learning and remembering bespoke processes, reduce opportunism and exploitation, cater for clients employing frequently and infrequently, and mitigate each parties' risk of early-termination by the other.

The effect of 2S—ECI on transaction cost has not been established. Mohammed *et, al.* (2015) developed and tested a theoretical model in order to compare the transaction costs (TCs) between traditional procurement and design and build. The framework (p247-9) aligns 11 indicators (constructs) with four latent variables (pre and post-contract TCs). The latent variables include Pre-Contract TCs; information cost (INFO), procurement cost (PROC), and Post-Contract TCs; administration cost (ADMIN), and enforcement cost (ENFO). Mohammed *et, al.* (2015, p261) used the model to ground the following hypothesis:

- H1. Procurement system has a positive effect on information cost. Project complexity and certainty is the main contributor, regardless of whether procured through traditional or design and build.
- H2. Procurement system has a positive effect on project procurement cost. Both human and environmental uncertainties were the greatest contributors to procurement cost.
- H3. Procurement system has a positive effect on contract administration cost. Conflict, disputes, and decision-making are the main contributing factors influencing contract administration cost.
- H4. Procurement system has a positive effect on contract enforcement cost. Conflict, disputes, and decision-making are the main contributing factors influencing contract enforcement cost.

- H5. Transaction costs are higher in the traditional systems than in design and build systems. Based on a case study comparing a project manager's time-spent on procurement activities as a surrogate for cost, TCs represent 18.5 percent of a project manager's annual salary in the traditional system, and 14.5 percent in the DB system.

Given the above, it follows that a procurement system that reduces the following variables and constructs (see Mohammed, *et al.* 2015, Table 1, p249) should reduce the pre- and post-contract transaction costs:

- Information cost (information gathering)
- Project procurement cost (attending meetings, translation of client's needs, training, project preliminary design, transition observation, site visits)
- Administration cost (contract administration, decision-making, conflict resolution)
- Enforcement cost (contract enforcement, verifying compliances)

Research has found that 2S-ECI can reduce uncertainty, contractor claims, and disputes (Mosey, 2011; Whitehead, 2009) (ADMIN and ENFO costs). Therefore, if the information cost and project procurement costs remain constant, then 2S-ECI should reduce the TCs compared with traditional systems. However, the effect of 2S-ECI on procurement costs depends on such factors as how or whether payment to the contractor for their early involvement, the scope of their pre-construction services and the extent of real value added. The level of client involvement and an agreed pre-construction programme are further drivers of ECI success (Kings College, 2016) and so likely influence project procurement costs. Administration costs may reduce through 2S-ECI by ironing out issues to reduce claims and disputes (Mosey, 2011). However, the form of construction contract and pricing influences administration. For example, a cost reimbursement contract will require substantially more payment auditing (Menches and Chen, 2012, p1046) than monthly claims against a fixed price contract. It is therefore difficult to compare the effect of 2S-ECI on procurement costs with traditional procurement pathways without a clear contractual framework of 2S-ECI to form the basis of comparison.

3.11 ADVANTAGES OF ECI

Previous studies identified a range of benefits through ECI over traditional procurement generally linked to the contractor's buildability input to design. The contractor is responsible for 'how' the design is constructed. Combining the designer and constructor's knowledge can improve design buildability. Traditional procurement systems often rely on the architect as a third party supervisor to assure quality. However, architects may lack expertise in buildability issues or sufficient resources to make timely responses to problems onsite (Hardie and Saha, 2009). Mosey (2011, p10) warns of the temptation in single-stage tendering for consultants to develop construction programmes that meet the client's needs without input from those actually performing the work. The Chartered Institute of Building similarly found problems with construction programmes prepared by programmers in isolation from those doing the work (Pickavance, 2009). The increased size, complexity and specialisation within the construction industry has contributed to the need for early involvement of head contractors and specialist subcontractors in order to achieve structures which were previously unimaginable (Song, *et al.*, 2006). In modern construction more work is being designed by subcontractors (RIBA, 2009; Tommelein, Kirkendall and Ballard 2001). This necessitates a method of employing contractors during the design phase for both design and construction obligations. Contractors design evaluation can include resource availability, costs and performance, access, and site conditions (Song, *et al.*, 2009, p13). Song, Mohamed and AbouRizk (2009) observed savings on actual projects where contractors were involved in design, including; reduced design errors, more standardisation, and prefabrication delivered on schedule. Steel Construction New

Zealand (SCNZ, 2017) provided a market update to August 2017 showing strong commitment, but significant spare capacity of steel. They conclude that:

Additionally, fabricators report a significant upturn in demand but not, as yet, committed workload. Early contractor involvement (ECI) adds value to projects and the practice is growing – ECI allows lead contractors to ensure adequate resources are assigned to maintain their excellent performance in a rising market.

Turner and Riding (2015) provide an example of buildability input through ECI where a ventilation system for a new road project in 2000 reduced the specified three-monthly maintenance times down to 20 minutes instead of hours. They also provided an example of a design error in the absence of ECI, involving two gas-processing units constructed too closely to enable a crane to operate between them.

Research has found that ECI can improve cost and time certainty (Francis and Kiroff, 2015). ECI can maximise the amount of change when the cost of change is least. Once detailed design is complete, the opportunity to make value-adding changes decreases and the cost of change becomes more expensive (Kirkham, 2007). Mosey (2011, p4) argues that the single-stage approach excludes the contractor and their subcontractors and suppliers from making meaningful contributions to design, risk management, programming or achieving cost savings. Relying on competitive bidding is inefficient for procuring customized products in Lean Construction (Elfving, Tommelein and Ballard, 2005). Ma and Xin (2011) highlight how in traditional tendering, contractors typically have perhaps a one-in-three chance of winning the contract, making it a waste to invest their own significant resources on investigation and design analysis. Involving contractors during design development, in a collaborative project team environment, reduces the risk of contractor's bidding low in a single-stage tender with a view to maximise profits through aggressive claiming (Heaphy, 2011a). If fixed-price offers are based on incomplete information, the client may receive a false sense of security as the contractor may exploit errors and omissions through claiming variations, the client has no way of knowing whether their consultants may have made such errors or omissions when they appoint the contractor (Mosey, 2011). Vidogah and Ndekugri (1998) argue that disputes reduce through developing relationships with contractors who adopt sound claim management practices and by agreeing costs that are usually in contention within the contract. They found the most contentious costs relate to; the cost of preparing claims, overhead costs, and time-related preliminary costs. To do this, they recommend (i) placing greater emphasis on the contractor's quality of claim management practice and information systems, (ii) requiring that contractors provide a schedule of preliminaries to provide transparency around overheads and time-related costs (iii) implementation of electronic documentation management systems by contractors, and (iv) stricter contract provisions around programmes, timesheet and content of claims. 2S-ECI may support this, particularly (i) and (ii). Contractor reliability and performance are prominent in 2S-ECI. Contractors could provide a P&G schedule for the pre-construction stage pricing for transparently calculating costs relating to claims for delay or disruption.

2S-ECI may improve certainty of project outcomes through more equitable planning and risk management. Rahman and Kumaraswamy (2005, p367) found that the majority of 92 industry respondents across 17 countries (62 from Hong Kong and 30 from other countries, including 12 from Europe and five from the USA) recommended involving consultants and head contractors and (to a lesser extent) specialist subcontractors and suppliers during the early project stages to jointly manage risks effectively. All parties benefit from well-planned projects with fewer risks and from the early collaboration, which can build relationships, iron out issues, and reduce disputes throughout the project (Mosey, 2011, p15). Contractors can provide specialist buildability knowledge to foresee and manage risks and maximise value (Laryea and Watermeyer, 2016; Pheng, Gao and Lin, 2015; Mosey, 2011; Rahmani, Khalfan and Maqsood, 2014; Song, et al., 2006).

2S-ECI may duplication in tendering costs across the construction sector. The *Project Procurement and Delivery Guidance Using Two Stage Open Book and Supply Chain Collaboration* (King's College London, 2014) provides that 'the two—stage open book model reduces industry bidding costs.' When tendering for the pre-construction stage, contractors only need to price P&G. Then only the successfully contractor works with the integrated project team toward selecting the subcontractors and suppliers and establishing a construction stage price. This suggests that greater use of 2S-ECI could reduce tendering costs across the sector.

Contractors can also benefit from ECI. Through providing more services, achieve sound profit margins, and improve client satisfaction, helping toward establishing long-term relationships with clients and designers, thus increasing their capability for securing future contracts (Rahman and Alhassan, 2012; Song, et al., 2006). Rahman and Alhassan (2012) found the following advantages from a head contractor's perspective in order of descending importance; potential to improve relationships, collaborative risk management, enabling contractor expertise in design buildability, overall improved project delivery, more opportunity for innovation, less adversarial relationships, increased customer satisfaction, increased understanding of parties, risk exposure, reduced over-runs/time/cost/conflict, and sound profit margins. Francis and Kiroff (2015) found the following perceptions of ECI from designer's and contractor's perspectives in the Auckland commercial construction market based on the enhanced design and build model (which they asserted is the most commonly used model in New Zealand commercial construction). Designers reported higher profits due to working through design options collaboratively. However, contractors reported that design and build either had no effect on profitability or potentially less profitable due to greater risks. Most respondents agreed that project completion was more likely to be within time and budget, design and build provides earlier cost certainty, and that designs are likely to be cost effective. All generally perceived contractor's design input as a positive aspect. There was little consensus about the effect on quality due to the difficulties in measuring and defining quality. Contractors found they could better manage risk. However, these findings relate to design and build procurement, under which the contractor is responsible for both design and construction. Under 2S-ECI, the contractor may only be responsible for construction only. Design and build features early cost certainty because the client can obtain a quote for design and build without first paying for the design. The form of contract and pricing may also influence findings, for example, whether the construction price is fixed lump sum, target value or a guaranteed maximum price.

Whitehead (2009, p23-24) provides the following benefits of 2S-ECI (paraphrased):

- Reduced pre-tender costs: The detailed design is not required prior to the tendering process. In an overheated market, this also helps reduce demand on resources and duplications of roles.
- A team approach: The collaboration between client, contractor and consultants can help to build working relations and communications and improve staff retention.
- Experienced harnessed early: The experience of both the client and the contractor is harnessed during the design development stages of the project at which time it can achieve the greatest impact.
- Increased opportunity for innovation: There is greater flexibility and opportunity for innovation because the design has not fully developed.

- Increased decision-making: The early cooperation between the parties enables effective decision-making and approvals.
- Earlier procurement of materials: The early collaborative planning and faster decision making enables earlier procurement of materials. This is particularly beneficial for materials with long lead delivery times.
- Shortened delivery times: Work can commence on stages while the design and documentation for later trade packages is developed.
- Better integration of construction methods: The collaboration between all parties provides for the integration of construction methods with the design.
- Sustainability: The early collaboration of the project team can enable parties to develop new ways of working across the client organisation and to ensure fulfilment of sustainability goals.
- Reduced risk of 'surprise': Risks can be reduced through improved communications and understanding by all parties about the project and its requirements and costs.
- Fewer variations during construction: The greater understanding about the project by all parties and reduced risks reduces the number and cost of variations during the project.
- Realistic price: The contract price should be realistic, without an excessive contingency, but not so low as to lead the contractor focus on pursuing claims throughout the project.

Kumaraswamy (1997) identified through data collection and questionnaires the following top ten causes of claims in the Hong Kong construction as perceived by contractors, clients and consultants, in descending order of significance:

- Inaccurate design information;
- Inadequate design information;
- Inadequate site investigations;
- Slow client responses;
- Poor communications;
- Unrealistic time targets;
- Inadequate contract administration;
- Uncontrollable external events;
- Incomplete tender information; and
- Unclear risk allocation.

These causes of claims may reduce through the benefits identified by Whitehead (2009) around early planning, design buildability input, and more collaborative decision-making and risk management. Mosey (2011, p6) also argued that many of these causes would be less likely if the client entered into an early relationship with the head contractor (and consultants, subcontractors and suppliers as appropriate). This would enable the following to occur during the pre-construction stage:

- Joint design review and development, whereby there is an opportunity for the main contractor and its specialists to comment on buildability and affordability and to offer alternative solutions (causes 1 and 2);
- Second-stage supply chain tendering to encourage the main contractor, after first-stage selection, to price or re-price works packages by means of subcontractor or supplier tenders, working jointly with the client so as to iron out errors or omissions in the brief and achieve accuracy in the flow-down of risk (cause 9);
- Joint risk management, whereby the main contractor can make proposals for early risk reduction actions rather than just quoting risk contingencies (causes 3, 8 and 10);
- Advance agreement of a construction phase programme, identifying contractual deadlines for key client, consultant and contractor activities (causes 4 and 6);
- Development and implementation of a communications strategy during the pre-construction phase, with clear delegated authority, early warning mechanisms and advance notification of the cost of variations (cause 5);
- Closer client involvement with its project team, for example by attendance at key meetings, commencing during the pre-construction phase to ensure access to information other than only via the contract administrator (cause 7).

A pre-construction services agreement (PCSA) to support 2S-ECI overcomes more bespoke contractual agreements, such as letters of intent. Mosey (2011, p7) provides that a 'conditional' (pre-construction) contract can provide a contractually robust alternative to a letter of intent when a contractor can be appointed before full project documentation is complete. The conditional contract can recognise outstanding matters which prevent the parties from concluding the contract unconditionally, providing contractual machinery to move the contract from the conditional to unconditional, and express a clear contractually enforceable timetable. However, the PCSA can specify the scope of pre-construction services, parties' obligations and pricing provisions. A standard form PCSA reduces the need for parties to draft or learn new documentation for each project. See benefits of standard form contracts in Chapter 3.20.

3.12 LEAN CONSTRUCTION PRINCIPLES

Integrating design and production has been a principle of lean design and construction inspired from Toyota Production System. Lean Construction principles focus on creating efficiencies through removing wastage from all stages of the supply chain. A key focus is cooperative and partnering relationships, combining various individuals' competencies into joint-problem-solving (Jorgensen and Emmitt, 2008) and involving specialist contractors in the design process (Gil, et al., 2004, p496). Jorgensen and Emmitt (2007) found through ethnographic case studies that crucial factors influencing effective lean integration include; identifying client values, project team and planning process, transparent decision-making, management and leadership, continuous learning, and establishing an appropriate project delivery framework. Delivery frameworks are defined by Jorgensen and Emmitt (2007) as the incentives, agreements, resources (incl. time, financial means, and human and organizational resources), contracts etc. supporting design/construction integration and an overall lean approach.

Prior research has correlated the benefits of ECI and Lean. Pheng, Gao and Lin (2015, p831) concluded that ECI may help improve productivity through Lean Construction. They correlated the benefits of ECI with the 11 Lean principles that focus on process design flow and improvement; reducing the share of non-value adding activities; increasing output value through systematic consideration of customer requirements, reducing variability, reducing the cycle time; simplifying by minimizing the number of steps and parts, increasing output flexibility, and increasing process transparency. ECI had particular potential for reducing

variability and cycle time, minimizing steps, and increasing output flexibility. However, they concluded that this requires raising building professionals' awareness of both Lean and ECI. One potential benefit of ECI not mentioned by Pheng, Gao and Lin (2015) is the reduction in non-value-adding activities because only the one head contractor already employed for the pre-construction stage, prices the second-stage construction works. This reduces duplication of multiple contractors bidding through the tender market. This supports (Elfving, Tommelein and Ballard, 2005)' argument that competitive bidding is inefficient for procuring customized products in Lean Construction (Elfving, Tommelein and Ballard, 2005).

3.13 PROJECT TYPES SUITABLE FOR ECI

Prior research has linked ECI application to high-risk projects that benefit from buildability input, but not actual project types or what 'buildability' input actually means. According to Rahman and Kumaraswamy (2005, p370) non-traditional procurement systems are needed on projects where contractor's inputs are needed 'on buildability, construction methods and risk management at earlier project stages'. Ma and Xin (2011, p83) concluded that ECI is best suited to projects with uncertainty (where tender prices would otherwise be high to reflect the uncertainty), but smaller than a typical alliance projects, featuring ongoing relationships or pain/gain share pricing. The New Zealand Transport Agency (2018) recommends ECI for projects featuring scope uncertainty, that may benefit, from fast-tracking, constructability input, and engaging work packages during the design stage.

ECI open-book negotiation can support ongoing client and contractor relationships. The open-book pricing of 2S-ECI may be suitable for securing resources in boom markets where contractors may either bid high prices in competitive tenders, or not bid at all. Zuo, Wilkinson and Seadon (2013) found procurement practices between clients and contractors in post-earthquake Christchurch largely u-turned from selecting lowest price conforming bids to more relational negotiated procurement strategies. A key driver was demand exceeding supply, meaning competitive pricing would no longer provide best value for money. Whitehead (2009) described the same driver for two-stage ECI in Australian infrastructure. However, the actual effect of ECI is yet to be determined. Relational and open-book procurement may provide lower pricing during boom markets (Zuo, Wilkinson and Seadon, 2013; Whitehead, 2009). However, recessionary conditions may drive contractors' pricing to break-even point or even below. Heaphy (2011a) found that even when contractors price below cost during recessions, the final project might cost more than target-value reimbursement contracts, due to contractor aggressive variation claiming. However, Ross (2011) challenged the assumed benefits of supply chain management during economic recession, and called for further research in this area, highlighting the lack of empirical evidence. McDermott and Khalfan (2006 p50) argued that procurement strategies such as partnerships and strategic alliances are best reserved for large public clients who can leverage better pricing, whereas, most lay private clients are unlikely to be in such a position of dominance over the supply chain due to their 'ad hoc construction profile and limited understanding of the marketplace'.

3.14 PRICING PROVISIONS

The Department of Building and Housing (DBH) Building and Construction Taskforce (Constructing Excellence in New Zealand, 2009 p16) recommended two-stage ECI for; providing price quality, allowing a target price, being quality-based, while also enabling lowest conforming pricing. They recommended that stage 1 pricing should be quality based. In their evaluation of delivery models, *two-stage ECI* and *negotiated tender (preferred list)* are the only two models recommended against all four criteria of model selection. *Negotiated tender*

(preferred list) (also known as selective tendering) is used where the tenderers are known to the client and have been pre-qualified and proven to be equally capable of delivering the project.

Based on the author's ethnographic experience working as a Contracts Manager for a tier 1 head contractor in New Zealand (2003 – 2009), the first-stage pricing of 2S-ECI commonly comprises the following:

- I. A lump sum price for the preliminaries works for the whole project where construction work is staged;
- II. A lump sum price for the construction of any first stage for which design is already developed (for example where the project is released in stages);
- III. Percentages to be applied for onsite and offsite overheads and profit to be applied to variations and subcontractors to be procured;
- IV. Negotiated rates for any direct construction works (for example carpentry and concrete) based on conceptual design;
- V. Non-price attributes such as a base construction program, methodology, and history of similar past projects.

Lump sum contracts provide price surety before work commences. The contractor has narrow grounds under which the contractor can claim additional costs or time. In cost reimbursement contracts, contractors are reimbursed for actual time and materials incurred, typically based on agreed rates and percentages applied to materials and subcontractors. However, this may incentivize the contractor to overspend (Turner, 2004). A target value or guaranteed maximum price can help align goals through gain-share / pain-share provisions. However, cost reimbursement contracts require extensive payment auditing (Menches and Chen, 2012, p1046). Using case study interviews and questionnaires, Menches and Chen (2012, p1047) found that clients adopt substantially more risk under cost reimbursable contracts, but that in return, clients (i) receive more information and cooperation from the contractor and (ii) greater involvement in decision-making and control over progress and productivity.

One argument for partnering with open-book pricing is that the lack of defined scope at the time of early involvement prohibits competitive pricing (Alhassan, 2012, p218). Ma and Xin (2011) provide how, in Australia, contractor selection for the first-stage is a non-price selection process based on capability of the project team. They identified that a key challenge can be developing the scope and a cost estimate when the contractor appointment is very early in the design stage, and without any competitive pricing. The project manager interviewed felt that given the uncertainty, ECI is not suited to all projects. The most difficult part of the process was the transition between stage 1 and stage 2. However, lump sum pricing can be determined for preliminary and general works so long as sufficient concept design exists to establish such requirements such as management, supervision, insurances, and temporary works. Head contractors declare margins for profit and overheads to apply to subcontractors and variations and a lump sum construction price for any first-stage work already designed or fixed rates for carpentry and concrete works against a provisional schedule of quantities. Once the design is developed, provisional quantities are re-measured to produce a bill of quantities applying the rates of the original tender (see Pheng, Gao and Lin, 2015) and arrive at a lump

sum construction price. This may increase the work of the PQS to measure provisional quantities and negotiate contractor rates. However the provisional quantities could be measured by a consultant PQS or the contractor. The client or consultant will need to check the accuracy of the contractor's final quantities. Indeed, Ma and Xin (2011) found that engaging an independent estimator was an important feature of ensuring a realistic price by the contractor. What is not yet clear is the perceptions of 2S-ECI pricing arrangements in New Zealand.

3.15 PRE-CONSTRUCTION SERVICES

Through 2S-ECI, contractors provide a range of pre-construction services before agreeing a construction contract for the construction stage. Table 1 presents a list of pre-construction services coded from literature review. Services have been categorised under design management, planning and scheduling, financial, and supply chain procurement.

Table 1: Pre-construction services

Pre-construction services	Sources
Design management	Tzortzopoulos and Cooper (2007); Sidwell (1983)
Plan and co-ordinate design	Tzortzopoulos and Cooper (2007)
Stakeholder management and communications strategy	Tzortzopoulos and Cooper (2007); Mosey (2009); Education (2016); Berends (2006)
Develop design brief	Tzortzopoulos and Cooper (2007); Education.govt.nz (2017)
Construction planning	
Planning and sequencing construction activities	El-sayegh (2009); Mosey (2009); Kashiwagi, Kashiwagi and Savicky (2009); Sidwell (1983)
Buildability evaluation	Laryea and Watermeyer, (2016); Pheng, Gao and Lin (2015); Rahman and Alhassan (2012); Mosey, (2011); Rahmani, Khalfan and Maqsood (2014); Whitehead (2009); Song, et al. (2006); Jergeas and Put (2001); Sidwell (1983)
Financial	
Budget advice	Kirkham (2007); Laryea (2010); Sidwell (1983)
Value management	Mosey (2011); Kirkham (2007); Whitehead (2009); Jergeas and Put (2001); Kashiwagi, Kashiwagi and Savicky (2009)
Risk management	Rahman and Alhassan (2012); Mosey (2009); Education.govt.nz (2017); Jergeas and Put (2001); Kashiwagi, Kashiwagi and Savicky (2009)
Supply chain	
Subcontractor and supplier procurement	El-sayegh (2009); Whitehead (2009); Mosey (2009) ; Sidwell (1983)

El-sayegh (2009) conducted an extensive literature review, including research papers, guidelines from professional societies and several requests for proposals, to identify selection factors when evaluating firms for construction management at-risk (CM@R) (the US equivalent of management contracting or 2S-ECI) then construction professionals ranked the factors. Table 2 categorises the 20 factors identified by El-sayegh (2009) into 12 general factors that could apply to all procurement models and eight factors that are more specific to ECI. The values beside each factor represent the priority weighting relative to the whole selection criteria.

Table 2: Selection factors relative to ECI

ECI specific	General

<i>Firm characteristics:</i>	
Firm experience (0.05)	Firm organization (0.04)
Technical ability (ability to add innovation) (0.06)	Classification and reputation (0.04)
	Financial standing (0.04)
<i>Commercial and technical bid</i>	
Shortest completion time (0.06)	Financial bid-lowest price (0.02)
Ability to meet schedule (0.05)	Ability to meet price (0.04)
Technical bid (0.04)	
<i>Construction management services</i>	
Construction management methodology (0.07)	Construction phase experience (0.06)
Pre-construction phase experience (0.06)	
CM key staff (0.07)	
Performance on previous projects (0.08)	
<i>General contracting services</i>	
Proposed construction methods (0.04)	Key staff and personnel (0.04)
Subcontracting strategies (0.03)	General contracting experience (0.05)
	Proposed construction resources (0.05)

From Table 2, the important pre-construction services from a head contractor are; time planning, providing technical solutions, developing construction methodologies; and procuring subcontractors. While not stated, examples of providing innovative technical solutions could include analysing design alternatives and proposing alternative solutions. This would form part of the value management process and buildability evaluation. When considering head contractors for ECI, the firm's experience and quality of key project staff are important attributes.

Some of the specific factors could also apply generally, such as firm experience. However, the context of the research by El-sayegh (2009) was selection criteria using CM@R. Therefore, clients and consultants found that employing a firm with experience in CM@R was important. Unsurprising, construction professionals generally ranked ECI specific factors higher than general factors when asked to score the most important factors when evaluating firms for CM@R.

The buildability and value management input through 2S- ECI require a different skillset to traditional building companies. Opportunity may exist for construction companies to develop planning and management skills in order to demonstrate value during the design stage. Murdoch and Hughes (2008, p74) warns that:

The intention to split design from management requires the construction manager to be a specialist in management. This calls for skills quite different from those of a general contractor and probably different from those of a management contractor. The wise employer should steer clear of firms who claim to be specialists in all these things. In any event, the employer should always be wary of contractors using the appellation as a marketing tool, rather than as an accurate description of the services offered. Construction management firms in the UK estimate that it can take at least 18 months to acclimatize someone from a general contracting background into the construction management philosophy.

Khalfan and McDermott (2007) describe how a construction company in the United Kingdom developed a new Pre-construction department with a team of people who look at project management, financial and productivity issues at the inception phase of projects. This relies on buy-in from clients and across the integrated supply chain. Since developing the new department, the company found that clients approach them for integrated services including at pre-construction, with some clients even using them solely for their pre-construction services. One council uses the company for their pre-construction services for projects up to a certain value, and then assigns a small regional contractor for construction. For larger projects, the council contracts them to deliver the whole project including pre-construction services. The potential advantages to clients include; single point accountability, faster project delivery, improved quality, and improved trust through developing long-term relationships.

3.16 DESIGN MANAGEMENT

A designer, a project manager or a contractor may perform design management. Debate centres on *design* skills being different to design *management* skills. However, the two disciplines may not be mutually exclusive. Murdoch and Hughes (2008, p18) argue that the most valuable architects are those who can design and manage. Improvement in project performance was expected through the introduction of management-based procurement systems that introduced project management principles to overcome time and budget blowouts. However, concerns have emerged about the quality of design management (Tzortzopoulos and Cooper, 2007) raising serious questions about whether anyone other than the architect or engineer should manage the design process. Tzortzopoulos and Cooper (2007) found the role of design management poorly defined, contractors lack design management processes, contractor's design managers originate from various professional backgrounds without design qualifications or experience, and approaches vary. They also found that under design and build contracts, contractors struggle to interface between the client and their subcontracted designers; contractors struggle to bargain with clients and designers, poor contractor management of client requirements and design decisions still made by architects without considering the effects on time and cost. Architects may feel intruded on when someone else manages the design (Tzortzopoulos and Cooper, 2007; Brensen, 1991) leaving architects struggling to find their place (Whitehead, 2009). In management-based procurement, project managers may add value through challenging the Architects' design. An example of this is value management (VM). VM facilitators may be project managers, professional quantity surveyors (PQSs), architects, or contractors. This again highlights design versus design management. A project manager may have facilitating skills for harnessing input through brainstorming sessions, while the PQS and contractors may have access to detailed pricing, subcontractors and suppliers.

In the United Kingdom, the increase of procurement models such as design and build, and public private partnerships (PPPs) has seen design management shift from the traditional role of the architect to contractors and PM consultants. Two major construction companies in the United Kingdom report that 60 percent of work undertaken involves managing the design and construction processes, and both consider design management to be of strategic importance (Tzortzopoulos and Cooper, 2007, p20). One of the companies perceived design management as a significant risk because poorly managed designs can result in increased construction costs, time delays, rework, and bidding failure, and therefore impacting on their competitiveness.

Architects have sometimes fought to hold onto their traditional dual role of lead designer and project manager. In a response to the New Zealand Ministry of Business Innovation and

Employment (MBIE) (MBIE, 2013's proposed all-of-Government solution for the provision of consultancy services, the New Zealand Institute of Architects (NZIA) (NZIA, 2013) criticized the default separation of project management from design services and the use of consultant project managers. The NZIA argued that a Registered Architect could design and manage the project and achieve cost savings by otherwise employing two separate consultants:

The training and expertise of Architects enables them to lead and deliver projects from project conception and design to post occupancy. This is an important point given that no other profession can be involved in a building and construction project in this way. The separation of 'Project Management' services by default assumes that this service is needed for a building and construction project, when in effect, a Registered Architect could undertake all of this work. Any procurement process should recognise this opportunity – as it has the potential to deliver cost savings, time efficiencies and innovation across the project.

The Royal Institute of British Architects (RIBA) (RIBA, 2007) found a strong feeling amongst its members that architects should develop management skills earlier in their education. However, only a limited number of architects expressed an interest in working in roles such as developers or project managers.

3.17 POTENTIAL CHALLENGES WITH ECI

The majority of literature about ECI has identified advantages and no clear disadvantages (Pheng, Gao, and Lin, 2015). Potential issues tend to relate to the use of two-stage ECI as a form of relational partnering with open-book pricing. Rahman and Alhassan (2012) found the following potential issues in order of descending importance; lack of 'win-win' attitude, lack of commitment to common objectives, lack of team member empowerment, extent of trust, lack of a clear boundary, lack of continuous open and honest communication, non-inclusion of consultants in pain-share/ gain-share arrangements, lack of pro-active problem solving, unwillingness to compromise, failure to develop combined ownership of the works and commercial pressures compromising common benefits. These focus on potential partnering and relational aspects, such as trust, collaboration and common goals. However, the form of construction price need not be target-value a pain share/ gain share as the researched model was. Trust and collaboration become more important in target-value contracts, than fixed price construction contracts. The, *non-inclusion of consultants in pain-share/gain-share*, also would not feature in fixed price contracts. According to Rahman and Alhassan (2012, p218), ECI requires 'open book accounting, and open and honest communication between client, consultant and contractor, including sharing any sensitive information...' However, this assumes ECI as a partnering model, where 'contractors in ECI approaches are selected on the basis of their track records, not on the lowest bid, since there is not yet a design to bid for.' However, 2S-ECI can use competitive fixed-pricing. Pheng, Gao and Lin (2015, p835) provide that large developers may feel they have sufficient buying power to obtain the best bids from both consultants and contractors and that the pre-construction activities of value management, risk management, buildability analysis and construction planning are unnecessary. However, such a focus appears to place lowest cost ahead of other drivers such as quality.

A common theme about ECI is the need for collaboration. Laryea and Watermeyer (2016) provide that the advantages of ECI are; collaboration between project participants, integration of design and construction, value for money and utilisation of market capacity, but warn that success relies upon; an intelligent client, a framework agreement, collaborative contracts, cost-based pricing strategies, the professional team's flexibility, and a committed contractor. Whitehead (2009, p24-25) provides that in the United Kingdom, the generally held view is that

there have been no peculiar disadvantages of the concept, however provides the following issues to bear in mind:

- **Tender costs:** The client may pay the contractor to develop their risk-adjusted price (RAP) as part of stage 1. Whereas, clients do not directly pay contractors to prepare tender bids.
- **Involvement of senior staff:** Senior staff are likely to be involved for longer periods in the early project stages. However, this should be balanced with the costs saved during the tender processes.
- **Potential loss of innovation:** This may result if the team does not work well, and the designers step back from the design as the contractor pursues buildability and cost savings as an early stage.
- **Going too early:** While early involvement of the contractor can provide greater scope for adding value, if the contractor is appointed too early they may not be motivated to provide their best staff.
- **Too many cooks:** If the client has very specific ideas about the finished product, the input from a contractor may lead to unnecessary additional costs. Alternatively, if the client lacks any a grasp of what it wants, the contractor may waste time developing proposals. The type of project should dictate the timing of the contractor's involvement.
- **Potentially higher prices:** One concern with ECI is that the risk-adjusted price (RAP) is built-up in the absence of competitive pressure, which may lead to an artificially high RAP. Appropriate controls may include open-book pricing, or third party audit.
- **Finance:** The owner may face an increased difficulty in obtaining finance at the commencement of the works without confirmed total costs.
- **Uncertainty:** Once criticism about the NEC contract is that it is entirely new and does not have the benefit of familiarity and of being tried and tested for many years. The Australian models adopt language consistent with existing standard contracts, or by using existing standard contracts as the base for the stage 2 contract.

The first two points (tender costs passed onto client) assumes the head contractor is paid for their pre-construction involvement. However, this need not be the case. Laryea and Watermeyer (2016) provide a case study of two construction projects, which used early-contractor involvement for the Wits University in South Africa. Once concept designs and elemental cost estimates were prepared, the contractor was engaged to assist with value management and design development. They found that the ECI pathway achieved a 12% cost savings in one project and 32% in the other. The contractor received 'no remuneration for the involvement in design development, they value the benefits of developing early cost models and production plans.' The author of this thesis also worked on a \$9 million NZD project in 2016-2017 procured through 2S-ECI in which the contractor did not charge for their early involvement. Under single-stage procurement, contractors incur the costs of preparing tenders and only earn profit on the construction stage if they win. 2S-ECI is attractive because contractors only need price P&G for the first stage. Then only the successful contractor prices the construction stage. One pricing option is no payment for early involvement, unless no construction contract agreed through no fault of the contractor.

Timing of contractor involvement is a key issue. Some argue that contractors should be involved from 'day one' of the design process in order to maximise value (Jergeas and Put, 2001, p283). According to Ma and Xin (2011, p78), the contractor can be engaged after a business case has been prepared. Others contend that a concept design is needed first because if the client has very specific ideas about the finished product, the contractor may have nothing to add, or may waste time developing proposals for a client who does not know what they want (Francis and Kiroff, 2015). If contractor appointment is too early, the contractor might lack motivation to appoint their best staff and there can be a loss of design creativity if the team does not work well together and the designer steps back as the contractor pursues buildability and cost saving efficiencies (Whitehead, 2009). Designers may also prefer to work solely with their client to develop concept design (Francis and Kiroff, 2015).

The open book pricing of 2S-ECI may require an independent cost consultant. This is supported by New Zealand Transport (2018) who recommend that when selecting a projects' suitability for ECI that, 'as this is a quality based procurement method to ensure value for money is achieved you will need to engage with an independent parallel estimate peer review and conduct a reconciliation process.' Ma and Xin (2011) also describe how in the 2S-ECI process for \$100 million Australian infrastructure and construction project, the contractor developed a cost estimate on a confidential open-book basis, based on other projects. The client engaged an independent estimator to prepare a cost estimate. The parties could then negotiate the design and costs.

3.18 HEAD CONTRACTOR VERSUS CONSULTANT ECI

Prior research offers differing perspectives around whether the best form of contract to employ the entity responsible for construction planning and management is a head construction contract or a consultancy contract for services (or construction management agreement (CMA)). Jergeas and Put (2001, p284) recommend that constructability expertise be provided by the contractor responsible for the actual construction of the works, and not through a construction consultant. They found that traditional procurement gets in the way of enabling any meaningful constructability input into the design 'even when construction expertise is brought in early in the project through the owner's own construction experts or through a third-party construction management consultant'. They argue, 'the benefits are often limited because these will typically not be the people ultimately responsible for the actual construction of the facilities.'

A major problem is the lack of consensus around pricing between management contracting head contractors and construction management consultants. This is likely due to the difficulty in accurately and objectively comparing costs on projects between too different procurement pathways given the uniqueness and complexities of each project and lack of clear contractual frameworks. Tenah (2001, p33) argues that the construction management 'offers potential reduction in the contractor's overhead by elimination of the general contractor.' This is supported by Murdoch and Hughes (2008, p77) who provides that 'experienced developer-clients report savings of between 5% and 30% when trade contractors realize the full implications of being in direct contract with the employer.' However, if a consultant's price includes a margin on the total project value then the effect would be the same as a head contractor's margin on subcontractors. Loosemore (2014) found that some Australian subcontractors would price lower to a client's consultant manager than to a head contractor because they felt a head contractor was likely to bid shop so subcontractors held back their best price. Tenah (2001, p33) similarly argued that construction management consultants increase fairness in the bidding because specialist contractors can bid directly to the client, 'thus eliminating bid shopping, auctioning, and other unethical practices.' However, this assumes that head contractors participate in bid shopping and that consultant managers do

not. Moreover, in a competitive market, head contractors may submit very low price to the client (possibly even below cost) and then try to recoup profit through bid shopping their subcontractors. Therefore, clients could pay more through construction management agreements not less. It is difficult to make any accurate comparisons without transparent pricing. Tenah (2001, p34) further argued that construction management procurement may reduce or eliminate adversarial relationships by emphasizing teamwork and encouraging participants to work with rather than against each other, thus 'creating a harmonious team.' However, Tenah' (2001, p33)'s comments actually suggest that head contractors may have a better relationships with subcontractors than consultants 'since the head contractor may work with these subcontractors in the future, she tends to side with them in claims.' IN relation to management contracting (head contractor), Kirkham (2007, p131) provides that 'usually, competitive tendering is used to obtain a percentage or fixed fee bid for management and sometimes a GMP.' New Zealand Government Procurement (2015, p29) provides that under both management contracting and construction management 'the work is bid for on the basis of a percentage management fee' and that, 'the management contractor takes more risk (and therefore fees) under management contracting, therefore the fees tend to be higher than those for construction management.' This refers to the fact that the head contractor adopts single point accountability for construction, whereas, clients must establish negligence by consultants to claim damages for a breach. However, this all ignores such factors as market conditions, access to plant and equipment, and preferential pricing from subcontractors and suppliers.

One challenge with construction management procurement is the lack of clarity around administrative responsibilities. Under traditional procurement, the client typically employs a head contractor and a contract administrator who certifies the contractor's claims. The contract administrator may be a project manager, architect or engineer. Under construction management procurement, design is separate from construction and the client shares responsibilities with their consultant construction manager for administrating the various trade contracts employed directly by the client. Murdoch and Hughes (2008, p74) warn that 'an inherent problem with such separation is the question of who signs certificates.' They further warn that funders and insurers insist upon designers signing certificates so that, despite the split between design and management, 'it is almost inevitable that both designer and construction manager have a central role to play in certification and, by implication, other aspects of contract administration.' Add to this the requirement for clients to take a more active role in management (Murdoch and Hughes, 2008 p71) and it becomes evident that the certification procedures are more complex under construction management than other procurement pathways.

