Study Report SR445 [2021]

Procuring for quality

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ISSN: 1179-6197

Preface

This is part of a series of reports prepared as part of the BRANZ research programme entitled *Eliminating quality issues*. This programme of work aims to utilise existing knowledge and design new solutions to eliminate common quality issues in the construction industry. This report investigates how procurement can impact quality and suggests a matrix to help clients select a procurement method.

Acknowledgements

We would like to thank everyone who took part in this study, including those who helped frame the study and those who took part in the interviews.

Procuring for quality

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Reference

Curtis, M., Simpson, A. & Kennerley, T. (2021). *Procuring for quality*. BRANZ Study Report SR445. Judgeford, New Zealand: BRANZ Ltd.

Abstract

This report explores industry perspectives on procurement and how procurement methods impact on the construction quality of a building. It discusses how client knowledge levels, the adversarial relationship caused by low-cost tendering and price at the expense of value are impacted by procurement methods and the flow-on effect to construction quality. Finally, it offers a procurement matrix that helps keep quality front of mind when deciding on a procurement method.

Keywords

Eliminating quality issues, procurement, procuring for quality.

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Executive summary

Procurement is one of many variables that impact construction quality. However, many of these variables may be interrelated, and procurement can be central to a number of quality issues throughout construction.

This report focuses on the relationship between the procurement method and quality and how quality can be better managed through procurement processes.

Clients' knowledge levels

Clients play a key role in the procurement process, particularly when it comes to specifying quality standards of the build. The client's precision is a vital component to ensuring a quality outcome.

Where clients may not have enough knowledge to fully specify quality standards and/or undertake construction monitoring to ensure quality throughout the construction process, it is important that they employ someone to independently perform quality control.

One interviewee suggested that procurement and subsequently quality issues resulted from clients' lack of ability to visualise and inadequate planning. They felt that it was the architect's responsibility to elicit information from the client to assist in specifying the quality standards of the build and minimise variations down the track.

An adversarial relationship

Current traditional procurement methods, such as those that invite or promote selection based on a predominantly price-oriented method, may create an antagonistic relationship from the outset. Low-cost tendering can create incentives for contractors to not apportion risk equitably and charge high fees for variations to base specifications.

One interviewee (a client) stated that they felt that some builders would deliberately underspecify the baseline build and then charge variations for adding to the build those things that should have been specified. On the other hand, contractors know that, if they do quote for what is specified and price in risk, they are unlikely to win new work.

Another interviewee stated that the best quality outcomes they had observed were as a result of the project team (client, design team, planner and contracting firm) being united.

Price at the expense of value

Clients tend to focus on lowest upfront or initial cost rather than highest value for money, which is detrimental to build quality. This can be attributed to the competitive bid process, which emphasises cost at the expense of value, resulting in potential problems delivering the expected quality. Another potential reason for this focus is the lack of definition of value for money, which can lead clients to believe that value for money is synonymous with lowest cost.

The literature suggests that there is opportunity to move to a value-based rather than cost-based procurement system. This would enable the industry to improve build quality, industry performance and customer satisfaction.

Quality the long-suffering casualty

The focus on lowest cost not only affects the project being procured but also has long-lasting effects throughout the construction industry. Low-cost tendering depletes margins for construction firms and limits the potential for training new apprentices or upskilling existing labour. The longer-term consequences of this are increased costs for skilled labour and the supply of skilled labour reducing. Quality is the long-suffering casualty.

Quality can also be traded off for timeliness. One interviewee stated that construction firms sought to maintain clients' expectations of timelines at the expense of quality. They suggested that the trade-offs that the residential construction firm was making in building several modest builds and one high-end build affected quality. The time and effort necessary on the high-end build placed subcontractors' margins under pressure, and the modest builds subsidised the higher-end build.

The procurement method matrix

The literature suggests that conventional (or traditional), management-oriented and some partnering procurement methods provide the highest chance that quality and functional standards will be met. Researchers have found that the traditional methods are suitable for those clients who require a high level of quality and minimal risk.

It is vital to choose the most appropriate procurement method for the construction project from the outset. To assist with this, we have created and tested a procurement method matrix (Table 1).

There are two ways to use the matrix:

- Assign an importance weighting to each of the aspects and choose the method that has the highest weighted score.
- Determine what are the most important aspects to control within the build and look at which procurement methods score these aspects highest.

Table 1. BRANZ procurement method matrix

	Direct managed	Design-Bid-Build	Construction Management	Design-Build	Design-Build-Operate/Maintain	Early Contractor Involvement	Alliance	Public-Private Partnership
Quality								
Which model provides the most…?								
Opportunity to innovate	1	1	1	2	3	4	4	3
Buildable designs	1	1	1	2	2	3	4	3
Demonstrable value for money	4	4	2	3	3	3	4	3
Flexibility to change design mid-project	0	0	1	2	2	3	4	2
Risk transfer - finance	0	0	0	0	0	0	1	4
Risk transfer - design	1	2	2	4	4	3	3	4
Risk transfer - construction	1	2	2	4	4	3	3	4
Risk transfer - maintenance	0	0	0	0	4	0	0	4
Risk transfer - operations	0	0	0	0	4	0	0	4
Risk transfer - traffic-revenue	0	0	0	0	2	0	0	4
Project owner control	4	2	1	2	2	2	1	2
How well does this model deal with…?								
Complexity	1	1	2	2	3	4	4	4
Cost								
Which model provides the most…?								
Price certainty	2	4	2	4	4	1	1	3
Demonstrable value for money	4	4	3	3	3	2	1	3
Risk transfer - finance	0	0	0	0	0	0	0	4
Risk transfer - design	1	2	2	4	4	3	3	4
Risk transfer - construction	1	2	2	4	4	3	3	4
Risk transfer - maintenance	0	0	0	0	4	0	0	4
Risk transfer - operations	0	0	0	0	4	0	0	4
Risk transfer - traffic-revenue	0	0	0	0	1	0	0	4
Number of potential contractors	2	4	3	3	3	2	2	2
How well does this model deal with…?								
Large-scale projects	1	1	2	3	3	4	4	4
Limited Project Owner capability/resource	1	3	3	4	2	1	1	2
Timing								
Which model provides the most…?								
Timing and completion certainty	3	2	1	4	4	1	3	4
Flexibility to change timing mid-project	4	1	2	2	2	3	4	1
How well does this model deal with…?								
Long-term projects	1	1	2	3	3	4	2	4

1. Introduction

New Zealand construction sector participants frequently cite the 'triangular trade-off' faced by clients with the phrase: "You can have a cheap build, a fast build or a quality build: choose two." This reflects an underlying belief that the industry continues to struggle to produce timely, reasonably priced buildings that meet the quality expectations and requirements of those who inhabit them. Research completed by BRANZ supports this anecdotal notion, as the legacy of poor-quality construction continues to resonate through New Zealanders' sense of wellbeing.

The triangular trade-off belies the extent of interdependency between these choices, however. Where quality outcomes are established and routinely delivered, construction timelines are likely to improve through fewer call-backs and duplicated efforts. Improved timelines benefit the project budget, which is likely to result in a satisfied client and a more financially robust industry that subsequently has an improved ability to focus on delivering quality buildings. Setting this productive triangle in motion is therefore key to delivering quality outcomes alongside the positive side-effects for timelines and costs. The difference between a reluctant trade-off versus endogenous, positive project outcomes often stems from procurement decisions.

This research project looks to determine how procurement practices impact on construction quality and how these practices could improve construction quality.

1.1 Defining procurement

We note that the term 'procurement' in a construction context has been defined internationally in various ways, reflecting the complexity of both the construction industry (McDermott, 1999) and procurement itself. Under Rowlinson (1999), procurement systems are typically complex and cannot be dealt with in a simple, straightforward manner.

Of the literature reviewed, definitions of procurement can be categorised as follows:

- Functional in nature, emphasising procedural aspects of procurement – for example, defining procurement as the framework within which construction is brought about, acquired or obtained (McDermott, 1999) or as an organised method or process and procedure for clients to obtain or acquire construction products (Rashid et al., 2006).
- Risk focused, viewing procurement as a succession of calculated risks as even experienced clients cannot know all of the potential benefits or risks for each procurement system (Tookey, Murray, Hardcastle & Langford, 2001; CIOB, 2010).
- Relationship focused, seeing procurement as the determination of relationships between different elements of a construction project and the way it is placed or not placed in the market. This recognises that construction projects are complex and involve many stakeholders, long project durations and complex contractual relationships (Oyegoke, Dickinson, Khalfan, McDermott. & Rowlinson, 2009).

The different emphasis of these definitions reinforces that, while there is no commonly acceptable definition of construction procurement, definitions have moved substantially away from simple definitions concerning client choice or contractual arrangements (McDermott, 1999).

In New Zealand, however, definitions of procurement remain predominantly functional in nature. Procurement is defined by the Ministry of Business, Innovation and Employment (MBIE) as: "All aspects of acquiring and delivering goods, services and works. It starts with identifying the need and finishes with either the end of a service contract or the end of the useful life and disposal of an asset."[1]

Procurement is similarly defined by the New Zealand Transport Agency (NZTA) as "the actions, processes and conduct employed by an approved organisation when procuring the outputs required to deliver activities" (NZTA, 2019).