There appears a clear absence of contractual risk evaluation between head contract and consultancy contract amongst construction research. Prior research has largely focused on perceptions using social sciences methods, which can all be prone to the quality of the people and organisations involved in the specific project, rather than contractual obligations. This indicates disconnect between legal research and construction research. A head contractor takes absolute liability for construction of the product. This includes procuring all subcontractors and carrying out all work required even if not specified on the drawings. This is the *inclusive contact* principle (Dennys and Clay, 2015). *Great Eastern Hotel v John Laing Construction Management Ltd* [2005] established that a consultant construction manager incurs a similar duty when procuring individual trade packages to avoid gaps. However, it remains unclear whether the client should pay where, for example, a roofing contractor claims \$800.00 NZD for additional flashings at a new and existing roof junction. This reinforces the need for experienced clients using construction procurement. Certifying or challenging such costs is likely to be a difficult proposition for a client's employee who has no experience managing construction projects. See Chapter 5 for a legal comparison between head contractor and consultant in 2S-ECl.

3.19 CHALLENGES IN PROCUREMENT DECISION-MAKING

A key focus arising over recent decades is the need to understand client's needs (Masterman, 2002). The client's key drivers may not be a new building at all, but rather for example a change in their product distribution methods (Kirkham (2007, p136). The procurement pathway best align with the project type and client requirements (Murdoch and Hughes, 2008, Kirkham, 2007). For example, it might be pointless to invest in preparing a schedule of quantities (SOQ) to enable better cost control for clients, whose main drivers are time and quality, not cost.

The consensus is generally that no one perfect procurement solution exists; instead, a strategy should be developed using sensible judgement and based on client's needs (Murdoch and Hughes, 2008; Thomas, Luu and Swee, 2002). Important prerequisites to consider include; the type of project, the market situation for bidding, the lead-time for the project, and uncertainties causing risks of variations during the execution phase (Murdoch and Hughes, 2008; Toolman 2008) and accepted criteria to consider include:

- Level of client involvement
- Ability of client to make changes
- Separation of design from management
- Clarity of client's contractual remedies
- Complexity of the project
- Speed from inception to completion
- Certainty of price and time
- Need for value for money;
- Need for lowest price.

Procurement decisions have become increasingly complex over recent decades due to the growing range of procurement systems and their variants (Masterman, 2002). Procurement considerations can include whether to employ specialist trade contractors directly and a consultant to manage them (construction management) or employ a head contractor, whether design and build or construction only, whether ECI or single-stage tender, whether competitive pricing or negotiation; and whether fixed price or cost reimbursement. Clients and their needs have also become more complex. Clients' core business is generally something other than construction, such as manufacturing or retail (Rowlinson and McDermott, 1999). Masterman (2002, p171) describes how the process of selecting between procurement decisions have;

...become increasingly complex, mainly as a result of the continuing proliferation of different methods of procuring building projects, the projects' ever-increasing technical complexity and the client's need for speedy commencement and completion, which has led to a demand for more sophisticated and systematic methods of selection to be devised.

Bowen, Pearl, Nkado and Edwards (1997) found that clients often lack understanding about procurement systems despite often perceiving their own understanding as better than the industry perceives them. According to Masterman (2002, px) clients perceive construction work as expensive and risky, and some are increasingly reluctant to become directly involved in their construction projects, while others, particularly inexperienced clients, want to be involved, but 'in the most inappropriate way.' They may rely on the advice of a single appointed representative to co-ordinate their interests, often called a project manager. Every construction project needs a project manager. Masterman (2002, p53) categorises three types of project manager as follows. First, an employee of the client organisation with no construction knowledge who acts as a coordinator and single point of contact for the design team who will have day-to-day responsibility for the project management. Second, an

experienced construction professional, permanently employed by the client who is the single point of contact, and is responsible for the financial, technical and administrative project management. Third, an external consultant project manager appointed for a specific project, typically on a percentage fee for the same duties as the 'in-house' project manager. The 1998 NEDO report: *Faster Building for Commerce* (NEDO, 1998) identifies the need for inexperienced clients to appoint a 'customer representative' with experience in working with the construction industry, and recommended that such a representative may be found among architects, engineers, project managers, surveyors or construction companies who have the management or design skills as well as construction. However, developing procurement strategies to align with their client's may not be the core business of such entities.

An effective procurement strategy should satisfy the specific needs of the client and their particular project (Masterman, 2002: 10). However, Cain (2015) found that the New Zealand construction industry still provides procurement strategies based on the provider's preferences and not their clients wants or needs. According to Rowlinson and McDermott (1999, p33) the initial strategic decisions including the procurement strategy is one area where the industry has been 'particularly weak in the past' and Masterman (2002: 27) provides that the selection of the most appropriate strategy 'is often carried out in a haphazard manner.' A study in the United Kingdom (Hibberd and Djebarni, 1996) found that 89% of respondents were dissatisfied with the procurement model they had adopted. Masterman (2002: 199) concluded that 'a substantial proportion of all clients are likely to be adopting an incorrect approach to the selection of procurement systems and that their satisfaction is thus very often unknowingly based upon the acceptance of lower levels of success than are really necessary.' The Chartered Institute of Building (2010) concluded that 'clients should have a greater understanding of the procurement process in the construction industry – the CIOB recognises that, in order to facilitate this, accessible information and guidance is necessary. 77% of respondents have indicated that clients do not have a sufficient understanding of construction procurement.'

In the absence of a clear contractual framework, procurement decisions may largely come down to the client's or their consultant's experience. Once appointed, consultants are likely to recommend pathways that they are familiar with and that suite their interests. Caine (2015) found procurement decisions in New Zealand largely based on industry preferences over clients' needs or wants. Masterman (2002) categorizes clients in terms of whether they are; public or private, experienced or inexperienced, and whether their primary business is that of construction or property development or whether the need for a new building facility is something secondary to their core business which may something such as retail or manufacturing. Inexperienced secondary clients are at greater risk than those experienced clients who have in-house capabilities or those whose core-business is in construction development. Large public clients may be able to leverage better pricing through relational contracting and strategic alliances, whereas, most lay private clients are unlikely to be in such a position of dominance over the supply chain due to their 'ad hoc construction profile and limited understanding of the marketplace' (McDermott and Khalfan, 2006, p50). Ashworth (2012, p96) asserted that consultants' advice is usually sound, but may be 'tainted with self-interest' and decisions often come down to 'who gets to the client first.' The potential for bias is something also argued by Masterman (2002: 90), 'there is a remarkable lack of independent authoritative advice available to clients on how to provide a satisfactory brief and generally commission a design and build project...' Masterman (2002, p187) recommends that the procurement path be selected sufficiently early so that no individuals or organisations are appointed 'other than perhaps an independent advisor, who might be prone to giving subjective advice on the choice.' Masterman also describes the effect on clients who leave the procurement selection too late, when detailed design is under way and '...any possibility of unbiased choice had been removed by the appointment of design consultants.' Section 3.6 of Latham (1994) warned about the potential bias of consultant procurement advice. Consultants help their clients decide whether projects are necessary, therefore, if the

'Professional Adviser' has been retained in the expectation of becoming the lead consultant for the project, it will be difficult to advise the client that the project is not needed or, if it is, that it could be so small as to require no further consultant advice. Section 3.7 of Latham (1994) provides that procurement strategies should precede design development and should focus on the evaluation of project risks:

Once a client is satisfied about real need and feasibility within overall budgetary constraints, the instinctive reaction is to retain a consultant to design the project - the "ring up an architect/engineer" syndrome. That takes a crucial step too quickly, and closes off potential procurement options. The next step should be the use of internal risk assessment to devise a contract strategy. The client should decide how much risk to accept. No construction project is risk free. Risk can be managed, minimised, shared, transferred or accepted. It cannot be ignored. The client who wishes to accept little or no risk should take different routes for procuring advice from the client who places importance on detailed, hands-on control.

3.8 The basic decision on the procurement route should precede the preparation of the outline (project) brief, since it necessarily affects who shall assist with the design brief as well. That choice of route must be determined by the nature of the project and the clients' wishes over acceptance of risk. Such decisions are difficult. Inexperienced clients need advice. There are a number of publications which can assist.

Interestingly, the consultant architects surveyed by Bowen, et al. (1997) appeared to favour the idea of a 'briefing consultant' who would have a clearly defined role for developing and formulating the brief. In the current context, client's project managers often decide the procurement strategies. The value added by project managers comes down to the quality of the PM employed. According to Franks (1998, p9) employing a project manager incurs an additional cost for the project manager's fee, which may be offset to some extent by savings through their management involvement. Bowen, et al. (1997) found that in traditional procurement, the most frequent participants in the briefing process are clients, architects and QSs, and that same are most likely to adopt the temporary leadership role of the process. Project managers perceived their involvement as 'significantly greater than perceived by the other procurement team members.' Masterman (2002, p59-61) concluded that data; '...appears to support the widely held belief that the use of the conventional procurement system results in a final project cost which is lower than any other methods (with the exception of design and build) subject of course to the tender documentation being based upon a fully completed design'. Masterman further concluded that the significant pressure exerted by large property developers over the 1990s was sufficient to change procurement procedures, but that the pressure actually resulted in the inappropriate use of alternative methods, and the unnecessary discarding of traditional procurement.

What is not yet clear is the effect of 2S-ECI on the project governance structure. The involvement of contractor's project managers in the design stage planning may raise questions around who should do what, and who for example should project manage design and construction. Historically architects provided a dual role of client's agent and designer. Alternative – management-based - procurement pathways evolved largely on the criticism that architects were not the best project managers. If construction companies took up the challenge of client project management, 2S-ECI may provide a procurement model to marry the contractor's project management abilities with the architect's design skills and the independence of a PQS, and potentially reducing an additional separate consultant's fees. The author worked on a construction project, extensions to a hospital, procured in that way. However, the client's in-house representative had experience and qualifications in project management in the health sector. The NEDO report (NEDO, 1998) identifies that construction companies who have the management capabilities may act as the client's project manager. With regards to design and build, Ashworth (2012, p92) says 'the arguments for engaging a

consultant rather than a contractor as the main employer's advisor are inconclusive' and summarizes the advantages of employing a contractor as; better time management, single-point accountability, inherent buildability, certainty of price, teamwork, inclusive design fees. He also highlights the potential disadvantages in relation to; problems of contractor proposals matching with employer requirements, payment clauses, emphasis may be away from design towards other factors, employers may still need to retain consultants for payments, inspections, etc.

Ultimately, project specifics and client preferences for acceptance of risk should form the basis for procurement decisions (Franks, 1998). For inexperienced clients, a single externally appointed representative to co-ordinate the client's interests (such as a project manager) may be particularly beneficial for large complex projects. This is also when ECI may add most value. Construction management research into procurement has generally focused on identifying client needs and correlating these to different procurement models based on criteria such as those identified by (Murdoch and Hughes, 2008; Toolman 2008):

- Level of client involvement
- Ability of client to make changes
- Separation of design from management
- Clarity of client's contractual remedies
- Complexity of the project
- Speed from inception to completion
- Certainty of price and time
- Need for value for money;
- Need for lowest price.

However, procurement pathways are like contracts. Parameters include parties' responsibilities, obligations and liabilities, and timing of involvement. This makes accurately comparing between procurement pathways difficult without fully evaluating the client's legal risks under each method. A doctoral thesis by Ismail (2007) found risk aversion to be the predominant factor for private client procurement selection. The thesis questionnaire only included four owner-occupier residential clients out of 50 responses. Unsurprisingly, the overall findings show single-stage traditional as the most used procurement system whereas design and build dominates residential housing in New Zealand. The thesis concluded that construction management procurement is preferable for private clients, because it allows more client involvement, even though the findings show most private clients want to transfer risks (time, cost, quality) to a head contractor. Unlike legal research, construction management research often fails to evaluate the contractual risks of construction management. The thesis (p67) asserts that construction management is riskier because:

the system is incapable of offering price certainty and places more risks on the client due to lack of established standards benchmarking quality of workmanship and outputs'. Overall, the system is incapable of addressing with the New Zealand private sector clients' needs preference of paying someone to take the risk of cost and time slippage from them. It should be noted that the New Zealand private sector clients cannot desire to have control over the project and at the same time desire to shift the risks to the contractor. They should choose between both conflicting preferences (underling by author).

However, from a legal perspective, under construction management procurement, the client employs all the trade packages and a consultant to manage them. This means for example, the client may be legally responsible for the health and safety of all the trade workers onsite because they employ them directly. Unlike head contractors' stricter commercial liabilities, (see Chapter 5) client must establish a negligent breach to pursue damages against a

consultant. Therefore, a 2S-ECI procurement pathway that enables partnership and collaboration through a pre-construction services agreement, and then a fixed price construction contract seems preferable. 2S-ECI also provides some flexibility. The client and their project manager could decide whether to novate design liability to the contractor and the form of the construction-stage price after deciding to use 2S-ECI, with the default being traditional fixed lump sum construction-only. However, clients and project managers need a clear contractual framework and contract documentation. A starting point would be whether the project is suitable for 2S-ECI. Then a standard form pre-construction agreement (PCSA) would provide ease and familiarity, helping to overcome the complexities of procurement decision-making or drafting bespoke contract agreements.

3.20 ADVANTAGES OF A STANDARD FORM CONTRACTS

Standard form construction contracts are single contracts that used repeatedly across projects, rather than individual parties developing their own bespoke contracts. The advantages of standard form contracts have been well documented. Standard form contracts increase clarity, transparency, and consistency, reducing complexity and potential for bias in decision-making processes. Once a client has identified the need for a new building, the process begins with developing a project strategy framework to establish their needs, project objectives, risks, environment, and the method of procuring the project (Masterman, 2002, p1). Standard form contracts are well understood and having a significant body of case law on their interpretation (Bajari Tadelis, 2001). They should deal with foreseeable situations in construction projects (Ashworth, 2012; Ramus, Birchall and Griffiths, 2006) to provide greater predictability and certainty in legal relations (Richards, Bowen, Root and Akintoye, 2005) and minimising avoidable transactions leading to overall efficiencies in procurement (Sharkey, Bell, Jovic and Magineer, 2014). In terms of transaction cost theory, this should reduce risks associated with uncertainty, bounded rationality and opportunism.

The construction industry typically favours familiar procedures and forms of contract (Kirkham, 2007, p133). Most standard forms of construction contract only provide for single-stage procurement and the industry at large may therefore feel uncomfortable adopting unfamiliar contracts that are untried and tested in the courts (Pheng, Gao and Lin, 2015, p835). Public clients can face additional requirements around transparency through government rules for procuring products and services. Some inter-jurisdictional agreements require transparency and consistency, such as the World Trade Organisation (2016) plurilateral *Agreement on Government Procurement* (GPA). New Zealand belongs to the GPA and to the *Australia and New Zealand Government Procurement Agreement* (New Zealand Government, 2014). Murray and Langford (2003, p21) describe how in the United Kingdom, reports as early as the Simon Report (1944) recommended abolishing open tendering for public sector clients, but that such practices continued at least into the 1970s until registers of preferred tenderers were compiled and selective tendering took over. However, even using selective tendering, the number of bidders was too high, often more than 12 resulting in unnecessarily high cost of obtaining a successful bid. According to Murray and Langford (2003, p21) it was decades before the National Joint Consultative Committee (NJJCC) recommended sensible numbers. In single-stage procurement, clients typically do not pay the contractor's tendering costs directly. Although, contractor tendering costs must be recovered somewhere, so clients may pay indirectly through contractor overheads on projects.

Previous research suggests that the lack of standard form pre-construction services agreement (PCSA) may hinder the uptake and effective use of 2S-ECI in New Zealand commercial construction. The lack of standard form contracts has been a source of frustration. Sharkey et al (2014) found broad support for standard form contracts in Australia. However, Varmalis (2008, p19) found that, despite state government influences in Australia, a lack of

consistent tendering procedures across local councils remained the greatest source of frustration to civil contractors. The differences between tender documentation and practices required greater time for contractors to digest, and when contractors were pushed for time, they may simply load their price to allow for the risk. Turner and Riding (2015) provide examples of poor ECI practices where three or more contractors provide ideas during the early design stages without payment. Sometimes clients selected the best ideas from each provider to create a scope then put out to tender. Such processes, they argue, act as a barrier to sharing knowledge and stem the growth of ECI.

3.21 CONCLUSIONS DRAWN FROM LITERATURE REVIEW

Clearly, research is needed to establish a clear contractual framework for 2S-ECI in New Zealand construction, ideally integrating legal scholar research with social sciences methods to establish user perceptions based on clear contractual obligations. Prior research has focused on the benefits associated with integrating those responsible for design and construction. However, gauging the perceptions of 2S-ECI without first establishing any clear contractual framework renders findings largely subjective particularly in areas such as risk transfer and market pricing. Theoretical modelling of cost and time means less than evaluating actual outcomes based on real industry contracting practice. Equally, perceptions of 2S-ECI using social science methods means little unless the contractual framework used is clearly established.

Research studies based on literature reviews and survey questionnaire run the risk of perpetually looking backwards and not forwards, by asking industry to rate and rank features based on procurement 'models' defined in textbooks, rather than exploring potential opportunities to improve actual industry processes. This is supported by the contrasting opinions of researchers. For example, some authors consider lump sum pricing impossible under 2S-ECI, while others describe industry practice (similar to that depicted in New Zealand) in which competitive lump sum P&G pricing is based on concept design, then subcontractors are procured on an open book basis. The only term that seems clearly defined in procurement is the word 'procurement.'

Previous research has described early contractor involvement as both a concept, being any procurement pathway that involves contractors during the design stage (design and build, managing contracting and construction management) and as its own procurement pathway, typically referred to as a two-stage process or 2S-ECI. Following the textbook models, 2S-ECI is a form of tendering to support the 'models' such as design and build, management contracting or traditional contracting with a two-stage tender process. However, 2S-ECI as a procurement pathway itself means the textbook procurement 'models' become variables within the 2S-ECI process. See figure 1 below.

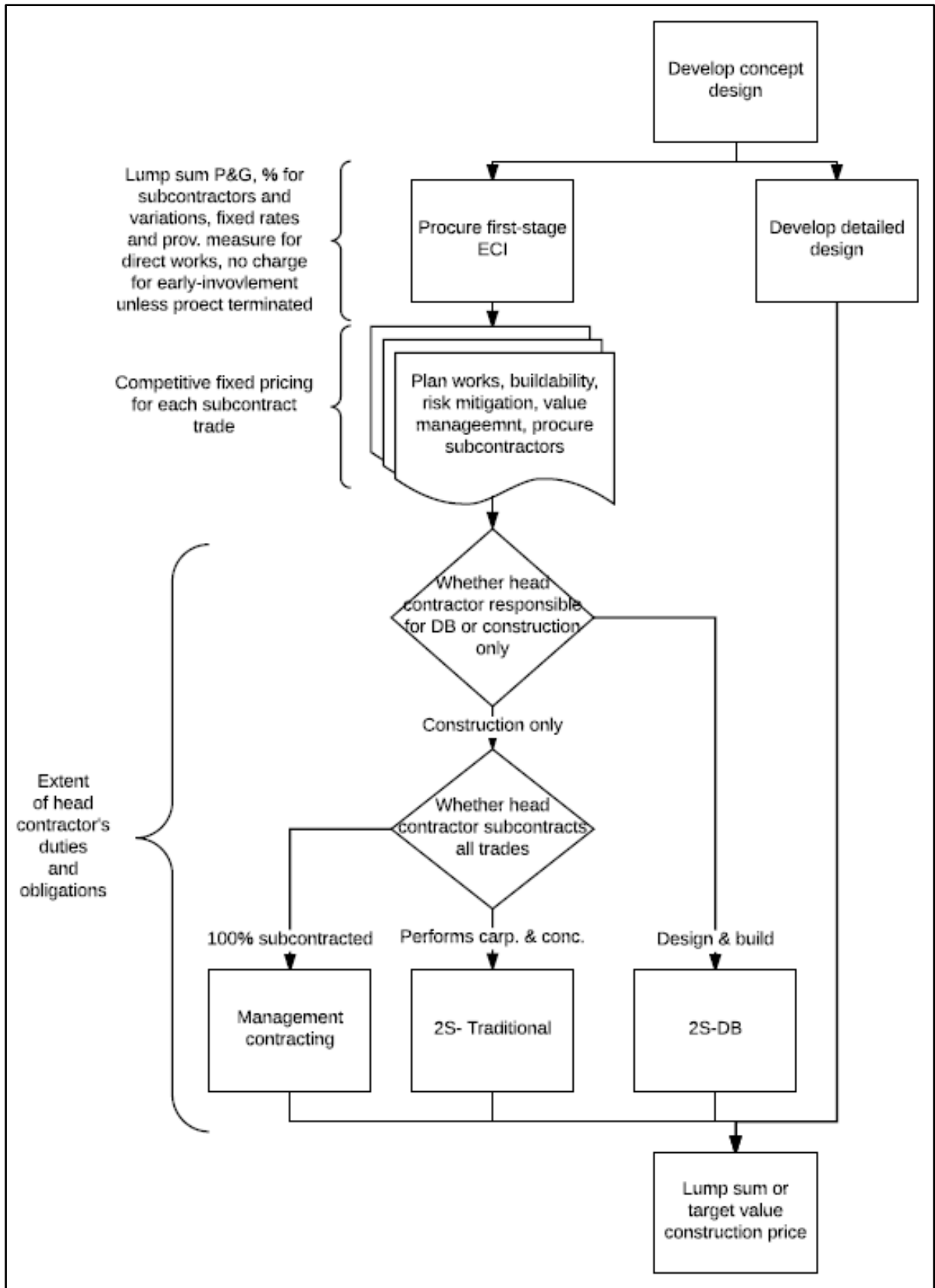


Figure 8: 2S-ECI Process model variants

Integrating the supply chain between those who design and those who construct derives from the extensive criticisms of traditional procurement segregation resulting in adversarial

relations and project inefficiencies. Recent research, including governmental reports, have also heightened the need to move from a purely lowest-price-based procurement to a more value-based procurement environment. However, the construction industry continues to favour procurement pathways that are familiar, and tried and tested and that provide competitive lump sum pricing prior to construction work commencing, with clear recourse for breaches in project performance. This supports the need to establish a contractual framework for 2S-ECI toward potentially developing a standard form PCSA.

2S-ECI appears to harness the collaboration and transparency of partnering philosophies, with provisions for competitive fixed-pricing across the supply chain. Transaction cost theory suggests that opportunism risk reduces through more transparent pricing and bounded reality risk reduces through using a standard contractual framework with advantages largely independent of the transaction frequency. While design and build appears the optimal form of integrating design and construction, research highlights the need for sophisticated design briefs particularly on large projects, with similar administrative burdens to traditional procurement. In traditional design and build procurement (where the contractor develops the design from the client's brief), it may be difficult to accurately compare competitive lump sum prices (to compare apples with apples) in the absence of any design from which to tender construction costs. The design and build contractor may also drive cost and time savings at the expense of design aesthetics, making this an unattractive option where clients want to retain control over design decisions. Conversely, the design and build contractor may risk incurring substantial losses if they enter a fixed price contract in the absence of detailed design. Target value contracts with pain share/ gain share more commonly feature in infrastructure projects with high risks. Given the commercial construction market desire for fixed price contracts, this may again be unattractive. Target value contracts also substantially increase the administrative burden. 2S-ECI supports contractor design input, but for client or their project manager's approval. 2S-ECI is suitable for novated design and build contracts where a contractor provides input during design development then design responsibly is contractually novated to the contractor through a design and build construction contract.

There is clearly a need to explore how 2S-ECI is conducted in commercial construction projects in New Zealand and user perceptions of challenges and potential improvements to improve practices and expand its uptake. Key areas include the composition of the project team using 2S-ECI, the scope of services provided by each party, particularly the contractors and the project manager, the timing of involvement, pricing arrangements, provisions for not agreeing a construction contract, liabilities for providing design input. Establishing the contractual framework will enable evaluations about the effect of 2S-ECI on risk transfer and market pricing.

Chapter 4: Existing ECI procedures and standard form contracts

This chapter provides an overview of contractual developments toward ECI. ECI first emerged in the United Kingdom in the late 1990s and early 2000s when the Highways Authority developed an ECI approach toward contracting in pursuit of establishing long-term supply chain relationships and creating integrated project teams (see Whitehead, 2009, p21). The Authority utilised a two-stage tendering process using the New Engineering Contract (NEC) with a target value contract price. In Australia, the Queensland's Department of Main Roads (DMR) and Department of Public Works (DPW) both use ECI (Ma and Xin, 2011; Whitehead, 2009). The DMR reported great success including projects completed earlier, reduced costs, improved design, and simplified construction (Whitehead, 2009). The Department of Public Works (DPW) in Queensland subsequently adopted ECI concepts for its Managing Contractor Contract and released a new version of the Managing Contractor Contract in 2007 specifically for use on large complex projects. Transit New Zealand has also shown interest in following the DMR model contract.

4.1 UK GOVERNMENT FOCUS ON ECI

In 2014, King's College London Centre of Construction Law and Dispute Resolution analysed the United Kingdom Government Trial Projects and found that the procurement and delivery model named; *Two Stage Open Book and Supply Chain Collaboration* generated cost savings and improved project value. As a result, the *Project Procurement and Delivery Guidance Using Two Stage Open Book and Supply Chain Collaboration* (King's College London, 2014) was published under the United Kingdom Government Open Source Licence. The document provides that:

The processes, activities and outcomes described in this Guidance reflect strong evidence that Two Stage Open Book and Supply Chain Collaboration, implemented separately or together, can have a significant, positive impact on project costs and other outcomes if led by a Client committed to creating an Integrated Team and if supported by clear contractual processes for the early conditional appointment of Tier 1 Contractors and Tier 2/3 Subcontractors and Suppliers.

Three public construction and infrastructure projects and programmes of work were analysed using the United Kingdom government cost reduction validation method, measuring project costs against benchmark cost data (Cabinet Office, 2012) and reported 14 – 20% savings. This supports the GOV.UK (2011) *Government Construction Strategy* aim to achieve savings in construction procurement of up to 20%.

The *Project Procurement and Delivery Guidance Using Two Stage Open Book and Supply Chain Collaboration* provides a flowchart of *two stage open book – integration, information and innovation*, adapted from the RIBA plan of work (figure 9).

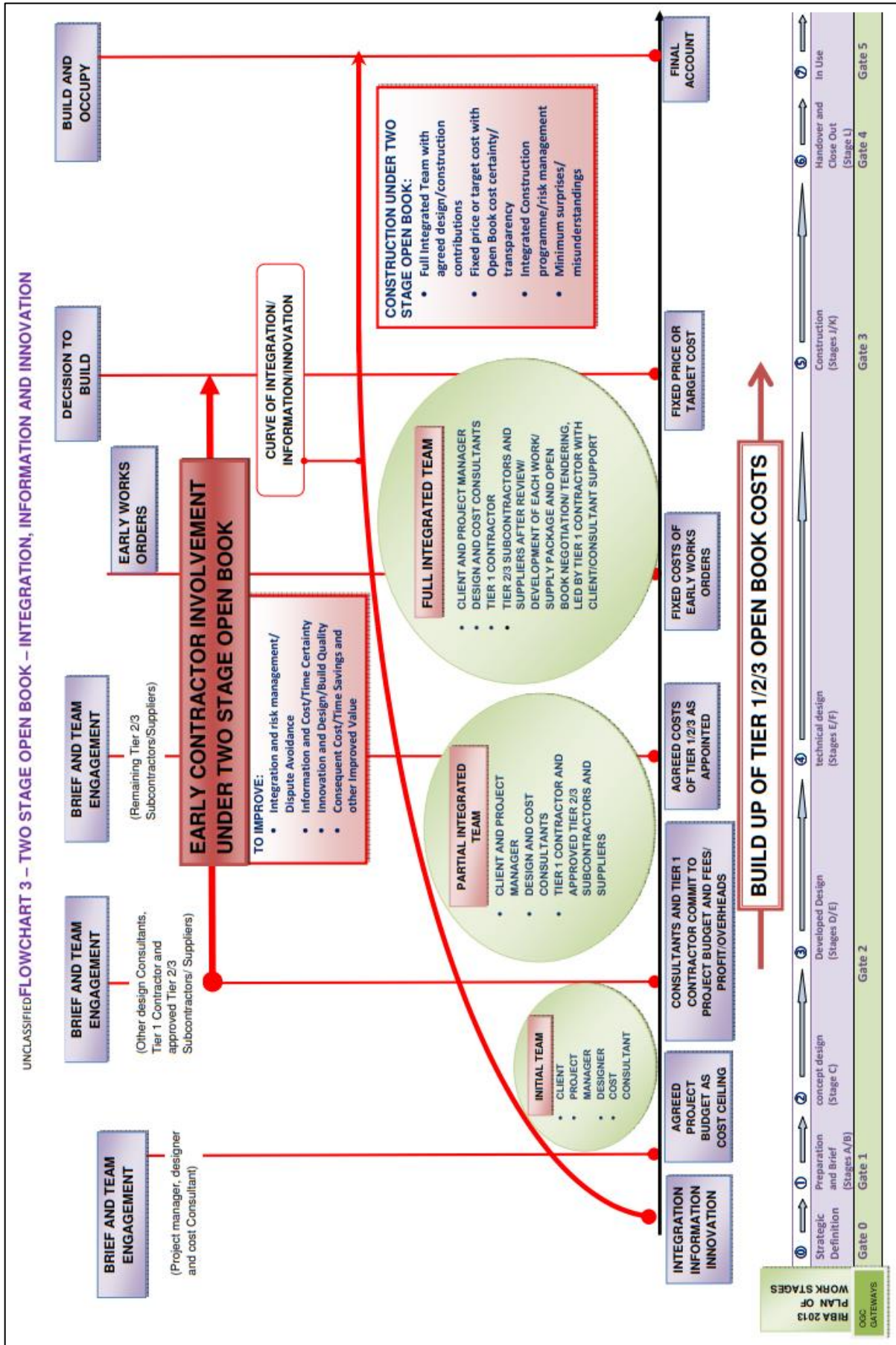


Figure 9: Process model for 2-stage open book (Kings College, 2016)

The model typifies the two-stage process parameters outlined in this thesis including:

- Head contractor appointment after concept design;
- Head contractor pricing for pre-construction stage based on a schedule of P&G and a schedule of rates for construction items where appropriate. Enabling works can also be priced in advanced or negotiated at the time;
- Head contractor pricing for construction stage can be fixed price or open book with target value;
- Two-stage ECI enables competitive pricing across all tiers of the contractor supply chain (referred to as contractor tiers 1, 2, and 3);
- Integrated project team allowing collaborative planning, risk management and subcontractor selection;
- Head contractor obligations can be for construction only or for design and build;
- Emphasis on pre-construction services such as; an agreed pre-construction programme, collaborative risk and value management, and subcontractor selection.

The guide also adds the following:

- The head contractor prohibited from receiving pricing discounts from subcontractors or suppliers.

Some parameters not considered in the guidance document include:

- The types of projects best suited to 2S-ECI;
- Scope of pre-construction services and how these should best be distributed across the integrated project team in order to best utilise parties' strengths and avoid duplication;
- Whether and how the head contractor should be paid for their pre-construction contributions;
- Key risks to consider during the pre-construction stage;
- The contractor's contractual liability for providing design input the pre-construction stage;
- When the client might consider transferring design obligations to the head contractor for the construction stage (novated design and build);
- The intended application of the guidance document is for the United Kingdom public sector. Such clients may have the advantage of strong buying power through large construction or infrastructure programmes. Continuous learning and ongoing relationships are key features of supply chain integration. However, the document

concluded that ‘two Stage Open Book and Supply Chain Collaboration, implemented separately or together, can have a significant, positive impact on project costs and other outcomes if led by a Client committed to creating an Integrated Team and if supported by clear contractual processes for the early conditional appointment of Tier 1 Contractors and Tier 2/3 Subcontractors and Suppliers.’

It is difficult objectively compare project costs and quality given the uniqueness and complexities of each individual construction project. However, the work done by Kings College (2014) provides a useful framework for comparing projects costs procured through ECI with average benchmark costs. In New Zealand, the QV Cost Builder (Quotable Value Limited, 2019) provides average benchmark costs of various projects costs. This could provide useful further research once a clear contractual framework for 2S-ECI in New Zealand is established.

4.2 NEW ZEALAND INDUSTRY TRANSFORMATION AGENDA (ITA) FRAMEWORK

National and international strategies toward improving productivity in construction have promoted ECI. The Industry Transformation Agenda (ITA) is a project led by the Building Research Association of New Zealand (BRANZ) and based on the *World Vision Economic Forum on Shaping the Future of Construction: A Breakthrough in Mindset and Technology* (World Economic Forum, 2017). The forum report provides a framework (figure 13) which categorises measures of productivity into the following eight topical areas:

- Technology, materials and tools
- Processes and operations
- Strategy and business model innovation
- People, organization and culture
- Industry collaboration
- Joint industry marketing
- Regulation and policies
- Public procurement

Productivity in the construction sector has generally remained static and lagged behind other industries with the US productivity actually falling between 1964 and 2012 (The World Economic Forum, 2017, p9 and 15). Page16 of the report highlights the following barriers to productivity reform; conservative clients, complexity of contracts and dispute resolution, over-preference of lowest-price bids, and increased risk transfer to contractors.

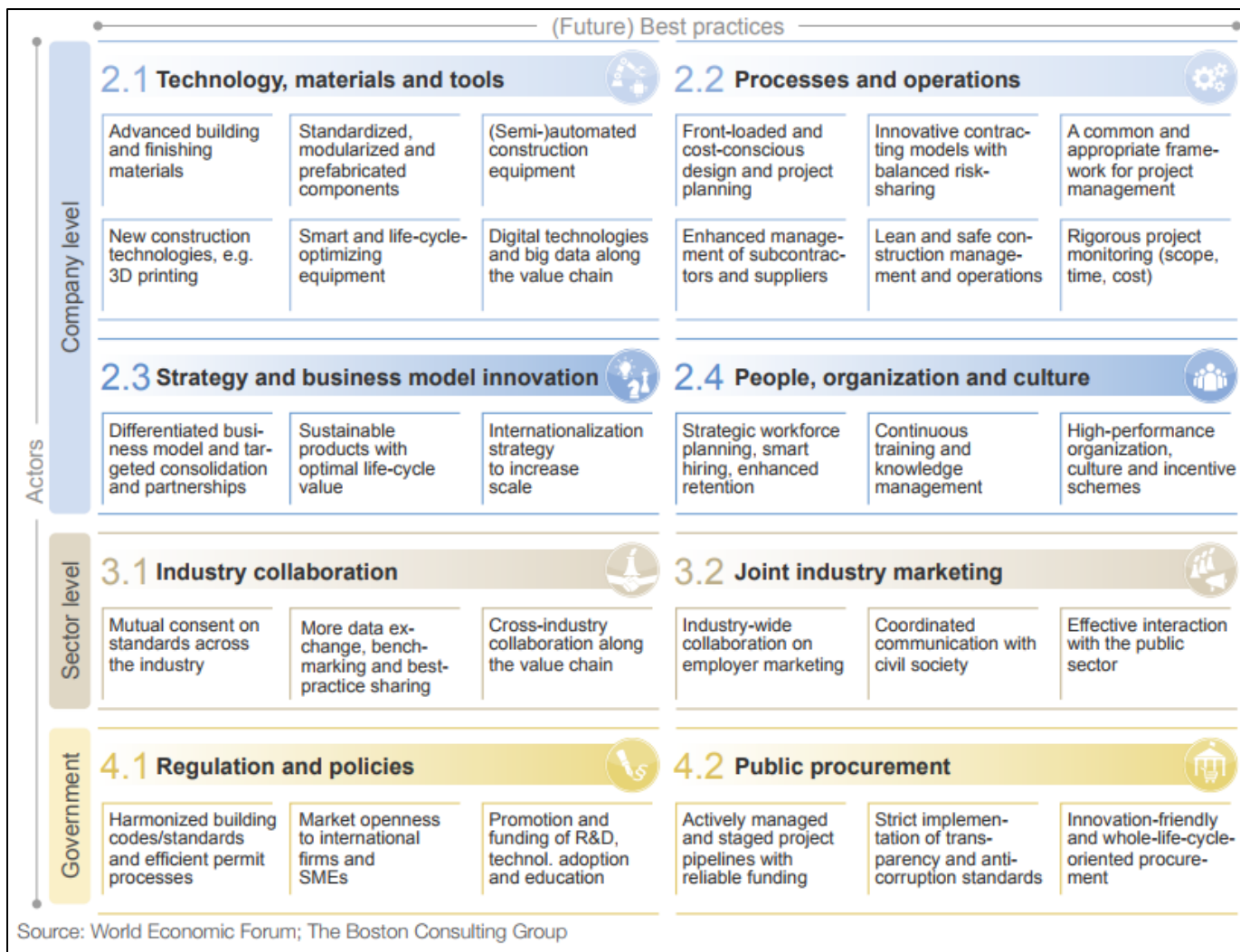


Figure 13: Industry Transformation Framework (World Economic Forum, 2017, p17)

There are parallels between the ITA and the potential use of 2S-ECI. The ITA promotes standardisation, modularisation or prefabrication as a means to substantially boosting productivity through production in factory-like environments, improving process sequencing, and reducing weather-delays and construction timeframes. 2S-ECI provides a contractual system to involve contractors during the design stage. This is necessary for contracting prefabricated modules or units for early ordering. Steel Construction New Zealand (2017) highlighted this as a key advantage of ECI. Improving efficiencies through collaboration is a key focus of the forum: ‘collaboration is, or should be, a hallmark of the construction industry itself: the industry’s future success will rely heavily on effective collaboration among all stakeholders.’ A primary feature of ECI is the integration of those who design and those who construct into an integrated project team, as a relational procurement system.

4.3 STANDARD FORM CONTRACTS FOR ECI

The following sections provide overviews of the standard form contracts that enable contractor involvement in the design stage. These include the new form of design and build contract by the Chartered Institute of Building (CIOB) and contracts for management contracting and construction management produced by the Joint Contracts Tribunal (JCT) and the New Engineering Contract (NEC). The evaluation of each contract establishes that only the JCT

PCSA and the NEC ECI Clause support the 2S-ECI pathway. They provide contract agreements for engaging contractors during the pre-construction stage, ahead of agreeing a construction contract as recommended by Mosey (2011) and Kings College (2014). The JCT PCSA also supports lump sum construction contracts and the flexibility for either construction-only or novated design and build. The JCT PCSA and NEC ECI Clause are compared with three bespoke contract agreements used in New Zealand construction in Chapter 6.

4.3.1 Integrated Design & Construction – Single Responsibility (IDCSR)

The Chartered Institute of Building (CIOB) supported the release of the IDCSR A Code of Practice (Harding, 2015). The intent is to integrate the responsibilities for design and construction into a single team. The aims and objectives of the code are set out in the foreword:

The code of practice for Integrating Design and Construction-Single Responsibility (IDCsr) integrates within a single team all the key participants involved in the process of designing and constructing a successful project. The objective of the team is a focus on delivering the end product within the pre-defined parameters. This marks the final extension of the paradigm shift initiated by Sir Michael Latham almost two decades ago and then further developed by Sir John Egan.

Key features include:

- (i) the thorough effort in developing the design and managing risk at the pre-construction stage with a strong focus on minimising variations, producing defect free handover and proactively and collaboratively managing risk and not pushing risks down the supply chain.
- (ii) the focus on an efficient and empowered client project team, comprising those empowered to make decisions, who remain actively involved from establishing a clear design brief through to completion and building use.

The IDCSR goes a step further than design and build by developing a single business entity for all members of the project including designers, constructors and suppliers. Like design and build, performance relies on the quality of the design brief, and cost and time efficiencies may remain driven at the expense of design aesthetics. Page xiii provides that:

Client need, particularly cost certainty, will take precedence over design-centric aspirations.

A Client Team Manager (project manager) is required to develop the client brief, establish feasibility and represent the client's interests across the project design and delivery. Success of the system is dependent on having 'like-minded' participants and 'trust and collaboration'.

P18 provides that achieving best results, depends on a 'well-structured, integrated Client Team in place, all committed to integrative working with the IDCC Team and following the guidelines and processes set out in this Code of Practice.' An effective integrated project team is likely to enhance project performance in any ECI procurement pathway regardless of the single business entity model. The composition of the IDCC can change from project to project as different consultants, constructors and suppliers are selected. While the Code of Practice suggests that entities may choose to establish a consortium, this is a feature of supply chain integration, not specific to the IDCC system. Proactively managing risks at the pre-construction stage and ironing out subcontractor tags collaboratively between the contractor, designer and

client, is a key feature of ECI, as is the contractor evaluating buildability risk. These need not be specific to the IDCC single business entity model.

Quality and risk management functions are integrated, with the quality manager is responsible for planning and overseeing both functions. P18 provides that 'instead of passing it down the supply chain, risk is managed by the whole IDCC's integrated team working with the Quality Manager: educating, encouraging and, where necessary, advising team members on how to achieve consistently high-quality results.'

A key feature of the IDCSR is its insurance provisions. Rather than traditionally separate insurances for design and construction, a single insurance policy covers all the forms of loss including late completion, negligence and product failure. This covers all members of the project including the client, designers, constructors, and suppliers.

The model sale terms and conditions are introduced in the Code on p31. The key feature is that; 'As the IDCC accepts total, single responsibility for the entire design and construction process as well as the finished product, all the mechanisms within traditional construction contract forms designed to apportion authority, responsibility and blame are inappropriate and redundant.'

It is difficult not to include some provision for defence at least between the client and the IDCSR construction team. Clause 4 grants the client exclusive possession until satisfactory completion or until they breach the contract, 'say in not proceeding and so forth.' Clauses 20 and 21 dealing with breach and dispute resolution provide for a pre-agreed Mediator. Disputes still unresolved are referred to adjudication.

The contract provides that terms are required for force majeure, delays, and liquidated and ascertained damages, and clauses to set out the types, delivery mode, and procedures for signing off notices.

This contract appears less suitable for client who wish to retain the right to make changes, a restriction of design and build (see Murdoch and Hughes, 2008). The design is frozen before the construction stage. Then no variations permitted, except those deemed essential. These become separate smaller IDCSR. Under clause 8, the contractor is not obliged to accept any variations after the signing the agreement. Any variations must be agreed through mutual consent based on pre-agreed fixed price, and are carried out under separate IDCSR sales agreements. This is a substantial shift from other procurement pathways. However, clause 9 does enable parties to agree minor changes in specifications that have no financial or completion date consequences (The implied common law position).

4.3.2 Joint Contracts Tribunal (JCT) MC and CMA

The Joint Contracts Tribunal (JCT, 2019) suite of contracts includes the *MC Management Building Contract 2011*, updated since its first edition in 1998. However, studies suggest that its uptake has been limited. Glover (2013) provides that the JCT MC: 2011 remains 'one of the least used forms of contract, produced by JCT'. Glover concludes that, while management contracting provides advantages, particularly for larger projects, the provisions of the MC 2011 contract are 'clearly unsatisfactory, especially for a Management Contractor, and do create a very serious risk both for the Works Contractor and the Management Contractor.' Unlike 2S-ECI, where parties first agree a pre-construction services agreement (PCSA), and then work toward agreeing a construction price and enter a standard form construction contract, the JCT MC contract spans both the pre-construction and construction stages. This creates a more complex approach to pricing. Under clause 4.2.1 of the JCT MC contract, the Management Contractor is paid a Pre-Construction Fee and a provisional Construction Period Fee. These

fees can either be a fixed sum or calculated by other means, such as a target value contract. Clause 4.2 provides that where the Construction Period Fee is a fixed sum, it can be adjusted up or down where the Prime Cost (project cost) exceeds or is less than the Project Cost Plan by more than five percent or other percentage stipulated. Schedule 2 provides a formula for calculating the adjustment. This may be off-putting to a construction sector that tends to favour familiar, and tried and tested contracts and traditional competitive fixed pricing.

The JCT suite also includes a Construction Management contract, (CM/A 2011). Under clauses 3.3.1, 3.3.2 and 3.2.3, the client employs trade contractors directly and a consultant construction manager to manage them on the client's behalf. This approach fits the general interpretation of construction management procurement in the United Kingdom (Gruneberg and Hughes, 2004). The contract defines a Trade Contract as; 'the contract between the Employer and a Trade Contractor as referred to in clause 3.3.'; and a Special Trade Contract as; 'a trade contract prepared by the Construction Manager for a Trade Contract where the trade contract CM/TC is not to be used.'

The additional requirements for the client to issue instructions and scope changes and ensure the Principal Contractor carries out their duties and obligations highlights that the need for experienced clients using construction management procurement (Murdoch and Hughes, 2008; Kirkham, 2007). Section 2 sets out the Construction Manager's obligations in relation to procurement. These include managing the procurement of the project and providing services required in accordance with the Project brief, Project Cost Plan and the Construction Phase Plan. Clause 3 highlights the need for the client to take an active role under the construction management procurement process, and the need for clear administration between the client and the consultant construction manager. For example, the following provisions set out client responsibilities for issuing instructions and scope changes.

3.2.1 The Employer shall issue to the Construction Manager such instructions as are reasonably necessary to enable the Construction Manager properly to discharge his obligations under this Contract.

3.2.2 If instructions are issued by the Employer other than in writing they shall within 7 days of issue be confirmed in writing by the Employer to the Construction Manager and vice versa.

3.2.3 The Employer may issue instructions to alter or modify the design, quality, quantity, duration or sequences of the Project.

At common law, varying contracts requires agreement between the parties. Construction contracts commonly contain provisions enabling the contract administrator to instruct contract variations. Otherwise, the contractor could potentially renegotiate terms of the whole contract (Murdoch and Hughes, 2008). The CM/A Clause 3.2.3 enables the client to vary the contract by instructing scope changes to their construction manager. Under procurement obligations, Clause 2.1.4 requires the construction manager to 'as agent for the Employer fulfil all the duties required of the Construction Manager as such agent under each Trade Contract.' However, there appears to be no provision for the construction manager to issue variations to the trade contractors (only to issue completion certificates clauses 2.5 and 2.6 and certificates of making good clause 2.4). The client also incurs duty under United Kingdom safety regulations:

3.5.1 Where the Construction Manager is not the CDM Co-ordinator, the Employer shall ensure that the CDM Co-ordinator carries out all his duties and, where the Construction Manager is not the Principal Contractor, shall ensure that the Principal Contractor carries out all his duties under those regulations.

The consultant construction manager's duty is less strict than that of a head contractor (see chapter 5). Clause 2.7 of the JCT CM/A defines the construction manager's duty of care similarly to any other consultant in the project team:

2.7 The Construction Manager in the discharge of his obligations under this Contract shall exercise the degree of skill, care and diligence to be expected of a reasonably competent construction manager experienced in carrying out projects of a similar size, scope and complexity.

Clause 2.8 limits the construction manager's liability for design errors:

2.8 Subject to the indemnities to the Employer given in clauses 6.1 and 6.2, and notwithstanding any liability for design placed on a Trade Contractor under a Trade Contract, the Construction Manager shall not be liable to the Employer in respect of any defect or insufficiency in the design of the Project.

Clause 2.9.2 limits the construction manager from any liability when hindered by an act or omission of the Consultant Team, provided the construction manager takes all reasonable efforts to avoid or mitigate the effect of the act or omission.

2.9.2 The Construction Manager shall not be liable under this Contract to the extent that the discharge of his obligations is prevented or delayed by any act or omission of the Consultant Team or any member of it, provided that all reasonable efforts have been made by the Construction Manager to avoid or mitigate the effect of any such act or omission on the discharge of his obligations.

Neither the JCT MC nor CM/A contracts support a two-stage procurement process where the second stage is a standard form construction contract.

4.3.3 JCT Pre-Construction Services Agreement (PCSA)

In 2011 the JCT released, and subsequently updated, standard Pre-Construction Services Agreements (PCSA) for engaging head contractors and subcontractors; *Pre-Construction Services Agreement (General Contractor) (PCSA)*; and *Pre-Construction Services Agreement (Specialist) (PCSA/SP)*. The JCT CSA is for appointing a contractor to carry out pre-construction services under a two-stage tender process, and supplement the JCT standard contracts for building works only or for design and build. JCT state that the PCSA is not suitable for use with the Management Building Contract, but is suitable with the Construction Management Contract with minor amendment (JCT, 2017). The JCT provide the following description:

JCT's Pre-Construction Services Agreement (General Contractor) is designed for appointing a contractor to carry out pre-construction services under a two-stage tender process.

The Pre-Construction Services Agreement enables the contractor to collaborate with the employer or their team of consultants to develop detailed designs, to develop the main contract works, or to compile specialist tender documents.

The contractor's involvement at the pre-construction stage is valuable and often essential in the final design process of a project, as well as making preparations for the construction phase, such as the programme, cost plans, buildability and any specialist procurement.

The agreement covers the period from the submission of first stage tenders up to the submission of a definitive second stage tender and entry into a main contract for the construction phase.

The JCT PCSA provides standard and specific terms that enable parties to agree such provisions as the scope of pre-construction services, payment provisions, insurances and liabilities for providing design input, ahead of agreeing a construction contract.

4.3.4 New Engineering Contract (NEC) MC and ECI Clause

The New Engineering Contract (NEC) suite includes a management contract option, the *NEC3: Engineering and Construction Contract Option F: management contract*. However, the client adopts more risk through construction management procurement, and pricing is cost reimbursement, rather than a fixed-price. NEC (2014a) provide the following:

Option F is a cost reimbursable management contract where the financial risk is taken largely by the client. This document contains all the core clauses and secondary option clauses the schedules of cost components, and contract data, relevant to an option F contract.

In November 2015, NEC released a supplementary ECI clause for use with NEC contract options C (target contract with activity schedule) and E (cost reimbursable contract) (NEC, 2014b). The clause is for contractors to assist the client's consultant or to provide design proposals. The clause is five pages long plus three pages of guidance notes. It provides basic ingredients for the pre-construction stage, such as; provisions around updating the contract budget; the contractor's first-stage pricing (rates, resources, overheads and profit, preliminaries and fee percentages); contractor responsibility for obtaining consents and approvals; client and contractor ownership of intellectual property; the client's right not to proceed with construction; the contractor's liability for any design. The clause assumes the contractor is paid for their early-involvement with the contractor submitting regular cost forecasts of stage 1 costs. However, the ECI clause is not suitable for use with lump sum contracts (NEC, 2014c).

Only the JCT PCSA and NEC ECI Clause support a 2S-ECI process where parties enter a pre-construction services agreement, then work toward agreeing a traditional standard form construction contract. No standard form PCSAs exist for New Zealand construction market, leaving clients to draft their own bespoke agreements. Chapter 6 compares the JCT PCSA and NEC ECI Clause with three bespoke agreements used in New Zealand, after a contractual framework of contractor's obligations for design buildability are first established in chapter 5.

Chapter 5: Contractor design buildability obligations

5.1 INTRODUCTION

This chapter sets out to establish who pays for detailed design development once a fixed-price construction contract has been entered into under NZS 3910:2013, 'Conditions of contract for building and civil engineering construction' (SNZ, 2013). Consider this scenario: a head contractor is employed through a fixed-price construction contract to build a new university block. During construction, they submit a request for information requesting further drawing details for particularly complex areas on the basis that they cannot otherwise build what has been designed. The contract administrator (called an engineer under NZS 3910:2013) issues drawing details. The head contractor then submits a variation claim for the detailed work, including timber blocking, bolt fixings, flashings and seals. Research objectives include establishing

- when the variation claim may be accepted
- the effect of contractor involvement in design development
- the effect if claimed from a building subcontractor to a consultant construction manager (CCM) (i.e. no head contractor).

A following journal article has been accepted for publication based on this chapter (issue and number to be confirmed at the time of writing):

- Finnie D, Ameer Ali N and Park K (2019) Design development post contract signing: client's or contractor's cost New Zealand?. *Proceedings of the Institution of Civil Engineers – Management, Procurement and Law* XXXX (XXXX): 1–XX, <https://doi.org/10.1680/jmapl.18.00044>

5.2 RESEARCH METHODOLOGY

The implied liabilities of contractors entering fixed-price contracts are examined in terms of how they may influence the interpretation of NZS 3910:2013 when deciding claims for design development post contract signing. A flow chart for aiding claim entitlement decisions is provided. Then, the head contractor's and consultant manager's liabilities are compared at common law, with a tabulated comparison of the two.

While design buildability obligations have been considered for ground conditions and foundations (Bailey, 2007; Dennys and Clay, 2015; Rosenberg, 2012; Walton, 2007), there is an absence of literature specific to detailed design development. Few legal precedents exist, with disputes generally negotiated or referred to adjudication or arbitration where outcomes remain private.

Similarly, few precedents exist specifically relating to the construction management procurement pathways where the client employs a CCM. Therefore, cases related to a contractor's liability for design buildability are applied through analogy. Similarly, cases related to PMs and contract administrators are considered for CCMs. Legal commentary is also applied from respected textbooks and published papers. According to Chynoweth (2008), analogy is the common tool of legal scholar research and legal scholarship involves

developing 'scholastic arguments for subsequent criticism and reworking by other scholars, rather than any attempt to deliver results which purport to be definitive and final' (Chynoweth, 2008: p. 30). This study is not intended as legal advice.

5.3 CONTRACTOR CLAIM ENTITLEMENT

5.3.1 Common law position: absolute liability and the inclusive-price principle

New Zealand courts have so far followed the United Kingdom in holding building contractors strictly liable for design buildability. According to Walton (2007: p. 3), a New Zealand barrister, 'the common law position is that, without an express provision to the contrary, ground condition risk rests with the contractor like any other physical condition or buildability issue'. The contract administrator must decide whether the contractor should have allowed sufficient costs for the newly detailed work within their fixed price or whether the detailed work is sufficiently different to constitute a variation to the contract. The distinguishing point is that the contractor should have included for all costs necessary to complete the works, even if not specified on the drawings. This is the 'inclusive-price' principle. If the drawing is considered within the contractor's inclusive price, it may be instructed as a variation 'for the contractor's convenience' without additional time or cost (see the book by Dennys and Clay (2015, p. 402)). However, the extent of application ultimately depends on the interpretation of the contract and specified scope (see the book by Dennys and Clay (2015: p. 391)). Therefore, the contractor may not automatically be entitled to costs of additional materials shown in detailed drawings instructed after contract signing. The contractor's absolute liability is not necessarily reduced by the client providing a schedule of quantities. While the contractor may rely on the accuracy of the SOQ aligning with the drawings (unless the SOQ disclaims liability), this may not reduce the contractor's absolute liability for unforeseen circumstances. In *Worksop Tarmacadam Co Ltd v. Hannaby (CA)* (1995), a contractor's claim for additional quantities due to encountering hard rock was rejected, despite the contract containing a remeasurement clause. Russell LJ said it would have been the 'easiest thing in the world' for the plaintiffs to make a specific provision for dealing with 'unforeseen conditions being encountered', had they chosen to. The main relief at common law is if the contract becomes impossible or radically different (frustrated).

The case of *Wilkins and Davies Construction Co Ltd v. Geraldine Borough* (1958) provides an example of a building contractor being held liable for both the original and redesign of a concrete tank chamber after the original design was abandoned midway through construction. The contractor argued that a contract for sinking a sewage tank became wholly inapplicable after uncovering ground conditions that made excavation impossible and the designed pump system (44 gallons (200 litres) or even 400-gallon drum) unworkable due to the volume of groundwater, so not buildable as designed. However, the High Court in Wellington followed the United Kingdom case of *Tharsis Sulphur & Copper Company v. McElroy & Sons* (1878) in finding that the contract was not frustrated because performance remained possible. The tank could still be constructed albeit using a different design methodology involving craning precast rings under water with a diver. The contractor was therefore held to their contract obligations. In *Tharsis Sulphur & Copper Company v. McElroy & Sons* (1878), the contract specified girder dimensions, and without written instruction to make the girders of thicker metal, the contractor could not recover extra costs. Lord Blackburn stated that 'When in this case, the contractor says "We cannot do the works as we have promised to do it unless you permit us to make it thicker than we undertook to make it" and the engineer on behalf of the company says "I will not object to your making it thicker if you cannot do it otherwise", I think there is nothing in that to imply that there was to be payment for the additional thickness' (*Tharsis Sulphur & Copper Company v. McElroy & Sons* (1878)).

Other examples of New Zealand courts applying a strict liability include *Slowey v. Lodder* (1900) and *Gore District Council v. Power Co Ltd* (1997). In *Slowey v. Lodder* (1900), the

Court of Appeal followed *Thorn v. London City Council* (1876) in finding that a local council owed no implied warranty against known latent defects, after a previous contractor packed above a tunnel with brushwood and logs following a previous slip. This led to a tunnel collapse when the new contractor carried out work. Instead, contractors should make their own inquiries. *Gore District Council v. Power Co Ltd* (1997) demonstrates parties' freedom to agree contractually their own risk allocations. A contract for supplying power to the council for 1 penny per unit for time hereafter was upheld on the basis that contracts are not frustrated just because they turn out to be bad bargains.

The long-established principle is that the client who provides drawings to the tenderer does not warrant that the design is buildable (Bailey, 2007). Rather, it is the contractor who, by submitting a fixed price, legally warrants that they can build what has been designed and do so for their price, even if unforeseen events make performance more difficult, including buildability problems arising from the engineer's negligent design (Rosenberg, 2012: p. 16). *Thorn v. London City Council* (1876) is another early United Kingdom case where the contractor was held to an absolute liability for design buildability when caissons failed to support the water pressure. Rosenberg (2012) confirmed that both *Thorn v. London City Council* (1876) and *Tharsis Sulphur & Copper Company v. McElroy & Sons* (1878) remain good case law.

Building contractors align with product manufacturers in that both must deliver a fit-for-purpose, defect-free product (Burrows et al., 2012). The principle of absolute liability, first established in *Paradine v. Jane* (1647), dictates that by entering a contract to do something absolutely, the provider must do that thing regardless of anything making the task more difficult (as opposed to a mere promise). As an absolute liability, the client does not first have to establish negligence as they might with a contract for services. For design development, the contract administrator must decide to what extent the contractor should have allowed for within their fixed price to compensate for incomplete drawings (inclusive price principle). While no clear legal definition of design buildability exists (see *Benaim (UK) Ltd v. Davies Middleton & Davies Ltd* (2005)), Rosenberg (2012: p. 2) suggests the following definition of 'buildability design risk' incurred by contractors, being the allocation of

deficiencies in the permanent works design which make it more time consuming or costly (or even impossible) during the construction phase to build to the specifications and drawings. (italics by the authors)

This suggests that the contractor must include sufficient costs to complete the works, including those for the permanent building works. NZS 3910:2013 clearly requires contractors to allow for costs both temporary and permanent, whether specified or 'inferred' from the contract.

NZS 3910:2013 clause 5.1.1, 'General responsibilities', states the following.

In carrying out the Contract Works the Contractor shall complete, handover to the Principal, and remedy defects in the Contract Works and provide all services, labour, Materials, Plant, Temporary Works, transport, and everything whether of a temporary or permanent nature required so far as the necessity for the same is specified in, or is to be inferred from the contract. (italics by the authors)

Under NZS 3910:2013, contractors may be entitled to costs for drawings when they are instructed to resolve matters relating to clause 9.5, 'Unforeseen physical conditions' or clause 5.13, 'Underground and above-ground utilities'. However, additional costs may be deemed within the contractor's inclusive price when the drawings are instructed in response to the contractor's request for greater detail or a change to suit their methods.

Scenario: under NZS 3910:2013 clause 5.1.1, the contractor is deemed to have included all costs required to complete the works, both of a temporary and a permanent nature, including work specified in, and inferred from, the contract. Including for all works of a 'permanent' nature indicates that contractors must allow sufficient costs to compensate where details may be lacking. Ultimately, the contract administrator must consider whether the instructed detail is sufficiently similar in nature to be deemed included in the contractor's fixed price or different enough to constitute a contract variation.

5.3.2 Extent of the contractor's 'inclusive' fixed price: work similar or wholly different

The contract administrator may consider the extent of the contractor's inclusive fixed price under three main categories.

- No entitlement for instructions sufficiently similar in nature to the original scope that the contractor should have allowed for all necessary costs, even if not specifically shown.
- Instructions sufficiently different to enable variation claims. According to Dennys and Clay (2015: p. 403), absolute liability 'will extend to variations, such as extra work, which can be shown to be similar in general character to the contract work but may not extend to unforeseeable variations which are different in character or location'.
- Instructions wholly outside the contract itself, which could be refused or performed for rates outside the contract (quantum meruit). Dennys and Clay (2015: pp. 649–650) provide how for a single house, the addition of a garage might be
- acceptable, but a variation to build a second house might not, whereas in a contract for 300 houses, instruction for another 20 houses might not vitiate the original contract.

The first two categories may apply where the contractor requests further details, whereas the third category is more likely client instructed scope changes.

Scenario: the contract administrator must decide whether the details are sufficiently similar in nature that the contractor should have included the costs within their fixed price or are different enough to constitute a variation. In any case, the administrator might ask the contractor what they allowed for to produce a fit-for-purpose product.

5.3.3 Whether the contractor can claim work outside the contract: frustration and restitution

At common law, the main relief from absolute liability is when unforeseen circumstances render performance impossible or radically different from the original contract. The contract may then be deemed frustrated, relieving parties of their contractual obligations irrespective of the elect of either party (Burrows et al., 2012; Dennys and Clay, 2015). However, the threshold for frustration is generally high, and contractors may suffer great loss arising from unforeseen circumstance, such as ground conditions (Burrows et al., 2012).

If an instruction was deemed a necessary solution to overcome circumstances that would otherwise frustrated the contract, the contractor may be entitled to claim costs for the work outside the contract rates under the doctrine of restitution based on unjust enrichment. However, restitution claims are available only when no other avenue exists through contract or tort and where enrichment of the benefited party at the expense of the other would be unjust (Davenport and Harris, 1997). Restitution is still an evolving doctrine in Australasia. New Zealand courts have not yet 'accorded it the status of a cause of action' (Burrows et al., 2012: p. 27), and *Pavey & Matthews Pty Ltd v. Paul* (1987) was the first Australian case to apply

unjust enrichment formally. In *Pavey & Matthews Pty Ltd v. Paul* (1987), a client refused to pay for residential building work on the basis that no contract existed. The work was performed on an oral contract when the Builders Licensing Act 1971 (New South Wales) required that residential contracts be in writing. While this case may have provided clear application of the doctrine, Dean J in *Pavey & Matthews Pty Ltd v. Paul* (1987) cautioned that future judges should not use 'judicial discretion to do whatever idiosyncratic notions of what is fair and just might dictate'. The following scenarios theorise where restitution might apply in construction claims.

Example 1 (Davenport and Durham, 2013: p. 37): ground conditions

... the principal or superintendent refuses to order a variation to overcome some obstacle, eg a defect in the design or a latent site condition. Assume that it is impossible to continue the work specified until the obstacle is overcome. An example may be where the principal has provided a design for footings of a building but the subsoil conditions prove to be such that the design of the footings must be amended or the buildings will be unstable.

Example 2 (Davenport and Durham, 2013: p. 87): latent structural defects

The specification requires the contractor to replace the tiles on an existing building. When the contractor starts work, the contractor finds some rotten beams that need to be replaced before the tiles can be safely laid. Assume that replacement of beams is not part of the work prescribed by the contract. The owner refuses to direct a variation and tells the contractor that it is the contractor's problem. A contractor must not perform unsafe work so the contractor has the choice of replacing the rotten beams or not proceeding with the work. If the contractor replaces the beams, that additional work is not a variation. It is not work under the contract. (italics by the authors)

Both examples involve work required to fulfil the contract. In the absence of express contract provisions, by offering fixed-price contracts, contractors adopt the risk of unforeseen circumstances that render performance more difficult but not impossible or wholly different. This restricts restitution to where the contract becomes frustrated. According to Burrows et al. (2012: p. 815), the threshold for frustration is high (italics by the authors).

Performance must have become impossible of performance or 'totally different'; the obligation must have been fundamentally altered. Anything less will not do. *This, as seen, even drastic fluctuations in currency over a period of time do not normally frustrate contracts; nor do very substantial obstructions to the progress of building contracts.* Some of this can be justified on the basis of the acceptance of risk by one of the parties. Nevertheless, the hardship caused can be very real and out of proportion to what was envisaged.

If the contract does provide for such events, then the work is handled within the contract. For example, NZS 3910:2013 clause 5.13, 'Underground and above-ground utilities', treats locating, altering or protecting latent utilities as a contract variation. Similarly, clause 9.5, 'Unforeseen physical conditions', treats reasonably unforeseeable physical conditions including artificial obstructions as variations. Davenport and Durham (2013) recommend a catch-all contract clause to avoid restitution claims (such as NZS 3910:2013 clause 5.1.1, 'General responsibilities').

In example 2, the contract might be frustrated if replacing roof beams is impossible or represents a wholly different scope. If the contract specified replacing a dozen tiles, then replacing most of the roof structure may constitute frustration, whereas if the contract involved replacing the whole roof, then replacing two rotten roof beams might not.

Scenario: it is unlikely that the instructed detail could constitute something wholly outside the contract scope. NZS 3910:2013 contains provisions for variations, including a change in type or quantity or materials (clause 9.1), for underground and aboveground utilities (clause 5.13) and unforeseen physical conditions (clause 9.5).

5.3.4 Duty to warn

At common law, contractors must warn of design issues that are reasonably foreseeable to contractors similar to that employed. Warning of issues early allows for solutions before costs escalate. NZS 3910:2013 clause 5.21, 'Advance notification', was introduced in the 2013 version to require the following (SNZ, 2013: p. 37).

5.21.1

The Contractor and the Engineer shall each notify the other in writing as soon as either of them becomes aware of any matter which is likely to:

- (a) Materially alter the Contract Price;
- (b) Materially delay completion of the Contract Works; or
- (c) Result in a breach of a statutory duty in connection with the Contract Works.

Clause 5.21.3 provides that 'if the Contractor does not notify of a matter which it reasonably ought to have ...' (SNZ, 2013: p. 37), then any variation will be calculated on the basis that they had and accounting for the impact being avoided or reduced.

According to Dennys and Clay (2015: p. 430), the test of reasonable foreseeability is a matter of fact. Contractors will not be expected to vet design details of experts, and it will 'only be relatively glaring or obvious design deficiencies judged in the light of the *knowledge to be expected from a Contractor of the type employed* which will give rise to the duty to warn' (italics by the authors). Example cases include the following.

- Failing to warn of serious design faults and safety dangers. In *Plant Construction Plc v. Clive Adams Associates and JMH Construction Services Ltd* (2000), the court held that the subcontractors should exercise appropriate skill, protest vigorously and even walk off-site unless a safe design was produced.
- Failing to warn of increased costs: A builder in New Zealand was found liable for failing to warn of increases to their estimate after being repeatedly asked to firm their price by the client (*J & JC Abrams v. Ancliffe* (1978)). Cook J held that any reasonably careful builder would have warned the client earlier of cost inflation.

While these cases centre on safety and costs, Craig (1999) commented that the duty imposed in *J & JC Abrams v. Ancliffe* (1978) could be likened to a duty to warn of design defects.

Scenario: ECI could influence the extent of what is reasonably foreseeable. For example, the contract administrator may take a stricter stance on contractors claiming variations for requested details if the contractor had greater opportunity to evaluate the design through ECI and if their ECI team included qualified architects and engineers (being the 'knowledge to be expected from a contractor of the type employed').

5.3.5 Accuracy and clarity of contract documents

The contractor may be entitled to claim costs for the detail if it is issued to resolve ambiguities in the original documents. The contra proferentem principle implies that ambiguities in contract documentation err against the provider of the document. In construction, the principle

generally applies to drawings, specifications and specific terms or exclusions, rather than standard terms (drafted with representation across clients, engineers and contractors).

Recent cases relating to exclusion clauses suggest that courts are taking a practical approach when considering what constitutes ambiguity and balancing the intended purpose and natural interpretation of the clause, commercial bargaining power of the parties and their freedom to agree risk apportionment contractually, leaving *contra proferentem* as a last resort where ambiguity remains (*Transocean Drilling UK Ltd v. Providence Resources plc* [2016]). New Zealand appears to be adopting this approach, in that only where the natural and ordinary meaning cannot be ascertained due to genuine ambiguity will *contra proferentem* apply (*Lumley General Insurance (NZ) Ltd v. Body Corporate No 205963* [2010]; *Persimmon Homes Ltd v. Ove Arup and Partners Ltd* [2017]).

NZS 3910: 2013 clause 2.7.4 allows variation claims for reasonably unforeseen ambiguities that, after clarification from the engineer result, in additional time or cost. In relation to 2S-ECl, the Joint Contracts Tribunal's pre-construction services agreement (JCT, 2019) requires contractors to warn of document inconsistencies and ambiguities ahead of agreeing to the construction contract.

Scenario: contractors may be able to claim the difference in costs between conflicting details across drawings. However, if the contractor installs materials based on ambiguous drawings, they may be entitled to the difference in cost between materials but not the cost of removing what has been already installed if it is deemed that they should have notified in advance. If the contractor was involved in design development through ECI, the threshold of what is considered reasonably foreseeable may be higher. The contractor's bargaining power may also be considered higher when negotiating through open-book pricing than through competitive tender.

5.3.6 Designer negligence for buildability

Designers have been found negligent for their designs lacking buildability on the basis that designs should not rely on exceptional levels of workmanship in order to comply with codes unless the level of workmanship is specified, such as for a prestigious hotel (*Dennys and Clay*, 2015: p.289; *Department of National Heritage v. Steensen Varming Mulcahy* (1998)), and that the quality of documentation should be sufficiently detailed and legible to enable construction without further clarification. While this appears at odds with the contractors' strict liability, there is no evidence that this changes the contractor's commercial liabilities when offering fixed-price construction contracts for client supplied design.

Three further cases provide examples.

- Roof lap tolerances were found unlikely to be achieved by ordinary standards of workmanship, and ordinary supervision suffices in less extreme conditions. Judge Hicks QC held the designer negligent for not considering trade literature warning about low-pitched roofs and the client's representative negligent for failing to supervise (*George Fischer Holding Ltd v. Multi Design Consultants Ltd* (1998)).
- A front-sealed cladding system was held to lack buildability because it relied on a level of 'exceptional skill' – above the 'care and skill ordinarily to be expected', including working in windy conditions and partly from scaffold (*Equitable Debenture Assets Corporation Ltd v. Moss (William) Group Ltd* (1984, 9.16)). It was similarly held that designs may be defective if they incur very difficult supervision and may be described as lacking 'supervisability'. The contractor was also found liable for breaching an implied term to warn of design buildability issues (*Equitable Debenture Assets Corporation Ltd v. Moss (William) Group Ltd* (1984)). An adhesive-fixed tile cladding

resulted in difficulties achieving concrete tolerances to receive the tiles (*Victoria University of Manchester v. Hugh Wilson Lewis Womersley (a firm) and Pochin Contractors* (1984)). Judge Hewey held that the architects failed to heed tiling literature or properly consider junctions and movement joints and in specifying very small gaps between tiles 'did not have proper regard for buildability' (*Victoria University of Manchester v. Hugh Q29 Wilson Lewis Womersley (a firm) and Pochin Contractors* (1984)).

The above cases involved completed buildings that leaked. They did not involve contractors requesting design changes on the basis they could not otherwise build what was designed. Also, both *Equitable Debenture Assets Corporation Ltd v. Moss (William) Group Ltd* (1984) and *George Fischer Holding Ltd v. Multi Design Consultants Ltd* (1988) involved design and build contractors, meaning the client did not provide the contractor with the design. Instead, the clients sued the designers, who in both cases had provided collateral warranties directly to the clients. In *George Fischer Holding Ltd v. Multi Design Consultants Ltd* (1988), the design and build contractor went into liquidation at the start of the trial.

Interestingly, in New Zealand, Building Amendment Act 2013 section 362 (l) requires that materials for residential building work be 'suitable for the purpose' and workmanship be performed using 'reasonable skill and care'. However, this applies only to residential building contracts over NZD \$30 000.00 for household units, whereas NZS 3910:2013 is typically used for commercial or infrastructure works.

A designer in New Zealand was found negligent for, among other things, their design lacking buildability (MBIE, 2016) under the LBP scheme, which came into effect in 2007 and requires that all designers and residential building practitioners be licensed. The board cancelled the designer's licence and ordered them to pay costs for incompetence and disrepute after the designer failed to carry out adequate site investigations and varied a producer statement from a previous project and their design was found to be incomplete with hand-drawn notes that were deemed illegible and lacking sufficient detail to prescribe how the building was to comply with the New Zealand Building Code (NZBC) (MBIE, 2019). The board (MBIE, 2016) noted that

... a designer's plans should be able to stand by themselves, should not require clarification, and should document how the building work is to be undertaken so that code compliance is achieved. The Board has also consistently conveyed in previous decisions the message that it is not appropriate for licensed building practitioner designers to use the building consent process as a peer review or quality assurance mechanism and/or rely on the building consent authority to pick up any anomalies in the design documents.

The senior technical advisor agreed that contractors may incur a strict commercial liability for buildability when tendering fixed-price contracts but clarified that the LBP board take a holistic approach to 'accountability' based on the reasonable standard that they expect of licensed designers. This, therefore, differs from 'an implied guarantee of buildability and the subsequent liability to compensate for the problems experienced – of which the Board would have no comment' (personal e-mail communication, 15 December 2016).

Based on the above, contractors remain liable for the costs of design solutions when they request these after entering a fixed-price contract for design supplied by the client. Separately, licensed designers may be accountable to the LBP board (and possibly ordered to pay costs) if their design is deemed negligence based on such breaches as insufficient investigations or illegible and inadequately detailed drawings. Courts may also deem designers negligent if their designs rely on exceptional levels of workmanship in order to comply with the building code,

as supported by the Building Amendment Act 2013 requirements for residential building contracts over NZD \$30 000.00 for work involving household units.

5.3.7 Claim-entitlement flow chart

Figure 1 provides a decision flow chart summarising the key considerations when evaluating claims related to design buildability. Decision gateways are referenced to the authoritative Hudson’s Building and Engineering Contracts (Dennys and Clay, 2015). This demonstrates two main grounds for claims

- instructed details sufficiently different in character from the original scope to constitute a contract variation, so long as the contractor has not breached their implied duty to warn
- instructions wholly different from the original scope or the contract is frustrated when unforeseen events render
- performance impossible or wholly different.