Building on these existing definitions, for the purposes of this report it will be useful to adopt a definition of procurement that applies more specifically to the New Zealand construction industry and to the research questions posed. Any definition must be clear and concise while accommodating the complexity of both the construction industry and the procurement environment.

For these reasons, the following definition of procurement will be used for the purposes of this project:

> Procurement in construction is a methodology for delivering building projects that specifies the type of delivery model and contract to be used.

1.2 Procurement and quality

The depth of analysis and consideration provided above shows procurement strategy is not new to the New Zealand construction sector, with both the private sector and government striving to implement guidelines that augment commercial considerations with a suite of intangible aspirations such as cultural values, fair operation, industry development and environmental sustainability. Balancing the latter aspects against cost can prove difficult, particularly when trying to justify short-term pain for long-term gain to a client or taxpayer. This is in addition to the, at times, subjective process of allocating fair weighting to each factor. Amongst this cacophony of competing tensions sits quality.

Quality – or lack thereof – is the final visible result of a construction project. However, the factors that influence this end outcome stem from the first principles of best-practice procurement and effective contracting – how the project will be delivered and who will be responsible for doing so. As the design, innovation, scale and associated risks of each construction project are distinctly different, it is appropriate to consider how various procurement methods affect project outcomes throughout the project life cycle.

Seeking methods for improving quality in the construction sector, in 2015, BRANZ embarked on a workstream to examine the role of procurement methods in construction quality. This programme of work aims to eliminate quality issues in the building and construction sector by identifying the most prolific problems and investigating potential solutions. Further, this programme looks at the incentives for industry to make these changes, recognising that providing a research-based solution does not necessarily translate into changed behaviour on site.

[1] https://www.procurement.govt.nz/procurement/principles-and-rules/government-rules-of-sourcing/definitions/

To provide a measure of progress, BRANZ defined quality in terms of three key parameters:[2]

- Functionality: The building meets all of the functional requirements set out in the building contract.
- Durability: The ability of building materials, components and construction methods to satisfy performance and functional requirements of the Building Code for the expected life of the building without a reconstruction or major renovation (or repair).
- Performance: Defined through measurable aspects of the building's design – thermal, structural, seismic, acoustic, etc. Performance, as built, must be verified during construction and upon completion of the building process.

The above definition will be used for the purposes of this project, ensuring clarity and consistency across BRANZ's *Eliminating quality issues* programme and the language used during interviews and allowing outcomes from multiple reports to be assessed against a uniform benchmark.

1.3 Government Procurement Rules

The 4th edition of the Government Procurement Rules[3] was published in July 2019, setting out good-practice standards for government procurement ahead of their implementation on 1 October 2019. With government agencies procuring approximately NZ$41 billion from external suppliers, it was timely to provide an updated version of the Rules, which were last reviewed in 2015.

The 4th edition of the Rules essentially directs government agencies to broaden their scope when making procurement decisions, taking a wider range of factors into account. While the 3rd edition made general reference to balanced decision making,[4] the new Rules expressly direct procurers to take secondary benefits (including cultural, social and environmental) into account alongside economic considerations. The Rules also identify four priority outcomes, although these outcomes are not mandatory for all agencies:[5]

- Increase New Zealand businesses' access to government procurement.
- Increase the size and skill level of the domestic construction sector workforce.
- Improve conditions for workers and future-proof the ability of New Zealand businesses to trade.
- Support the transition to a net- zero emissions economy and assist the government to meet its goal of significant reduction in waste.

In terms of potential impact, rules 18, 19, 64 and 69 hold the most promise for New Zealand's construction sector:

- Rules 18 and 19 focus on improving conditions for construction sector workers and placing a greater emphasis upon the skills development and training practices of the supplier and their subcontractors when procuring construction works over NZ$9 million (lowered from the previous NZ$10 million threshold).

[2] www.branz.co.nz/eqi
[3] https://www.procurement.govt.nz/procurement/principles-charter-and-rules/government-procurement-rules/
[4] Including social, environmental and economic effects.
[5] Specific sectors in which one or more of the four priority outcomes are mandatory will be designated by government.

- Rules 18, 64 and 69 address the processes for public-private partnerships (PPPs). The Rules remove the required consultation with Treasury's PPP unit while also stipulating that all procurements of infrastructure with an ownership cost of NZ$50 million must consult with the New Zealand Infrastructure Commission/Te Waihanga.[6]

The Rules also note that, when purchasing construction goods and services, agencies are required to adhere to the principles and practices of MBIE's construction procurement guidelines[7] and obliged to show clearly documented reasons when this does not occur. These guidelines include:

- matching capability to complexity
- developing your construction procurement strategy
- construction project governance
- whole-of-life considerations.

Having outlined the functional purpose and definition of procurement alongside a baseline definition of quality and a brief overview of the most significant legislative changes to procurement in New Zealand construction in recent years, the ensuing sections outline the 2015 BRANZ procurement method matrix (2015) and interview responses from current industry participants to provide an examination of evolving views on procurement and the relevance of the 2015 matrix to New Zealand's 2020 construction sector.

[6] The 4th edition Rules specifically refer to Treasury's Interim Infrastructure Transactions Unit. This Unit was established in November 2018 before shifting to the New Zealand Infrastructure Commission/Te Waihanga.

[7] https://www.procurement.govt.nz/procurement/specialised-procurement/construction-procurement/

2. Methodology

In 2015, BRANZ devised a procurement method matrix to express the respective strengths of each procurement method and the role each plays in influencing construction quality, cost and timelines (Tables 2–4).

Table 2. BRANZ procurement method matrix – quality.

	Direct managed	Design-Bid-Build	Construction Management	Design-Build	Design-Build-Operate/Maintain	Early Contractor Involvement	Alliance	Public-Private Partnership
Quality								
Which model provides the most…?								
Opportunity to innovate	1	1	1	2	3	4	4	3
Buildable designs	1	1	1	2	2	3	4	3
Demonstrable value for money	4	4	3	3	3	3	1	3
Flexibility to change design mid-project	0	0	1	2	2	3	4	2
Risk transfer - finance	0	0	0	0	0	0	1	4
Risk transfer - design	1	2	2	4	4	3	3	4
Risk transfer - construction	1	2	2	4	4	3	3	4
Risk transfer - maintenance	0	0	0	0	4	0	0	4
Risk transfer - operations	0	0	0	0	4	0	0	4
Risk transfer - traffic-revenue	0	0	0	0	2	0	0	4
Project owner control	4	3	3	2	2	2	1	2
How well does this model deal with…?								
Complexity	1	1	2	2	3	4	4	4

Table 3. BRANZ procurement method matrix – cost.

	Direct managed	Design-Bid-Build	Construction Management	Design-Build	Design-Build-Operate/Maintain	Early Contractor Involvement	Alliance	Public-Private Partnership
Cost								
Which model provides the most…?								
Price certainty	2	4	2	4	4	1	1	3
Demonstrable value for money	4	4	3	3	3	2	1	3
Risk transfer - finance	0	0	0	0	0	0	0	4
Risk transfer - design	1	2	2	4	4	3	3	4
Risk transfer - construction	1	2	2	4	4	3	3	4
Risk transfer - maintenance	0	0	0	0	4	0	0	4
Risk transfer - operations	0	0	0	0	4	0	0	4
Risk transfer - traffic-revenue	0	0	0	0	1	0	0	4
Number of potential contractors	2	4	3	3	3	2	2	2
How well does this model deal with…?								
Large-scale projects	1	1	2	3	3	4	4	4
Limited Project Owner capability/resource	1	3	3	4	2	1	1	2

Table 4. BRANZ procurement method matrix – timing.

	Direct managed	Design-Bid-Build	Construction Management	Design-Build	Design-Build-Operate/Maintain	Early Contractor Involvement	Alliance	Public-Private Partnership
Timing								
Which model provides the most…?								
Timing and completion certainty	3	2	4	4	4	1	3	4
Flexibility to change timing mid-project	4	1	2	2	2	3	4	1
How well does this model deal with…?								
Long-term projects	1	1	2	3	3	4	2	4

The purpose of the matrix is to act as a 'strawman', testing its scoring and prioritisation against responses from new interviews with participants in key areas across the New Zealand construction sector in 2020.

This phase of the project has centred on retesting the 2015 matrix with New Zealand industry, using interviews to ascertain whether the matrix still seems reasonable and accurate in the current sector and gain an understanding of the perceived quality outcomes of each method from the perspective of clients, head contractors and subcontractors,

In doing so, this project has sought a breadth of responses rather than a deep dive into one particular subsector, with the aim of understanding more about how industry and clients feel towards procurement on the whole. Given the interviewees' busy schedules, the interviews were completed over the period November–December 2019, and interviewees were briefly contacted again in February and March 2020 to ensure their views and associated scores remained current.

2.1 Procurement methods

To analyse the relevance of the matrix, it is first important to understand the intended benefits of each procurement method presented and the factors that influence the choice of procurement method. The interview findings can then be considered against this backdrop.