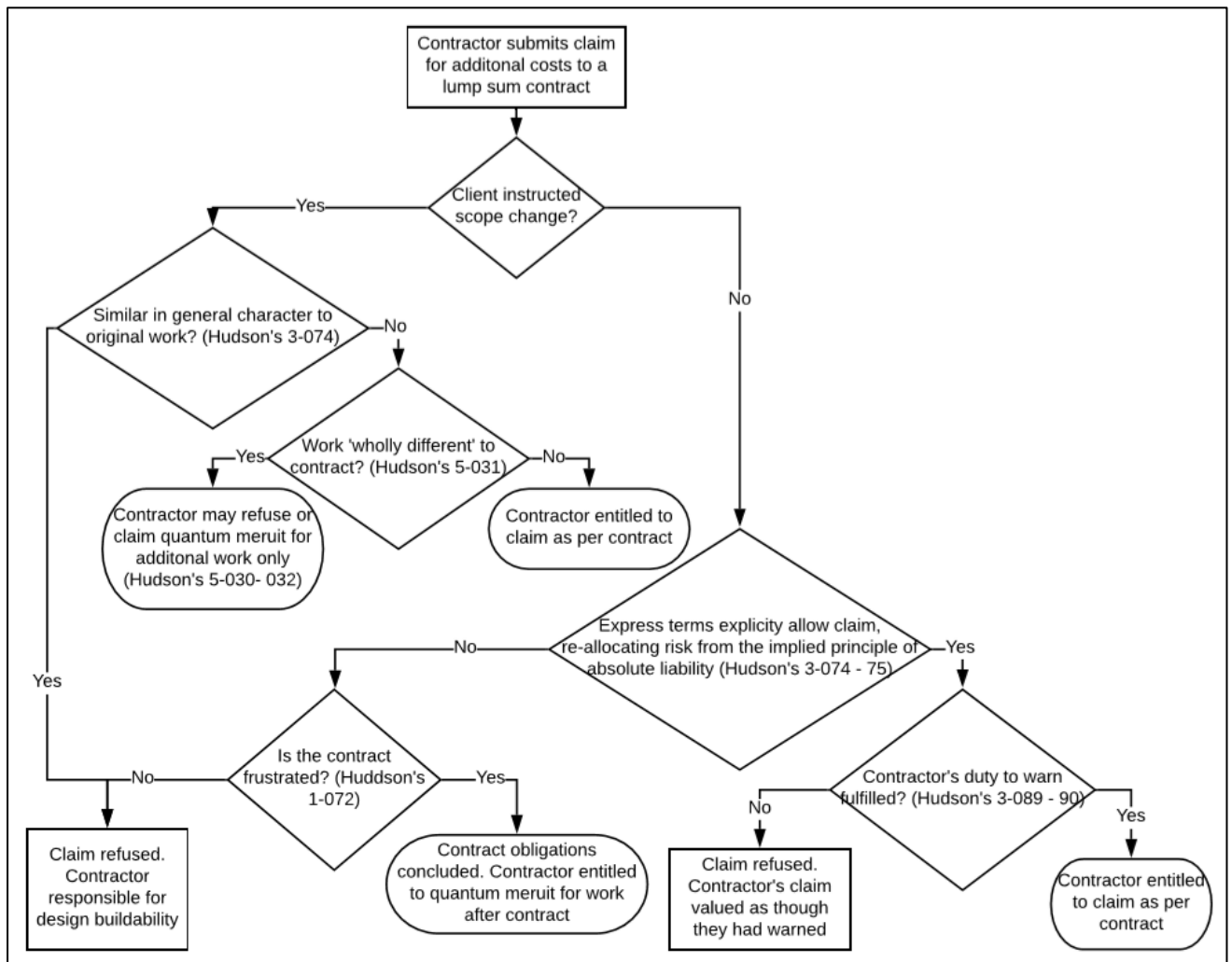


Figure 10: Decision-matrix for determining contractor claim entitlement

5.4. EFFECT IF CONSULTANT MANAGER (NO HEAD CONTRACTOR)

CCMs are employed under the construction management procurement model. The client employs the CCM to act as their representative in planning and administering the works under a contract for services, sometimes called a construction management agreement (CMA), with the client employing the trade packages directly (no head contractor).

5.4.1 Duty of care

CCMs have a lesser duty than head contractors. CCMs provide professional services, unlike contractors, who are deemed to deliver a product. As such, CCMs do not guarantee project outcomes, only that they will take reasonable skill and care. For example, head contractors may incur damages for delay by their subcontractors, whereas clients might rely on their CCM to apportion damages to individual trade contractors or otherwise establish that late completion was resultant of the CCM's negligence. The test of professional conduct was established in *Bolam v. Friern Hospital Management Committee* (1957) and extended to other professionals who, like doctors, cannot guarantee successful operations. The test of what is reasonable skill and care is measured in terms of what any other reasonably competent professional would have done given similar circumstances; anything less may be deemed negligent (*Monastiriotis and Bodnar*, 2013).

5.4.2 Procuring trade packages

However, what is considered 'reasonable' of CCMs is yet to be fully tested in terms of scope and strictness. For example, *Great Eastern Hotel Company Ltd v. John Laing Construction Ltd* (2005), the first case involving a CMA (Keating Chambers, 2018), held that CCMs must avoid gaps when procuring sub-trades. The strict outcome has been compared with a contractor's fitness-for-purpose warranty (O'Carroll, 2006).

5.4.3 Duty to warn

CCMs provide services like PMs, architects or engineers in representing their clients and administering projects. A key duty is keeping their client informed and protected from foreseeable risks, such as warning about the following: non-performance by others in the project team (*Chesham Properties v. Bucknall Austin* (1996)); tendering packages of substantially incomplete design (*Plymouth & South West Co-operative Society Ltd v. Architecture, Structure & Management Ltd* (2006)); recommending that clients obtain adequate insurances to cover potential damages sufficiently (*William Tomkinson and Sons Ltd v. the Parochial Church Council of St Michael and Others* (1990)); ensuring that contractors have adequate insurances in place (*Pozzolan Lytag Limited v. Bryan Hobson Associates* (1999)); ensuring that the scope of works is not underestimated (*Ralphs v. Francis Horner & Sons* (1987)); budgeting for inflation costs (*Nye Saunders and Partners v. Alan E. Bristow* (1987)); advising about contractor reliability (*Pratt v. George J Hill Associates* (1987)); and serving notice on contractors in serious breach of their obligations to maintain progress (*West Faulkner Associates v. London Borough of Newham* (1995)). In doing so, they must act persuasively. It is insufficient to act simply as a 'postbox' (Gould, 2011; *Royal Brompton Hospital NHS Trust v. Hammond* (2001)).

The extent that PMs or CCMs should warn of design documentation problems is less clear. PMs should ensure that other team members satisfy their obligations. However, this may not extend to ensuring the correctness of their decisions (*Royal Brompton Hospital NHS Trust v. Hammond* (2001)). Otherwise, PMs would effectively be doing everyone else's work (Gould, 2011). This indicates a lower-level duty to warn about detailed drawing matters than contractors, engineers or architects, who are likely more intimately involved in the drawings.

5.4.4 Application of CCM obligations

Both contractors and consultants typically provide services in the first stage of 2S-ECl. Then, CCMs provide services through the construction stage, while head contractors adopt a strict liability for project outcomes when they enter fixed-price construction contracts. Contractors' strict liability includes the work of their subcontractors and coordination and connectivity between trades, whereas CCMs may instruct individual trade contractors to manage connectivity, on the client's behalf. Instructions for extra blocking, fixings, flashings and sealants may involve, say, three different subcontractors (carpentry, cladding and sealants). Table 1 summarises key comparisons.

Scenario: a carpentry subcontractor is unlikely responsible for integration with the cladding system, instead relying on the head contractor's methodology. For example, in *Aurum Investments Limited v. Avonforce (in liquidation)* [2001], a subcontractor was deemed not liable for a partial excavation collapse, because they could not know the design and build contractor's method of work. CCMs could argue the inclusive-price principle against individual subcontractor claims, such as the carpentry contractor requesting details of fixings, although calling an instruction that details extra work a 'variation for the contractor's convenience' could be a hard sell. The client may claim negligence of the CCM if they can demonstrate that the instruction resulted from the CCM failing to procure trade packages or that they failed to warn of foreseeable design problems, unlikely for a construction detail.

Table 3: Summary comparison of head contractor and CCM obligations

Obligation	Head contractor	Consultant manager
Construction	Absolute liability and fitness for purpose. NZ Building Amendment Act 2013 stipulates reasonable standards of workmanship and fit for purpose materials for residential work.	Reasonable skill and care for planning and managing construction work on behalf of the client who employs trade packages directly. (Section 5.4.1 - 2)
Duty to warn	Duty through tort to warn of design compliance issues or cost increases after providing a budget. (Section 5.3.4) Test of foreseeability based on facts, and what any other reasonably competent similar contractor would have foreseen. (Section 5.3.4) ECI may influence foreseeability threshold in terms of time afforded and ECI team composition. (Section 5.3.4)	Duty to warn of contractual risk and non-performance by team members, taking reasonable skill and care. (Section 5.4.3)
Procurement	Absolute liability for procuring all necessary work (inclusive price principle). (Section 5.3.1)	Procure all works necessary without gaps, so far as not negligent. (Section 5.4.2)
Time	Absolute liability. Client can charge liquidated or general damages for late completion except for extension of time grounds permitted in the contract. (Section 5.3.1)	Client relies on consultant apportioning remedial work to individual trade packages or must demonstrate the defects are a consequence of the consultant's negligence. (Section 5.4.4)
Quality	Absolute liability. Contractor responsible for remedying defects at their expense. (Section 5.3.1) Contractor may request that instructed drawings will comply with the Building	Client relies on consultant apportioning remedial work to individual trade-packages, or must demonstrate the defects are consequential of the consultant's. (Section 5.4.4)

	Code when building using reasonable levels of workmanship (Section 5.3.6)	
Cost	Held to fixed price, except for contractual compensation events, sufficiently different instructions, document ambiguities, or frustration. (Sections 5.3.1 – 5.2.5)	Reasonable skill and care when providing a budget. (Section 5.4.1). Must warn of cost increases. (Section 5.4.3)
Instructed drawing details	<p>Contractor incurs absolute liability for instructions similar in nature. Contract administrator respond to claims for instructed drawings by enquiring what the contractor allowed within their fixed price to produce a fit for purpose product. (Section 5.3.1)</p> <p>Contractor may claim variation costs for instructions sufficiently beyond the original scope. (Section 5.3.2)</p> <p>Contractor may refuse instructions wholly different to the original scope or perform work outside contract rates (Section 5.3.2)</p> <p>Contractor may claim cost difference for ambiguities in drawings under contra proferentem. (section 5.2.5), but not the cost for removing incorrect materials if they reasonably ought to have warned in advance (5.4 and NZS3910:2013, 5.21.1)</p>	May enforce inclusive price principle to individual trade-packages, though does not adopt an overall absolute liability for connectivity like a head contractor. (Section 5.4.4)

5.5 CONCLUSIONS

Key considerations for determining whether instructed detailed drawings vary the contract under NZS 3910:2013 when instructed post contract signing were found to include the following.

- Whether the detail is within what the contractor should have allowed for within their fixed price to compensate for any
- lacking details, including works of both a temporary and a permanent nature (inclusive-price principle and NZS 3910:2013, clause 5.1.1).
- Whether the instruction details work that is different enough to constitute a contract variation or so wholly outside the original scope to be considered outside the contract itself.
- Whether the drawing is issued at the contractor's request to suit their construction methodology. Generally, contractors warrant buildability when offering fixed-price contracts for client-supplied designs. Such instructions may be issued as variations for the contractor's convenience with no additional time or cost, although NZS 3910:2013 treats reasonably unforeseeable latent conditions as variations (such as clause 5.13, 'Underground and above-ground utilities', or clause 9.5, 'Unforeseen physical conditions').
- Whether the instruction resolves problems that could have been mitigated had the contractor provided advanced notification (clause 5.21.1). Any resulting variation would be calculated on the basis that the contractor had warned where they reasonably ought to.

- Whether the instruction resolves drawing ambiguities. The contractor may be paid the difference between two products on the basis of contra proferentem. NZS 3910:2013 clause 2.7.4 treats reasonably unforeseeable ambiguities as variations. The threshold for foreseeability may be deemed higher where the contractor was involved in design development through ECI.

Design buildability responsibilities were also considered for designers through case law and the New Zealand LBP scheme. While designers may have responsibilities for ensuring that their designs are sufficiently detailed to comply with the building code when built using reasonable levels of workmanship, this does not appear to change the commercial liabilities that contractors face when entering fixed-price construction contracts.

Implied duties of contractors and CCMs were compared at common law. Both provide services in the first stage of 2S-ECI, taking reasonable skill and care. During the construction stage, CCMs continue to provide project management and administration services, whereas head contractors adopt a more absolute liability to deliver a defect-free product with single point responsibility for all work including that of subcontractors and including for connectivity. The benefit of single-point accountability should perhaps be balanced in terms of, for example, CCMs acting on behalf of their clients to reduce contractor claims rather than head contractors claiming against their clients.

In the absence of an implied body of opinion, the actual scope of CCM obligations depends on the written service agreement. CMAs should carefully consider the scope of work, such as planning and procuring a comprehensive set of trade packages without gaps, administration and warning of contractual issues, such as cost increases and insurances, non-performance by other team members and whether the CCM is responsible for reviewing designs.

Chapter 6: 2S-ECI Contractual application in New Zealand

6.1 INTRODUCTION

This chapter explores the use of 2S-ECI in New Zealand. This is done by comparing two standard form pre-construction service agreements (PCSAs) published in the United Kingdom with two bespoke PCSAs used in New Zealand, plus gauging the perceptions from construction professionals working in New Zealand about how 2S-ECI is conducted and what is working well and what can be improved.

The interviewees all had responsibility or knowledge of project procurement methods for projects in their region and typically had communication with other regions nationally, i.e., the purposive sample comprised of regional directors, general managers or senior consultants.

The names of ECI contract documents vary. This study adopts the term PCSA for consistency. The PCSAs are analysed in terms of; obligations and liabilities, scope of services, price formation, payment and termination, and dispute resolution. Findings inform industry about contractual procedures and risks associated with 2S-ECI, and help toward drafting of improved 2S-ECI documentation.

Standard form PCSAs first appeared in 2011 when the Joint Contracts Tribunal (JCT, 2019) and the Institution of Civil Engineers in the United Kingdom released, and subsequently revised, standard form pre-construction contracts to support 2S-ECI. The NEC3 supplementary ECI clause (NEC, 2018) supports NEC target value or cost reimbursement contracts, but not competitive fixed price contracts. The JCT *Pre-Construction Services Agreement (General Contractor) (PCSA)*; and *Pre-Construction Services Agreement (Specialist) (PCSA/SP)* supplement JCT building works or design and build contracts. Again, the approaches of these two standard forms vary (cost reimbursement or target value versus fixed lump sum).

The following conference paper has been accepted for publication based on this chapter:

- Finnie D, Ameer Ali N, and Park K (2019, August) Improving 2-stage early contractor involvement: lessons from New Zealand. Paper accepted for the 22nd Pacific Association of Quantity Surveyors Congress, Kuching Sarawak, Malaysia.

A further paper has been written and ready for submission to a conference or journal. This paper was accepted for the PAQS Congress in 2018, but was withdrawn in favour of pursuing a journal publication.

- Contractual Procedures for 2-Stage Early Contractor Involvement – Application in New Zealand

6.2 RESEARCH METHODOLOGY

Data was collected through 21 semi-structured with senior construction professionals to explore the contractual application of 2S-ECI in New Zealand and the perceived benefits,

project types suitable, challenges, and opportunities. A thematic analysis was done of the interview data. This was done manually using an MS Excel spreadsheet comparing interview responses. Specialist software was not required since one person interviewed all 21 participants and recorded the interviews both using audio equipment and hand dictated. Findings were coded with a focus on how 2S-ECI is used in New Zealand and benefits, challenges and opportunities for improvement. Following is the interview process adopted.

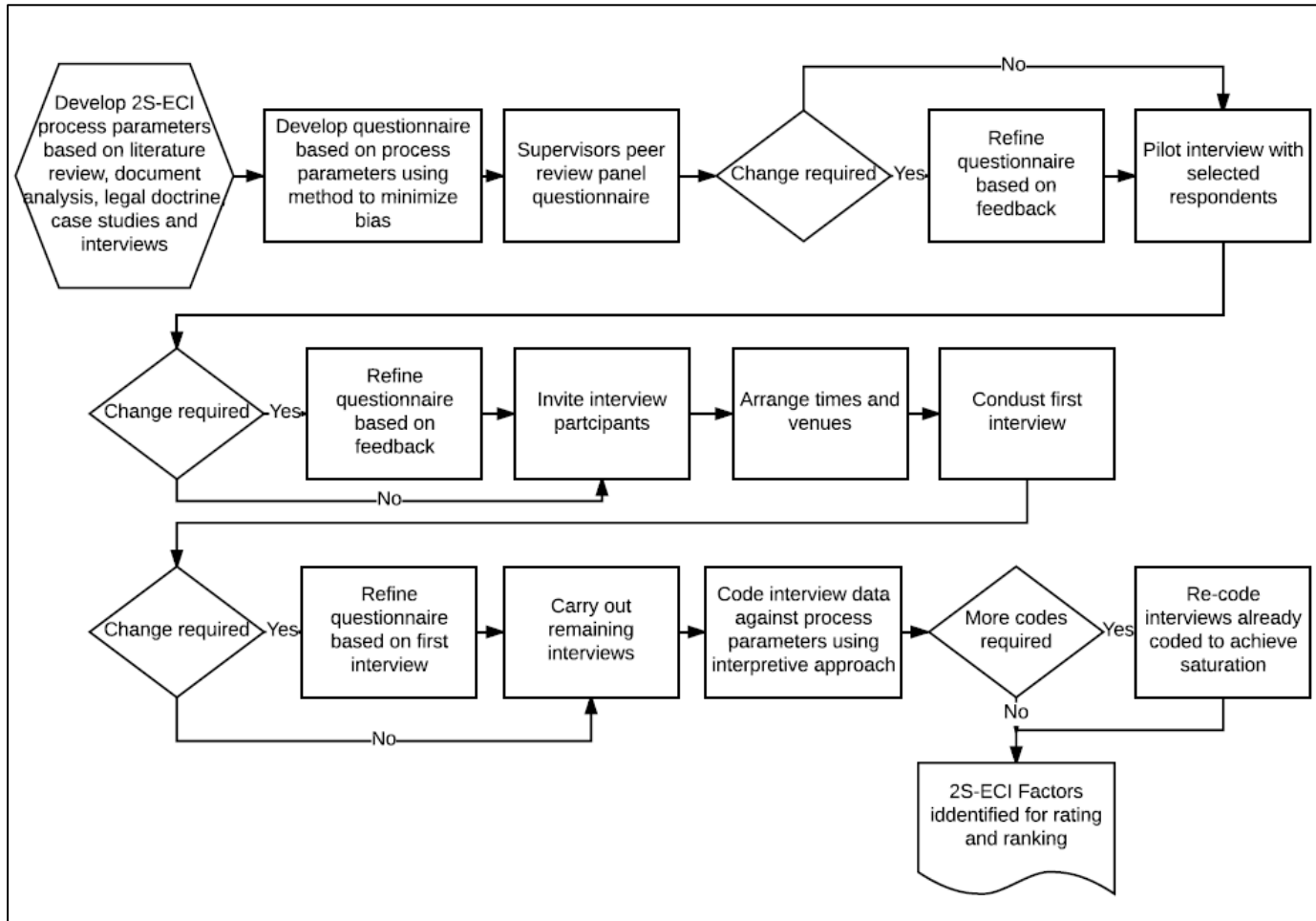


Figure 11: Interview process

The purposive interview sample included five senior PQSs; seven senior management staff, one project management staff, and one senior QS of head contractors; one senior PM and one director of consultant PM firms; three senior staff of large client organizations; two directors or partners of architect firms.

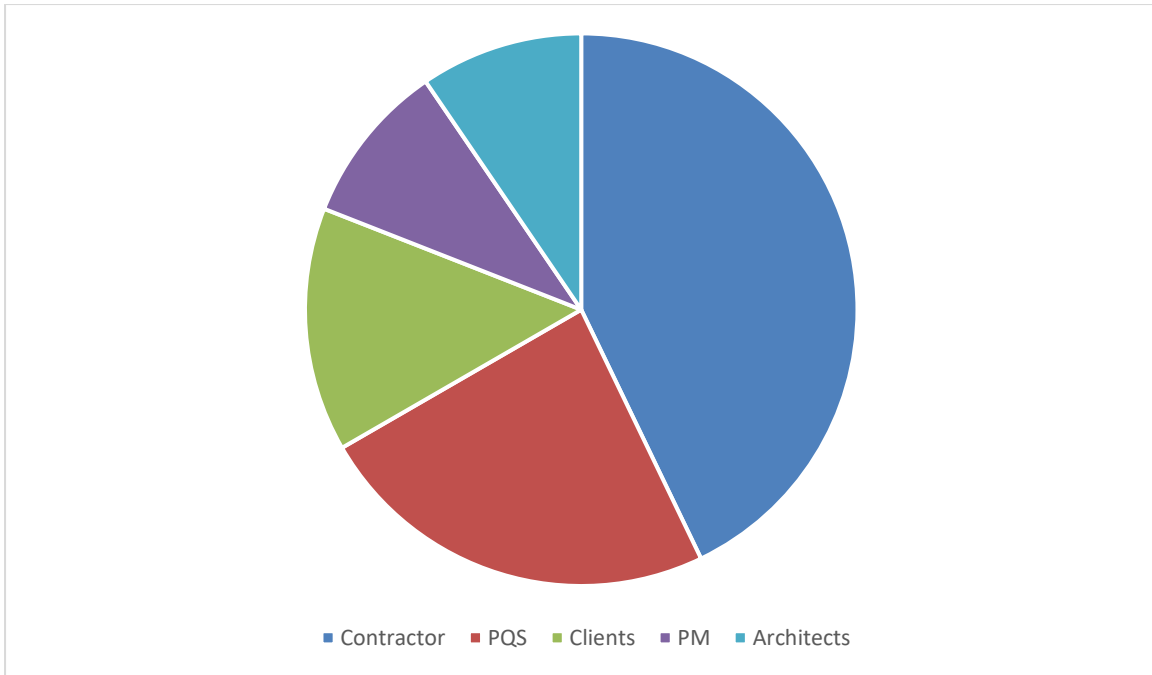


Figure 12: Sample distribution by organisation

All interviewees were in management or senior roles within their organisation, making them aware of the success or otherwise of projects procured through ECI. All had over 10 years' experience in the construction industry and experience working on ECI projects. All the ECI projects involved commercial construction. The demographic spread included Dunedin, Queenstown and Auckland (see Figure 13). Most organizations had nationwide coverage, meaning interviewees had communications across other divisions.

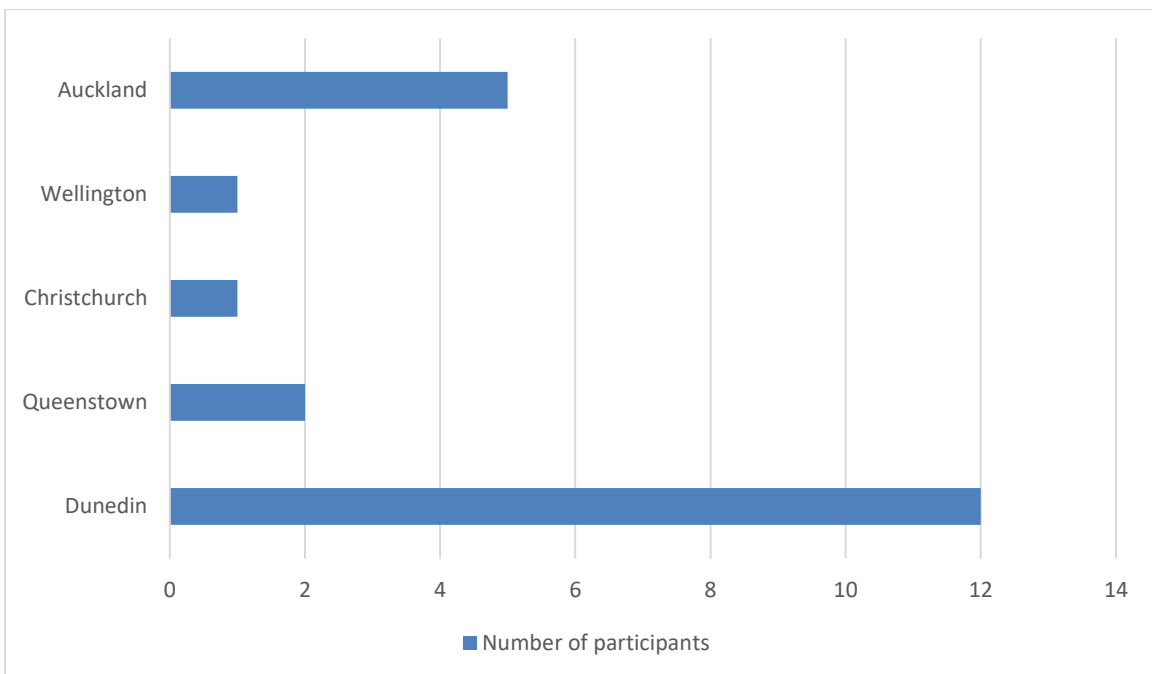


Figure13: Sample geographic distribution

Interviews consisted of the following process:

Explain:

- the purpose of the interview,
- why the participant has been chosen, and
- the expected duration of the interview.

Seek informed consent of the interviewee:

- use the information sheet,
- explanation of how the information is confidential, etc.,
- the use of note taking and/or the tape recorder,
- written or documented oral consent. If the interviewee has consented, conduct the interview.

The five-part interview framework consisted of 33 questions, and was adapted and modified from a study method used by Gameson and Sher (2009) and subsequently refined after pilot interviews. See Appendix 1. Each interview took between approximately one and three hours.

- **Section 1: General Questions.** Collects general information about the interviewee (name, company, role, years of experience) [4 questions]
- **Section 2: Background Information.** Collects data about participants' experience with ECI (number of ECI projects, value range, and type) [3 questions]
- **Section 3: Case Study Project Information.** Collects data relating to a typical facility (facility type, complexity, location, cost, time scale, head contractor or consultant, reason for ECI) [7 questions]
- **Section 4: Contractual Issues.** Collected data relating to specific contractual parameters (timing of contractor involvement, scope of pre-construction services, services by client's PM, formation of contractor pricing, whether contractor paid for ECI, form of construction contract price, contractual documentation used and key ingredients, risk considerations, lessons learnt) [14 questions]
- **Section 5: Perceptions.** Collects data about participants' overall perceptions of ECI (Effect on pricing, timing, quality, clarity of risk, composition of the project team, project features suitable for ECI, main barriers and opportunities to improve ECI. [5 questions]

The following ECI contract documents were compared:

- Contract type A: JCT Pre-Construction Services Agreement,
- Contract type B: NEC ECI Clause
- Contract types C and D: pre-construction agreements used by New Zealand public employers (both anonymized)
- Document E: Request for Proposal Early Contractor Involvement used for a tertiary education project

A matrix was developed to compare key contract provisions. The content was coded into the following key contractual parameters. Each is examined under the following sections by incorporating industry perceptions with the contractual terms.

- Project suitability for 2S-ECI
- Contract type
- Scope of pre-construction services

- Governing law
- Project team, composition, communication and cooperation
- Services liability and design obligations
- Planning and risk management
- Insurances
- Intellectual property and confidentiality
- Retaining key personnel and assignment
- Client obligations
- Price formation and payment
- Timing of contractor involvement
- Termination and suspension and whether payment for early involvement
- Disputes

6.3 PROJECT SUITABILITY FOR 2S-ECI

Each interviewee described the features of a typical 2S-ECI project they worked on. Twelve projects involved alterations or extensions to existing buildings, often maintaining client operations. Two projects involved new buildings with substantial site constraints, such as neighbouring historic buildings and complex traffic management. Three involved large complex new buildings. (The total number of projects is less than number of interviewees because some interviewees worked on the same projects.)

Interviewees generally identified four key drivers for 2S-ECI project suitability:

- (i) Projects involving planning logistics around existing operations (all interviewees);
- (ii) 2S-ECI as a means of open-book negotiation to support client/contractor relationships, or to secure resources in heated markets (all clients, PMs, architects and contractors, and 4 PQSs);
- (iii) Complex design solutions benefiting from contractor input (All PMs, architects and clients, 4 PQSs, and 4 contractors), and;
- (iv) Projects requiring fast-tracking (3 contractors, 3 PQSs, and one architect).

These project features can overlap. Clients may employ a preferred contractor who develops knowledge of their operations to support future logistical planning and buildability input, supporting continuous improvement through lessons learnt (Song, *et al*, 2009). Securing the most reliable contractor may mitigate the risk of disruption, which could far outweigh any potential premium paid for early involvement (1 PQS, 1 architect, and 1 contractor). According to one PM:

ECI can provide a means of negotiating contracts to maintain client and contractor relationships and to retain the knowledge of head contractors and specialist subcontractors, e.g., alterations to an existing hospital.

A contractor benefit associated with 2S-ECI is securing ongoing client relationships (Rahman and Alhassan, 2012; Song, *et al.*, 2006). This is exemplified by the seven contractors who typically do not charge for early involvement. According to one PQS:

Head contractors have not charged for early involvement in my experience. The Dunedin construction market is largely based more on ongoing relationships. Contractors are incentivized by securing profit through the construction contract, and

the prospect of future work with the same client or consultants. Once appointed for ECI, the contractor has a very strong chance of being awarded the construction contract.

According to two PQSs, the primary driver for 2S-ECI in Auckland is securing resources in the heated construction market, where there would otherwise be a lack of contractor appetite (and therefore high cost) for competitive tendering.

6.4 CONTRACT TYPE

The majority of interviewees felt that 2S-ECI could be improved through development of a standard form PCSA (60% across disciplines). Over half thought 2S-ECI could be improved through clearer obligations, and one thought guidelines for clients would be helpful. The recommendations for a standard form PCSA aligns with the benefits of standard form contracts identified by (Sharkey et al., 2014; Cunningham, 2013; Ashworth, 2012; Whitehead, 2009; Ramus et al., 2006; Richards, et al., 2005; Bajari Tadelis, 2001). One client developed their own PCSA contract and another client was in the early stages of developing one. Sixteen Interviewees (mix of disciplines) described pre-construction agreements being typically based on either oral agreements or invitation letters. Five interviewees described large clients developing their own pre-construction documentation. One PQS interviewee provided that in Auckland sometimes:

Educated clients who have been doing ECI and 2 Stage for a few years like [names omitted] have either a solid Pre-Construction Services Agreement with solid KPI's or a Stage 1 Contract in Place ahead of the ECI phase to Stage 2 trade tendering (or Stage 3 and 4 and 5!).

Another PQS described a 'complicated' client prepared PCSA on a \$15 million NZD project where 'no one knew how to handle it'. One complication was integrating the head contractor's ECI contract (and fixed ECI fee) with the construction contract across multiple project stages. The client sent the PCSA back to their lawyers, resulting in contractual delay. Inevitably, one stage became a contract variation. Five interviewees (all disciplines) felt that ECI documentation needs to be flexible in order to accommodate project variables. This aligns with recommendations by Turner and Riding (2015).

The lack of clear definition of 2S-ECI (or ECI) and associated contractual documentation was an area of concern. In the absence of clear contractual procedures, one architect warned (similarly to Murdoch and Hughes, 2008, p74) that 2S-ECI could simply be a marketing 'buzz-word' to describe a process for negotiating construction contracts rather than a genuine process to add value. Seventeen interviewees (across disciplines) felt that 2S-ECI could be improved with clearer pre-construction agreements, in particular to set out the scope of pre-construction services and expected obligations of parties. Ten interviewees specifically recommended developing a New Zealand standard form pre-construction services agreement (PCSA). For clients and consultants looking to use 2S-ECI for the first time, there seems no clear avenue for processes or contract documentation, leaving parties to '*feel their way*', particularly outside Auckland where practices remain informal.

PQS:

Lack of clear procedures can mean that client's expectations are not met, and parties' responsibilities are not defined. This can leave everyone to 'feel their way.'

Contractor:

No standard ECI documentation. Typical documentation comprises an invitation to treat, offer and acceptance. Sometime invitation can be very brief. Tend to ‘feel our way’, do what feels right.

Contractor:

Lack of clear contractor responsibilities; lack of ECI documentation; everyone is feeling their way.

PQS:

No standardised documentation for ECI. Client prepared a complicated ECI contract, and ‘no one knew how to handle it.’

In the absence of clear contract provisions and measurable outcomes, it is perhaps unsurprising that 17 interviewees (across disciplines) perceived client and consultant attitudes towards 2S-ECI as a barrier to its uptake, with some recommending further education in this area. This supports earlier findings (Turner and Riding, 2015; Pheng, *et al.*, 2015; Mosey, 2011; Whitehead, 2009).

PCSAs should consider construction stage provisions, such as completion dates and liquidated damages, and whether construction-only or novated design and build. One PM interviewee described the difficulty in negotiating LDs after the contractor was already involved in ECI. For example, Doc D (4.4) states that the construction contract completely supersedes the pre-construction agreement, and contains no provision for LDs. Regardless of their roles and types of organisation, 90% of respondents said that the construction-stage contracts were typically for construction only. Only one contractor described a target-value novated design and build contract. This contrasts findings by Francis and Kiroff (2015) that design and build is the most preferred form of ECI in the Auckland commercial market.

Interestingly, the RFP (Doc E) requires tenderers to provide a construction programme which, once agreed ‘*will become a Contract Document.*’ (Clause 3.11). This is problematic because if the client or their consultant’s actions result in changes to the contractor’s methods or sequence of works, this may result in a contract variation (Thomas and Wright, 2011). This highlights the advantages of a standard form PCSA readily available for clients and their consultants to adapt and use for their projects.

Document lengths vary considerable, from 14 to 43 pages. The JCT PCSA has 32 pages with 15 pages of standard terms, while the NEC ECI Clause has 14 pages with three pages of standard terms. Being a RFP, Document E contains provisions for tender communication (1.3), submitting the proposal (1.4), validity period (1.6), tender timeline (1.2), scope of services and project staging (2.3), preliminary development programme (2.5), tender information required (Section 3), and tender evaluation approach (Section 5). These provisions have not been included in the tabulated analysis above, as this would form additional separate documentation used with the other ECI contracts.

Table 4: Document type and length

Code	Title	Length	Construction contract
Doc A:	JCT PCSA	32 pages	<ul style="list-style-type: none"> · <i>for the supply of pre-construction services by a Contractor selected under two-stage tendering procedure; and</i> · <i>where the main contract is to be the JCT Standard Building Contract, Design and Build Contract, Major Project Construction Contract,</i>

			<i>Intermediate Building Contract or Intermediate Building Contract with contractor's design, 2016 Edition:</i>
Doc B:	NEC ECI Clause	14 pages	NEC contract options C (target contract with activity schedule) and E (cost reimbursable contract)
Doc C:	Preferred Contractor Contract	43 pages	Construction Works Contract (Schedule 5) 'refer to attached draft Construction Works Contracts'.
Doc D:	Preconstruction Services Agreement	16 pages	4.2 <i>'The terms of the Construction Contract shall be substantially those attached as the first schedule to the RFT.'</i> 4.4 <i>'The Construction Contract shall, if entered into, supersede this agreement. Upon entering into the Construction Contract, the Parties shall cease to have any powers, duties, rights, obligations or responsibilities under this agreement, whether accrued or otherwise, and the Construction Contract shall constitute the entire agreement between the Parties relating to the subject matter of this agreement.'</i>
Doc E:	Request for Proposal Main Contractor Early Involvement	35 pages	3.8 <i>Form of Contract: NZS3910:2013 and listed contract documents, including preliminary design documentation.</i>

The JCT PCSA and Doc provide for varying the contract. The JCT PCSA enables the client to instruct scope changes, and requires the contractor to promptly notify the effect of the instruction before proceeding, for agreement with the client. Doc C provides that costs for additional services are agreed. Either party may request a variation to the terms of the construction contract, and non-agreement is a grounds to dissolve the pre-construction contract. Doc E restricts the contractor from adjusting their management fee for any variations during construction. The contractor could still claim for the construction costs. It should be clear whether this term overrides NZS3910 provisions for valuing on and off-site overheads for variations. Doc B and D are silent, leaving the parties to agree any changes.

6.5 SCOPE OF CONTRACTOR PRE-CONSTRUCTION SERVICES

The scope of pre-construction services varies across the ECI documents (Table 4). Based on interview findings, contractors typically provide; planning and sequencing, buildability advice, value management input, procurement of subcontractors and suppliers. Risk management was often provided in the context of logistical planning and design buildability.

One third of interviewees (six contractors and one PQS) said 2S-ECI could be improved by providing a clearer scope of services. Two contractors said a checklist of pre-construction services might be helpful to clarify the scope of services. None of the documents analysed provide a clear schedule of pre-construction services to choose from. Most services are specified throughout the standard terms or left for parties to specify themselves.

Four interviewees (two PQSs, one contractor and one client) recommended including clear milestones for pre-construction deliverables. This aligns with Kings College (2014) recommendation for pre-construction milestones. The JCT PCSA (2.7.1) and Doc D (3.2.6 and 4.1) specify by when the contractor must submit their construction offer.

The scope of pre-construction services is compared across the documents in Table 5. The left-hand column represents pre-construction services identified from the literature review. This shows that scope of ECI contracts and literature generally align.

Table 5: Pre-construction services open-coded from literature

Pre-construction services	Literature review	Doc A JCT PCSA	Doc B NEC ECI Clause	Doc C	Doc D	Doc E (RFP)
Design management	Tzortzopoulos and Cooper (2007); Sidwell (1983)					
Stakeholder management	Tzortzopoulos and Cooper (2007); Mosey (2009); Education (2016); Berends (2006)	Annex B Pre-Construction Services	3.5 approvals and consents	Schedule 1	7.2	
Buildability advice	Turner and Riding (2015); Laryea and Watermeyer, (2016); Pheng, Gao and Lin (2015); Rahman and Alhassan (2012); Mosey, (2011); Rahmani, Khalfan and Maqsood (2014); Whitehead (2009); Song, et al. (2006); Jergeas and Put (2001); Sidwell (1983)	Annex B		Schedule 1	Verify buildability (2.1.6), assist and review buildability analysis (3.2.1)	Constructability and advice (2.2)
Advance warning		2.2			3.2.9	
Methodology		Annex B		Advise H&S hazards, assist with solutions (Schedule 1)	Assist and review construction methods (3.2.1)	Construction methodology advice (2.2)
Planning and programming	El-sayegh (2009); Mosey (2009); Kashiwagi, Kashiwagi and Savicky (2009); Sidwell (1983)	Annex B		Schedule 1	3.2.5	Programme development (2.2) 3.11 Programme Preliminary programme
Risk management	Rahman and Alhassan (2012); Mosey (2009); Education.govt.nz (2017); Jergeas and Put (2001); Kashiwagi, Kashiwagi and Savicky (2009)			Schedule 1	2.1.3	Value Engineering Services (2.3) <i>formal value engineering and risk management workshops</i>
Value management	Turner and Riding (2015); Mosey (2011); Kirkham (2007); Whitehead (2009); Jergeas and Put (2001); Kashiwagi, Kashiwagi and Savicky (2009)	Annex B Recommended materials comply with Good Practice guidelines (2.4)	Provide design proposals including the effect on cost and time (3.1 – 3.7)	Schedule 1	Optimise design in terms of cost and future maintenance (2.1.6)	Value Engineering Services (2.3)
Procuring subcontractors and suppliers	El-sayegh (2009); Whitehead (2009); Mosey (2009); Sidwell (1983)	Annex B		14-22, 30 - 39	2.1 – 3.2	Sub-trade consultation, procurement and coordination (2.2)
Cost and budget	Turner and Riding (2015); Kirkham (2007); Laryea (2010); Sidwell (1983)	Annex B	Prepare regular forecasts of stage 1 and total costs	Cost estimates to assist the PQS develop target cost plan (Schedule 1) (Schedule 1)		
Investigations, demolitions, enabling works					3.2.10 other services	Demolition of existing building

None of the PCSAs analysed included design management as a service by the contractor. Although the NEC ECI Clause provides for the contractor to make design proposals (for use with the NEC design and build contract).

Projects involving procurement of pre-fabricated modules from overseas require early design planning in order to demonstrate compliance with the New Zealand Building Code (NZBC) and obtain a building consent from local authorities. Local authorities in New Zealand have no jurisdiction outside New Zealand.

The scope of pre-construction services identified from literature was presented to at the Modular Construction and Pre-Fabrication Conference in Auckland, New Zealand, in December 2017. The following pre-construction services were suggested during the feedback session:

- liaising with local authorities to obtain compliance for prefabricated components
- coordinating documentation for building information modelling (BIM).

Doc's B and C provide for the contractor to obtain approvals and consents, and liaise with local authorities, adjacent landowners and service providers respectively. Doc D (3.2.10) provides for any other reasonably requested services, and prohibits the contractor to bind the client to third parties. The JCT PCSA (Annex B) Particulars section contains an option to specify a BIM Protocol.

6.6 QUALITY OF PRE-CONSTRUCTION SERVICES

Most interviewees (across disciplines) saw benefits in the early collaboration of 2S-ECI. However, 11 interviewees perceived a lack of pre-construction skills as a barrier to achieving real added value. Fourteen Interviewees (all disciplines) identified upskilling in pre-construction services as a way to improve 2S-ECI. Specific skills identified include VM, design buildability evaluation, and design coordination. Tables 6 and 7 exemplify the comments relating to contractors and then consultants.

Table 6: Pre-construction services by contractors

Contractor services	Comments
Lack of ECI maturity	<i>Theoretically 2S-ECI should reduce claims and disputes. However, in practice many contractors don't understand the ECI process. The lack of contractor maturity with ECI means you don't get the benefits.</i> (Contractor)
Lack of understanding	<i>In practice, the full benefits may not always be realised. Some contractors may not properly understand the ECI process and the different approach needed.</i> (Contractor)
Real added value added	<i>Theoretically, ECI should reduce administration and disputes, but this can depend on other factors, such as the real value offered by contractors.</i> (PM)
Effective planning, buildability and value management	<i>The contractors ECI advice is often then about how to de-risk it for the contractor and make it easier and simpler to build. Need specialist ECI skills (buildability and genuine value management) – absolutely without them no genuine ECI.</i> (PQS)

	<i>The theoretical benefits of ECI may not be realised if the contractor does not provide effective planning, buildability and value management services. (Client)</i>
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Table 7: Pre-construction services by consultants

Consultant services	Comments
Need more accountability for design coordination	<i>Designers need more accountability for design coordination to reduce document inconsistencies and ambiguities. (Client)</i>
Questionable design coordination capability of designers. ECI could help	<i>Questionable whether designers are able to coordinate design development effectively. Most failings seem to occur here. ECI may help if contractors can provide these skills. People able to coordinate designs well are 'worth their weight in gold.' (Client)</i>
Need more skilled design managers and experienced Site Managers	<i>Need resource (across all sides of the table), specifically more skilled design managers (many projects don't have them), more experienced site managers giving advice who know how to build (and not fresh faced "paper" PM's out of school). (PQS)</i>
Lack of design management capacity and design risk transfer	<i>NZ contractors lack the capacity to manage the design of very large projects. There appears to be a growing problem of designers trying to transfer more risk to contractors and contractors wanting more design work provided for them. Transferring excessive risk to contractors can either increase the project cost (as contractor's price for the risk) or create major problems as the contractor incurs large losses. (PM)</i> <i>Performance-based specifications are being used to transfer more design risk to contractors. Over the past 5-10 years, the quality of design documentation has reduced. We're looking at employing our own architect. (Contractor)</i>
Diminishing role of the Architect with introduction of PMs	<i>The architect's role has been diminished by the introduction of consultant PMs and franchise house builders. (Architect in Dunedin)</i> <i>There is often no longer a lead architect. This can create more design coordination issues. (Contractor)</i>
Inclusion of subcontractors for design and coordination	<i>Successfully, we are often looking at the bits we need to solve via ECI and then actually doing it without the main builder by engaging with the sub-contracting market ("subbie ECI"). Facades, Steel, Lifts, Piling are some of these. We had a façade contractor in the design team meetings before concept design had even been drawn on one job. The fully coordinated fully shop drawn steel and façade drawings are proving a massive benefit. (PQS)</i>

The move away from architect led designs, and questions around design management support earlier findings that Architects can feel intruded on when design management is performed by another party (Tzortzopoulos and Cooper, 2007; RIBA, 2007; Bresnen, 1991) and that architects can struggle to find their place (Whitehead, 2009).

Some contractors are developing their pre-construction services. One contractor employed a services manager in one division to evaluate building services designs, and a contractor was looking to employ an architect as part of their ECI team to address the declining quality in design documentation. This aligns with United Kingdom construction companies investing in design capabilities for strategic importance and to reduce design related risks (Tzortzopoulos and Cooper, 2007, p20). Similarly, Khalfan and McDermott (2007) described a United

Kingdom construction company who developed a pre-construction department for project management, financial and productivity issues at inception phases of projects.

There was no evidence of New Zealand contractors being engaged separately for the pre-construction stage, with the construction stage tendered to others. Indeed, five interviewees (across disciplines) highlighted the advantage of communicating pre-construction thinking across construction-stage site teams and potential involvement of site managers in the contractor's ECI team.

2S-ECI is a relational procurement strategy. The focus is on employing reliable constructors. When the priority of contractor selection is based on the bid price, Rahman and Kumaraswamy (2005, p370) argue that contractors may 'desperately lower their bids to win a contract and 'cut corners' during project execution to recover their money. This frequently leads to conflicts and distorts the relationships.' Rahman and Kumaraswamy (2005) found a combination of hard and soft skills was seen as important for the parties, with 'mutual trust' in the top of the list for 'building a successful relational contract' (p367). Almost all 25 interviewees (expert local Hong Kong consultants and contractors) felt that lowest price bidding does not assist industry development and often results in problems on projects. Interviewees suggested that clients should focus on value for money and select parties based on capacity and capability in terms of 'resources; technology and safety; managerial and operational capabilities; and motivation/commitment in terms of teamworking, joint problem-solving and so on' (p367). Ma and Xin (2011, p82) provide the following contractor selection criteria for first-stage of 2S-ECI in Australian infrastructure projects:

- Experience in similar works
- Management team qualities
- Appreciation of and approach to tasks
- Financial viability and insurance

Document E (RFP document) *Section 3: What we require* specifies the following tenderer attributes:

- **Capability** (3.2) in delivering the type project, including what percentage of work will be done by the tenderer's own work-force;
- **Proposed Team** (3.3), including names, qualifications and experience, roles in the project, whether a full-time or part-time employee, experience specifically relevant to the project, and their primary location;
- **Team Structure and Availability** (3.4) showing how the proposed team will interact on the project, and a resource schedule showing the involvement of each member;
- **Sustainability** (3.5) systems, procedures and commitment to environmental sustainability, both organisational and project specific capability;
- **Knowledge Sharing and Transfer** (3.6) outline opportunities to maximise involvement with students (educational project);
- **Price** (3.7) fixed fee or percentage fee, and include a 'fixed disbursement fee for all local travel to Dunedin as required for the duration of the project, general project printing and communications.'
- **Form of Contract** (3.8) details the type of construction contract and lists contract documents. The successful tenderer must provide a bond and will be subject to liquidated damages;
- **Supply Chain** (3.9) commitment that the tenderer will obtain three competitive prices for key subcontract trades;

- **Programme** (3.11) tenderers are required to provide a detailed construction delivery programme, which will form the basis of the Comprehensive Construction Programme;
- **Preliminaries and General** (3.12) price to include a Lump Sum Preliminaries and General price for the project
- **Pre-Construction Costs** (3.13) 'Tenderers are to submit a Lump Sum Pre-Construction Services price for the Pre-Construction Services';
- **Contractor's Margin** (3.14) Tenderers to declare a percentage margin, to be used to establish the fixed lump sum across all procurement stages;
- **Tender Pre-Conditions** (3.15) confirmation of professional indemnity insurance, ability to start the project immediately upon being awarded the contract, confirmation of the form of contract listed in 3.8, confirmation of supply chain required listed in 3.9, and completion and execution of the tender declaration form in Appendix 1.

The above requirements align with the contractor selection criteria suggested by Ma and Xin (2011, p82); experience in similar works (3.3 and 3.4), management team qualities (3.3 and 3.4), appreciation of and approach to tasks (3.5 and 3.6), and financial viability and insurance (3.15). However, there is no specific evidence of 'motivation/ commitment in terms of teamworking, joint problem-solving and so on' as suggested by Rahman and Kumaraswamy (2005).

6.7 SCOPE OF PROJECT MANAGER SERVICES

Interviewees identified the following services typically provided by clients' PMs:

- Procurement strategy;
- Overall project programme;
- Chair design team meetings and record minutes;
- Contract administration by PM or Architect;
- Generally, act as client representative.

The PM's role may be focused at the front-end of the project. If the head contractor becomes involved once concept design is developed, stakeholder management and developing the design brief must be done by the client's project manager or architect. The remainder could be specified for the contractor. Contract administration may then be done by the PM, the architect, or a combination of both. One contractor described how some projects could potentially transition to a more traditional architect or engineer model for the construction stage.

PM involvement is in the inception and conception stages. Once the construction stage commences, their services may reduce (as the contract effectively becomes a traditional construction contract following early collaborative planning), depending on the scale of the project.

A PQS described the potential for duplication in administration:

Contract administration may be by PM or Architect or Engineer. When PM is the contract administrator, the architect becomes a non-contractual administrator, e.g., provides architect directions for approval and issue by the PM (like other consultants). This can add another layer of complexity and timing.

One architect and two contractors described architects project managing and chairing design team meetings, with the PM acting as client representative.

A key advantage of PMs over architects appears to be challenging the design. However, some interviewees raised concerns over PM performance. According to one architect: *'Some add real value while others tend to "clip the ticket"'*, a contractor said *'Sometimes PMs can tend to act as letterboxes'*, and a client said they have *'sometimes struggled with performance of local PMs. More recently we are seeing larger PM consultants from outside local area that perform well coming into the local market.'* The potential variance in PM performance aligns with Gould (2011) who described project management as an emerging discipline, and identified the need for PMs to act persuasively in conducting their central role of client representation, and not merely act as a 'post box'.

6.8 GOVERNING LAW

The JCT PCSA is governed by English law, the NEC ECI Clause is for use 'in any location', and Docs C and D are governed by the New Zealand law and the non-exclusive jurisdiction of the High Court of New Zealand. Interestingly while Docs C and D refer to 'non-exclusive jurisdiction' of New Zealand Courts, Document E refers to 'exclusive jurisdiction' as copied from the government's standard RFP process, terms and conditions. If the JCT PCSA were to be adapted and modified to suit New Zealand, it would require the amendments shown in Table 8.

Table 8: JCT PCSA adaptations to New Zealand law

JCT PCSA reference to UK legislation	Clause
Governed by the law of England	1.5
Contracts (Rights of Third Parties) Act	1.3
Material recommendations in accordance with Good Practice in the Selection of Construction Materials (British Council for Offices)	2.4
Joint Fire Code	2.5
CDM Regulations	3.1
VAT Tax	6.1
'...insurers that have a place in the United Kingdom'	7.1
UK Freedom of Information Act 2000 (FOIA)	8.3
UK Public Contracts Act	10.5, 10.6, 10.8

6.9 PROJECT TEAM, COMPOSITION, COMMUNICATION AND COOPERATION

Over 60% of interviewees (across all disciplines) thought ECI can improve relationships, and almost half thought ECI requires quality relationships, in particular trust. This aligns with literature that team work is a key driver of successful relational procurement (Kings College, 2014; Ma and Xin, 2011; Rahman and Kumaraswamy; 2005).

While English law has struggled to define 'good faith' as a legal concept, Harvey (2018) asserts that 2S-ECI provides a procurement pathway analogous with 'good faith', but requires clear express for co-operation in terms of; disclosure of information, open-book aligning of commercial interests, collective risk management and a duty to warn.

The JCT PCSA and New Zealand contracts contain provisions for cooperation and information sharing. The New Zealand contracts also require 'no surprises' or 'prompt problem-solving'.

Unlike the other contracts, Doc C's partnering philosophy is expressly not given contractual effect, which seems at odds with Harvey (2018) recommendation for clear express contract terms. Doc E (a RFP document) requires the client to act fairly and reasonably in dealing with tenderer, as copied from the government's standard RFP process terms. However it contains no provisions for the contractor appointment during the pre-construction stage.

Table 9: Communication and cooperation

Code	Title	Communication	Cooperation
Doc A:	JCT PCSA	Notices and other communication (1.4)	Co-operation and supply of information (2.3)
Doc B:	NEC ECI Clause	No provision	No provision
Doc C:	Preferred Contractor Contract	Notices (137)	Attend all appropriate meetings (12.3) Liaison with the Project Consultancy Team (14) Partnering Partnering philosophy (100) Partnering obligations (101) Partnering in the contract (102, 103)
Doc D:	Preconstruction Services Agreement	No provision	Project objectives (2.1) Attend and report at weekly (or more frequently if requested) meetings (3.2.7 and 3.2.8)
Doc E:	Request for Proposal Main Contractor Early Involvement	General project communication and reporting	Section 6: RFP Process, terms and conditions

All PCSAs were between the client or their representative (e.g., a project manager) and the contractor. Terminology varies. The JCT PCSA uses Employer and a Contractor. The NEC Clause refers to a Project Manager, Employer, Employer's Agent, Principal Designer and Contractor. The New Zealand contracts uses Principal and a Contractor.

Most interviewees thought 2S-ECI team composition is generally the same as for traditional procurement, except that 2S-ECI typically involves a PQS and contractors providing more resource. Six interviewees (across disciplines) described contractors generally providing more leadership through 2S-ECI through involving their project managers, site managers and senior staff during design development, compared with estimators pricing tender bids. One contractor explained:

The expectation is a head contractor appointed through negotiated ECI should provide the top team, top programme, top quality, and top safety. Contractor's Site Manager can be involved in the design team meetings. This provides better integration between the contractor's estimating and onsite construction teams. An astute contractor with their Site Manager can work with the design team to determine construction detail requirements.

The majority of interviewees (14 across disciplines) felt that a PQS was needed for independent budget advice and to negotiate contractor rates. This aligns with the New Zealand Transport Agency (2018) and Ma and Xin (2011). However three contractors contextualized the need for a PQS as dependent on such factors as trust levels between contractor and client, the PQS fee relative to the likely benefit of negotiation, and the level of design standardization. One contractor described some experienced clients accepting their take-offs without engaging a PQS, being comfortable that the contractor provided their open-book workings.

All interviewees felt that 2S-ECI can improve design decisions through faster round-the-table decision-making. Most identified trust as crucial for successful 2S-ECI, supporting findings

that trust is a central ingredient of relational procurement (Rahman and Alhassan; 2012; Ross, 2011; Toolanen, 2008; Rahman and Kumaraswamy, 2005).

Three interviewees specifically felt that 2S-ECI can improve levels of trust, though only one contractor described specific partnering workshops. Five interviewees said that the quality of people were important. According to a PQS trust must operate both ways:

ECI requires trust. There is no sense being too precious about information. Contractors cannot conceal information, and the PQS may discuss budget information to the head contractor before negotiating the rates. Quality of relationships is paramount to the effectiveness of ECI.

This supports finding by Rahman and Alhassan (2012, p218) that ECI requires 'open book accounting, and open and honest communication between client, consultant and contractor, including sharing any sensitive information....'

Another PQS linked relationship-building with better forward planning:

ECI enabled the contractor to get to know the client and their operations: We were 'able to build relationships between client and contractor.' This helped 'everyone know what was going to happen.'

It is important for contractors to understand their client and their operations when planning the logistics of construction work around ongoing building operations, a project feature identified as particularly suited to 2S-ECI. One contractor suggested 2S-ECI could be improved through more active client involvement, supporting (Kings College London, 2014; Ma and Xin, 2011; Rahman and Kumaraswamy; 2005).

6.10 SERVICES LIABILITY AND DESIGN OBLIGATIONS:

As discussed, contractors incur an absolute *fitness for purpose* obligation to produce a *product* as designed, similar to manufacturers (Burrows, Finn and Todd, 2012). However, through ECI, the contractor initially provides pre-construction *services*, similar to a consultant. Accordingly, the JCT PCSA and the New Zealand contracts (C and D) require *reasonable skill and care, and diligence*. The JCT PCSA and Doc D add ...of a contractor providing services on similar projects. The NEC ECI Insurance clause requires the contractor to insure against claims arising out of failure to '*use the skill and care normally used by professionals providing services similar to those required in the Works Information.*'

Construction contracts, such as NZS3910:2013 and NZIA SCC, reduce the contractor's design liability to that of *reasonable skill and care*. However, this does not address the contractor's liability for providing design buildability and value management *advice*. Only the JCT PCSA addresses the contractor's obligation for design. Clause 2.8 exempts the contract from any design contributions (except injury or death) until the construction contract is agreed, and those terms then apply.

JCT PCSA

Liability for design work

2.8 Where the Pre-Construction Services include design work, the Contractor shall unless otherwise specifically provide in Annex B have no liability of any kind to the Employer under this Agreement for that design work, whether in contract, negligence, breach of duty or otherwise (other than any personal injury or death arising from that

work), unless and until the Main Contract is entered into by the Parties, upon entry into which the Contractor's obligations and liability in respect of that design work shall be the same as if it formed part of the design work undertaken by him under the Main Contract and shall be subject to any relevant exclusions or limitations of liability contained in that contract.

A contractor interviewee who described recommending an alternative basement design to avoid potential leaking highlights this distinction. The alternative was accepted and the contractor assumed that the architect and engineer adopted liability for the design and therefore saw no need for professional indemnity insurance. However, the contractor was threatened with legal action when the basement incurred minor leaking on the basis that the construction contract included a weather-tightness guarantee. One PM also said that 'in ECI – Contractors are worried that, by providing design input, they may be taking on design risk.'

The majority of interviewees described the client's PM chairing the design team meetings (managing the design process). Murdoch and Hughes (2008) describe design management as a separate but not mutually exclusive function of architects that may be done by a separate manager. Only two interviewees described an architect leading design management, and one contractor described managing design on a novated design and build project.

With conceptual design typically done before contractor involvement, unsurprisingly, the contractor's duties more typically involved buildability evaluation, services coordination and providing detailed input building information modelling (BIM). This is supported by the ECI contracts, none of which contained design management as a pre-construction service, focusing more on design buildability and value management (though the NEC ECI Clause provides for the contractor design proposals, supporting the NEC design and build contract).

Design management and coordination were areas highlighted for improvement in 2S-ECI by almost half the interviewees across disciplines. Two of the three clients recommended better design coordination skills. One PQS interviewee recommended more skilled design managers, saying 'many projects don't have them and a Contractor sited problems with design coordination with the diminution of lead architects and recommended projects have a lead design consultant. A PM questioned whether any New Zealand contractors are capable of design management on very large projects, supporting Tzortzopoulos and Cooper (2007) who found contractors often lack design management skills. However, one client interviewee questioned whether designers are able to coordinate design development effectively and thought ECI may help if contractors can provide these skills, asserting that people able to coordinate designs are "worth their weight in gold." Some head contractors appear to be seeing the opportunity to specialize, with two contractors now providing specialist building services managers as part of their ECI teams, and another contractor looking to employ an architect as part of their ECI team.

The JCT PCSA and Docs C and D contain provisions restricting assignment. The JCT PCSA requires both the client and contractor to obtain the written consent of the other before any assignment. Doc C and D require the contractor to obtain consent from the client, though Doc C allows the client to '*do so at any time without requiring the consent of the Contractor.*' (16).

6.11 PLANNING AND RISK MANAGEMENT

The JCT PCSA (2.3.1) requires the Contractor to supply re-construction services information in accordance with the programme. This aligns with Kings College (2014 p11) recommendation for an agreed pre-construction programme with milestones for providing information, particularly when BIM is used.

The majority of interviewees, (67% across all disciplines) thought 2S-ECI can improve risk management. One contractor interviewee thought single stage procurement may provide clearer risk allocation, but not so well managed. A key theme was that ECI provides more time to understand the project. Another contractor said that in single-stage procurement, contractors have only weeks to submit their tender for a project with hundreds of drawings. Another contractor said that this could lead to pricing assumptions. This aligns with literature that identifies fair risk allocation as a key feature of relational procurement (Rahman and Kumaraswamy, 2005) and that ECI can enable parties to identify and manage risks more collaboratively, reducing costly pricing assumptions (Mosey, 2011). The New Zealand contracts (C and D) require the contractor to participate in risk management workshops.

There appears a lack of clarity around the extent that early-involvement contractually affects the contractor's ability to claim variations throughout construction. Over 60% of interviewees (across all disciplines) thought overall ECI should theoretically reduce the quantum of variation claims, however that in reality this depends on factors such as contractors understanding the ECI process (one PM and three contractors), completeness and quality of documentation (PM, Architect, contractor, and two clients) and clarity of ECI contract documents (PQS). Under the legal rule of interpretation - *contra proferentem* - ambiguities in contract documents err against the author. Potentially contractors' ability to foresee and mitigate issues may improve through 2S-ECI. Regardless of their disciplines, almost 40% of interviewees perceived a *moral* expectation on contractors not to claim for minor design issues after being involved through ECI. However, the *contractual* affect was less clear. One client thought that a contractor's early involvement might *contractually* influence the extent that variations were foreseeable. One PM interviewee described valuing variations under 2S-ECI on the basis the issue were resolved during the design stage. A PQS said 'one advantage of ECI is that; when evaluating contractor variation claims, can balance the contractor's reason for claiming with their input during the design stage and whether they failed to mitigate a foreseeable issue.'

The JCT PCSA and Doc C contain early warning requirements. The JCT PCSA (2.2.2) requires the contractor to notify of any instructions that may '*materially and adversely*' affect the project. Clause 2.3 makes the contractor responsible for managing inaccuracies and inconsistencies in project documentation, including notifying their suppliers of inconsistencies and corrections. Doc D (3.2.9) requires the contractor to notify the client '*immediately*' of any material impediment to achieving the objectives of the agreement.

Over half the interviewees identified the need for contractors to contributing genuine VM and design buildability analysis as a key area for improving ECI. Design Buildings Wiki (2018) define VM as a collaborative technique used to maximize value for money, with the greatest potential to enhance value in the initial stages of a project. All of the ECI contracts provide for value management as a pre-construction service in some form. Doc's C, D and E provide for the contractor to participate in VM, though the wording varies. Doc's C and E use 'value engineering', while Doc D requires the contractor to optimise design in terms of cost and future maintenance. The JCT PCSA (Annex B) includes value engineering as a selectable pre-construction service. Clause 2.4 requires the contractor to select or recommend materials only in accordance with '*Good Practice in the Selection of Construction Materials (British Council for Offices)*' unless authorised in writing. Document B (NEC ECI Clause) requires any contractor's design proposals to include the effect on cost and time (3.1 – 3.7).

PCSAs provide the opportunity to require contractors to warn of risks such as inconsistencies or inaccuracies in drawings, and buildability issues such as unavailability of resources, difficult access, lack of crane reach, and the like. Only the JCT PCSA expressly makes contractor responsible for managing inaccuracies and inconsistencies in project documentation, including information supplied to others.

JCT PCSA:

Co-operation and supply of information

2.3

.3 promptly notify the Employer's agent of any inconsistency or divergence (actual or prospective) of which he becomes aware in relation to the Employer's Requirements or other documents referred to in clause 2.1 and of any delay or impediment in performing the Pre-Construction Services; and

.4 promptly notify those to whom the Contractor has supplied Contractor's Information of any changes to it, and of any inaccuracies or inconsistencies in it of which he becomes aware, together with any necessary corrections, and similarly notify those from whom he has received Information if he becomes aware of inaccuracies or inconsistencies in the items received.

The JCT PCSA 2.2.2 requires the contractor to notify of any instruction that may adversely affect the project. Similarly, the RFP (Doc D) 3.2.9 requires the contractor to notify the client 'immediately' of any material impediment to achieving the objectives of the agreement:

3. SCOPE OF PRE-CONSTRUCTION SERVICES TO BE PROVIDED BY THE CONTRACTOR

3.2.9 Notifying the Principal immediately in the event that the Contractor becomes aware of any material impediment to achieving the Objectives of this agreement.

Doc C requires the contractor to advise of health and safety hazards and assist with solutions.

6.12 INSURANCES:

During ECI, contractors predominantly provide services, requiring professional indemnity for negligence. However, some interviewees highlighted the potential for contractors to carry out more in-depth exploratory works than single-stage procurement, potentially requiring public liability insurance. All four ECI contracts require the contractor to provide professional indemnity and public liability insurances. The JCT PCSA and Doc C address the need to maintain professional indemnity beyond the construction period.

JCT PCSA (7.1) and Doc C (72) require the contractor to use 'reputable insurers'. Doc C also requires public liability for motor vehicles. Both also address the need to maintain professional indemnity beyond the construction period. Doc C requires the contractor to maintain professional indemnity insurance for six years from completion (72). If contractor fails to maintain insurance, the client may pay and deduct from contractor's payment (75). The JCT PCSA 7.3 requires that parties (Employer and Contractor) to discuss how best to 'protect their respective positions' if the insurance ceases to be available at commercially reasonable rates.

6.13 INTELLECTUAL PROPERTY AND CONFIDENTIALITY:

If confidentiality is not considered, clients and contractors risk disclosure of commercially sensitive information or intellectual property. This might include e.g., designs, methods or pricing information. Turner and Riding (2015, p181) describe poor ECI processes in Australia where multiple contractors are engaged during design to provide ideas for free, then clients select the best ideas from each provider to create a scope that is then put out to tender.

With the majority of interviewees describing informal ECI contract documentation, most were unaware of any provisions for intellectual property.

All four ECI contracts allow client use of contractor's information for purpose of the project. The JCT PCSA and NEC ECI Clause allow the contractor to use their information on other projects unless otherwise agreed. Doc D (7.3) restricts contractors' use of their information, with ownership belonging to the client. Presumably, the intent is for design information, not pricing. Docs C and E provides non-exclusive ownership of intellectual property between the client and contractor. The provisions in Doc E are contained in Section 6 containing the government's standard RFP Process, Terms and Conditions.

Table 10: Intellectual property and confidentiality

Code	Title	Client use of contractor's information	Contractor's use of client information	Contractor's use contractor's information
Doc A:	JCT PCSA	Client has use of the contractor's information for the execution and use of the building (8.1.2) and for extensions to the project (except reproducing contractor's design (8.1.3)). The contractor is only liable for their information for the purpose it was prepared (8.1.4).	Contractor must keep confidential and only use any information from the employer for the purpose of the project, except when information is public or required by law (8.2). Both parties acknowledge any disclosure requirements under the Freedom of Information Act 2000 (8.3). <i>The Employer's consent shall be required to any publication relating to the Project, but shall not be unreasonably withheld (8.2).</i>	Sole ownership of contractor's information with the contractor unless otherwise agreed (8.1.1)
Doc B:	NEC ECI Clause	Client has use of the contractor's information for the purpose of the works, contractor obtains same right from subcontractors (7.1)	Contractor has use of client's information only to provide the works, contractor may give subcontractors same right, contractor returns all information (7.2)	<i>7.3 The Contractor may use the material provided by him under this contract for other work unless stated otherwise in the Works Information.</i>
Doc C:	Preferred Contractor Contract	Client adopts non-exclusive license, benefits the client, its agents, contractors and consultants and any subsequent owners, occupiers or operators. Client can only use of the completion, use, alterations, extensions and maintenance of the facilities (76-79),	Confidentiality Contractor to take 'all reasonable precautions' to keep confidential information confidential, and not to disclose to third-parties except as required to perform the services, contractor not to use confidential information in a way that may incur loss to the client (99). Publicity and publication <i>8. The Contractor shall not release public or media statements or publish material related to the Services or Project without the written approval of the Principal.</i>	Grants non-exclusive license to client (76-79)
Doc D:	Preconstruction Services Agreement	Client has ownership of all material including provided by subcontractors and suppliers, subject to any construction contract provisions (7.3)	<i>7.6 Except where necessary to perform the Services, the contractor shall not without the prior written consent of the Principal disclose or make public any matter in</i>	No provision

		Contractor must deliver all material to client if agreement is terminated early (7.4) <i>7.5 If the Parties do not enter into a Construction Contract, any sub-trade packages will be novated to the Principal or other third party as directed by the Principal.</i>	<i>connection with the agreement for the Project.</i> Contractor responsible for insuring other parties are bound by the same conditions relating to confidentiality, ownership and return of information (7.7).	
Doc E:	Request for Proposal Main Contractor Early Involvement	RFP and its contents remain property of the buyer, buyer may request immediate return and destruction of RFP documents and copies (12.1) All documents forming the proposals become buyer's property (12.2) Ownership of intellectual property in the proposal remain property of the respondent. However, respondent grants buyer a non-exclusive non-transferable, perpetual licence for the purpose related to the RFP process(12.3)	Both parties will take reasonable steps to protect confidential information and will not disclose without consent (9.1) Both parties may disclose confidential information to parties directly involved in RFP process (9.2), Both parties recognise the Official Information Act 1982 (9.3).	Ownership of intellectual property in the proposal remain property of the respondent. However, respondent grants buyer a non-exclusive non-transferable, perpetual licence for the purpose related to the RFP process (12.3)

6.14 RETAINING KEY PERSONNEL AND ASSIGNMENT

Contractor selection is typically based on performance and reliability under ECI (Turner and Riding, 2015). Ma and Xin (2011, p83) found that terminating the relationship with the contractor, and the associated loss of knowledge, could be highly problematic for the client. This makes retaining key personnel and restricting assignment important features for ECI contracts. With the majority of interviewees describing informal ECI procedures, again, most were unaware of any requirements around key personnel or assignment. The following summarizes the ECI document provisions:

- Contractor requires approval to change key personnel: JCT PCSA (4.2.1); NEC ECI Clause (4.1); Doc C (25).
- Contractor to provide reasonable attendance of key people and supply chain at meetings (JCT PCSA, 2.1.2, 2.1.3)
- Contractor restricted from assignment: The JCT PCSA and the New Zealand contracts (C and D).
- Client may remove contractor personnel for unsatisfactory conduct or performance: (JCT PCSA (4.3)

Doc E is a RFP so requires tenderers to nominate their project team and demonstrate capability. The other pre-construction contracts may leave this to the invitation to treat and associated tenderer evaluation criteria.

Table 11: Key personnel

Code	Title	Standards	Availability	Changes
Doc A:	JCT PCSA	2.1 <i>The Contractor shall perform the Pre-Construction Services in accordance with the Employer's Requirements, the Statutory Requirements and the Programme and with due regard to the Cost Plan and any Third Party Agreements.</i>	2.1 .2 <i>ensure that, unless otherwise agreed with the Employer, Contractor's Key Personnel shall fulfil their identified roles and that they and the Contract's Representative (or competent deputies) are at all reasonable times available for communication and consultation with the Employer and Project Team; and</i> .3 <i>duly consult with members of his supply chain and, at the Employer's request, endeavour so far as practicable to ensure the attendance at relevant Project meetings of those suppliers whose attendance is necessary or desirable.</i>	Contractor's Representative and Contractor's key Personnel – changes 4.2 .1 <i>The Contractor shall not remove the Contractor's Representative or any of the Contractor's Key Personnel from their post or replace such person without the Employer's prior approval of the removal or of the replacement appointee. Where practicable, the Contractor shall arrange an appropriate handover period. The Employer shall not unreasonably withhold or delay his approval.</i> .2 <i>If the Contractor's Representative or any of the Contractor's Key Personnel ceases for any reason to hold their post, the Contractor shall, subject to such approval, promptly appoint a replacement.</i> 4.3 <i>After consultation with the Contractor, the Employer may require the removal of the Contractor's Representative, of any of the Contractor's Key Personnel or any other person engaged in the Pre-Construction Services if, in the Employer's reasonable opinion, their performance or conduct is or has been unsatisfactory.</i>
Doc B:	NEC ECI Clause			<i>Stage 1 key people listed in Contract Data (p11).</i> 4.1 <i>The Contractor does not replace any key person during Stage One unless:</i> · He is instructed by the Project Manager to do so or · The person is unable to continue to act in connection with this contract.
Doc C:	Preferred Contractor Contract			Contractor must dedicate key personnel to the Services until the Principal is satisfied they have completed their function. Can only be released if; approved, permanently leave the firm, or becomes incapable of continuing (25). Contractor must replace key personal promptly and demonstrate that they have the necessary skills and experience, approved by the Principal (26).
Doc D:	Preconstruction Services Agreement			
Doc E:	Request for Proposal Main Contractor Early Involvement	Tenderer must nominate their project team and demonstrate their capability (3.3 and 3.4).		

6.15 CLIENT OBLIGATIONS

Clients incur obligations implied through legislation and common law. For example, the Construction Contracts Act (2002) provides default payment provisions and the Building Act (2004) requires owners to obtain consents and approvals. Courts may also imply obligations for cooperation and non-hindrance (Steensma, 2010). Following are key client obligations in the analysed ECI contracts:

- Provide site access: Doc C (52)
- Provide design packages in accordance with the programme: Doc C (29)
- Arrange services from other consultants: Doc C (53)
- Once notified by the contractor, promptly, correct any delay or hindrance to the contractor caused by delay or default by the project team, as far as reasonably practicable: JCT PCSA (3.3).
- Supply health and safety information: JCT PCSA (3.1)
- Promptly notify of changes, updates or corrections to information supplied: JCT PCSA (3.1)
- Provide decisions, approvals and instructions within reasonable time: JCT PCSA (3.2)

Doc D (7.1) reduces the client's liability for supply of information. The client does not warrant the '*completeness or accuracy of such information.*' The Contractor must '*undertake such investigations or measurements as may be necessary before submitting its offer.*' This generally reflects the legal position at common law (see Craig, 1999, p474).

6.16 PRICE FORMATION AND PAYMENT

2S-ECI can provide more transparent pricing. The effect on overall project pricing is depends on a number of factors such as whether the contractor charges for early involvement, whether consultants (particularly the PQS) increase their fees, and the effect of potentially reduced pricing competition. However, these factors can have a positive or negative effect depending on the market conditions.

In New Zealand the most common approach to 2S-ECI price formation appears to be fixed-price P&G costs and margins following concept design, then open-book subcontractor selection to arrive at an agreed lump sum construction contract (usually construction only) (19 interviewees mixed disciplines). This aligns with case study findings in New Zealand by Finnie, Ameer Ali, and Park (2018). This contrasts the different approach identified by literature. For example, in the UK, ECI is often based on partnering and a target value (Turner and Riding, 2015) and contractor selection is based on track record and capability, 'not by lowest price bid because there is not yet a design to bid for' (Scheepbouwer and Humphries, 2011 p45). In Australia where ECI tends to be based on first-stage partnering and a second-stage target value design and build contract (Whitehead, 2009).

2S- ECI need not remove all aspects of competitive pricing, and nor can it. Once appointed, the head contractor can competitively tender the subcontract packages. Subcontractors may be attracted to 2S-ECI through improved odds of securing contracts (as selected tenderers) though this may inflate their prices. It is not possible to eliminate market pressures. For example, the only subcontractor offering specialist piling equipment can hold their price regardless of the procurement system. Pricing the P&G consumes less resource than pricing the whole construction works in traditional tenders. In this way, 2S-ECI could reduce industry tendering costs, by eliminating unnecessary duplication (three contractors).

Clients may pay a premium for 2S-ECI due to less competitive tension (seven interviewees, mixed disciplines) with contractors incentivised to submit the highest justifiable rates through negotiation, rather than the lowest possible tender price. However, 2S-ECI is used in heated markets (such as Auckland) to attract head contractors and subcontractors who might not otherwise bid through competitive tender. It also provides a means of negotiation to support ongoing relationships (in Otago).

In some instances, PQSs may incur considerably more work, evaluating head contractor rates and subcontractor terms ('de-tag'). Consultant views varied about whether they increased their fees for 2S-ECI. However, a PQS working on large projects in the heated Auckland market described:

Our procurement fee is often now 4 to 6 times bigger for ECI and 2 stage (or more) procurement with multiple trade reviews and recommendations. This is regardless of schedules. Even without Schedules, a single trade review, detag and rec could be as much QS time as if we did schedule and then review trade. Depends how good or motivated the Contractors QS is on their review and detag, too often they have inexperienced guys who just throw money at each and every sub tag (& not what the contractor would be doing with subs on a competitive bid!!!) and then we sort it out / push back / reject/ redo – sometimes 10 weeks for a single trade on big jobs.

A key influence of 2S-ECI effect on project costs is whether contractors are paid for their early involvement (15 interviewees, mixed disciplines). Interestingly, eight interviewees (mixed disciplines) described projects where the contractor was not paid for their early involvement. Others described the contractor's ECI fee forming part of their P&G. Other factors influencing costs include whether the contractor or PQS measure schedules of quantities (seven interviewees, PQSs and contractors) and how much real value the contractor adds.