As noted in earlier BRANZ-funded scholarship research (Russell, 2019), the selection of procurement method plays a significant role in a projects ability to meet the three aspects of the triple constraint, that is, the delivery of quality project deliverables on time and on budget. While Russell's work looked more specifically at BIM procurement approaches, findings related to procurement costs versus project scale are pertinent to the wider procurement discussion:

> The implementation of innovative procurement is only suitable within large (complex), high cost or bespoke projects, with there being very few projects within New Zealand that meet these criteria. The governing reason as to why this procurement method should only be implemented within projects meeting these criteria, is due to there being a large expenditure required to set up a project via these innovative methods, where this cost is unable to be justified within projects of a smaller, less complex size. (Russell, 2019, p. 208)

The following aspects remain front of mind when choosing a procurement delivery model:

- The project complexity and potential for risk management and mitigation – a development near a waterway carries considerable additional environmental risk, for example.
- Uncertainty regarding the final project deliverable and its placement in the post-construction market.
- Scale and associated financing capability.
- Project timelines and impact on overall feasibility.
- Existing team skillsets in regard to innovative procurement.
- The capability of both the client and supplier to assess this Rubik's cube of interconnected risks and incentives.

With this decision-making environment in mind, a brief outline of the procurement methods cited in the matrix is provided below.

Direct management

The client assumes a large degree of responsibility under the direct management delivery model, managing each component of the build and therefore the delivery of the overall project. As the overarching project manager, the client will negotiate, contract and liaise with all subcontractors while monitoring outputs, timelines and expenditure.

While this represents a significant undertaking (with associated significant risks), this approach can be efficient on smaller projects and/or where the client has project management experience and/or where the client has very specific requirements that may require a higher degree of consultation and flexibility during the build.

The direct management delivery model also includes a 'light' version in which the client remains highly involved throughout the project on the above aspects but also teams up with a specialised construction manager to provide their building expertise.

Construction management

At times replacing the traditional payment of a lump-sum contract between the client and contractor, the construction management model covers a range of slight variations, most of which stem from the varying contractual arrangements and subsequent obligations. This can include the client, construction manager and design team working together and remaining contractually independent from the contractor who delivers the project or a client finding an architect and a construction manager who then procures and oversees the contracting firm or a client engaging a firm that possesses both skills in house to deliver the project.

This typically sees the owner, architect and construction manager work together during the design phase, owing to their shared set of closely aligned incentives, before the construction manager then assumes responsibility for delivering the project. Crucially, this model ideally sees the construction manager continue to protect the best interests of the client throughout this stage across a range of areas, including:

- doing their utmost to minimise costs
- completing appropriate documentation and budgets as per the guaranteed maximum price where applicable
- exercising project management expertise to ensure the project timelines are met

- maintaining tight quality controls to eliminate quality issues and deliver a high-integrity, defect-free product built to best-practice industry standards.

Design and build/design, bid and build

A design and build/design, bid and build delivery models see the client effectively specify the quality of the end result by confirming their performance requirements for the building.

By winning the tender, the head contractor assumes responsibility for delivering a design that meets the client's needs and completing construction according to their specifications. Although the initial process of ascertaining the client's needs and clearly expressing this in the set of tendering documents can be very involved, when it functions well, the design and build approach provides greater assurance that the building will be fit for purpose.

On such highly specified projects, 'fit for purpose' may be considered synonymous with quality. However, conflicts are possible where novation means the project varies from the straightforward design and build approach.

Novation sees one party effectively swap out of a contract, transferring all obligations and benefits to a replacement third party under a joint agreement between the original, replacement and contracting parties. In a perfect market where all players have equal power and a complete understanding of all projects risks, novation can allow parties to obtain significant equipment and contracted skills before the (often expensive) tendering process occurs, with premium contract pricing to reflect this risk. Novation has proven a controversial approach in the New Zealand sector in recent times, however, drawing sharp criticism from parts of the construction sector that government procurers inequitably assigned high risk but low contract pricing when they used this approach during Canterbury's Justice and Emergency Services Precinct and Metro Sports Facility projects (amongst others).

Design-build-operate-maintain

Typically utilised in a project environment with lean available capital, the design-build-operate-maintain procurement approach can allow clients to simply request a final deliverable to be fit for purpose, therefore giving clients the impression of saving themselves considerable design resources while offering an attractive package for potential contractors who are then able to apply their margin to the project inputs.

While this process allows an inexperienced or time-poor client to effectively shift the initial design risk to the contractor, the lack of transparency in the design and pricing processes could be problematic, and in reality, the design costs are likely to be predominantly transferred via the tender price.

In an ideal world, this issue would be mitigated by a range of tenderers creating a competitive pricing environment and the client receiving sufficient guidance to interpret the final design and ensure it is fit for purpose before construction begins (including, but not limited to, thorough whole-of-life analysis). In this 'perfect' project environment, the tenderer's expertise would allow them to create a cost-effective solution far more efficiently than the client could, with these savings subsequently transferred to the client.

Early contractor involvement

The premise of the early contractor involvement (ECI) model is largely self-explanatory – obtaining advice from contractors in the preliminary stages with the objective of improving design and subsequent timelines and costs throughout construction. The benefits of this approach are largely dependent on the quality of the planning and a positive team culture, as this will ensure the principles captured in the contract translate to a genuinely collaborative project environment.

Where other procurement approaches may forego the agile nature of a design and build contract in favour of better project outcomes overall, a project team using ECI aims to enjoy the best of both worlds by 'keeping the client close' and emphasising their input. Despite this seemingly foolproof approach, the client faces the risk of engaging a contractor that doesn't possess the capability (or inclination) to deliver their envisaged project and/or, in the crucial initial design phase, being unduly influenced towards outcomes that benefit the contractor more than client. Quite simply, without a spectrum of ideas to compare, sometimes even a suboptimal idea can appear a winner.

Alliance

The alliance model centres on the concept of shared risks and rewards. This collaborative approach is largely used on significant infrastructure projects, the complexity of which can pose challenges for accurate scoping and delivery forecasts. By creating an environment of cooperation, the alliance model aims to ensure each party has an incentive to adhere to their contract conditions, therefore producing better outcomes for all alliance parties and the project.

The alliance model has been used to unite the client party with several non-client parties, including engineering, contractor and design consultancies, on projects across New Zealand such as the rebuilding of Christchurch's infrastructure and the Waterview Connection.

The wholesome 'no blame, no disputes' approach of the alliance model certainly has a comfortingly edifying tone, and the relevant interviewee reported that it remains their favoured method for delivering large-scale consortium projects on an open-book, jointly beneficial basis.

Public-private partnership

With government contracts comprising approximately 18% of all large-scale construction projects, public-private partnerships (PPPs) play a significant role in delivering New Zealand's buildings and facilities. A broad term that encompasses a diverse range of partnerships between government and the private sector, under a PPP, the asset is typically transferred to public ownership (and ongoing management) once completed. As such, PPP contracts frequently place a significant emphasis on private sector innovation to minimise operational costs, including whole-of-life thinking.

3. Literature review

A literature review comprising literature from both New Zealand and abroad, was completed to inform the research undertaken for this study. In order to set the scene, this literature review firstly provides a general understanding of current and historical procurement methods in the construction industry (section 3.1). It then outlines the challenges that current procurement practices pose for the achievement of build quality (section 3.2).

The literature review is then organised to respond to the following research questions:

- Do other countries incentivise build quality through construction procurement? If so, how? (section 3.3)
- What opportunities exist to incentivise build quality in the New Zealand construction procurement environment? (section 3.4)
- Are [client and industry] interests aligned or misaligned? What are the impacts of this? (section 3.5)
- How can this alignment or misalignment be leveraged or remedied to improve build quality? (section 3.6)

Finally, section 3.7 summarises key findings to inform subsequent research undertaken in response to the remaining research questions.

3.1 Procurement methods in the construction industry

Significant work has been completed both internationally and in New Zealand to document the characteristics and attributes of various procurement methods in the construction industry and their impact on build quality. This work is summarised in the following sections.

3.1.1 Categorisation of procurement methods

As identified above, a significant amount of literature exists regarding the types of procurement methods (or systems) available to undertake construction projects and their various advantages and disadvantages (Rowlinson, 1999; Masterman, 2002).

Arguably one of the most well-known works is Masterman's categorisation of building procurement systems, as replicated in Figure 1. This divides procurement systems into one of four categories (each with their own set of variants) based on how the procurement process is structured and where responsibility falls: the separated (traditional), integrated, management-orientated or discretionary procurement systems (Masterman, 2002).

A brief description, key characteristics, advantages and disadvantages of each of Masterman's four procurement systems are summarised briefly in Table 5.