The transparency of 2S-ECI pricing may help to address the cyclic market pressures of the construction industry. Contractors are more likely to retain their margins during heated markets through the ECI open book pricing compared to competitive tender (three contractors). Conversely, open book pricing means fairer margins during downturns. The open-book negotiation may require more accurate pricing because 'contractors can't just bury risk within their pricing' (contractor), supporting that 2S-ECI reduces unnecessary pricing assumptions (Mosey, 2011). Turner and Riding (2015, p181) offer a contractor's perspective of best practice ECI where the 'service provider is engaged as a single-source basis and receives monetary recognition of their involvement, regardless of whether their solution is accepted and a long-term relationship started' (p181). The service provider is appointed based on qualification-only criteria. The service provider then passes through a series of 'defined staged gates as the design progresses' (p181) before arriving at a target cost which is checked by an independent estimator. Laryea and Watermeyer (2016) provide case studies of two construction projects for Wits University in South Africa procured through two-stage ECI in which the contractor received 'no remuneration for the involvement in design development' as, 'they value the benefits of developing early cost models and production plans.'

Selecting stage 1 contractors may also reduce wider industry procurement costs because only the appointed contractor prices the construction works (two contractors). Competitive bidding is considered inefficient for procuring customized products in Lean Construction (Elfving, *et al.*, 2005). Pheng, *et al* (2015) found that ECI can improve Lean efficiency through reducing non-value-adding activities. Reducing wider procurement costs is an example of this. Ma and Xin (2011) highlight the waste associated with multiple contractors investing their own resources on investigation and design analysis in traditional tenders, when they typically have a one-in-three chance of winning the bid. The *Project Procurement and Delivery Guidance Using Two Stage Open Book and Supply Chain Collaboration* (King's College London, 2014) also provides that 'the two—stage open book model reduces industry bidding costs.' However, some interviewees (three contractors and one client) pointed out that the resources invested by contractors (often comprising senior managers) during ECI was higher than their estimators' time in a single-stage tender. Though this may add value to the project.

Price certainty can be considered at two stages; pre-construction and construction. The general consensus amongst interviewees was that 2S-ECI could improve final price certainty through planning and de-risking, to reduce contract variations, though there may be less price

certainty at the pre-construction stage (five interviewees, mixed disciplines). Most interviewees (17 interviewees, mixed disciplines) felt there was at least a moral obligation on contractors to minimise variation claims following early involvement, but none were able to articulate any actual contractual implications. One of the greatest challenges of 2S-ECI is the difficulty in measuring the actual value added compared with other procurement pathways such as traditional competitive tenders (11 interviewees, mixed disciplines). The following client statement expresses a commonly held view:

The theoretical benefits of ECI may not be realized, if the contractor does not provide effective planning, buildability and value management services.

The need for at least a concept design to select contractors on P&G and margins is supported by Ma and Xin (2011) who highlighted the need for sufficient design to enable competitive pricing. A potential reason for the different approaches may be that much of the prior literature (including Turner and Riding, 2015; Whitehead, 2009) focused on infrastructure work where unforeseen risks may be higher than commercial construction possibly making target value contracts and early involvement more attractive.

The JCT PCSA and the New Zealand contracts (C and D) stipulate agreed lump sum construction contracts. Both New Zealand contracts specify pricing based on P&G, margins and open-book subcontractor selection. The New Zealand contracts also require the head contractor to source a minimum of three prices per trade and negotiate subcontractor terms in consultation with relevant consultants before submitting for approval. Doc C enables the head contractor to also tender for the carpentry and concrete works (30). This provides a mechanism to evaluate the head contractor's rates for carpentry and concrete through competitive pricing, potentially reducing the need for negotiating contractor rates. The JCT PCSA leaves the parties to agree the 'Second Stage Tender Requirements' (2.7). In contrast, the NEC ECI Clause is for use with cost reimbursement or target value contracts.

6.17 TIMING OF CONTRACTOR INVOLVEMENT

While all interviewees identified that 2S-ECI can be used to fast-track projects, this was not seen as a lead driver. One PQS noted that:

Fast-tracking does not necessarily provide the benefits of ECI. For example, fast-tracking can be used to stage building work without contractor input for logistical planning and value management etc.

Overall views on timing varied. Some perceived similar timing for 2S-ECI. One client and one contractor warned that design packages should be fully complete before agreeing lump sum construction contracts. For this reason, an architect suggested 2S-ECI provides similar timing to traditional tender. A contractor said that 2S-ECI timing might be similar when the design is finalised before construction, 'though the tendering period may be reduced, because it overlaps with the design stage.' Others perceived 2S-ECI as potentially prolonging the design stage. One client identified the risk of contractors exploring too many options, supporting Whitehead's (2009) identified risk of 'too many chefs in the kitchen.' One contractor said the design stage can be elongated, but 'for the right reasons, i.e., to reduce budget or buildability problems later.' One PQS suggested 2S-ECI procurement could take longer, but that early staging may maintain completion dates. Another PQS said that any 'programming advantages should be weighed up against the potential premium paid for ECI' and that 'tight timeframes also reduce the time available for negotiation.' This supports the need for clear pre-construction milestones (King's College London, 2014).

Most interviewees described contractor involvement between concept and detailed design. One contractor did describe working with developer clients from early stages to work through resource consent applications and manage stakeholders, although this was regarded an exception to the norm. Appointment after concept design aligns with findings that contractors may have limited input at early design stages (Francis and Kiroff, 2015) and that this could risk too many chefs in the kitchen (Whitehead, 2009).

None of the PCSA documents specified when the contractor should be involved. Though provisions requiring the contractor to submit a fixed fee for P&G would require a concept design in order for the contractor to determine temporary works costs such as craneage and scaffolding. Docs A (2.7.1) and D (3.2.6 and 4.1) provide dates by which the contractor must submit their construction offer. According to Kings College (2016) pre-construction milestones are a key driver of ECI performance.

6.18 TERMINATION, SUSPENSION AND WHETHER PAYMENT FOR EARLY INVOLVEMENT

Turner and Riding (2015, p181) describe ECI best practice from a contractor's perspective in Australia where a single contractor is engaged and receives payment 'regardless of whether their solution is accepted and a long-term relationship started'. However, the majority of the contractors interviewed said they sometimes do ECI without payment, generally as a means of client negotiation. Only one contractor said they would not do ECI without payment. This supports Pearman (2007) who found that the ability to negotiate projects is an advantage of ECI. Laryea and Watermeyer (2016) case studied two ECI projects for Wits University in South Africa where the contractor received 'no remuneration for the involvement' because, 'they value the benefits of developing early cost models and production plans.'

2S-ECI may help to address the cyclic market pressures of the construction industry, and reduce overall tendering costs. Contractors are more likely to retain their margins during heated markets through the ECI open book pricing compared to complete tender (three contractors). Conversely, open book pricing means fairer margins during downturns. Two contractors saw potential for 2S-ECI to reduce overall procurement costs across the industry because only the successful stage 1 contractor prices the construction works. However, some interviewees (three contractors and one client) pointed out that the resources invested by contractors (often comprising senior managers) during ECI was higher than their estimators' time in a single-stage tender.

One question is whether contractors should receive reimbursement if there is no agreed construction contract, due to no fault of the contractor, particularly when the contractor invest substantial costs in early involvement. All four ECI contracts give the client the right not to enter into a construction contract. The JCT PCSA and the New Zealand contracts (C and D) expressly enable the client to terminate the contractor's employment at any time upon serving notice.

The JCT PCSA and New Zealand contracts (C and D) contain payment procedures for the pre-construction stage. However, only the JCT PCSA and Doc D specifically address payment if no construction contract is agreed. Doc D Schedule 2 provides for a 'total amount payable for the Services...' and invoicing procedures. Then, once a construction contract is agreed, the contractor's P&G is deemed to include their ECI fee (5.3). Clause 4.6 reimburses the contractor if the contract is terminated but, if for default; payment is based on reasonable added value or expenses for proper performance (5.2). Similarly, The JCT PCSA (10.6) reimburses the contractor upon termination for costs plus a proportion of their ECI fee, unless termination is for insolvency or breach (10.6.2.3), in which case the client can deduct reasonable costs of procuring another contractor.

The JCT PCSA and Doc C enable the client to suspend and recommence the works. JCT PCSA enables the contractor to terminate their own employment for continued suspension or non-payment. In New Zealand the Construction Contracts Act (2002) provides a statutory right to suspension for non-payment.

Table 12: Termination

Code	Title	Termination by client	Termination by contractor	Frustration
Doc A:	JCT PCSA	Termination at will or for default/insolvency or under regulation 73(1) of the PC Regulations Employer may terminate Contractor's employment giving 14 days' notice (10.5.1) If either party is insolvent, the other may give notice to immediately terminate the Contractor's employment (10.5.2) If either party commits a material breach (default), the other may give notice requiring its remedy. If not remedied within 7 days, the party may give notice to terminate with immediate effect (10.5.3) Where PC Regulations apply, Employer may terminate the Contractor's employment (10.5.4)	Extended suspension – termination by the Contractor Contractor may serve notice to terminate if Employer does not instruct to remobilise within 6 months. Contractor gives Employer 14 days' notice (10.4) If either party is insolvent, the other may give notice to immediately terminate the Contractor's employment (10.5.2) If either party commits a material breach (default), the other may give notice requiring its remedy. If not remedied within 7 days, the party may give notice to terminate with immediate effect (10.5.3)	
Doc B:	NEC ECI Clause	Client may appoint another contractor if failure to agree pricing to contractor fails to achieve performance (5.3).	No provision	No provision
Doc C:	Preferred Contractor Contract	Client may terminate at any time for any reason giving 10 days' notice (96) or for breach (97,98)	No provision	Force majeure: Obligations suspended, other party may terminate after 90 days (119-121).
Doc D:	Preconstruction Services Agreement	Principal may serve notice to terminate giving five days' notice (6.1), or for immediate effect if the contractor is in serious or persistent default (6.2). The Principal may also suspend service in writing (6.3)	No provision	No provision
Doc E:	Request for Proposal Main Contractor Early Involvement	No provision	No provision	No provision

Table 13: Suspension

Code	Title	Suspension by client	Suspension by contractor
Doc A:	JCT PCSA	Suspension by Employer The Employer may suspend the whole or part of the works giving 14 days' notice. The Employer shall pay the Contractor (10.1): any accrued instalments of the Fee and any Additional Payment then unpaid (10.1.1); a fair proportion of the next instalment having regard to the services performed (10.1.2);	Contractor's right of suspension Contractor may suspend for no payment after giving notice (6.6.1) Contractor may claim reasonable costs (6.6.2)

		all Reimbursable Expenses accrued; and (10.1.3) any demobilisation costs properly and necessarily incurred by the Contractor in complying with the notice (10.1.4) Remobilisation Employer may instruct Contractor to remobilise within 6 months. The Contractor shall remobilise as soon as reasonably practicable. The Employer pays any remobilisation costs (10.2).	
Doc B:	NEC ECI Clause	No provision	No provision
Doc C:	Preferred Contractor Contract	Proposed Construction Works Contract Client may suspend at any time for any reason giving 10 days' notice (91) and may instruct recommencement (95).	No provision
Doc D:	Preconstruction Services Agreement	No provision	No provision
Doc E:	Request for Proposal Main Contractor Early Involvement	No provision	No provision

6.19 DISPUTES

ECI has been found to reduce levels of conflict and disputes (Jelodar, Yiu and Wilkinson, 2015; Mosey, 2011). The majority of interviewees who felt that relationships may be improved through 2S-ECI and that 2S-ECI requires effective relationships supports this. One contractor specifically thought 'ECI Projects are less prone to disputes due to the early collaborative planning work.'

Construction contracts commonly require the parties to first attempt negotiation and mediation (interest-based methods) before engaging in arbitration or litigation (rights-based methods).

The New Zealand contracts (C and D) require the parties to resolve disputes through methods alternative to the courts. Both require parties to first attempt negotiation. Doc D (8.1 - 8.3) then requires expert determination, and Doc C (107-118) requires mediation before arbitration. The inclusion of arbitration clauses mean that courts are likely to stay any hearings until the parties have undergone arbitration as they agreed contractually to, then awards can generally only be appealed for procedural breaches, even where decisions may be erroneous (see Finnie, 2016). Outcomes of alternative dispute methods also remain private. Doc D requires that, in the failure to resolve the dispute through good faith negotiations, the parties must agree on an expert to determine the matter, or otherwise appointed by the New Zealand Law Society.

In contrast, the JCT PCSA and the NEC ECI Clause do not restrict access to courts through requiring alternative dispute resolution. This has the potential to enable continuous learning from public court judgements and help overcome the issue highlighted by (Whitehead, 2009) about ECI standard contracts needing to become familiar and *tied and tested*.

Table 14: Disputes

Code	Title	Negotiation	Mediation	Adjudication	Expert determination	Arbitration
Doc A:	JCT PCSA			<i>Adjudication</i>		

				<i>10.77 If a dispute or difference arises under this Agreement which either Party wishes to refer to adjudication, the Scheme shall apply except that for the purposes of the Scheme the adjudicator shall be the person (if any) and the nominating body shall be that stated in the Particulars.</i>	
Doc B:	NEC ECI Clause				
Doc C:	Preferred Contractor Contract	Amicable resolution (104-107)	Mediation (108-111)		Arbitration (112—118)
Doc D:	Preconstruction Services Agreement	Best endeavours in good faith to resolve the dispute (8.1),			<i>if not resolved in five working days, dispute may be referred to an expert, or failing agreement within two business days, appointed by the President of the New Zealand Law Society (8.2). Expert must give decision within 10 working days or such period by agreement. Expert's decision is final and binding. Unless expert determines otherwise, costs are shared equally between the parties (8.3).</i>
Doc E:	Request for Proposal Main Contractor Early Involvement				

6.20 SUMMARY OF CONTRACTUAL ANALYSIS

Contractual procedures in New Zealand are often informally with little or no written contract terms for early engagement. The interview findings such that, while some large clients have developed their own ECI contracts, there is no sign of any standard form of ECI contract. The content of the ECI contracts analysed varied, but generally include provisions for liabilities, scope of services, advanced warning, good faith, professional indemnity insurances, intellectual property, and termination, suspension and dispute resolution.

The main drivers when considering whether to use 2S-ECI include securing resources in markets, maintaining client/contractor relationships, planning the logistics of construction around existing operations, or providing specific design buildability and value management advice. 2S-ECI may be particularly beneficial for projects where the cost of disruption might outweigh any premium paid for the benefit of logistical planning and reliability, such as airport extensions or hospital alterations. Specialist subcontractors may be involved through the head contractor, or independently, to provide design input for the likes of facades, structural steel, lifts, and piling.

The most common approach for 2S-ECI in New Zealand appears to be involving a head contractor once a conceptual design exists, with pricing based on fixed price P&G and margins. Once appointed, the head contractor procures subcontractors on an open-book basis to arrive a fixed lump sum construction contract.

2S-ECI may help to address the cyclic market pressures of the construction industry, and reduce overall tendering costs. The more open-book approach may discourage contractors disclosing excessive profit margins during heated markets. Equally they should be able to rely on fair margins during downturns. However, this should be balanced against potentially higher consultant fees, whether the contractor charges for early involvement and the actual added value, something difficult to measure.

Contractors appear to bring greater leadership to the table through 2S-ECI. Contractors can better plan construction and integrate early planning with their site teams regardless of the actual value management and buildability input provided, are able to. This is particularly beneficial given that 2S-ECI was found particularly suited to projects requiring logistical planning of construction to existing client operations. Risk management and buildability analysis appear integrated. Buildability analysis includes logistical planning of construction around existing client operations; analysis of design risk in terms of constructability and resource and systems availability.

Key challenges of 2S-ECI include:

- Lack of clear contractual procedures and pre-construction contract documentation, leading to unclear obligations and expectations;
- Reluctance from clients and consultants, perceived lack of competitive tensions, and difficulty measuring added value;
- Lack of genuine quality pre-construction services,
- Increased risk transfer to contractors through amended standard from contract terms and performance-based specifications; and
- Declining quality of design documentation possibly attributable to design coordination capability.

Potential opportunities to improve 2S-ECI include:

- Standardizing pre-construction contracts with pre-construction milestones, scope of services and obligations and the flexibility to suit client preferences and project types. One area of potential conflict could result when designers adopt alternative systems recommended by contractors. Contractors may incur uncertainty about their liabilities and insurance requirements. Only the JCT PCSA specifically provides for (excludes) the contractors' liability when providing design advice.
- Educating clients and consultants including optimal project types for 2S-ECI, expectations and timing of contractor involvement, using the contractor to de-risk the project through exploratory works, insuring designs are complete at the time of agreeing a fixed lump sum construction contract;
- Developing contractual mechanisms for specialist subcontractor early input;
- Contractors developing specialist ECI skills, particularly in value management, design buildability and coordination.

The PCSA analysed were inconsistent in their approach to specifying the scope of pre-construction services. A clearer approach could be to provide a list of pre-construction services under specific constructions. Obligations such as advanced warning and buildability analysis could be standard obligations, while carrying out exploratory investigations could be specific, as demonstrated in the following table.

Table 15: Suggested contractual scheduling of pre-construction services

Pre-construction services	Standard	Specific
Design management		x
Stakeholder management		x
Buildability advice	x	
Advance warning	x	
Methodology	x	
Planning and programming	x	
Risk management		x
Value management		x
Procuring subcontractors and suppliers	x	
Cost and budget		x
Investigations, demolitions and construction enabling works		x
Other		x

Conducting ECI on large complex projects (sometimes \$100's millions) on an informal basis could expose the parties to increased uncertainty around what happens if the project does not proceed to construction, what constitutes sufficient performance by contractors, and who accepts responsibility for projects being over-budget, late or for design documentation or performance problems. This makes measuring the success of ECI difficult and risks its overall perception as a procurement pathway. 2S-ECI appears to be gaining popularity in New Zealand despite a small number of high-profile failures. 2S-ECI formation through existing relationships between the client and contractor, and contractor selection based on past-performance and reliability may be reasons that more problems do not arise.

An important consideration is whether the contractor is paid for their early involvement. Parties could agree no payment unless the construction contract is not agreed, through no fault of the contractor. Otherwise, the contractor's P&G is deemed to include their ECI fee if the project does proceed. The JCT PCSA and Doc D support this position. Both provide procedures for termination of the pre-construction contract.

Findings benefit parties looking to develop or revise their own PCSA contract, and toward the development of a standard form PCSA contract for New Zealand construction. Further areas to explore include how to best involve subcontractors through ECI, negotiate subcontractor terms and conditions and P&G costs on large projects.

Chapter 7: Survey questionnaire

7.1 INTRODUCTION

This chapter presents analysis of the survey findings. The survey questionnaire was sent to all interviewees eight months after completion of the last interview to improve the validity of the research findings. The interviews provided rich and deep findings, however one drawback was that a later interviewee might raise a valuable point that the interviewer would like to have discussed with prior interviewees. For example, the second-last interviewee might provide an interesting suggestion for improving 2S-ECI. The survey questionnaire was developed based on the coded interview findings to provide all participants with the chance to rate for relevance or provide comment.

7.2 RESEARCH METHODOLOGY

The interview sample was surveyed because they were considered an expert panel who had participated in in-depth discussion about the use of 2S-ECI. All participants had responsibility for or awareness of procurement pathways of projects within their region and typically had communications on a national level. A wider survey across industry groups was ruled out due to the lack of clarity around what constitutes 2S-ECI, given the lack of a contractual framework. Analysis of previous research demonstrated how this can distort findings. Surveying an expert panel aligns with the Delphi method. The Delphi method typically comprises a three-step process used to move toward establishing consistency from the panel (see Kerzna, 2013, p890). However, a single-round questionnaire was adopted because a consistency of findings was not expected. For example, clients, PMs and PQSs may hold different perceptions to contractors, and participants in Otago may have different experiences to those in Auckland. Perceptions may also vary depending on the market conditions. For example, interview findings suggested that 2S-ECI is used as a means of negotiating a transparent price where strong client/contractor relationships exist, whereas 2S-ECI appears primarily used in Auckland as a means to secure contractors in a boom market. Comparing the different perceptions was therefore felt to provide more meaningful findings than pursuing consistency through conducting repeated survey rounds.

The use of an expert panel, rather than a wider industry survey, is supported by Hallowell and Gambatese (2010, p99). They describe how the Delphi method is particularly useful in contemporary construction research when objective data is unattainable, there is a lack of empirical evidence, experimental research is unrealistic or unethical, or when the heterogeneity of the participants must be preserved to assure validity of the results.

Most questions received 13 responses from the sample of 21 interviewees who were invited to participate. An expert panel of 13 still aligns with typical Delphi method studies. Ibrahim, Costello and Wilkinson (2013) suggest a panel of eight to 12 experts should be adequate. Data was analysed using the mean rather than the mode, as it was felt the mean was better suited to a broad average for qualitative analysis.

7.3 RESPONSE SAMPLE

The survey questionnaire (Appendix 2) was distributed using Qualtrics software. The questionnaire was reviewed by a mathematician (Head of College of Engineering, Construction and Living Sciences at Otago Polytechnic) and the head of Organisational Research at Otago Polytechnic, for structure and response options (e.g., number of Likert options). The survey was then tested by the Organisational Researcher and the PhD supervisors before being emailed as a link to the 21 participants. Three reminders were sent by email through Qualtrics. A total of 13 responses were received out of the 21 interviewees invited to participate. One of the interviewees sadly passed away before completing the survey. All types of construction participants were represented in the survey responses (clients, PMs, PQSs, architects, and contractors).

Table 16: Survey response sample

	Frequency	Percent	Cumulative Percent
Client	1	7.7	7.7
PM	1	7.7	15.4
PQS	2	15.4	30.8
Architect	1	7.7	38.5
Head Contractor	8	61.5	100.0
Total	13	100.0	

Only one response was received from each of the groups clients, PMs, and architects, and two responses from PQSs. The gathering and reporting of the data from industry participants is not an exact science in that participants' perspectives are not definitive judgements on their experiences to date, however every response is valid. Each survey response represents one participant's perception and must be taken seriously. The collective responses to the survey are representative of those who provided the feedback. Likewise, responses from what might appear to be an unrepresentative minority are still valid and they cannot be disregarded simply because they are few; nor however should be they taken as a definitive indication about the perceptions of that industry group as a whole. Importantly, the survey questionnaire does not form a primary research method for this study. Rather it is used to support the deeper interview findings.

7.4 RESPONSES

The following sections analyse participants' responses to the 16 questions about 2S-ECI contractual provisions. Due to the qualitative methodology of this research and small sample size of senior construction professionals (considered an expert panel) the focus is on descriptive analysis rather than statistical analysis, although percentages of responses are sometimes shown to indicate themes of participant perceptions.

7.4.1 Project suitability

Participants were asked to rate factors to consider when deciding project suitability for 2S-EC from 1 - no relevance, to 4 - substantial relevance. The survey and interview findings align,

with projects benefiting from logistical planning around maintaining clients' existing operations as the most substantial factor, except that tight time-frames was a more dominant factor in the survey findings. While interviewees identified that 2S-ECI enables project staging to fast-track projects, some highlighted that fast-tracking does not necessarily provide contractor buildability input generally associated with 2S-ECI. Nevertheless, the head contractor's P&G and open-book subcontractor pricing does provide an effective way to negotiate pricing across multiple stages.

Table 17: 2S-ECI Project suitability factors

Factors	No relevance	Minor relevance	Moderate relevance	Substantial relevance	Moderate and substantial	Mean
	1	2	3	4		
Projects requiring logistical planning around client's existing business operations	0%	0%	8%	92%	100%	4.85
Tight time-frames	0%	8%	38%	54%	92%	4.00
Designers wanting contractor buildability advice for innovative design solutions	0%	8%	54%	38%	92%	3.69
A means to secure resources in a busy market	0%	15%	46%	38%	85%	3.62
Utilising specialist contractor input, such as for building services of cladding systems	0%	23%	46%	31%	77%	3.38
A means to negotiate with a preferred contractor based on client - contractor relationships	0%	23%	62%	15%	77%	3.08

7.4.2 Advantages of 2S-ECI

Participants were asked to rate the perceived benefits of 2S-ECI when compared with traditional competitive tender: 1 - worse using 2S-ECI, 2 - same, 3 - minor benefit, 4 - moderate benefit, 5 - substantial benefit. A mean over 3.0 indicates at least minor benefit. Items with a mean of less than 3.0 are highlighted in the tables below.

Table 18: 2S-ECI Advantages over competitive tender

Advantages	Mean
Better planned construction works, e.g., more time to understand and plan works	4.4
Improved knowledge transfer from pre-construction to construction stage workforce	4.2
More senior input from head contractors during pre-construction (i.e., not just estimators)	4.2
Supports more equitable risk transfer	4.2

Improved project decision-making	4.1
More transparent pricing	4.1
Reduced risk of client disruption on project involving alterations or extensions	4.1
Supports ongoing relationships	4.0
Improved price certainty, i.e., reduced variation claims or disputes during construction stage	3.7
Faster project completion	3.6
Improved project timing certainty	3.3
Reduced chance of remedial works	3.0
Reduced tendering costs (i.e., only the successful contractor prices the construction stage)	2.8

Contractors rated 'Supports more equitable risk transfer' as the most significant benefit with a mean of 4.5. Contractors rated 'Reduced tendering costs (i.e., only the successful contractor prices the construction stage)' as having a minor advantage with a mean of 3.0, though overall this was not found a significant advantage, with a mean of 2.8. The tables below presenting results by role type rank the risks in order of importance perceived by contractors, being the larger sample population, and to enable comparison with other role types.

Table 19: 2S-ECI Advantages over competitive tender per role type

Advantages	Client	PM	PQS	Architect	Head Contractor
Supports more equitable risk transfer	3.0	5.0	3.5	3.0	4.5
Better planned construction works, e.g., more time to understand and plan works	5.0	5.0	4.0	4.0	4.4
More transparent pricing	5.0	4.0	3.5	3.0	4.3
Improved project decision-making	3.0	5.0	3.5	4.0	4.3
Improved knowledge transfer from pre-construction to construction stage workforce	5.0	5.0	3.5	3.0	4.3
Reduced risk of client disruption on project involving alterations or extensions	5.0	2.0	4.0	4.0	4.3
More senior input from head contractors during pre-construction (i.e., not just estimators)	5.0	4.0	4.0	4.0	4.1
Supports ongoing relationships	5.0	4.0	3.0	4.0	4.1
Improved price certainty, i.e., reduced variation claims or disputes during construction stage	2.0	5.0	3.5	3.0	3.9
Faster project completion	3.0	5.0	3.5	3.0	3.6
Improved project timing certainty	3.0	4.0	3.0	3.0	3.4
Reduced chance of remedial works	3.0	2.0	3.0	3.0	3.1
Reduced tendering costs (i.e., only the successful contractor prices the construction stage)	2.0	4.0	2.5	2.0	3.0

Participants were given the opportunity to rate 'other' advantages in addition to those listed in the questionnaire. The following were added as 'substantial benefits':

- Gives better understanding of Client drivers - why they are doing the project
- Higher Quality and less Defects (as a result of the right price and de-risking time and cost by contractor)

Two of these comments could be considered additional commentary to the listed benefits, i.e., better planned projects (understanding client drivers), and reduced chance of remedial works (higher quality and less defects). Increased opportunity for innovation is a benefit that was not listed in the survey and does align with findings in prior studies (Rahman and Alhassan, 2012; Whitehead, 2009).

7.4.3 Pre-construction services

Participants were asked to rate the pre-construction services in terms of typical benefit. A 1 to 4 rating scale was used to establish the mean responses: 1 – no benefit, 2 - minor benefit, 3 - moderate benefit, 4 - substantial benefit.

Table 20: Pre-construction services benefits

Pre-Construction Services	Mean
Risk management	3.4
Collaborative 'open-book' subcontractor selection	3.3
Design buildability advice	3.2
Contractor contributing design elements	3.1
Site logistics planning	3.0
Value management	3.0
Warning of design document errors or inconsistencies	2.9
Contractor liaison with external stakeholders (e.g., neighbours and local authorities)	2.5
Contractor providing design coordination (e.g., services coordination)	2.5
Contractor providing document control systems	2.1
Building information modelling (BIM)	2.1
Contractor leading design management	2.0

Interestingly, the PM and PQSs perceived only minor benefit in the contractor '*Warning of design document errors or inconsistencies*'. In contrast, architects and contractors perceived this as a moderate benefit and the client perceived this as a substantial benefit. No interviewees could clearly articulate how the contractor's early involvement influenced the contractor's entitlement to claim for design related issues during the construction stage.

Table 21: Pre-construction services benefits per role type

Pre-construction services	Client	PM	PQS	Architect	Head Contractor
Risk management	4.0	4.0	2.5	4.0	3.4
Site logistics planning	2.0	3.0	2.5	3.0	3.3
Value management	4.0	2.0	2.0	3.0	3.3
Collaborative 'open-book' subcontractor selection	4.0	4.0	3.0	3.0	3.3
Design buildability advice	4.0	3.0	3.0	3.0	3.1
Warning of design document errors or inconsistencies	4.0	2.0	2.0	3.0	3.1
Contractor contributing design elements	4.0	3.0	2.5	3.0	3.1

Contractor liaison with external stakeholders (e.g., neighbours and local authorities)	2.0	1.0	3.0	2.0	2.8
Contractor providing design coordination (e.g., services coordination)	4.0	1.0	3.0	1.0	2.6
Contractor leading design management	1.0	1.0	1.5	1.0	2.5
Contractor providing document control systems	1.0	1.0	2.0	1.0	2.5
Building information modelling (BIM)	1.0	1.0	2.0	2.0	2.4

7.4.4 Risks to consider at pre-construction stage

Participants were asked to rate risks to consider during the pre-construction stage in terms of importance: 1 – no importance, 2 – minor importance, 3 – moderate importance, 4 – substantial importance. *'Disruption to existing building operations during construction'* was ranked most important. This aligns with logistical planning around existing client operations being the most significant driver for 2S-ECI project suitability. All role types perceived all the risks to have at least minor relevance. Other buildability related risks such as *'design being difficult or impossible to build'*, *'ground conditions'*, *'resource availability'*, *'quality of design documentation'*, *'building services coordination'*, *'site logistics'*, *'long lead delivery items'*, and *'connectivity between construction elements'*, were all considered to have moderate to substantial importance.

Table 22: Risks to consider pre-construction

Risks to consider at pre-construction	Client	PM	PQS	Architect	Head Contractor
Disruption to existing building operations during construction	4.0	3.0	4.0	4.0	4.0
Design being difficult or impossible to build	4.0	4.0	3.5	4.0	3.8
Ground conditions	4.0	3.0	3.5	4.0	3.6
Resource availability	4.0	3.0	3.0	4.0	3.5
Quality of design documentation	4.0	3.0	2.5	4.0	3.5
Weather-tightness	3.0	4.0	3.5	4.0	3.4
Building services coordination	4.0	3.0	3.0	4.0	3.4
Health and safety	4.0	3.0	2.5	4.0	3.4
Site logistics (e.g., access, craneage, public protection)	4.0	3.0	3.0	4.0	3.4
Long lead delivery items	3.0	3.0	3.5	4.0	3.3
Subcontractor performance	4.0	4.0	3.0	4.0	3.0
Connectivity between construction elements	3.0	4.0	2.5	4.0	3.0
Passive fire design	4.0	3.0	1.5	4.0	3.0
Design obligations	4.0	4.0	2.5	4.0	2.9

7.4.5 Head contractor or consultant manager

Participants were informed that the entity employed to plan and manage construction (during the construction stage) may be a head contractor (contract for works) or a consultant construction manager (contract for services), and asked to select their typical preference. Only one participant selected consultant construction manager.

Table 23: Head contractor or consultant manager

	Client	PM	PQS	Architect	Head Contractor
Head contractor (contract for works)	1	1	2	1	7
Consultant construction manager (contract for services)	0	0	0	0	1

Participants were also given the opportunity to provide comment. The comments tend to focus on contractor versus consultant performance (rather than the form of contract) and therefore tend to align with interview findings that the early collaboration of 2S-ECI is generally perceived as advantageous, but that this relies on contractors demonstrating real added value. The comments support interview and survey findings that opportunity exists for contractors to develop specialist ECI skills particularly in buildability analysis and value management, and for New Zealand to develop clear contractual provisions and guidance to support 2S-ECI.

Three participants provided comments:

- i. *ECI is a good idea and works well overseas, unfortunately the majority of main Contractors in NZ lack experience and maturity to provide effective ECI services. There tends to be a lack of continuity between the pre-construction team and the Construction team, as such contractors site teams revert to the traditional model and behaviours once the second stage is awarded, and tend to ignore any pre planning advice provided by their pre-construction teams. i.e. they use it as a means to get their foot in the door.*
- ii. *Consultant construction Manager, tend to have a higher level of maturity and follow the spirit of the ECI process through the entire project lifecycle*
- iii. *The current 2-stage ECI process I consider is flawed as has been seen in 2 major projects in Christchurch having failed to reach agreement after the pre-construction services and the project reverting to a traditional tender with one project being abandoned altogether and the other significantly delayed while going back to the market. A Managing Contractor process as is utilised in Australia I believe has a much better potential of a successful outcome.*

The third comment above (iii) also highlights the need for clear pre-construction obligations and milestones as recommended by Mosey (2011).

7.4.6 Preferred timing of contractor involvement

Participants were asked to select their typically preferred timing for early contractor involvement. Perceptions were mixed about the preferred timing of contractors during the pre-construction stage. This makes sense as timing of contractor involvement will depend on the type of project, client and contractor relationships, and whether it is a head contractor, or subcontractors being engaged.

Table 24: Preferred timing of early involvement

	Count	Total N %
Before or during preliminary design brief	4	30.8%
After preliminary design brief, before concept design	4	30.8%
After concept design, during detailed design brief	5	38.5%

7.4.7 Whether payment for early involvement

Participants were asked to select their preference for whether the contractor is paid for their early involvement. All participants felt that contractors should receive financial compensation for their early involvement, whether through payment for their involvement, or through profiting from the construction project, with no payment for early involvement unless the project does not proceed. No respondents felt that the contractor should simply receive no payment for their early involvement. Interestingly, contractors were slightly more inclined to be satisfied with no payment for early involvement than consultants. This aligns with the interview findings that revealed some contractors did not charge because they saw value in securing the construction contract and enjoying a better planned project, and supports findings from prior studies (Laryea and Watermeyer, 2016; Rahman and Alhassan, 2012; Song, et al., 2006).

Table 25: Whether payment for early involvement

	Client	PM	PQS	Architect	Head Contractor
Contractor paid for early involvement, unless they breach obligations	1	1	1	1	6
Contractor not paid	0	0	0	0	0
Contractor not paid, but reimbursed if project does not proceed, subject to any breaches	0	0	1	0	2

7.4.8 Form of payment for early involvement

Participants were asked to select their preferred option for early contractor payment against three different times of early involvement. Perceptions were mixed between preferences for a fixed fee for early involvement versus some form of cost reimbursement. Cost reimbursement was preferred when the contractor is involved before any preliminary design brief, 53.8% (23.1% without target value + 30.8% with target value) versus 45.4%. Fixed fee is generally preferred after concept design, 46.2% versus 30.8% (23.1% + 7.7%). Fixed fee is slightly preferred after design brief before concept design, 46.2% versus 38.5% (15.4% + 23.1%). Note that the percentages do not total 100% because not all of the 13 respondents completed this question.

Table 26: Form of payment for early involvement

		Count	Column Total N %
Before or during preliminary design brief	Cost reimbursement	3	23.1%
	Cost reimbursement with target value	4	30.8%
	Fixed fee	2	15.4%

After prelim design brief, before concept design	Cost reimbursement	2	15.4%
	Cost reimbursement with target value	3	23.1%
	Fixed fee	6	46.2%
After concept design, during detailed design	Cost reimbursement	3	23.1%
	Cost reimbursement with target value	1	7.7%
	Fixed fee	6	46.2%

7.4.9 Preferred timing of early involvement

Contractors were split exactly 50:50 on whether to be involved before or after concept design. The PM preferred contractor involvement before or during design brief, the Architect preferred contractor involvement after design brief before concept design, and the client preference was for after concept design. Again, the findings are only relative to the type of project. For example, the PM interviewed described a project involving repairs to an existing building where the builder was engaged from the beginning largely for their knowledge of the existing building. One contractor described being engaged by a developer to work through a resource consent for a change of use, and manage stakeholders before any design brief, where the client was likely to sell the land once the resource consent was obtained.

Table 27: Preferred timing of early involvement

	Client	PM	PQS	Architect	Head Contractor
Before or during preliminary design brief		100.0%			37.5%
After preliminary design brief, before concept design			100.0%	100.0%	12.5%
After concept design, during detailed design brief	100.0%				50.0%

7.4.10 Form of construction stage price

Participants were asked to select their generally preferred option for the construction stage price. The majority of respondents preferred a fixed lump sum over some form of cost reimbursement 84.6% versus 23.1% (7.7% + 15.4%). This suggests that 2S-ECI is more commonly used in New Zealand commercial construction projects as a means to collaboratively plan and negotiate toward a fixed price construction contract, rather than more partnering-based models used overseas for infrastructure projects with high unknowns and prices based on target value with pain share/ gain share (Rahman and Alhassan 2012; Mosey, 2011; Whitehead, 2009).

Table 28: Preferred form of construction stage price

	Count	Total %
Cost reimbursement	1	7.7%
Cost reimbursement with target value or guaranteed maximum price	2	15.4%
Fixed lump sum based on P&G and subcontractors	11	84.6%

7.4.11 Design and build or construction only

Participants were asked to select their preferred form of construction-stage contract, construction only or design and build. All participants preferred construction only contracts over design and build, except for one contractor who generally preferred design and build.

Table 29: Preferred form of construction stage price

	Client	PM	PQS	Architect	Head Contractor
Construction only, possibly with some elements of design (e.g., facades)	1	1	2	1	7
Design and build	0	0	0	0	1

This aligns with the interview findings and again contrasts the assertion by Francis and Kiroff (2015) that design and build is the most common form of ECI in the Auckland commercial construction market.

7.4.12 Whether same contractor for construction stage

Participants were asked to select their preferred option for the construction stage in terms of whether the same contractor is used for both the pre-construction and construction stage, unless they breach obligations or a construction price cannot be agreed, or the construction stage is tendered separately and open to other contractors.

Table 30: Preferred form of construction stage price

	Client	PM	PQS	Architect	Head Contractor
Same contractor used for pre-construction and construction-stage, unless they breach obligations or a construction price cannot be agreed	1	1	2	1	8
Construction stage tendered separately, and open to other contractors	0	0	0	0	0

All participants felt that the same contractor should be used across the pre-construction and construction stage contract. This supports findings by Turner and Riding (2015) and aligns with survey participants rating the following benefits as substantial:

Better planned construction works, e.g., more time to understand and plan works, rated second most substantial benefit.

Improved knowledge transfer from pre-construction to construction stage workforce, rated fourth most substantial benefit.

7.4.13 Effect on contractor pricing

Participants were asked to select the effect of 2S-ECI on head contractor pricing compared with single-stage tender. The question was then repeated for consultant pricing.

Perceptions of contractor pricing varied. Admittedly, this question could have been clearer. During the questionnaire period, one participant phoned the researcher and asked whether this question related to overall contractor pricing for the project, when the original intent of the question was to ask whether contractors might apply more or less profit margin on the basis that contractors declare their margins in 2S-ECI, but not for competitive tenders. Nevertheless, the responses indicate that the client perceived contractors pricing higher in all market conditions, the PM, Architect and PQSs perceived higher pricing in recessionary or average markets, but the same or lower pricing in boom markets. Contractors' responses were more mixed, though the majority perceived the same or higher pricing in recessionary or average markets and the same or lower in boom markets. This supports the interview findings that 2S-ECI may help to even out the cyclical boom/bust nature of pricing in the construction industry. It also supports some interview responses from contractors that wider use of 2S-ECI may reduce tendering costs across the market, which supports prior literature (King's College London, 2014; Ma and Xin, 2011).

Table 31: Effect of 2S-ECI on head contractor pricing

		Client	PM	PQS	Architect	Head Contractor
In a recessionary market	Contractor pricing lower using 2S-ECI					4.2%
	Same		33.3%	16.7%	33.3%	12.5%
	Contractor pricing higher using 2S-ECI	33.3%		16.7%		16.7%
In an average market	Contractor pricing lower using 2S-ECI					8.3%
	Same		33.3%	16.7%	33.3%	4.2%
	Contractor pricing higher using 2S-ECI	33.3%		16.7%		20.8%
In a boom market	Contractor pricing lower using 2S-ECI		33.3%	16.7%	33.3%	12.5%
	Same			16.7%		4.2%
	Contractor pricing higher using 2S-ECI	33.3%				16.7%

Participants also provided the following comments:

- i. *Assume pricing refers to costs to margin, in an ECI project you would expect the pricing to include all that is required to complete the project. In a traditional tender you will get pricing only for what is detailed not necessarily what is required. ECI entry price should be close to the exit price*
- ii. *Contractors are able to manipulate the open book tender process to reduce their own commercial risk with subcontractors & suppliers, which results in a higher construction cost compared with a competitive tender, there doesn't to be a reduction in the quantum of variations through the build period.*
- iii. *This really depends on the 2S-ECI model used rather than the markets. There are a number of variants and no single ECI methodology.*

- iv. *ECI 2S works better in a quiet market (far more available resources to meet deliverables) but harder to achieve and justify commercially given the hunger in the main contractor market.*

The first comment (i) suggests the disconnect between interpretation of construction contract obligations by construction professionals (PMs, architects, engineers, QSs) and lawyers, as evaluated in chapter 5. Similarly comment (ii) supports the interview findings that construction professionals are unclear about the contractual effect that early involvement has on contractor entitlement to design buildability related claims during the construction stage contract. Comment (iii) highlights the need for flexible contract provisions supporting 2S-ECI and comment (iv) supports that 2S-ECI may reduce cyclic boom/bust pricing through contractors obtaining high prices during recessionary market conditions.

7.4.14 Effect on consultant pricing

The general perception from respondents was that consultant pricing is the same across all market types. Although the PQSs perceived sometimes higher prices in boom markets. This reflects the interview findings about PQSs sometimes facing considerably more work evaluating subcontractor tags and negotiating head contractor rates on large projects. Interestingly, only the client perceived both higher contractor and consultant pricing across all market conditions. This perhaps reflects one of the challenges identified by respondents being reluctance from clients to adopt 2S-ECI.

Table 32: Effect of 2S-ECI on head consultant pricing

		Client	PM	PQS	Architect	Head Contractor
In a recessionary market	Consultant pricing lower using 2S-ECI					5.6%
	Same		33.3%	33.3%	33.3%	22.2%
	Consultant pricing higher using 2S-ECI	33.3%				5.6%
In an average market	Consultant pricing lower using 2S-ECI					
	Same		33.3%	33.3%	33.3%	27.8%
	Consultant pricing higher using 2S-ECI	33.3%				5.6%
In a boom market	Consultant pricing lower using 2S-ECI					5.6%
	Same		33.3%	16.7%	33.3%	16.7%
	Consultant pricing higher using 2S-ECI	33.3%		16.7%		11.1%

Participants also provided the following comments:

- i. *Answered based on Designers. Big differences for PM and QS though which can be more.*
- ii. *For the QS, the increased workload is in procurement. 2 stage and progressive trade letting of 40 to 50 trades and open book audit nature can in some cases take years not weeks/months. Can save time in front end estimating and in post contract and price is de-risked / on later better documentation (in theory).*

- iii. *Consultants tend to have higher fee submissions due to increase in meetings, correspondence and dealing with the contractor as there is a tendency for the contractor to do a lot of optioneering through the project, which don't always align with the expected benefits and requirements of the project. (i.e. minor cost savings at the expense of value and whole of life costs)*

Comments (i) and (ii) recognise the potential increase in consultant workload, particularly for PQSs working on large projects. Comment (iii) further reinforces for the need for clear pre-construction obligations and milestones to mitigate the risk of delay resulting from 'too many chefs in the kitchen' (Whitehead, 2009).

7.4.15 Challenges

Participants were asked to rate the listed challenges to using 2S-ECI: 1 – no challenge, 2 – minor challenge, 3 – moderate challenge, 4 – substantial challenge. All challenges were perceived as at least minor. *'Difficulty measuring actual benefits', 'incomplete design documentation when agreeing a fixed price construction contract', 'unclear client expectations', 'theoretical benefits not being realised, i.e., lack of real added value', 'lack of clear definition of 2S-ECI' and 'perceived lack of competitive pricing'* were the biggest challenges (between moderate and substantial). These suggest an overall lack of clarity about 2S-ECI contractual provisions. This might suggest that *'lack of standard form pre-construction contract documentation'* would be ranked higher (minor to moderate). However, none of the interviewees were aware of any standard form PCSAs, and when shown the JCT PCSA and NEC ECI Clause, some interviewees highlighted the need for flexible provisions to suit project types and user preferences.

It is conceivable that amending contract terms to transfer risks to contractors may feature more in single-stage tenders, rather than in 2S-ECI where risks can be managed more collaboratively. However, *'amendment of standard form contracts (such as NZS3910) to transfer contractual risks to contractors'* was still rated as a minor to moderate challenge to 2S-ECI.

Table 33: Challenges to using 2S-ECI

	Mean
Difficulty measuring actual benefits	3.2
Incomplete design documentation when agreeing a fixed price construction contract	3.2
Unclear client expectations	3.2
Theoretical benefits not being realised, i.e., lack of real added value	3.2
Lack of clear definition of 2S-ECI	3.1
Perceived lack of competitive pricing	3.1
Unclear responsibilities	2.8
2S-ECI perceived as more expensive	2.8
Consultants transferring design risks to contractors	2.8
Lack of standard form pre- construction contract documentation	2.7
Use of 2S-ECI on wrong project type	2.6
Amendment of standard form contracts (such as NZS3910) to transfer contractual risks to contractors	2.5
Unwillingness from consultants to involve contractors early	2.4

Contractors generally rated all the challenges more substantial than the consultants, with *'perceived lack of competitive pricing'*, and *'2S-ECI perceived as more expensive'*, top of the contractors list. This suggests that contractors see benefit in securing projects through 2S-ECI and feel that they struggle to convince consultants of the benefits, although *'unwillingness from consultants to involve contractors early'* was rated slightly lower (minor to moderate challenge). This is somewhat reflected by the comment provided by a consultant: *'Contractors treating the process as little more than a foot in the door to negotiate a project at Stage 2.'*

Table 34: Challenges to using 2S-ECI per role type

	Client	PM	PQS	Architect	Head Contractor
Perceived lack of competitive pricing	3.0	3.0	2.0	2.0	3.5
2S-ECI perceived as more expensive	3.0	2.0	2.0	1.0	3.3
Unclear client expectations	4.0	1.0	3.5	3.0	3.3
Difficulty measuring actual benefits	4.0	3.0	3.0	3.0	3.3
Incomplete design documentation when agreeing a fixed price construction contract	4.0	1.0	3.5	4.0	3.3
Theoretical benefits not being realised, i.e., lack of real added value	4.0	3.0	3.5	2.0	3.1
Consultants transferring design risks to contractors	2.0	1.0	3.0	3.0	3.0
Lack of standard form pre-construction contract documentation	3.0	3.0	2.0	2.0	2.9
Lack of clear definition of 2S-ECI	4.0	3.0	4.0	3.0	2.8
Unclear responsibilities	4.0	1.0	3.5	3.0	2.8
Unwillingness from consultants to involve contractors early	3.0	1.0	2.5	1.0	2.6
Use of 2S-ECI on wrong project type	3.0	4.0	3.0	1.0	2.5
Difficulty involving specialist subcontractors early, in terms of contractual and pricing procedures	3.0	1.0	3.0	2.0	2.4
Amendment of standard form contracts (such as NZS3910) to transfer contractual risks to contractors	2.0	2.0	3.0	3.0	2.4

7.4.16 Opportunities to for improvement

Participants were asked to rate the listed strategies to improve 2S-ECI: 1 – no benefit, 2 – minor benefit, 3 – moderate benefit, 4 – substantial benefit. Perceptions were fairly consistent across role types. Interestingly, contractors saw substantial opportunity for *'contractors improving 2S-ECI capability (e.g., value management, design coordination and design buildability analysis)'* as did the client and consultants. *'Improving quality of design documentation when agreeing fixed price construction contracts'* was also perceived as substantial, which aligns with the strong feedback from interviewees that the quality of design documentation has declined over the past 5 to 10 years on New Zealand. *'Developing a*

standard form pre-construction services agreement, while maintaining flexibility for different clients and project types' was generally perceived as providing moderate opportunity for improving 2S-ECI. A standard form PCSA may also help address other opportunities such as 'improving the clarity of pre-construction responsibilities' (rated moderate to substantial).

Table 35: Opportunities to improve 2S-ECI

	Mean
Contractors improving 2S-ECI capability (e.g., value management, design coordination and design buildability analysis)	3.8
Improving quality of design documentation when agreeing fixed price construction contracts	3.7
Improving the clarity of pre-construction responsibilities	3.5
Improving contractual mechanisms for involving specialist subcontractors early	3.3
Reducing amendment of standard form construction contracts (e.g., NZS3910) transferring risks to contractors	3.1
Producing 'how to' guidelines for using 2S-ECI (e.g., suitable project types, expected benefits, responsibilities, pricing options etc.)	3.1
Developing a standard form pre-construction services agreement, while maintaining flexibility for different clients and project types	3.0

Table 36: Opportunities to improve 2S-ECI per role type

	Client	PM	PQS	Architect	Head Contractor
Contractors improving 2S-ECI capability (e.g., value management, design coordination and design buildability analysis)	4.0	3.0	4.0	4.0	3.8
Improving quality of design documentation when agreeing fixed price construction contracts	4.0	3.0	3.5	4.0	3.8
Improving the clarity of pre-construction responsibilities	4.0	2.0	4.0	3.0	3.6
Developing a standard form pre-construction services agreement, while maintaining flexibility for different clients and project types	3.0	3.0	2.5	3.0	3.1
Improving contractual mechanisms for involving specialist subcontractors early	4.0	4.0	3.5	3.0	3.1
Reducing amendment of standard form construction contracts (e.g., NZS3910) transferring risks to contractors	3.0	3.0	3.0	4.0	3.0
Producing 'how to' guidelines for using 2S-ECI (e.g., suitable project types, expected benefits, responsibilities, pricing options etc.)	3.0	4.0	3.5	3.0	2.9

Participants provided the following comments:

- i. *Establishing a commercial arrangement for the whole project before entering into pre-construction services; potentially with a pain/gain sharing arrangement*
- ii. *Specific gateways and deliverables before ECI fees paid with risk of project being re-tendered.*

Comment (i) again highlights the need for flexible 2S-ECI contract provisions to support timing and pricing arrangements and (ii) reinforces the need for clear pre-construction obligations and milestones.

7.5 SUMMARY OF KEY SURVEY FINDINGS

The interview findings generally align with the survey findings, improving validity of the research findings through triangulation.

All participants felt that the 2S-ECI was best suited to projects benefiting from contractor's logistical planning to plan construction around ongoing client operations. All thought that the same contractor should be retained across the pre-construction and construction stages, recognising the benefits associated with better planned projects and improved knowledge transfer from pre-construction to construction stage.

Findings suggest there is opportunity to improve 2S-ECI through developing clearer contractual provisions. No interviewees were aware of standard form PCSAs, leaving New Zealand clients and consultants to draft their own, often informal, bespoke provisions.

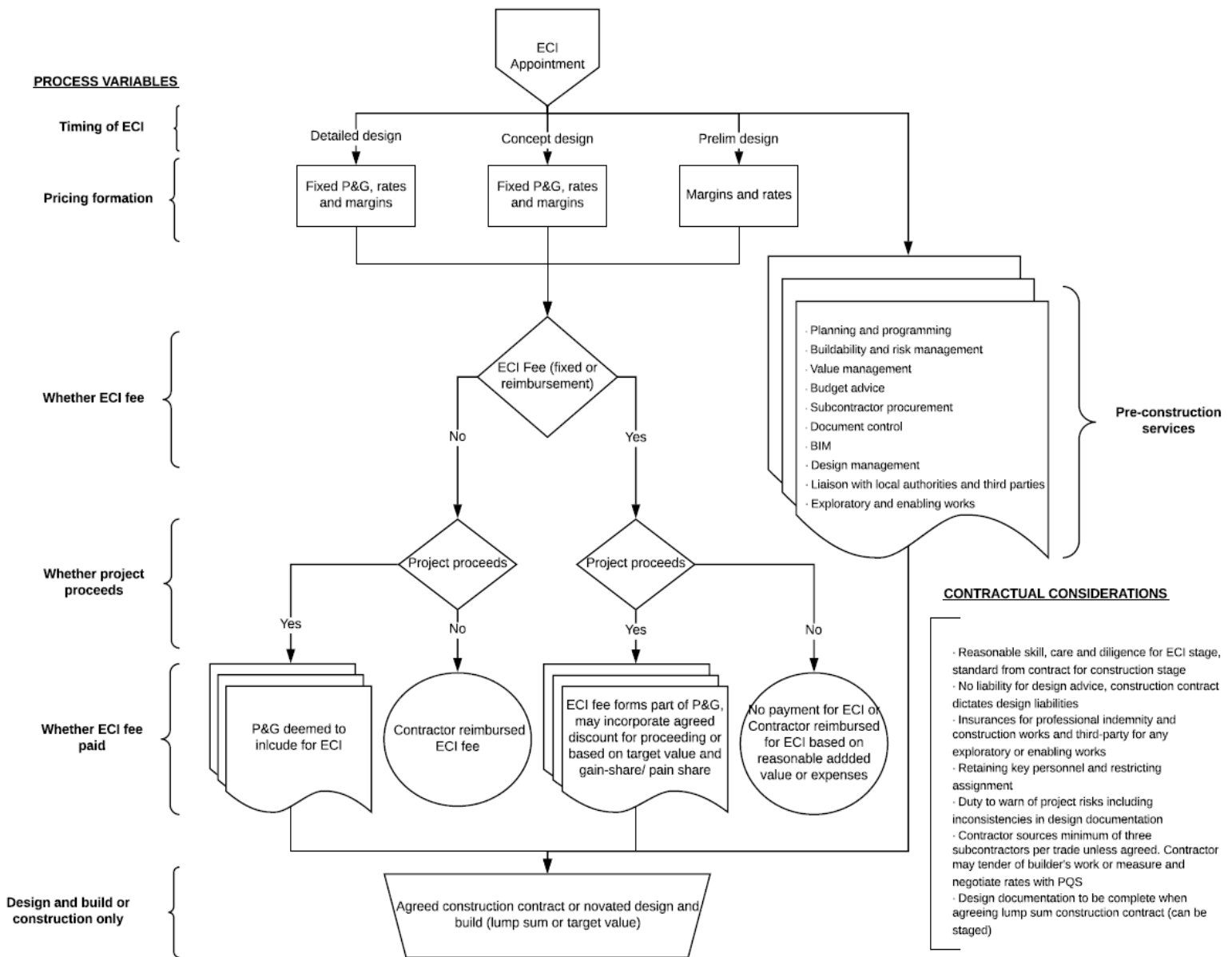
A key theme was the need for clear pre-construction obligations and milestones. This aligns with interview findings and prior literature (Mosey, 2011, Whitehead, 2009). This could operate to protect both parties. For instance, if the contractor is paid for their early involvement on a cost reimbursement basis, the client runs the risk of incurring extra contractor costs if design development takes longer than expected. If the contractor is paid a fixed fee for early involvement, this effectively becomes a fixed-price contract. The contractor may then be entitled to claim prolongation costs if delayed by the client's consultants, constituting an act of prevention at common law. The client would not risk this in the case of single-stage tender. Some interview responses demonstrated how this can influence perceptions of 2S-ECI. One contractor said they had never charged for their early involvement. They held a positive view of ECI, saying that on those projects 'ECI added real value.' In that instance, the contractor noted strong ongoing client/contractor relationships. Two contractors said that when they do not charge for ECI or charge a fixed fee, they are incentivised to drive the design process in order to get started on site without incurring escalating ECI costs. One contractor estimated their actual ECI costs at approximately \$90,000 for a \$16 million project. On the other hand, a PQS had worked on projects where the contractor was paid for early involvement, and the contractor claimed increased fees when the design was delayed. That PQS commented that 'we remain dubious about the real benefits of ECI.'

Another theme was the need for flexible contract provisions to support 2S-ECI. The mixed perceptions around timing and payment of early involvement demonstrate that any standard form PCSA needs to provide flexibility to accommodate the different project types and user preferences. Accordingly, different project types will likely benefit from different pre-construction services. Therefore, any PCSA should provide a range of pre-construction services for parties to select from to suit their project and agree clear milestones for all parties to fulfill their obligations.

Findings across interviews and survey responses also suggest a disconnect between interpretation of construction contract obligations between construction professionals and lawyers, particularly in terms of contractor entitlement to claim for design related issues and the influence of early involvement on claim entitlement.

Chapter 8: Conclusions - 2S-ECI Framework application

This chapter discusses the framework for 2S-ECI in New Zealand construction in terms of its effect on risks, optimal contractual ingredients, effect on market pricing and overall benefits, challenges and opportunities for improvement and scope for further research. Figure 14 depicts the key contractual parameters as informed through this research. The flexible contractual arrangements needed to support different project types, as suggested by interviewees, are evident from the range of scope of pre-construction services and options for



pricing and form of construction contract.

Figure 14: 2S-ECI Conceptual framework

8.1 EFFECT ON RISK

It is contractors who are the masters of *how*. When applied well 2S-ECI should help to improve the quality of risk management particularly associated with design buildability. Through 2S-ECI, contractors can be engaged early (before detailed design) to explore the optimal design methodology and working with (not against) the consultant design team. The contractor's methodology may include enabling works such as testing ground conditions, uncovering latent structural, services, or non-compliance work such as passive fire, seismic works or asbestos. Through 2S-ECI, project budgets can be staged alongside the method development.

Engaging contractors early can be particularly beneficial on projects when the clients' building operation are to remain in operation during the construction works. Any price premium paid for negotiating with a good contractor may be far the cost incurred to disrupt schools, hotels, accommodation, airports, or hospitals. It is the contractor who is named responsible for 'how' the building is to be built using labour and materials in NZS3910 and the New Zealand Building Act and therefore seems sensible to afford them some level of input to design thinking of complex buildings with complex methodologies. The more open-book pricing approach of 2S-ECI also supports supply-chain integration, and lessons learnt from project to project for continuous improvement.

9.2 OPTIMAL PCSA INGREDIENTS

A proposed standard form pre-construction services agreement (PCSA) has been drafted (see Appendix 4) based on the findings of this research. The structure and drafting style has been modelled on the NZIQS Contract for Quantity Surveying Consultancy Services. A clear theme from the interviews was the lack of clarity around 2S-ECI with many practitioners seeing benefit in the development of a standard form PCSA. This study has established the key ingredients of a standard form PCSA for use in New Zealand commercial construction projects. Based on the findings, the PCSA should clearly set out among other things:

- (i) the scope of services to be provided by the contractor such as planning, budgeting, buildability evaluation, risk management, value management, and subcontractor procurement;
- (ii) key milestones for communication exchange and supply of elements;
- (iii) who owns intellectual property;
- (iv) whether or how the contractor is paid for their early-involvement;
- (v) under what grounds the client can terminate the project;
- (vi) what happens if the project does not proceed to the construction phase; and
- (vii) parties' obligations around design and construction, whether for individual elements or for the overall design, and the contractor's early notification of design issues.

The following sections explain these key ingredients.

9.2.1 Project scope

The scope should include a description of the works, including any project staging, exploratory or enabling works, and the project duration and any liquidated damages for late completion. This enables the contractor to prepare a base construction programme and price their P&G works.

9.2.2 Duty of care

The contractor is employed to provide pre-construction services not to construct a product. Therefore, the PCSA should require the constructor to take reasonable skill and care.

9.2.3 Liability for providing design advice

The contractor may critique the design and provide alternative design options. These options are approved by the design team. Therefore, the PCSA should specify that the contractor takes no liability for any design, and that the terms of the construction contract will prevail once a construction contract is agreed. This follows the approach taken in the JCT PCSA. This provides for the design being novated to the contractor.

9.2.4 Selection of pre-construction services

The PCSA should list the possible pre-construction services under specific conditions. This enables the parties to agree on the scope, and provides flexibility for different project types. The pre-construction services can be linked to pre-construction milestones for clarity and to minimise the risk of the design stage being delayed due to 'too many chefs in the kitchen.'

9.2.5 Pre-construction milestones

Specifying pre-construction milestones protects all parties from the design stage being delayed. The contractor risks incurring costs over and above their fixed ECI fee or the client risks incurring unnecessary costs if the contractor is employed on a cost reimbursement basis. Delay to the design stage also risks condensing detailed drawings or the construction period available, or delay to the project completion.

9.2.6 Payment and termination provisions

The contractor may be employed on a fixed ECI fee. One popular option is to not pay the contractor an ECI fee unless the project is terminated. If the project proceeds, the contractor's P&G is deemed to include their ECI fee. This may be set at zero if the parties agree on the basis that the contractor benefits from the early involvement and earns fair profit for the construction contract. Contractors incur costs in competitive tendering where they may only secure say one in ten projects. However, they are likely to incur more cost through 2S-ECI when they involve project managers and site management to analysis buildability and explore design options.

9.2.7 Insurances

The PCSA should require the contractor to provide professional indemnity insurance for providing services and construction works for any enabling works. There should be provision for maintaining the professional indemnity insurance beyond the project completion.

9.2.8 Project team and retaining key people

The PCSA should state the parties to the contract. It should also state the ECI team composition of the contractor's ECI team and restrict the contractor from removing or substituting key people without agreement with the client.

The contractor may provide project managers and site managers to evaluate design buildability. Some contractors are involving employees with backgrounds in building services engineering or architecture. The composition of the contractor's ECI team may influence what is reasonable foreseeable in the construction contract, such as NZS3910: 2013 2.7.4 concerning drawing ambiguities or NZS3910:2013 Clause 5.1 Advance Notification.

9.2.9 Provisions for documentation inconsistencies or ambiguities

2S-ECI provides greater opportunity to iron out issues during the design stage to reduce claims and disputes during construction. Most interviewees expected contractors to minimise claims during construction, but could not articulate any contractual requirement for this. Some interviewees described how the quality and completeness of design documentation is crucial when agreeing a fixed price construction contract in order to minimise the risk of time and budget blowouts.

PCSA provisions should require the contractor to warn of document inconsistencies and ambiguities that are reasonably foreseeable by the contractor's ECI team, ahead of agreeing a fixed-price construction contract. This will reduce the contractor's entitlement to claim variations under NZS3910: 2013 2.7.4 for reasonably unforeseeable ambiguities that, after clarification from the engineer, result in additional time or cost.

A provision may also be included that enables the contractor to approve the quality of design documentation before agreeing fixed price construction contract.

9.3 2S-ECI EFFECT ON MARKET PRICING

2S-ECI may help address the problem of contractual risk transfer in New Zealand. Risks can be identified and managed collaboratively through 2S-ECI rather than transferred onto contractors who bid competitively, with the lowest price typically winning the bid.

The open-book approach to 2S-ECI may reduce the cyclical boom/bust nature of construction industry pricing. Open book pricing generally means more consistent and fairer rates, rather than purely market driven supply and demand.

If more projects were procured through 2S-ECI, then contractors' tendering costs may be reduced. Only the contractor appointed for the pre-construction stage invests the resource to price the construction works, compared to open tender where contractors may have a one in 10 chance of winning the bid. Open tenders inevitably drive tender prices down in highly competitive markets, which may seem attractive to clients and consultants. However, this increases the risk of contractors claiming aggressively or taking shortcuts to complete the project within their budget, or worse, the contractor goes into liquidation midway through the project.

The perceptions were mixed in New Zealand about the effect of 2S-ECI on overall project cost. More research is needed in this area. The United Kingdom government has reported substantial savings in the order of 15-20% through ECI and supply chain integration. Such savings would be significant for the New Zealand construction sector. While the United Kingdom government has focused on public sector construction and infrastructure works, the findings from this research study suggest potential for gains in the private sector, particularly when procuring repeat projects through supply chain integration.

8.2 BENEFITS

2S-ECI provides a synergy between partnering relational procurement with traditional competitive tender bid. The collaborative approach to risk management early in design, is generally seen as a key advantage of 2S-ECI.

2S-ECI provides a comparatively fair and transparent pricing system. Pricing by agreement supports ongoing supply chain integration, where parties continuously improve project-to-project through lessons learnt and better understanding each other's operations. Then, the construction contract is agreed, the head contractor adopts the same standards or stricter, than they would have through a traditional tender bid. The threshold of what may be reasonably foreseeable in terms of contractors warning of documentation issues or physical conditions may be considered higher after the contractor has been involved in design development, and taking into account the composition of their ECI team which may include project and site managers and even qualified architectural designers or engineers.

8.3 CHALLENGES

Contractors may also add value through contributing to value management, being close to subcontractors and suppliers and having access to detailed pricing. However, all this is heavily contingent on the contractor having the motivation, skills and resource to demonstrate real added value. The starting point is selecting the right project type for 2S-ECI that lends itself improvement by contractor input.

Moving from a traditional lost bid mind-set to a more collaborative and relational focus may require training and cultural changes. This can take time and money. There is also a current lack standard form PCSAs and associated literature supporting the use of 2S-ECI.

8.4 2S-ECI GUIDANCE

One of the main challenges identified with 2S-ECI is the difficulty in measuring the benefits of engaging the contractor during the design stage. The benefits of 2S-ECI may be difficult to measure objectively given that every project is unique, and using 2S-ECI on the wrong project or under the wrong conditions may result in expectations not being met. The following guidance is aimed at ensuring 2S-ECI provides optimal value based on the findings of this study.

8.4.1 Project suitability

The starting point is deciding whether 2S-ECI should be used on the particular project. 2S-ECI is best suited to the following project features:

- (i) Projects involving planning logistics around existing operations (all interviewees);

- (ii) 2S-ECI as a means of open-book negotiation to support client/contractor relationships, or to secure resources in heated markets (all clients, PMs, architects and contractors, and 4 PQSs);
- (iii) Complex design solutions benefiting from contractor input (all PMs, architects and clients, 4 PQSs, and 4 contractors), and;
- (iv) Projects requiring fast-tracking (3 contractors, 3 PQSs, and one architect).

There may be little benefit that contractors can contribute to straightforward on-time projects. A single-stage competitive tender process may be suitable for those projects. This could be on a selective or open tender basis.

8.4.2 Whether head contract or consultancy contract for services

The entity employed during the pre-construction stage provides services. The same duty of care applies whether the entity operates as a head contractor or a consultant construction manager (CCM). The difference is that the CCM continues to provide services during the construction stage, representing the client, whereas, the head contractor enters into a construction contract, typically on a fixed price basis. The head contractor has a stricter liability and provides single-point accountability. For example, the contractor must remedy any defects or pay liquidated damages for late completion without the client having to establish negligence. Clients that are experienced in construction may opt for the CCM procurement pathway where they employ the trade contractors directly and engage a consultant (or an employee) to manage them. The remainder of this section uses the term 'contractor' for the PCSA as the provisions at the pre-construction stage are effectively the same.

8.4.3 Single or multiple contractors

There are clear benefits in maintaining the same contractor from the pre-construction to the construction stage. A key advantage of 2S-ECI is the ability for contractors to better plan the construction works, regardless of the value they might add to design buildability. Through 2S-ECI contractors have more time to examine the drawings, prepare construction programmes and methods and order materials. Contractors can also involve their site management team in the planning process to better integrate pricing, project management and site management planning. This is supported by the interview findings and literature (Laryea and Watermeyer, 2016; Turner and Riding, 2015).

Involving multiple contractors during the design stage is likely problematic. Once appointed for the pre-construction stage, contractors should be more invested in the project because they are reasonably assured of securing the construction contract. This incentivises contractors to ensure the project does proceed within the client's budget. Contractors are more likely to invest greater time in planning and avoid unnecessary pricing assumptions (Mosey, 2011). Involving more than one contractor during the pre-construction stage means that only one contractor is reasonably assured of securing the construction contract. This is similar to a selective tender process. Depending on market conditions, contractors may invest less time and effort. If both contractors are paid for their early involvement, there is little incentive to drive project efficiency. Instead, if both contractors are reimbursed for their time, they may enjoy an extended design process while they pursue other projects, increasing costs to the client. Contractors may also be reluctant to share intellectual property such as pricing information or innovative construction methods when these may be shared with another contractor. A preferred approach would be to focus on engaging the best contractor. The open-book pricing of 2S-ECI supports a quality based contractor selection. The contractor's ECI team can be interviewed for their ability to foresee risks and add value, as recommended by Kashiwagi, Kashiwagi, Savicky (2009). This research showed no evidence of multiple contractors being involved in 2S-ECI in New Zealand.

8.4.5 Whether construction only or design and build

A potential drawback of design and build procurement is that the contractor may be incentivised to pursue cost and time efficiencies at the expense of design aesthetics. 2S-ECI enables contractor design input while the client retains design decision-making. However, the client may choose for the design to be novated to the contractor in order to enjoy single-point accountability for design and construction, and to reduce the contractor's ability to claim for design related issues. However, contracts such as NZS3910:2013 reduce the contractor's liability for design from absolute liability to that of reasonable skill and care, meaning that design related issues can be passed on to the client, possibly through a contingency sum. This research has found that most of the time 2S-ECI is used with construction-only contracts in New Zealand.

8.4.6 Timing of involvement

Timing of contractor involvement depends on the type of project. Most commonly the head contractor is involved after concept design and some detailed design is complete. The contractor's ability to add value is reduced if the design is too advanced. Head contractors can typically price their P&G and set an ECI fee based on concept design, project duration and any liquidated damages.

2S-ECI provides an opportunity to reduce project risk through the contractor carrying out exploratory works. In traditional competitive tenders, it is impractical for multiple contractors to test ground conditions or explore building elements by removing linings within the building. Involving the contractor too late may reduce the opportunity to mitigate the risk of, for example, re-designing foundations for unforeseen ground conditions, or uncovering asbestos or unexpected structure or building services.

Some projects may benefit from involving the contractor earlier. For example, the contractor may be employed to provide preliminary budgets and work through resource consent applications and manage stakeholders. While this tends to be the exception, the PCSA should provide flexibility for different project types.

8.4.7 2S-ECI and effect on off-site manufacturing and pre-fabrication

The following journal article has been published based on this section:

- Finnie, D, Ameer Ali N and Park K. (2018) Enhancing offsite manufacturing and prefabrication through early contractor involvement (ECI) in New Zealand. *Management Procurement and Law*, 171(4):1-35
<https://doi.org/10.1680/jmapl.17.00029>

2S-ECI supports projects that require early planning, such as off-site manufacturing and modular construction. Off-site manufacturing (OSM) is a form of modern method of construction (MMC) in which a key principle is to transfer work off-site, and includes systems such as modules, volumetric pods, panels and hybrid components (Wilkinson and Scofield, 2010).

Some of the benefits have been described by Wilkinson and Scofield (2010), including reduced on-site congestion, shortened project durations, reduced time-related costs allowing for earlier building close-in, reduced labour costs and improved quality through producing work in more controlled environments. However, there are numerous challenges associated with OSM. The design must be finalised earlier, making changes during the construction phase more difficult. In addition, tolerances can be difficult to maintain, resulting in connectivity issues; transported units are subject to size and weight restrictions; units require protection during delivery and storage; and an increased reliance is placed on manufacturers to deliver

when promised. Tradespeople who are passionate about their craft may be reluctant to adopt OSM processes.

Despite drivers towards the MMC concept, its uptake is not without challenges. Shahzad (2011) classifies the main barriers to the adoption of OSM in New Zealand into seven broad categories (in descending order of impact and relative contributions): industry and market culture (16.2%), skills and knowledge (15.5%), logistics and site operations (14.8%), cost/value/productivity (14%), supply chain and procurement (13.7%), process and programme (13.6%) and regulatory issues (12.2%). Under the category of industry and market culture, a conservative market approach and client mind-set was found to be a prominent constraint. The limited expertise of designers to handle OSM designs and the lack of experienced manufacturers were constraints under skills and knowledge. The lack of research and development into OSM was also noted. Design-related issues were the most prominent constraints under process and programme. The main issue is that OSM design choices must be made during design development, resulting in limited freedom to make design changes after the construction phase starts. Another issue relates to connectivity problems on-site and the potential 'mismatch between design and the manufacturing process' (Shahzad, 2011: p. 47). Issues associated with transporting large modular or pre-fabricated units and site restrictions affecting space required for craneage and manoeuvrability of heavy plant and equipment were the most significant constraints under logistics and site operations. This correlates with the main constraints under the cost/value/productivity category, which include concerns about increased project costs for transportation of OSM units, particularly modular or large units, and for the increased use of craneage.

Most of the constraints, including difficulties for designers to incorporate OSM technology, connectivity and potential mismatch between design and manufacturing and issues with transportation and site restrictions, may be summarised as design buildability issues. Some of these may also contribute to the first constraint – conservative market culture – particularly given the need to finalise design decisions earlier and the consequent difficulty to make changes during construction. Because OSM integrates design and manufacturing, it is critical to involve key manufacturers in the design process. Indeed, the integration of construction knowledge to maximise project performance is at the heart of the definitions of 'constructability' (see CII (1998) and CIIA (1992)), which, according to Jergeas (2009), is used interchangeably with the term 'buildability'.

The most prominent barrier to the uptake of OSM was the reluctance to adopt unfamiliar processes. Jergeas and Put (2001) found the risk aversion by owners and lack of knowledge of latest construction methods to be a key barrier to innovation. A key advantage of traditional lump sum contracts is that the procedures are well understood and the standard forms of construction contract provide familiarity and reliability through being well tried in case law (Ashworth, 2012; Kirkham, 2007). Traditional lump sum contracts remain the dominant contract form, accounting for about 75 percent of construction projects by number in the United Kingdom, with design and build the second most used at around 17.5 percent (RICS, 2010).

Therefore, the optimal procurement strategy to enhance OSM should enable contractor involvement in the design, effectively allocate the risks of design and buildability, enable competitive lump sum pricing, and be developed in the form of a standard model than can become familiar and tested over time.

Design and build procurement would be suitable for projects with OSM where the design is straightforward and changes during construction are unlikely. Under 2S-ECI the consultant or head contractor can provide input to the design around planning and buildability, while the client retains ownership of the design. The project can be fast-tracked by overlapping design and construction and OSM elements can be ordered in time to avoid delay. If pricing is equal, the single point accountability of a head contractor under 2S-ECI is advantageous over a

consultant construction manager (CCM) for lay clients. Under the construction management (CM) procurement model, the client employs the specialist contractors directly with a consultant CCM to manage them and so adopts more risk than the single-point accountability of a head contractor.

2S-ECI offers advantages for projects that use OSM technologies. Designers and contractors can work collaboratively in developing the design, managing risks, undertaking value management exercises, and procuring specialist subcontractors. The contractor can evaluate costs and buildability of design options, for example comparing OSM technology with more traditional assemblies, and adopt clearer contractual responsibility for design buildability than is afforded under many standard forms of construction contracts. The more integrated approach overcomes current segmentation, enabling clients and designers to make more informed decisions about adopting OSM, and can reduce the potential for future buildability problems and related variations and disputes during construction. Depending on whether or how the contractor is paid for their early involvement there may be little or no additional cost to the client - recognizing the benefit to the contractor of a better planned and more buildable project.

A standard form PCSA could help overcome the barrier to OSM relating to conservative market culture by becoming familiar and tested over time. Provision for competitive lump sum pricing across all tiers of the supply chain may also suit risk adverse clients. To the extent that a standard model for two-stage ECI becomes recognised for reducing design buildability risk, it is conceivable that in extreme cases consultants could potentially be held negligent for not recommending ECI processes for complex projects for exposing their client to unjustifiable design buildability risks.