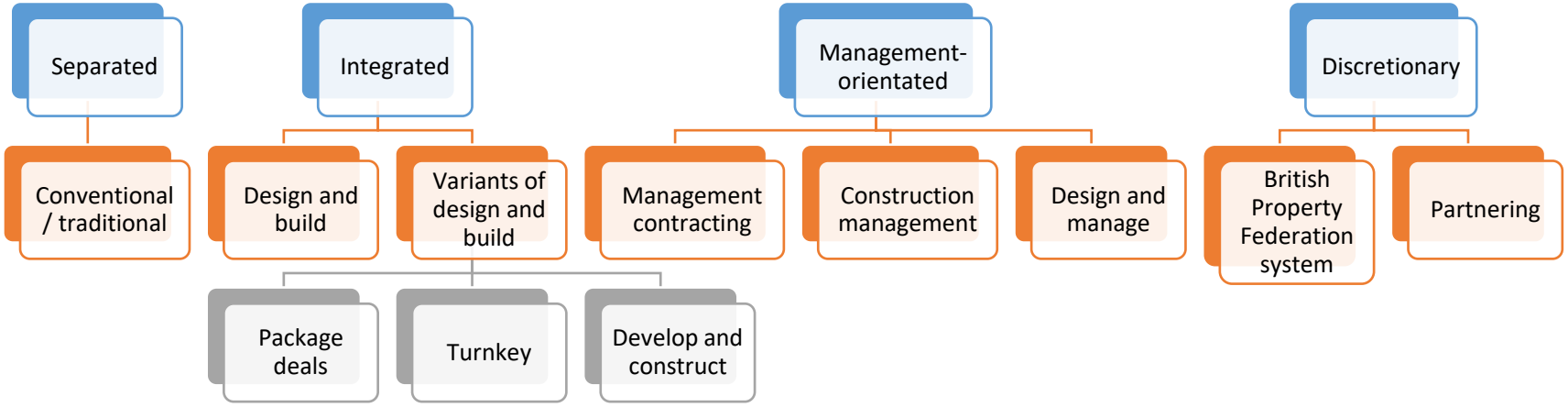

Figure 1. Categorisation of building procurement systems (Masterman, 2002).

Table 5. Characteristics of building procurement systems (Masterman, 2002).

Procurement system	Procurement method	Description	Advantages	Disadvantages
Separated	Conventional/ traditional	Separates responsibility for design of the project from responsibility for its construction. The client appoints independent consultants who fully design the project and prepare tender documents upon which comprehensive bids are obtained from main contractors. The successful tenderer enters into a direct contract with the client and carries out the work under the supervision of the original design consultants.	• Has stood the test of time. • Is understood by clients and industry. • Allows the client to select the most appropriate design team. • Can delay commitment to a building contract until design is complete.	• Does not motivate the client to make decisions early. • Does not induce designers and contractors to save cost or time nor improve build quality. • Designers may have no direct experience of managing construction work. • The contractor is unable to contribute to the design of the project.
Integrated	• Design and build • Package deals	An arrangement where one contracting organisation takes sole responsibility, normally on a lump-sum fixed-price	• Single point of contact between the client and the contractor.	• Ambiguous client briefs can lead to difficulty evaluating tender submissions. • The valuation of variations can be extremely difficult without a bill of

Procurement system	Procurement method	Description	Advantages	Disadvantages
	• Turnkey • Develop and construct	basis, for the bespoke design and construction of a client's project.	• Final project cost is usually less than when using other procurement systems. • Design and construction can be overlapped.	quantities and restricts the freedom of clients to make changes. • The client's control over achieving well-designed and aesthetically pleasing buildings is less than when using other methods of procurement.
Management-orientated	• Management contracting • Construction management • Design and manage	A process whereby an organisation is appointed to the professional team during the initial stages of a project to provide construction management expertise under the direction of the contract administrator. The management contractor employs and manages works contractors who carry out the actual construction of the project and is reimbursed by means of a fee for management services and payment of the actual prime cost of the construction.	• Timeliness. • High degree of flexibility. • Fragmented financial structure reduces the impact of monetary failure of any works contractor. • The use of individual works packages to carry out construction work ensures competition and makes it possible to adjust the cost or scope of uncommitted work.	• Allocation of the majority of project risk to the client. • The client is liable for the cost of any defects. • Maintaining quality control is problematic. • The client does not have a firm tender price available before commencing work.
Discretionary	Partnering	An administrative and cultural framework into which any procurement system(s) can be incorporated allowing the client to carry out the project by imposing a very specific management style or company culture while at the same time enabling use of the most suitable of all available procurement methods.	• Client's project costs and construction periods are reduced, and design periods are sometimes shortened. • Quality of the final product can be improved as a result of partnering, • Conflict among team members may be reduced. • Communication is improved, with more efficient working and greater productivity. • Can result in increases in innovation.	• Additional costs due to the need for extra management. • Clients may not be able to honour pipeline work promised. • Relationships built up during the partnered project(s) can lead to associations that do not encourage new ideas. • Confidentiality can be compromised. • Difficulties can arise as a result of conflicts that may occur between the partnering charter/framework and formal contracts.

The literature reviewed indicated that conventional (or traditional), management-oriented and some partnering procurement methods can provide a high degree of certainty that quality and functional standards will be met (Masterman, 2002; Rashid et al., 2006).

Of these procurement methods, however, the majority of literature indicated that the traditional procurement method was the most likely to result in a quality built outcome. Zuo (2010), for example, stated that the products from the traditional procurement system are usually of a higher degree of quality, while Naoum and Egbu (2016) considered the traditional method suitable for clients that require a high level of quality with minimum risk.

The suitability of a particular procurement method to achieve quality, however, is not straightforward and is highly dependent on the timing and other circumstances of a construction project (Rowlinson, 1999). In some cases, for example, the management contracting and construction management procurement systems can deliver complex projects quickly and to a high quality (Naoum & Egbu, 2016).

Despite these variances, remaining procurement methods were generally found not to emphasis quality to the same degree. For example, literature regarding design and build did not identify high levels of functionality or quality as a benefit when using this method of procurement (Masterman, 2002).

3.1.2 International trends

It is interesting to note that, internationally, the literature diverges as to whether the popularity of the conventional (or traditional) procurement method is declining, increasing or remaining stable.

McDermott (1999), for example, observed a wide dissatisfaction with traditional approaches to procurement. This was especially in terms of cost, time and the high potential for conflict between parties, which spurred the rapid expansion in use of alternative procurement methods such as design and build. The World Economic Forum (2016) also considered that the traditional approach to procurement is gradually being replaced by integrated and discretionary procurement systems.

Notwithstanding, the Royal Institution of Chartered Surveyors (RICS) Contracts in Use Survey 2007 found that the traditional method of procurement was the most used in the United Kingdom at that time (CIOB, 2010). Later research from a small sample of 21 builders and seven property developer/builders in Sydney, Australia, found that 75% of respondents saw no problem with traditional competitive tendering (Hardie & Saha, 2012). This potentially indicates that, while a desire to move away from traditional procurement methods may exist, it has yet to be actioned by the international construction industry.

3.1.3 The New Zealand experience

The literature reviewed indicated that the New Zealand construction industry utilises a range of procurement methods (Wilkinson & Shestakova, 2006). Notwithstanding, the traditional procurement method was generally considered to be the most commonly used in New Zealand as is the case overseas and for similar reasons (Ismail, 2007).

As well as the traditional method, other procurement systems frequently used in New Zealand were considered to include design and build, project management and management contracting procurement methods (Wilkinson & Scofield, 2003).

Research undertaken by Ismail (2007) indicated that there was a general willingness by the majority of clients in the New Zealand construction industry to adopt procurement systems other than those that they were familiar with. However, the largest constraint to this occurring was a perception that new systems are often not tried and tested and could introduce additional project risks.

The following section of this literature review explores such challenges further to better understand the procurement barriers to achieving build quality both internationally and in New Zealand.

3.2 Procurement challenges for build quality

The literature reviewed highlighted that current procurement practices did indeed pose a number of challenges for the achievement of build quality in the construction industry, both internationally and in New Zealand. The more significant of these challenges are outlined in the following sections. It is anticipated that, by articulating these challenges, the New Zealand construction industry will be able to better understand and overcome them.

3.2.1 Value versus cost

A very strong theme emerging from the literature reviewed was that the focus of clients on lowest cost rather than highest value during the construction procurement process was detrimental to the end quality of the build. This was especially true of the competitive bidding process prevalent in conventional (or traditional) procurement methods. For example, Hardie and Saha (2012) found that, in general, the competitive bidding process emphasised cost at the expense of value, resulting in problems when delivering project quality.

This is evident across both the public and private sectors. In New Zealand, industry dialogue has tended to focus on delivering the building as opposed to the value that the building delivers (Singer, 2018b). Internationally, the World Economic Forum noted that public procurement has a strong tendency towards the lowest bid. This focus on initial construction costs not only neglected the total cost of ownership but also inhibited innovation and productivity improvements (World Economic Forum, 2016). Farmer (2016) also observed that clients tended to fixate on lowest initial tendered price.

In response to this client focus on initial cost, construction companies have been known to submit unusually low bids in order to obtain work – a practice known as suicide bidding. Companies may do this to ensure that they have work for their staff, even if it means only breaking even on a project or, in some cases, making a loss (CIOB, 2010). Farmer (2016) frames this in another way, stating (somewhat tongue in cheek) that, in competitive tendering, whoever wins a project is often the party that has made the largest mistake in pricing it.

One of the reasons posed for this fixation on lowest initial cost is that cost is easily quantifiable and provides a ready measure to assess tenders (Hardie & Saha, 2012). Project value is often difficult to calculate and not fully quantifiable until a building is complete and occupied. Notwithstanding, opportunities exist to educate clients that value for money can be achieved and a project delivered to a high standard on time and on budget if a bid other than the lowest is accepted (CIOB, 2010).

Value for money should also be defined so that it does not automatically create the assumption that the lowest bid is the best option (CIOB, 2010). Hardie and Saha (2012) define value as the intersection of final project cost compared to the budget, timely project delivery and quality of the built project result as portrayed in **Error! Reference source not found.**.