8.5 OPPORTUNITIES FOR IMPROVEMENT AND FURTHER RESEARCH

8.5.1 Education

Interviewees highlighted the lack of 2S-ECI definition and the reluctance of clients and consultants to adopt 2S-ECI. A clear framework for 2S-ECI and development of a standard form PCSA would provide greater clarity, making it possible to incorporate 2S-ECI into tertiary construction programmes when teaching about procurement pathways.

This study has also highlighted the need for construction tertiary education programmes to incorporate content covering contract law, value management, buildability analysis, and 2S-ECI as a procurement pathway. The majority of interviewees were unable to articulate the effect of early contractor involvement on the contractor's ability to claim for design related issues during construction. A theme from the interviewees was that 2S-ECI requires a different approach and skillset from that of the traditional building company who simply tenders and builds what has been designed. Generally, interviewees saw the benefit of early collaboration through 2S-ECI, but qualified this with the need for contractors to provide genuine added value, particularly in value management and design buildability analysis, including design coordination. From the survey findings, the highest rated opportunity to improve 2S-ECI was found to be: '*Contractors improving 2S-ECI capability (e.g., value management, design coordination and design buildability analysis).*' In response to these findings, the following courses have been incorporated in Otago Polytechnic's Bachelor of Construction (Quantity Surveying) degree as an outcome of this research. Once introduced, the curriculum influence may be studied through interviewing or surveying graduates and their employers.

- A Construction Law (15 credit) level 7 course focusing on claim entitlement to design buildability related claims.

- Value Management (15 credits) level 6 course with a focus on value management processes and buildability analysis.
- A new third-year course is also being developed, Design Buildability and Building Information Modelling BIM (15 credits) level 7. Students will develop skills in coordinating construction elements through using computer aided clash detection systems. They will also learn to navigate building designs in 3D BIM.

There may be opportunity for tertiary education to focus on qualifications for commercial construction site managers. Site managers may contribute valuable planning and buildability input during the pre-construction stage. Five interviewees (across disciplines) highlighted the advantage of communicating pre-construction thinking across construction-stage site teams and potential involvement of site managers in the contractor's ECI team. In New Zealand, site managers are typically drawn from tradespeople who have become forepersons and then site managers (CareersNZ, 2019) rather than diploma or degree graduates who often enrolled into tertiary programmes from secondary school or retrained from other vocations. Many site managers have developed rich knowledge about how buildings connect together through their onsite trade experience, including the detailed sequencing of tasks and coordination of subcontractors. Yet, from the researcher's experience, many experienced site managers are operating with trade qualifications. A potential reason for this is the time required to study a degree or diploma part-time while working. Recall the argument by one PQS: *'Need resource (across all sides of the table), specifically more skilled design managers (many projects don't have them), more experienced site managers giving advice who know how to build (and not fresh faced "paper" PM's out of school.'* Most interviewees perceived a benefit of early collaboration through 2S-ECI but qualified this with the need for contractors to focus on upskilling in the areas of value management and buildability analysis. Further research could explore opportunities to upskill and qualify experienced construction site managers.

8.5.2 Contract development

The key ingredients of a standard form PCSA have been established in this study. The next stage is to draft a PCSA contract document. Then feedback on the draft may be obtained from potential users, lawyers and professional bodies. Once published, use of the PCSA may be researched through case studies toward continuous improvement.

Further research is needed to measure the effect of 2S-ECI on overall project cost. A theme from the interviews was the lack of clear measurables when using 2S-ECI. A clear 2S-ECI contractual framework and standard form PCSA enables clearer comparisons with traditional procurement methods. For example, case studies may explore user perceptions of project costs using the PCSA. The method used by the United Kingdom government could also be applied where final construction costs of projects procured through 2S-ECI are compared with industry benchmark costs. This approach could be used in New Zealand to compare costs between commercial projects procurement through 2S-ECI with average benchmark costs sourced through the QV Cost Builder (Quotable Value Limited, 2019).

Further research could explore subcontractor perceptions of 2S-ECI toward developing the optimal contractual mechanisms for involving them during the design stage. Some interviewees spoke about developing their own contractual procedures for involving specialist subcontractors during the design stage. A limitation of this study is the exclusion of subcontractors from the interviewees. Specialist subcontractors are commonly involved during the design stage, such as for facades and piling.

The perceptions of 2S-ECI could be explored when used during the rebuild in Christchurch following the 2011 earthquakes. The lack of focus on Christchurch is not considered to reduce the quality of this study because (i) many interviewees worked for nationwide companies and communicated across divisions, and (ii) the Christchurch earthquake represents an exceptional market environment, not the norm. Nonetheless, the high-profile project failures using 2S-ECI and feedback from interviewees, suggest that Christchurch may provide further lessons learnt about 2S-ECI under very challenging conditions.

8.5.3 Toward a universal pre-construction services agreement (PCSA) for two-stage early contractor involvement (2S-ECI)

It is submitted that a universal PCSA could be developed for use with many standard construction contracts, such as AS4000, FIDIC, JCT, NZIA SCC and NZS3910, to support better project planning through 2S-ECI. In 2S-ECI, parties generally work toward agreeing a construction contract. The construction contract may be either construction-only or novated design and build, with a price based on fixed lump sum, cost reimbursement or target value.

This study has established the optimal ingredients for a standard form PCSA for New Zealand commercial construction projects through evaluating case law, contractual documentation and industry perceptions. A standard form PCSA can provide basic ingredients for the pre-construction stage. Then parties enter a construction contract of their choice. There seems potential for such a standard form PCSA to be used with construction contracts internationally by, for example, avoiding specifying the legal jurisdiction within the PCSA (as the JCT PCSA does).

Despite the well-established benefits of standard form contracts, parties using 2S-ECI must draft their own contract agreements for the pre-construction stage, with no standard terms to draw on. This is despite the widespread use of standard form construction contracts. Kings College London (2014) found that 2S-ECI can achieve substantial efficiencies and savings in the order of 10-20% in United Kingdom infrastructure works, and in 2017 published the FAC-1 Framework Alliance Contract. This contract supports supply chain integration using 2S-ECI processes. However, commercial construction projects are often procured on a limited or one-time basis for private clients who lack the buying power of government bodies who can leverage ongoing long-term relationships with their supply chains. A standard form PCSA enables clients to pick up a readymade standard form contract without having to employ lawyers to draft something new. This likely helps overcome key barriers to the uptake of 2S-ECI, being lack of process clarity and clear measurables, and (likely leading to) resistance from clients and consultants. The pre-construction stage benefits from standard terms covering insurances, consents and payment and the like. These are important for such early works as design input, demolition or destructive testing to reveal structure and services, and testing for asbestos and ground conditions or carrying out demolition. As one New Zealand contractor said about 2S-ECI contracts - 'there's no I in team, until everything goes wrong'. Yet, only two standard form PCSAs exist, the JCT PCSA and the NEC ECI Clause. The JCT PCSA is for use under English law and makes several references to English regulations. The NEC ECI Clause is only for use with the NEC design and build or cost reimbursement contracts. A universal PCSA that strikes the right balance between consistency and flexibility may enable more relational procurement practices through clear contractual provisions.

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Appendix 1: Interview schedule

- **Section 1: General Questions:** Collects information on the interviewees and their organisations (e.g., name, company, role) [4 questions].
 1. Name?
 2. Company?
 3. Role?
 4. No of years' experience?
- **Section 2: Background Information:** Collects data relating to the number, type and scope of projects procured through ECI that the interviewees have been involved in [3 questions].
 1. Number of projects procured through ECI?
 2. Range of value?
 3. Types (residential, commercial, industrial)?
- **Section 3: Case Study Project Information:** Collects data relating to a typical construction project (e.g., facility type, complexity, location, cost, timescale, procurement method: contractor or consultant, reason for using ECI) [7 questions].
 1. Facility type?
 2. Complexity (simply/ moderate/ complex)?
 3. Location?
 4. Cost (\$0 – 100k/ \$101 – 500k/ \$501k – 1M/ \$1M – 10M/ \$11 – 50M/ \$51 - 100M/ \$101 – 500M/ \$500M +)?
 5. Time scale (less than one year/ approx. years)?
 6. Head contractor or consultant manager?
 7. Reason for using ECI?
- **Section 4: Issue Identification:** Collects data relating to issues identified from the literature and risk allocation framework (e.g., timing of contractor involvement pre-construction services offered, whether contractor paid for early-involvement, form of pricing, procedures for early-termination, ownership of intellectual property, obligations and liabilities) [14 questions]:
 1. When was the contractor or consultant involved?
 2. What pre-construction services did they provide?
 - a. planning and sequencing
 - b. buildability
 - c. risk mitigation
 - d. value management
 - e. subcontractor procurement
 - f. design management
 - g. liaison with local authorities
 - h. document or software control (including BIM)
 3. What services were provided by the client's PM?

4. How was the service provider employed for the pre-construction stage: (lump sum, declared margins on subcontractors and variations, rates for direct works, cost reimbursement)?
 5. Was the service provider paid for their pre-construction services?
 6. What was the form of pricing for the construction stage (lump sum, cost reimbursement with or without target value or GMP)?
 7. What were the procedures for early termination?
 8. What were the provisions for intellectual property?
 9. Was the contractor responsible for DB or construction only?
 10. Did the head contractor subcontract all work packages?
 11. Were contractual risks considered at the pre-construction stage?
 12. Were there any interesting issues?
 13. Can you compare how managing issues differs between the entity being employed through a contract for works and contract for services?
 14. How clear were contract obligations clear, i.e., absolute liability or reasonable skill and care?
- **Section 5: Perceptions Information:** Collects data relating to perceptions of risk and pricing (clarity of recourse for performance breach, pricing transparency, control over design decision-making, effect on time, cost, quality, most suitable project type) [5 questions]

1. What effect does 2S-ECI have on:

- a. Pricing?
 - i. Price certainty?
 - ii. Overall project cost:

Transaction cost theory:

- iii. Information cost (information gathering)?
 - iv. Project procurement cost (attending meetings, translation of client's needs, training, project preliminary design, transition observation, site visits)?
 - v. Administration cost (contract administration, decision-making, conflict resolution)?
 - vi. Enforcement cost (contract enforcement, verifying compliances)?
- b. Clarity of contractual risk?
 - c. Timing?
 - d. Quality?
 - e. Design decision-making?
 - f. Composition of the project team?
 - g. Quality of relationships?

2. What is the best suited project type for 2S-ECI?
3. What are the main barriers to use of 2S-ECI?
4. What key contractual risks should be considered at the pre-construction stage?
5. What could be done to improve the use of 2S-ECI?

Appendix 2: Survey schedule:

two stage early contractor involvement

Start of Block: Default Question Block

Q1

Introduction

This survey explores the use and perceptions of 2-stage early-contractor involvement in New Zealand.

The questions are based on findings from literature review, document analysis and 21 interviews conducted in 2018 with senior construction participants across New Zealand. 2-Stage early contractor involvement is defined as a process where the entity responsible for planning and managing construction is (1) employed to provide pre-construction services during the design stage, and (2) to deliver the construction works.

Page Break

Q2

Consent

(part

1)

You are invited to participate in this research project being conducted by David Finnie toward fulfilment of a doctoral degree at the School of Engineering and Advanced Technology, Massey University. The purpose of the project is to develop a process model for two-stage early-contractor involvement for the New Zealand construction industry.

Coding of any comments will be discussed with the research supervisors before disseminating. Names of respondents and all comments will be coded to ensure anonymity. Any personalized comments will be objectified. For example, if a project participant complained about the performance of another, the researcher will establish objective issues, such as for example levels of project team relations. Problems such as building defects will be described so not to identify contractors. 'Connectivity issues' can describe problems such windows or stairs not fitting. 'Delivery issues' can describe late delivery of elements. 'Technical supervision' can describe delay caused by for example, engineers not signing-off fire penetrations. Sensitive figures such as profit margins, quoted prices etc. will not be stated. If provided, they may portray the complexities of evaluating pricing between 2S-ECI and CM to inform a decision criteria framework without stating dollar figures.

A summary of the coded findings will be emailed to everyone who completes the survey. All data will be stored securely and destroyed within three-years of the thesis completion.

Page Break

Q21

Consent

(part

2.)

Participant's

Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question; withdraw from the study within one month of accepting;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded

Compulsory

Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application NOR 17/48. If you have any concerns about the conduct of this research, please contact Dr Ralph Bathurst, Acting Chair, Massey University Human Ethics Committee: Northern, email humanethicsnorth@massey.ac.nz

By selecting NEXT you are agreeing to the terms of this research study.

End of Block: Default Question Block

Start of Block: Block 2

Q6 Please rate the following factors when deciding project suitability for 2S-ECI:

	No relevance (1)	Minor relevance (2)	Moderate relevance (3)	Substantial relevance (4)
Projects requiring logistical planning around client's existing business operations (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tight time-frames (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Designers wanting contractor buildability advice for innovative design solutions (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A means to negotiate with a preferred contractor based on client - contractor relationships (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Utilising specialist contractor input, such as for building services of cladding systems (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A means to secure resources in a busy market (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7 Please rate the following benefits of 2S-ECI when compared with traditional competitive tender:

	Worse using ECI (1)	2S- Same (2)	Minor benefit using ECI (3)	2S- Moderate benefit using 2S-ECI (4)	Substantial benefit using 2S-ECI (5)
More transparent pricing (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced tendering costs (i.e., only the successful contractor prices the construction stage) (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved project decision-making (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Better planned construction works, e.g., more time to understand and plan works (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved knowledge transfer from pre-construction to construction stage workforce (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More senior input from head contractors during pre-construction (i.e., not just estimators) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced risk of client disruption on project involving alterations or extensions (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved price certainty, i.e., reduced variation claims or disputes during construction stage (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improved project timing certainty (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faster project completion (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced chance of remedial works (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supports ongoing relationships (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supports more equitable risk transfer (21)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10 Please rate the following pre-construction services in terms of typical benefit:

	No benefit (1)	Minor benefit (2)	Moderate benefit (3)	Substantial benefit (4)
Site logistics planning (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Value management (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk management (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collaborative 'open-book' subcontractor selection (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design buildability advice (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Warning of design document errors or inconsistencies (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contractor contributing design elements (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building information modeling (BIM) (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contractor providing document control systems (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contractor leading design management (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contractor providing design coordination (e.g., services coordination) (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contractor liaison with external stakeholders (e.g., neighbors and local authorities) (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Please rate the following risks to consider during the pre-construction stage:

	No importance (1)	Minor importance (2)	Moderate importance (3)	Substantial importance (4)
Ground conditions (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disruption to existing building operations during construction (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Long lead delivery items (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource availability (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subcontractor performance (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design obligations (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design being difficult or impossible to build (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of design documentation (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weather-tightness (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Connectivity between construction elements (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building services coordination (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and safety (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Passive fire design (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Site logistics (e.g., access, crantage, public protection) (24)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 The entity employed to plan and manage construction (during the construction stage) may be a head contractor (contract for works) or a consultant construction manager (contract for services). Please select your typical preference:

Head contractor (contract for works) (1)

Consultant construction manager (contract for services) (2)

Q17 Optional comments

Page Break

Q16 Please select your typically preferred timing for early contractor involvement:

- Before or during preliminary design brief (1)
- After preliminary design brief, before concept design (2)
- After concept design, during detailed design brief (3)

Page Break

Q18 Please select your preferred option for early contractor payment:

- Contractor paid for early involvement, unless they breach obligations (1)
- Contractor not paid (2)
- Contractor not paid, but reimbursed if project does not proceed, subject to any breaches (3)

Page Break

Q20 Assuming the contractor is paid for early involvement, please select your preferred for of pricing:

	Cost reimbursement (1)	Cost reimbursement with target value (2)	Fixed fee (3)
Before or during preliminary design brief (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
After prelim design brief, before concept design (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
After concept design, during detailed design (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21 Please select your generally preferred option for the construction stage price:

- Cost reimbursement (1)
- Cost reimbursement with target value or guaranteed maximum price (2)
- Fixed lump sum based on P&G and subcontractors (3)

Q22 Please select your preferred option for the construction stage:

- Same contractor used for pre-construction and construction-stage, unless they breach obligations or a construction price cannot be agreed (1)
- Construction stage tendered separately, and open to other contractors (2)

Q26 Please select your preferred form of construction-stage contract:

Construction only, possibly with some elements of design (e.g., facades) (1)

Design and build (2)

Q23 Optional comments

Page Break

Q24 Please select the effect of 2S-ECI on head contractor pricing, compared with single-stage tender:

	Contractor pricing <u>lower</u> using 2S-ECI (1)	Same (2)	Contractor pricing <u>higher</u> using 2S-ECI (3)
In a recessionary market (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In an average market (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a boom market (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q25 Please select the effect of 2S-ECI on consultant pricing, compared with single-stage tender:

	Consultant pricing <u>lower</u> using 2S-ECI (1)	Same (2)	Consultant pricing <u>higher</u> using 2S-ECI (3)
In a recessionary market (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In an average market (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a boom market (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q27 Optional comments

Q28 Please rate the following challenges to using 2S-ECI:

	No challenge (1)	Minor challenge (2)	Moderate challenge (3)	Substantial challenge (4)
Lack of clear definition of 2S-ECI (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unclear client expectations (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty measuring actual benefits (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unclear responsibilities (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwillingness from consultants to involve contractors early (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of standard form pre- construction contract documentation (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty involving specialist subcontractors early, in terms of contractual and pricing procedures (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2S-ECI perceived as more expensive (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perceived lack of competitive pricing (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incomplete design documentation when agreeing a fixed price construction contract (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Theoretical benefits not being realised, i.e., lack of real added value (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of 2S-ECI on wrong project type (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amendment of standard form contracts (such as NZS3910) to transfer contractual risks to contractors (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consultants transferring design risks to contractors (24)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q31 Please rate the following strategies to improve 2S-ECI:

	No benefit (1)	Minor benefit (2)	Moderate benefit (3)	Substantial benefit (4)
Contractors improving 2S-ECI capability (e.g., value management, design coordination and design buildability analysis) (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving quality of design documentation when agreeing fixed price construction contracts (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing a standard form pre-construction services agreement, while maintaining flexibility for different clients and project types (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing amendment of standard form construction contracts (e.g., NZS3910) transferring risks to contractors (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving the clarity of pre-construction responsibilities (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving contractual mechanisms for involving specialist subcontractors early (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Producing 'how to' guidelines for using 2S-ECI (e.g., suitable project types, expected benefits, responsibilities, pricing options etc.) (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, please state (25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix 3: Massey University Human Ethics Committee Approval



Date: 01 November 2017

Dear David Finnie

Re: Ethics Notification - NOR 17/48 - A Risk-based Two-Stage Early-Contractor Involvement Procurement Process Model for the New Zealand Construction Industry

Thank you for the above application that was considered by the Massey University Human Ethics Committee: Human Ethics Northern Committee at their meeting held on Wednesday, 1 November.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Appendix 4: New Zealand Pre-Construction Services Agreement (NZPCSA 2019)

NZ-PCSA 2019

New Zealand - Pre-Construction Services Agreement 2019

Foreword

This Pre-Construction Services Agreement (PCSA) is appropriate:

For employing a head contractor to provide services during the pre-construction stage. This may be used toward agreeing a construction contract for the construction stage (two-stage early-constructor involvement (2S-ECI)).

Contractor involvement in pre-construction planning may be of particular benefit for projects involving alterations or extensions to existing buildings where the client's operations are to continue during the construction works.

PART 1 – AGREEMENT

1.1 PARTIES TO THE CONTRACT

a) This is a consultancy contract between the Client and Contractor for pre-construction services.

(b) Project details:

i. Project name:

.....

ii. Project site address:

.....

(c) Client's details:

i. Client's name:

.....

ii. Client's company number:

.....

iii. Client's contact person:

.....

iv. Correspondence address:

.....

v. Phone number:

.....

vi. E-mail address:

.....

(d) Contractor's details:

i. Contractor's name:

.....

ii. Contractor's company number:

.....

iii. Contractor's contact person:

.....

iv. Postal address:

.....

v. Phone number:

.....

vi. E-mail address:

.....

1.2 SCOPE OF SERVICES

<p>(a) Services to be provided by the Contractor during the pre-construction stage:</p> <p><i>These are examples only. Please update to reflect actual services provided.</i></p>	<p>(b) Milestone dates for providing specific services and requirements from others</p>
<ul style="list-style-type: none"> • <i>Prepare financial feasibility studies.</i> • <i>Prepare an initial cost estimate and a cost plan</i> • <i>Provide cost planning advice to the design team and the Client during the design stage.</i> • <i>Provide a construction programme</i> • <i>Undertake design buildability analysis</i> • <i>Undertake value management exercises</i> • <i>Provide a document management system</i> • <i>Provide input into a building information modelling (BIM)</i> • <i>Liaise with third parties</i> • <i>Undertake enabling works</i> • <i>Provide design services</i> • <i>Other</i> 	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

1.3 PROGRAMME FOR SERVICES

(a) The services will be undertaken step by step to generally satisfy any indicative programme stated below:

ENTER THE NAME AND DATE OF ANY INDICATIVE PROGRAMME

b) The following documents form this contract:

- i. Part 1 – Agreement and specific contract terms
- ii. Part 2 – Contract terms

iv. Other documents listed below (if any):

--

ENTER OTHER DOCUMENTS [IF ANY]

1.4 TIMING OF SERVICES

(a) Date for starting the services
(see B.1.3.1):

.....

(b) Date for submitting offer for
the construction contract:

.....

If a date is not stated, the Quantity Surveyor must complete the services within a reasonable time.

1.5 PRE-CONSTRUCTION SERVICES FEE

The following is the Contractor's fee for providing the pre-construction services:

If not stated, the fee is a fixed lump sum.

If the Parties enter a Construction Contract:

NZD.....
[EXCLUDING GST]

If the Parties do NOT enter a Construction Contract:

NZD.....
[EXCLUDING GST]

Agreed targets for payment such as pain share/
gain share, if any:

1.6 DISBURSEMENTS

(a) The Contractor is entitled to payment for the following disbursements at their actual cost:

--

ENTER ANY DISBURSEMENTS TO BE PAID TO THE CONTRACTOR

(b) The Contractor's minimum level of professional indemnity insurance cover:

NZD.....

If not stated, the minimum level of professional indemnity insurance is five times the value of the Quantity Surveyor's fee or NZD 250,000 whichever is lower.

(c) The Contractor's minimum level of public liability insurance cover:

NZD.....

If not stated, the minimum level of public liability insurance cover is NZD 2,000,000.

(d) The Contractor's maximum limit of cumulative liability is **(see Part B.8.1.5):**

NZD.....

If not stated above, the maximum limit of cumulative liability is five times the value of the Quantity Surveyor's fee or NZD 250,000 whichever is lower.

(e) Insurance cover held by any third party engaged by the Client:

NZD.....

ENTER TYPE AND MINIMUM THIRD PARTY INSURANCE COVER

1.7 CONTRACTOR'S KEY PERSONNEL

(A) The following are the Contractor's Key Personnel (see 2.8, Part 2)

(a) The following rates apply to any variations (see 2.12, Part 2) undertaken by the Contractor:

ENTER NAME OR POSITION

ENTER NAME OR POSITION

ENTER NAME OR POSITION

ENTER NAME OR POSITION

ENTER NAME OR POSITION

If no rates are stated, then reasonable hourly rates will apply to any services variations.

1.8 SPECIAL CONTRACT TERMS – PRE-CONSTRUCTION

a) The following terms, if any, modify the contract terms in Part 2:

.....

ENTER SPECIAL TERMS OF CONTRACT [IF ANY]

1.9 SPECIAL CONTRACT TERMS – CONSTRUCTION STAGE CONTRACT

a) The following terms, if any, will apply to the construction contract if entered into:

- i. Terms of construction contract:.....
- ii. Liquidated damages:
- iii. Start and finish dates or duration period:.....
- iv. Other:

ENTER SPECIAL TERMS OF CONTRACT [IF ANY]

If not stated, the terms of construction contract will be NZS3910 Conditions of contract for building and civil engineering construction

1.10 PRICE STRUCTURE FOR THE CONTRACTOR'S CONSTRUCTION CONTRACT OFFER

(a) The Contractor's offer for the construction contract will be based on the following (see 2.5, Part 2). These rates may be adjusted as a result of variations as the design develops.

Preliminary and General (P&G):	NZD..... [EXCLUDING GST] If not stated, the price is a fixed lump sum.
Percentage margin for profit and off-site overheads applied to subcontractors and suppliers: Percent
Other (specify)	
Other (specify)	
<h2>1.11 SIGNATURE</h2>	
(a) The parties agree to be bound by this contract.	
(b) Client's authorised signatory: i. Signature: ii. Full name: iii. Date:	
c) Contractor's authorised signatory: i. Signature: ii. Full name: iii. Date:	
(d) This contract replaces any previous negotiations between the parties.	

PART 2 - STANDARD TERMS OF CONTRACT

2.1 GENERAL TERMS

- (a) This contract does not form a partnership or joint venture between the parties.
- (b) The New Zealand Consumer Guarantees Act 1993 does not apply to any services provided for the Client's business purposes.
- (c) Any waiver given by either party must be in writing.
- (d) Unless otherwise expressly stated, a waiver does not limit the parties' liability.
- (e) Neither party can assign their rights or obligations under this contract to another person unless the parties agreed to it in writing.
- (f) New Zealand law applies to this contract.

2.2 INTERPRETATION

- (a) No inconsistency, omission or error in the contract documents invalidates this contract.
- (b) Words used in the singular also include the plural, and words used in the plural also include the singular, as the context requires.
- (c) Reference to any statute includes any subsequent amendments.

2.3 CLIENT AND CONTRACTOR'S GENERAL OBLIGATIONS

- (a) Both parties must:
 - I. act in the spirit of mutual cooperation;
 - II. comply with all health, safety, and other legal obligations owed in law and under this contract;
 - III. comply with all health and safety practices on site;
 - IV. keep each other adequately informed of matters affecting the services;
 - V. take up all insurance cover as required by this contract; and
 - VI. undertake all their obligations in a timely manner.

2.4 CONTRACTOR'S GENERAL OBLIGATIONS

- (a) The Contractor must:
 - I. carry out the services in line with this contract and other services that may be agreed to be provided under this contract between the Client and third party;
 - II. request any information needed to carry out the services;

- III. request the Client to make decisions when required;
 - IV. get the Client's approval before ordering any goods or services on the Client's behalf that are additional to the services;
 - V. ensure that the Contractor's Key Personnel fulfil their roles and are reasonably available for communication and consultation with the Client and the Client appointed project team;
 - VI. duly consult with members of the Contractor's supply chain and, at the Client's request, endeavour as far as reasonably practicable to ensure attendance at relevant project meetings; and
 - VII. notify the Client as it becomes aware of any matter, which is likely to impede the performing its services.
- (b) If it forms part of the services, the Contractor may give instructions to a third party engaged by the Client or others. The Contractor must not give instruction to vary any work without the Client's consent.
 - (c) The Contractor must carry out the services with the reasonable skill and care expected of a contractor experienced in projects of similar size, scope and complexity and providing similar services.
 - (d) The Contractor is not responsible for the work of a third party that has been engaged by the Client or others.
 - (e) If an actual or potential conflict of interest arises, the Contractor must inform the Client and any other interested party of the conflict, and encourage the Client to get independent professional advice. The Contractor must not act or continue to act for the Client unless the Client provides written instructions and consent that acknowledges the actual or potential conflict.
 - (f) The Contractor must notify the Client if the completion of the services will be delayed. The Contractor must take reasonable measures within their control to reduce any delay to the services.
 - (g) The Contractor must report on the progress of the services when reasonably requested by the Client.
 - (h) The Client may instruct the Contractor to purchase materials and store for the construction stage of the project. The Contractor must identify where the materials are stored and include evidence of transfer of ownership and insurance to the full value of the materials in an appropriate form before payment of the materials.

2.5 CONSTRUCTION CONTRACT OFFER

- (a) The Contractor must duly prepare and submit their offer for the construction contract in accordance with the following requirements and the cost breakdown stated in 1.10, Part 1.
- (b) The Client is under no obligation to accept any offer for the construction contract and, unless the parties agree otherwise in writing, no binding construction contract exists.
- (c) Unless otherwise agreed, the Contractor's offer for the construction contract will be a fixed lump sum price based the Contractor's preliminary and general works (P&G) and percentage margin rates stated in 1.10, Part 1 along with agreed prices for the subcontractors and any agreed trade works done by the Contractor.
- (d) The rates stated in 1.10, Part 1 may be adjusted by agreement as the design develops.

- (e) The Contractor must tender for subcontractors based on the following:
 - I. As far as reasonably practicable, the Contractor will invite four to five subcontractors to price for each trade, with a minimum of three (it is understood and accepted that this level of competition may not be possible for certain trades);
 - II. Subcontract bids will be based on the information provided by the Client's project team;
 - III. Any terms of construction contract as stated in **Part 1** along with any requirements the Contractor may have, such as for health and safety and quality assurance;
 - IV. The subcontract tenders will close at a location chosen by the Client and tenders will only be opened in the company of the Client;
 - V. The Contractor will review subcontract tenders and negotiate any subcontractor terms with the Client and appropriate members of the Client's project team, and then submit its recommendations to the Client; and
 - VI. Upon approval by the Client, the Contractor will formally accept the subcontractors concerned. Approval by the Client does not limit, vary or reduce the Contractor's liability for the subcontractor.
- (f) If the Contractor wishes to carry out trade works using their own employees, the Contractor must provide a schedule of quantities with priced rates per item to the Client for the purpose of negotiation. The Contractor must provide further workings of their quantities and rates as reasonably requested.
- (g) If the Client wishes to under-take any enabling works, such as demolition, uncovering, borings, testing, sampling, constructing and the like, during the pre-construction stage, the parties may enter into a separate construction contract for this. The Client is under no obligation to appoint the Contractor for such works and may tender the works to others, giving the Contractor the opportunity to bid.
- (h) The Contractor must notify the Client of any inaccuracies or inconsistencies in the Information received by the Contractor before submitting their offer for the construction contract.

2.6 CLIENT'S GENERAL OBLIGATIONS

- (a) The Client must:
 - I. pay the Contractor in line with this contract;
 - II. promptly provide information to the Contractor when requested;
 - III. make decisions within a reasonable time when requested by the Contractor; and
 - IV. allow the Contractor access to the site and other locations as required.
- (b) If the Contractor's scope of services includes issuing instructions to a third party engaged by the Client, all instructions must be given through the Contractor.
- (c) The Contractor may request the Client to make decisions about some of the services to be provided by the Contractor. The Client must respond to a request within a reasonable time.
- (d) The Client must ensure it obtains advice from suitably qualified design consultants or other professionals regarding its design requirements or other professional services that do not form part of the Contractor's services.

2.7 COMMUNICATIONS

- (a) All notifications must be in writing, dated, and securely sent to the relevant parties by e-mail or registered post.
- (b) The Client must identify a contact person who is authorised to make decisions about the services. The Contractor must be notified in writing if the Client's contact person changes.
- (c) The Contractor's contact person is responsible for coordinating the services and all communication with the Client. The Client must be notified in writing if the Contractor's contact person changes.

2.8 KEY PERSONNEL

- (a) The Contractor must not remove or replace any of its Key Personnel stated in **Part 1** without the Client's prior approval. The Client must not withhold or delay their approval unreasonably. The Contractor must promptly appoint a replacement subject to such approval, and where practicable, arrange an appropriate handover period.
- (b) After consultation with the Contractor, the Client may require the removal of any member of the Contractor's Key Personnel if in the Client's reasonable opinion their performance or conduct has been unsatisfactory.

2.9 SUBCONTRACTING

- (a) The Contractor must not subcontract any of its services under this contract without the Client's written consent, which must not be unreasonably withheld. The Contractor remains fully responsible for any subcontracted services.

2.10 TIME OBLIGATIONS

- (a) The Contractor must complete the services in line with 1.3, Part 1.
- (b) The Contractor must take reasonable measures within its control to reduce any delay to the services.
- (c) Each party must notify the other promptly if the completion of their obligations will be delayed. If the Contractor did not cause the delay, the date for completing the services must be extended by agreement between the parties.
- (d) The Client may suspend the Contractor's services for up to six months. The Contractor must make arrangements to suspend the services and minimise further expenditure. The Contractor may provide written notice to terminate the contract if the suspension exceeds six months.

2.11 PAYMENT

- (a) The Contractor may invoice the Client once a month for progress payments for services performed to date including the cost of disbursements listed Part 1.
- (b) Each invoice must be submitted not later than the 5th of the month after the services are performed. Unless agreed differently, the invoice must be paid on or before the 20th of the month after the services are performed.
- (c) If the Contractor's invoice includes payment of materials authorised by the Client under 2.4(h), the invoice must identify where the materials are stored and include evidence of transfer of ownership and insurance to the full value of the materials in an appropriate form.
- (d) If the Contractor's invoice is intended to be a payment claim under the New Zealand Construction Contracts Act, it must state that the invoice is made under the Act and include any information required by the Act.
- (e) The Client may assess the Contractor's payment claim and respond with a payment schedule no later than the 15th of the month after the services are performed.
- (f) The Client's payment schedule must:
 - I. be in writing;
 - II. identify the payment claim to which it relates;
 - III. state a scheduled amount and how it was calculated; and
 - IV. provide reasons for any difference between the scheduled amount and the claimed amount; and
 - V. explain why, if the difference in 2.9 (e) (iv.) is because the Client is withholding payment.
- (g) Late payment of the claimed or scheduled amount entitles the Contractor to interest on unpaid undisputed amounts at 2% above the Quantity Surveyor's overdraft rate and costs incurred by the Contractor to recover the debt.

2.12 VARIATIONS TO SERVICES

- (a) The Client may vary the Contractor's scope of services by giving written notice.
- (a) The Contractor may notify the Client within 10 working days if it thinks any circumstance gives rise to a variation. The notice must set out:
 - I. details of the estimated cost of the variation;
 - II. the likely or estimated impact on the programme;
 - III. the likely or estimated completion date for the services; and
 - IV. recommendations on how to proceed.
- (b) After receiving a notice under 2.10(b), the Client must notify the Contractor within 10 days whether or not it considers the circumstance to be a variation.
- (c) If a variation by the Client to the Services will result in the Contractor incurring additional cost, the Client and Contractor must seek to agree on the adjustment to the Contractor's fee and time for completing the services.
- (d) The Contractor must seek to obtain approval from the Client for any adjustment to the fees before undertaking any variation to the services.
- (e) The parties may agree to vary the rates stated in 1.10, Part 1 for the pricing of the Contractor's offer for the Construction Contract.

2.13 LIABILITY AND INSURANCE

- (a) The Contractor is liable to the Client for any reasonably foreseeable claims, damages, losses, or expenses caused directly by any
- (a) The Contractor is not liable for:
 - I. Any indirect, consequential, or special damages of any kind;
 - II. The work of a third party that has been engaged by the Client or other; and
 - III. The act or failure to act by the Client or others engaged by the Client.
- (b) For any damage that has been caused by more than one party, the responsible parties will only be liable in proportion to how much they contributed to the damages.
- (c) Unless stated differently in this contract, the Contractor's maximum cumulative liability is five times the value of the Contractor's fee or NZD 250,000 whichever is lower.
- (d) The Contractor must hold professional indemnity and public liability insurance cover for at least the minimum levels stated in Part 1 of this contract. The Contractor must use reasonable endeavours to ensure the professional indemnity insurance required by this contract remains valid for six years after completion of the services.
- (e) Where requested, the Contractor must give the Client evidence of the required professional indemnity and public liability insurance cover.
- (f) The Client must ensure that any third party it engages is required to hold insurance as stated in **Part 1** of this contract.
- (g) Unless otherwise stated provided in **PART 1** of this Contract, the Contractor has no liability for design work. If the parties enter a construction contract, the terms of the construction contract will prevail for any design obligations.

2.14 CONFIDENTIALITY

- (a) The detailed terms of this contract are confidential to the parties.
- (a) Neither party may make public statements about details of this contract or confidential details of any project without the other party's consent.
- (b) If the Contractor obtains confidential information about the Client's affairs, the Contractor must not use the information for any purpose except the purpose for which it was obtained.
- (c) Neither party may disclose confidential information to others unless it is:
 - I. required to allow that party to undertake the services;
 - II. authorised by the other party;
 - III. permitted or compelled by law; or
- (d) If either party must disclose confidential information by law, they must first notify the other party.

2.15 INTELLECTUAL PROPERTY

- (a) All intellectual property that existed before this contract started remains the property of the original owner.
- (a) The parties jointly own all intellectual property produced by the Contractor while providing the services.
- (b) The Client and Contractor grant to the other an unrestricted royalty-free licence in perpetuity to copy or use such intellectual property.
- (c) The Client may only use documents produced by the Contractor for the purposes intended under this contract.

2.16 TERMINATION

- (a) Either party may terminate this contract by giving 20 days' written notice if the other party has materially breached the contract terms.
- (a) Following termination, the Client must pay the Contractor all amounts due up to the date of termination. Payment of the Contractor's Fee will account for:
 - I. the amount of actual resource used in relation to the original Fee;
 - II. the reasonable costs incurred by the Contractor to reallocate it's resources; and
 - III. the impact of any breaches by the Contractor or the Client.
- (b) Following termination, the Contractor must provide reasonable assistance to the Client when transferring the services to a new Contractor.
- (c) The provisions of this contract regarding insurance, confidentiality, and intellectual property remain in effect after the contract is terminated.

2.17 DISAGREEMENTS

- (a) The Client must notify the Contractor of any breach of this contract, and the Contractor must promptly remedy those breaches.
- (b) The parties must attempt to settle disagreements by negotiation or mediation in good faith.
- (c) The parties may at any time refer disagreements to arbitration in line with the Arbitration Act 1996. If the parties cannot agree on an arbitrator, either party may write to the authorised person of the Arbitrators' and Mediators' Institute of New Zealand Inc. for a sole arbitrator to be nominated. The arbitrator will decide the procedures and rules of the arbitration.