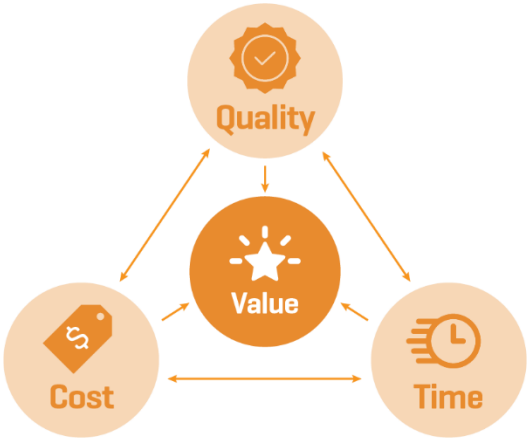

Figure 2. Cost-time-quality, the value triangle.

As noted by Hardie and Saha (2012), the opportunity exists to move to a value-based rather than cost-based procurement system to assist industry performance and customer satisfaction and achieve overall build quality.

3.2.2 Selection of an appropriate procurement method

The literature reviewed also indicated that there is no 'one size fits all' solution or process for selecting an appropriate procurement method for a particular construction project (Taylor, Norval, Hindle, Rwelamila & McDermott, 1999). As stated by The Chartered Institute of Building, "Comparing which procurement method is 'best' is nigh-impossible – there is no direct way to measure, as construction projects are bespoke and differ substantially from project to project in many aspects." (CIOB, 2010, p. 7).

The challenge of selecting a procurement method is also complicated by the fact that there are a number of different types of procurement methods available for clients to choose from, each with its own inherent advantages and disadvantages (Tookey et al., 2001). Masterman (2002, p. 99) also observed this "proliferation of different methods of procuring building projects", resulting in an increasingly complex selection process. However, in the absence of clear guidance when considering which procurement method to use, factors such as client preference and local culture should be considered (Ismail, 2007).

In New Zealand, MBIE's five principles of government procurement[8] provide some guidance of factors to consider when selecting a procurement method. However these are general in nature and not binding on all public sector agencies (Singer, 2018b). Therefore clients are generally left to select their preferred procurement method based on past experience, time and cost constraints (Masterman, 2002).

[8] Plan and manage for great results, be fair to all suppliers, get the right supplier, get the best deal for everyone, play by the rules.

This is significant given that the selection of the appropriate procurement method can shape the success of the project (Naoum & Egbu, 2016). Also, once the choice of procurement method has been made and implemented, it is unlikely that it can be changed without incurring cost and time delays to the project (Masterman, 2002). It is therefore important to select the most appropriate procurement method for a particular construction project from the outset.

3.2.3 Complexity of construction projects

As discussed in the preceding section, there is no one best procurement method for all projects given the nature of the issues, problem or project at hand (Naoum & Egbu, 2016). This complexity of construction projects provides a challenge in that it complicates the procurement method selection process and decreases opportunities to effectively replicate or standardise procurement practices.

As noted by The Chartered Institute of Building, construction projects are generally one-off products designed to satisfy the bespoke needs of the particular client at a particular time. Factors such as ground conditions, topography, logistics, weather, available technologies, finance, labour availability and services all affect the ability of a project to be completed on time, on budget and to a high quality (CIOB, 2010).

The classic criteria of time, cost and quality alone are therefore now considered too simplistic in the context of today's complex construction project environment (Naoum & Egbu, 2016). The challenge is to develop procurement systems that respond to the complexity of construction projects while ensuring that build quality and best value is consistently obtained.

3.2.4 Industry scale

The scale of the New Zealand building and construction industry also presents challenges to procuring for quality builds. By far the largest proportion of the construction industry in New Zealand is made up of small firms. For example, approximately 86% of firms in the residential sector have five or fewer employees (Clark, 2017). This is roughly comparable to the United Kingdom, where over 80% of all construction companies are classed as small and medium enterprises (CIOB, 2010).

This predominance of small firms raises particular challenges for procurement systems. For example, small and medium enterprises may not have the resources to be as competitive as larger contractors when it comes to pre-qualification (CIOB, 2010). In addition, collaborative procurement strategies may be preferred by larger clients but not smaller clients, who may still rely on traditional (lowest-price) procurement systems (Wilkinson & Shestakova, 2006).

Research in New Zealand has also established that the size of a firm has a large impact on the methods used to obtain work. Small firms were found to rely largely on repeat clients and recommendations from previous clients, while larger firms were found to rely more on tendering (Curtis & Page, 2014).

Opportunities therefore exist to ensure procurement systems do not preclude or discourage the involvement of small or medium-sized firms as long as project objectives (such as time, cost and quality) can be met.

3.2.5 Other factors

Although effective and up-to-date contracts and procurement processes are the foundation for quality construction (CIOB, 2018), it should be recognised that a number of factors other than procurement strongly influence construction build quality.

As summarised by Chan and Tam (2000), some of these other factors can be grouped under the headings of client, project, project environment, project team leaders, project procedures (including procurement) and project management procedures. More intangible elements such as the social interactions that exist in project teams are also a key determinant of success and thereby quality (McDermott, 1999).

It is therefore important to note that, although procurement does impact on build quality, it is but one of a number of influencing factors. All aspects of the construction process must be analysed in order to arrive at valid solutions for achieving build quality, including this current report.

3.3 Incentivising build quality – experiences from abroad

A small amount of literature was available regarding the use of procurement incentives to achieve build quality internationally. Discussion of incentivisation in the construction industry mostly related to increasing skills, training and innovation (Farmer, 2016; PwC, 2016) – not build quality itself.

Notwithstanding, incentivisation was generally considered to be a relevant tool available to meet the challenges posed by the marketplace and that opportunities existed for incentivisation systems to be applied for greater efficiency in achieving built outcomes (Oyegoke et al., 2009). Eriksson and Westerberg (2009) took this slightly further, stating that the more compensation is based on incentives connected to joint objectives, the better the quality of construction.

It is interesting to note, however, that the use of incentives may not be generally widespread. A 2004 RICS survey undertaken in the United Kingdom, for example, found that only 3.3% of contracts for both small and large projects included some form of incentivisation provision (Oyegoke et al., 2009).

The literature reviewed also yielded some disadvantages in the use of incentives. Kashiwagi (2016) noted that, in the 1970s, monetary incentives became an accepted method of increasing a company's productivity level. It was later found, however, that while incentives initially increased productivity, over time, they lowered productivity below the original level. It was concluded that, in this particular case, incentives were not a best-value practice (Kashiwagi, 2016). Although this example is relevant to productivity as opposed to build quality specifically, such unintended consequences should be kept front of mind as the use of incentivisation is explored.

It was also identified that the use of incentivised commercial engagement models abroad was sometimes limited to clients that had large-scale projects or longer-term outcomes with a reasonable degree of certainty (Farmer, 2016). The implication of this is that incentives may not be as appropriate for projects that are smaller in scale or shorter term in duration as is generally the case in the New Zealand construction industry. This may be due to a lack of client interest in deploying incentives to achieve build quality, and/or the time required to administer and verify incentive schemes for short-term projects may outweigh any perceived benefits.

3.4 Opportunities to incentivise build quality in New Zealand

Similarly to the international context, very little literature regarding the incentivisation of build quality in the New Zealand procurement system could be found. NZTA (2019) discusses the need to create sufficient incentives within contracts to encourage innovation and efficiency in delivering project outputs and ensuring value for money. However, specific incentives are not identified.

This gap in the literature is illuminating. It indicates that either no guidance is provided in the New Zealand procurement framework for the use of incentives (contractual or otherwise) to encourage build quality or that incentivisation is undertaken on a client-by-client basis dependent on each project or that build quality is largely not currently incentivised in the New Zealand construction procurement environment.

3.5 Alignment of industry and client interests

3.5.1 Client interests

Before discussing client interests in procuring construction projects, it is first useful to define the term 'client' in a construction context. Masterman (2002, p. 6) defines client as the "organisation, or individual, who commissions the activities necessary to implement and complete a project in order to satisfy its … needs and then enters into a contract with the commissioned parties". In New Zealand, a client is more simply defined as an agency that procures and delivers a project (MBIE, 2019).

Clients have an essential role in procuring construction work and specifying quality standards. The client is effectively the sponsor of the construction process and sets the objectives that the construction industry turns into reality (Rowlinson, 1999). The client is often the arbiter of quality, making decisions about a number of factors that influence build quality, including design, materials, techniques, timing, how the project is managed and trade-offs between immediate and longer-term costs (Page & Gordon, 2017).

A large amount of literature defining and ranking client interests is available. For example, Tookey et al. (2001) found that client core objectives can be summarised as highest realistic quality, lowest realistic cost, minimum realistic time into service, high prestige for the building (within affordability parameters) and minimum conflict during the process.

Other commentators note client interests as including projects that are free from defects on completion (Latham, 1994) and achieving a functional building and building quality at the right price (Bennett & Flanagan, 1983).

Later research has shown, however, that achieving build quality is often not a primary factor influencing how a client may choose to procure a construction project. A UK survey of construction industry professionals, for example, found that 32% of respondents saw the client's requirement to complete a project on budget as the primary factor in selecting a procurement method, ahead of completing on time and to a high quality (CIOB, 2010). Factors such as completing a project within budget on time with high client involvement and cost of the procurement method all ranked ahead of build quality influencing which procurement method clients may select (CIOB, 2010).

Similar research in New Zealand yielded consistent findings. A 2007 questionnaire of 60 New Zealand construction professionals (including clients, consultants and contractors) showed the top five priority needs of clients in the procurement process (in order of importance) as zero cost overrun, on-time completion, quality, project control and lowest price tender (Ismail, 2007). Quality was therefore the third consideration after cost and time. This indicates that, in the New Zealand construction industry, cost, time, and quality are the most influential factors for clients when initiating a construction project.

3.5.2 Industry interests

Interestingly, very little literature was available documenting construction industry interests in the procurement process. As outlined in the preceding section, the majority of literature refers to client interests or industry's perceptions of client interests. This may be because construction organisations are considered to be primarily profit-driven in that they need to make a profit to stay in business (Howe et al., 2015) and therefore little documentation exists regarding factors other than profit.

3.5.3 Degree of alignment

Some literature reviewed indicated that clients and industry usually have non-aligned interests, at times reinforced by traditional procurement protocols (Farmer, 2016). Competitive bidding, for example, creates an adversarial relationship between the two parties that can lead to undesirable outcomes for build quality (Langford, Martines & Bititci, 2007; Hardie & Saha, 2012). Misalignment may also be because clients and industry understand quality in different ways and because both parties may have different expectations throughout the building process (Curtis & Gordon, 2018).

Notwithstanding, a review of the interests of both parties indicates that some interests may in fact be aligned. There is alignment in terms of cost or profit being a major influencing factor in the procurement and delivery of construction projects. In addition, build quality was consistently found to be amongst the top half dozen factors identified as being influential for clients during the procurement process.

It should be noted that, although a substantial amount of literature was available regarding client interests, very little could be found regarding industry interests.

3.6 Achieving alignment to improve build quality

3.6.1 Client leadership

The majority of literature reviewed placed responsibility for aligning the interests of clients and industry squarely with the client. This is particularly in terms of leadership, given the vital role of client leadership in the success of any project and the opportunities clients have to take ownership and drive best practice in the construction industry (Eitelberg, Hutton, Harris & Sutherland, 2010).

Farmer (2016) makes this point quite emphatically with the observation that change will not happen in the construction industry unless it is instigated by clients changing their construction commissioning (procurement) behaviours. This is because clients set the design briefs, budget, timeframes and quality standards for construction projects. If a greater emphasis were placed on build quality, the construction industry would have clear parameters within which to operate and deliver quality builds. Farmer further noted:

> The current separation that exists between private clients, industry at large and government needs to be fundamentally overcome if there is to be any chance of changing the way in which construction is commissioned and executed such that it enables modernisation and better outcomes for all parties. (Farmer, 2016, p. 53)

This indicates that a much greater degree of alignment between clients and industry would yield better all-round built outcomes, including build quality. However, the specific mechanisms to achieve such client-led alignment are not articulated as clearly as the issues associated with misalignment.

3.6.2 Understanding industry

As identified in section 3.5.2, very little literature was available regarding construction industry interests in the procurement process. The only interest highlighted was that of the need for construction organisations to make a profit (Howe et al., 2015). Aside from profit, very little is understood regarding the interests and motivations of the construction industry, which is in direct contrast to construction clients, about whom a wealth of literature exists.

In order to understand how the alignment or misalignment between client and industry interests could be leveraged or remedied to improve build quality in New Zealand, it is therefore necessary to better understand what drives the construction industry and what its specific interests are throughout the procurement process. Only then will it be possible to undertake a full analysis of the degree of alignment between clients and industry and the resultant opportunities to leverage this to improve build quality.

3.7 Summary

Overall, it was found that, while a substantial amount of literature was available regarding various procurement methods and selection models and challenges associated with procuring for quality builds, far less literature was available regarding incentivising build quality and aligning client and industry interests. Therefore, although the problem is well documented, approaches to finding solutions are less so.

Notwithstanding, the following key points were raised and inform the subsequent interviews and survey undertaken, the findings of which are included in section 4.

Procurement methods

- The traditional (or conventional) procurement method appears to be the most widely used in New Zealand and abroad (Ismail, 2007; CIOB, 2010).
- Although the traditional method generally ensures high-quality built outcomes, issues can arise with competitive tendering and the lack of ability of contractors to influence initial design (Masterman, 2002).
- Research indicates a general willingness by the majority of clients in the New Zealand construction industry to adopt alternative procurement systems. However, there is a perception that new systems are often not tried and tested and could introduce additional project risks (Ismail, 2007).

Procurement challenges for build quality

- Opportunities exist to move to a value-based rather than cost-based procurement system to assist industry performance and customer satisfaction and achieve overall build quality (Hardie & Saha, 2012).

- There is no agreed process for determining the best procurement method for a particular project. Procurement is not a 'paint by numbers' exercise (Singer, 2018b).
- The complexity of construction projects can complicate the procurement method selection process and decrease opportunities to effectively replicate or standardise procurement practices.
- The New Zealand construction industry is dominated by small firms that may not have the resources to compete with larger firms during the tender process, may be disinclined to engage in collaborative procurement strategies (Wilkinson & Shestakova, 2006) and may rely more on repeat clients and recommendations than on tendering (Curtis & Page, 2014).

Incentivising build quality

- Incentivisation was discussed in relation to achieving build quality but was more likely to be used as a tool to increase skills, training and innovation (Farmer, 2016).
- The use of incentives may not be generally widespread. A 2004 RICS survey undertaken in the UK found that only 3.3% of contracts included some form of incentivisation (Oyegoke et al., 2009).
- Incentives may be effective for achieving specified outcomes for large-scale projects but may not be as attractive to administer for small-scale or shorter duration projects.
- There was very little literature available regarding incentivisation in the New Zealand construction industry.

Alignment of industry and client interests

- Clients have an essential role in procuring construction work and specifying quality standards. The client is effectively the sponsor of the construction process (Rowlinson, 1999).
- Research in New Zealand and abroad indicates that build quality is generally within the top half dozen priorities for clients during the procurement process, ranking after factors such as completing a project within budget and on time (Ismail, 2007).
- Very little literature was available regarding industry interests during the procurement process, apart from the ability to make a profit (Howe et al., 2015). This area would benefit from further research.
- Alignment of interests could be achieved through greater client leadership (Eitelberg et al., 2010; Farmer, 2016).

4. Procurement – mood of the sector

Often denoted as a highly fragmented industry plagued by conflicting incentives, the construction industry is experiencing a surge of strategic activity as sector participants voice their concerns and mobilise through industry initiatives including the Industry Transformation Agenda, the subsequent Construction Sector Accord and the Construction Strategy Group.

An analysis of responses to two broad industry sentiment surveys (Infrastructure New Zealand, 2019; AECOM, 2019) provides an indication of the sector's helicopter-level view and highlights where procurement is perceived to detract – both directly and indirectly – from achieving quality outcomes. These concerns centred largely on a perception that the overwhelming focus on lowest price is drowning out considerations of quality and depleting the margins that allow for training new apprentices and that, as costs continue to increase and the supply of skilled labour comes under increasing pressure, quality is the long-suffering casualty.

Uncertain global economic conditions – significantly worsened by the current COVID-19 pandemic – saw AECOM respondents express similar ongoing concerns about the low-quality outcomes produced by procurement processes that do not apportion risk equitably (and that erode trust), alongside persistently low returns for sector participants and "a short-term mindset that focuses on price at the expense of value" (AECOM, 2019, p. 2).

While overall performance was perceived to be slipping from 2017–2019, the areas that did show improvement are significant, with Infrastructure New Zealand survey respondents reporting a better understanding of risk allocation and management and efforts to reduce bid costs where possible (Figures 3–5) . Although this was partially countered by the impression of a reduced commitment to continuous improvement and a high-level outcomes-focused approach to projects, risk allocation and bid costs are a cornerstone of procurement and improvement in those areas is a promising sign for the sector overall.

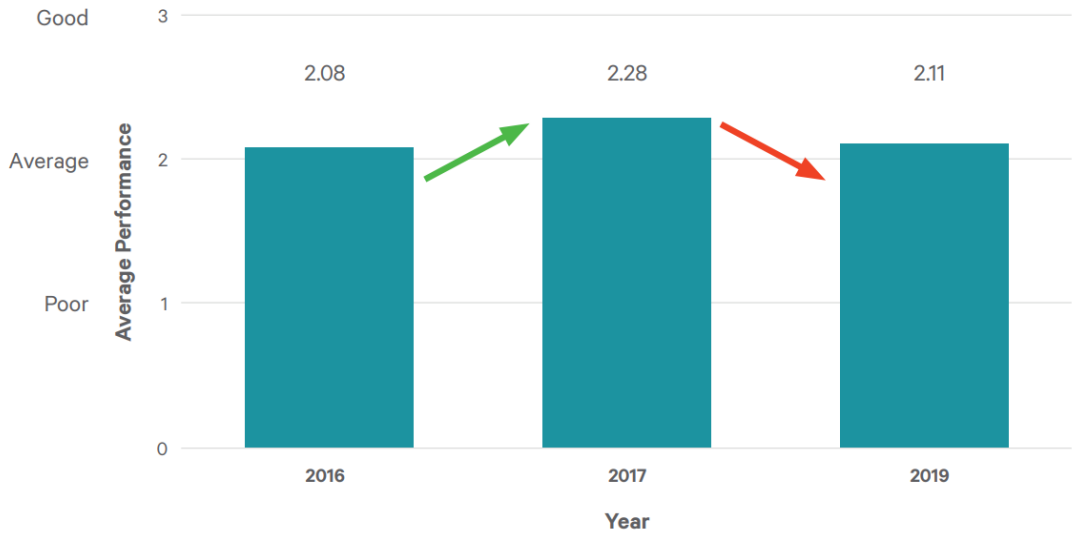

Figure 3. Infrastructure New Zealand survey – procurement performance.

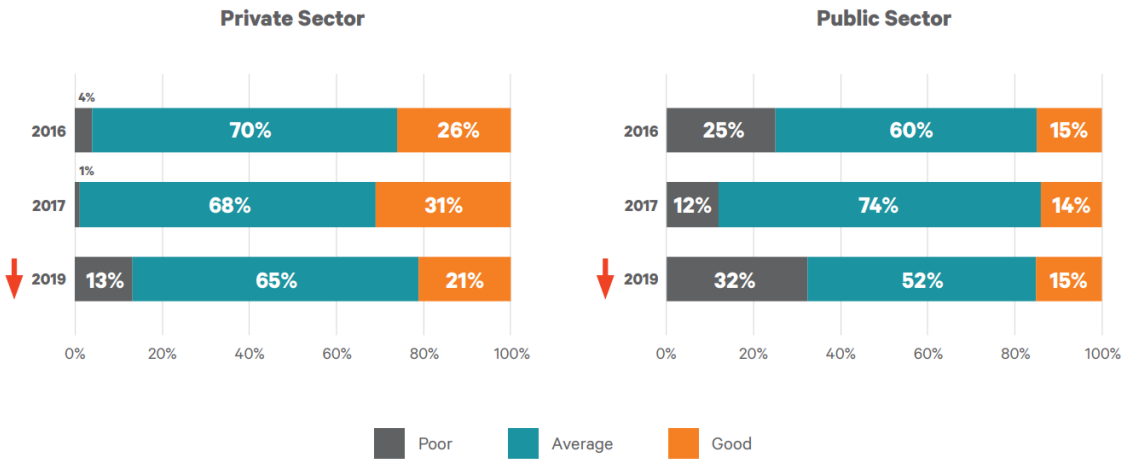

Figure 4. The decline in procurement expertise was more pronounced in the public sector.

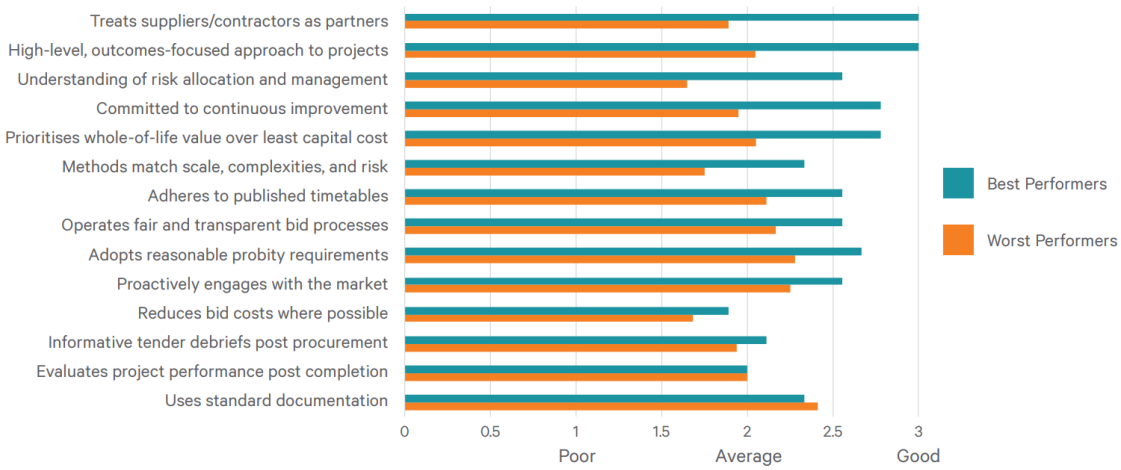

Figure 5. Infrastructure New Zealand respondents generally positive about improving risk allocation and efforts to reduce bid costs.

4.1 The interview process

The analysis of procurement methodologies and their impact on project outcomes tends to gravitate around large-scale infrastructure projects, largely in reference to the public sector's expenditure on private sector goods and services. This sectoral component is comprehensively examined in a report prepared for Infrastructure New Zealand, Construction Strategy Group and Civil Contractors, which notes:

> The New Zealand public sector is currently spending approximately $10 billion dollars a year on the procurement of New Zealand's physical infrastructure – our roads, rail, schools, libraries, hospitals, and even the pipes that feed the water to our taps. Yet when the public sector procures these assets, it does so via a complex process of planning, designing and constructing, much of which is outsourced to the private sector" (Singer, 2018a, p. 2).

Upon reviewing Singer's succinct summary of 12 key concerns, however, it becomes clear that ineffective procurement stretches beyond big infrastructure. The poor procurement brew of skill shortages, industry upheaval and an uncooperative culture also has significant downstream effects, at times leaving a sour taste in the mouths of New Zealanders seeking to procure high-quality smaller-scale private sector and residential projects.

With that in mind, Singer's findings were used alongside the BRANZ 2015 matrix as the basis for discussion to understand a breadth of interviewees' thoughts on the respective strengths and weaknesses of the listed procurement approaches, before honing the focus to specifically consider the relevance and accuracy of the matrix figures in the current construction sector environment.

Clients and industry participants were asked to consider whether they felt the various procurement methods had achieved the outcomes identified in the BRANZ matrix, 1 being lowest achievement and 4 being highest achievement of outcomes.

4.2 Interview responses classified by procurement method and industry role

4.2.1 Alliance – contractor

This interviewee found the 2015 matrix to be largely accurate, within the context of the following discussion points:

- The interviewee felt the alliance model is sometimes viewed as an expensive precursor to the real construction, but the matrix score of 1 for *Quality: Demonstrable value for money* understates the impact that such rigorous planning has on overall quality. The interviewee viewed this as meriting a score of 4.
- The best quality outcomes the interviewee has observed is where the client, design team, planner and contracting firm are united throughout the bidding process.
- The flexibility to change mid-project is critical to keeping large-scale infrastructure projects on track, as even the best plans come across unexpected hurdles. The cost of these under another model would be prohibitive and could be a shock to clients where the collaborative open-book approach is not employed.
- In terms of financial risk transfer, one of the big advantages of the alliance model is that incentives are aligned through the shared risks and rewards, so financial risk transfer should be self-regulating to a degree.
- Regardless of the procurement method used, client precision is a vital component in ensuring a quality outcome. This starts in deciding exactly what they are procuring and why and relies on maintaining decision-making protocols and a realistic degree of reliance on parties delivering the project as it progresses.
- The interviewee felt the alliance model genuinely minimised reworking on their most recent project – in some cases avoiding it altogether – as the workload was shared and the incentive structure functioned well.
- The interviewee readily acknowledged that the alliance delivery model is not the lowest cost. However, they remain convinced that it provides the best value and achieves the highest quality outcomes on large-scale infrastructure projects.

4.2.2 Design and build – head contractor

This interviewee found the matrix accurately reflects the real advantage of price certainty delivered in a design and build model, alongside the limited ability to change

timing or innovate once the project is under way. This is a summary of the interviewee's general discussion points:

- The interviewee felt a score of 3 for *Quality: Project owner control* seemed overly generous and suggested a score of 2. The interviewee also noted, however, that they believe the only effective method for ensuring quality and maintaining control is employing an independent quality control consultant to ensure the construction matches the design specifications.
- The interviewee described their direct experience with the design and build model on a project that incorporated novation. The client appointed design consultants in the first instance, who then devised a partial design to the stage where it could be tendered in the open market. Once the head contractor was appointed, the balance of responsibility altered significantly. The contractor assumed responsibility for completing the design and the construction of the specified design, and (if they remain involved as they did on this project) the design consultants took instruction from the contractor from then onwards. The interviewee believes this method attracted a deeper – and likely more competitive – pool of tender applications as contractors avoided much of the cost of developing their design without any guarantee of a successful bid. On a more generalised note, there are limitations, however. Given the design consultants' control is ceded to the contractor, conflict can easily arise where the former has delivered their outputs and the latter do not build to specification. The interviewee felt this potential issue was avoided on this project by installing the independent quality control consultant with oversight of the design and construction aspects.
- The contractual link means the architect is working for the client. When the client sees something better mid-project or decides an additional feature is needed to improve the building's use, the interviewee has observed situations in which the architect directs the variations to the contractor, sometimes with little thought as to how the changed features affect performance (in one case, new materials that had an impact on wall structure performance). Even apparently minor items such as extra windows and technological capacity added at a late stage can have an impact on the contractor's ability to deliver on their contracted obligations.
- The interviewee believed the procurement and subsequent quality issues stem from some clients' lack of ability to visualise and inadequate planning ("Is there sufficient light, will filming be required, will staff want to access north facing aspects, how will the building be used by inhabitants, how many people will be here on a daily basis versus travelling?"). It is concerning that some clients cannot necessarily envisage the range of ways the building will be used. However, the interviewee noted that it is essentially the architect's responsibility to carefully question this during the planning stages to minimise variations further down the track and ensure a quality project is delivered on budget.
- The interviewee observed that many design teams currently charge an additional fee to oversee the project and ensure that the building is delivered in line with their architectural plans, whereas this could potentially be incorporated in the contract price to streamline and clarify the contractual chain of command.
- It is important the contracts make clear where the duty of care lies between client, architect and the contractor, as vagueness in this area often creates conflict.
- Procuring for quality has less to do with the particular procurement model used and more to do with client education, pre-project planning, adequate supervision and quality control over the whole build through a dedicated construction manager and/or a clerk of works.

4.2.3 Construction management, residential bespoke build – client

This interviewee procured a residential home under a traditional construction management model with an independent construction manager controlling the bespoke architectural build, which was completed in late-2018. The contract specified quality control as one of the construction manager's key responsibilities, and the architect remained available for consultation if required. This was taken up on two occasions. The first occasion was where a fireplace was misaligned and required alterations to the room layout once the build was well under way. The architectural fee was charged to the client at cost, and the construction manager covered the cost of the reconfiguration. This interviewee believed this example supports the score of 1 for *Quality: Flexibility to change design mid-project*. The second occasion regarding water egress) is noted below. The interviewee provided the following feedback:

- The matrix largely reflects the interviewee's experience with an independent construction manager, and they therefore view a score of 3 for *Quality: Demonstrable value for money* as justified. The interviewee felt the home is a good quality build overall, including in respect to the fundamental components that the interviewee did not have the expertise to assess (such as foundations, drainage, electrical works and ventilation).
- The interviewee felt a score of 2 for *Quality: Risk transfer – design and construction* was fair. Although the construction manager added value in ensuring quality, the interviewee noted that, in terms of bearing risk for the design and construction, the construction manager appeared to contribute little to the project other than "banding together a team of contractors he had previously worked with". The management margin was then added to the contractors' own margins, an apparent reflection of the higher risk taken on by the construction manager. In reality, however, each package of work had an established cost level and the responsibility for ensuring the project sat within the overall budget still remained with the client. This created the sense that it was not the wholly hands-off approach that had been implied at the project outset (from a client perspective). Further, when conflict arose regarding the fireplace, both the architect and construction manager argued this was not within their control and only took responsibility after a number of "forthright" discussions with the interviewee/client.
- In relation to a score of 2 for *Quality: Complexity*, the interviewee noted a conflict between the architect and construction manager in regard to drilling holes for water egress in the internal swimming pool area. This discussion was about aesthetics, and the interviewee felt assured that the construction manager was making the correct decision for a robust building even if the holes were not as visually appealing. Although not a very complex build, the interviewee felt this slightly unusual layout was resolved well under the independent construction management model.
- The interviewee did express concern regarding the seemingly cavalier approach taken by the council representative during the sign-off process, noting that this seemed cursory and was largely based on "ticking off producer statements" rather than completing a meaningful inspection of the build quality.

4.2.4 Construction management, residential volume build – client

This interviewee procured a residential home with a volume builder. The interviewee selected a design after working with the firm's in-house architectural technicians, and the project was completed in February 2019 under a construction management

contract. Although the contract specified quality control lay within the in-house construction manager's charter of responsibility, the interviewee noted that this was not a strictly independent relationship given the nature of the manager's employment. Based on their client-side experience, the interviewee examined the matrix and provided the following feedback:

- A score of 3 for *Quality: Project owner control.* The interviewee felt their project owner's control over quality was limited but conceded that, apart from visible cosmetic components, they found it difficult to specify or discern quality.
- A score of 1 for *Quality: Flexibility to change design mid-project* and 2 for *Cost: Price certainty*. These two matrix scores were seen as accurate. However, the interviewee saw the former as reluctance on the part of the builder to be flexible rather than an issue with the procurement approach and viewed the latter as a reflection of the high costs associated with relatively minor variations mid-build. The interviewee cited their decision to change carpet to hardwood floors in the master bedroom prior to installation. This subsequently affected the aesthetics of the yet to be installed carpeted staircase up to the master bedroom, and the builder suggested changing that to hardwood also. The charge for changing the staircase finishing was four times the cost of the flooring in the bedroom, which the interviewee found to be excessive and an example of the disproportionate increase in costs relative to quality.
- A score of 3 for *Quality: Demonstrable value for money*. The combined effect of the two categories discussed above led the interviewee to believe that the construction management was primarily in place to ensure any costs could be transferred to the client rather than to ensure quality. He therefore believed a score of 3 for demonstrably improving quality was unjustified and allocated a replacement score of 2.
- A score of 3 for *Cost: Number of potential contractors*. The interviewee believed this was accurate and found the construction management approach did allow him to continue in his normal employment relatively undisturbed while the project was under way.

4.2.5 Direct management, residential bespoke build – client

This interviewee chose to build a residential home, which was completed in July 2019. With 15 years of procurement experience purchasing supplies for a large testing laboratory and having built two previous homes via construction management contracts with volume builders, the interviewee elected to directly manage this construction project. Assuming the role of project manager, the interviewee engaged an independent architect to design the home and a construction firm to complete the build for an agreed price. The architect was not involved in the construction phase, as the teams were contractually independent. The interviewee provided the following feedback:

- A score of 4 for *Quality: Demonstrable value for money*. The interviewee was on site the majority of the time and felt this gave added ability to oversee quality control and detect small issues that became larger problems in their previous two builds. As the interviewee was based at home the majority of the time prior to the project, they perceived this as demonstrable value for money. However, they did not take into account the opportunity cost of their time if the alternative had been paid employment.
- A score of 1 for *Quality: Buildable designs*. Two significant conflicts arose between the construction firm and the architect during the course of the build, with each

placing responsibility on the other team. The construction firm were unable to include a planned bath in the main bathroom, as the space allowed was physically sufficient but impractical from a functional point of view and a varied ceiling height shown in the design was not constructed to specification. When this detail was noticed, it was considered too expensive to remediate.

- A score of 4 for *Timing: Flexibility to change timing mid-project*. The interviewee believed this is an accurate reflection of their experience. However, the constrained capacity of the sector means this may not be the typical case (as they were only able to move timelines as a result of one of the construction firm's other projects being cancelled).
- If the interviewee built again, they would directly manage the project again but they would add an independent liaison to the project on a consulting basis (part-time) to resolve disputes and provide a second layer of project control with the aim of preventing the bath and ceiling errors.

4.2.6 Construction management – subcontractor to residential volume build firms

This interviewee is an experienced subcontractor, specialising in the manufacture and installation of kitchen joinery in New Zealand for the last 27 years. The interviewee has contracts in place with four volume build construction firms, supplying and fitting kitchens in Waikato and Bay of Plenty. These projects are delivered under a similar procurement model described in section 4.2.4, with the homes designed for the client by in-house architectural technicians and an in-house construction manager tasked with quality control. The interviewee provided the following feedback:

- A score of 3 for *Quality: Demonstrable value for money*. Having observed multiple builds, the interviewee was sceptical of any construction manager's ability to genuinely monitor quality on behalf of the client when they are employed by the construction firm and for this reason believed this particular type of construction management model merits a score of 2 in this category.
- The interviewee agreed a score of 1 for *Quality: Flexibility to change design mid-project* was accurate.
- The interviewee strongly disagreed with a score of 4 for *Timing: Timing and completion certainty* and believed it merited a score of 1. The interviewee felt it downplayed the complex conflicts at play where firms sought to maintain timelines to meet clients' expectations at the expense of quality. The interviewee has frequently observed firms juggling one high-end build against two or three more modest builds, and the trade-offs made in attempting to build the two categories is affecting quality. The time and effort required on higher-end builds is placing subcontractors' margins under pressure, and the lower-spec builds are subsidising the higher-end builds. For example, the last 12 high-end kitchens delivered only "broke even" for the interviewee's subcontracting firm, yet the volume build firm involved are seeking a discount on upcoming projects that the supplier is unable to provide.
- Kitchens in higher-end homes are requiring increasingly longer resource-sapping installation timeframes to achieve clients' expectations of quality, yet the impact of the skills shortage is also becoming increasingly apparent. Training is a critical component of resolving this issue. The interviewee believed many apprentices are too specialised in their training and have little understanding of how each of the components fit together to create a high-quality home. There is also a lack of oversight, and the LBP Scheme is not sufficiently monitored to ensure apprentices are receiving the support they need.

- The interviewee was in "absolutely disagreement" with a score of 3 for *Quality: Project owner control*, viewing this as a score of 1, as they believe the idealistic residential construction management procurement model falls apart quickly once an agreement is confirmed. The interviewee's perception was that the client has very little control over the quality outcomes as soon as the contract is signed, noting a cynical approach that sees some builders "deliberately underspecifying the baseline build then charging high fees for adding these to the build. The interviewee believed most clients are unable to specify their expectations in terms of quality. One example was a recent lower-spec 190 m^2 build with three bedrooms, two bathrooms and double internal garaging, as per the design selected by the client. Each bedroom was fitted with a single power point, with only three power points in the entire kitchen. Although this was specified in the plan, the client was not satisfied and paid for additional power points to be fitted at a cost of $6,200. The interviewee also noted that "the cost of delivering quality is mostly borne by the client, despite most clients finding it difficult to discern a quality build".
- The interviewee believed the optimal procurement model for achieving quality in residential building is a transparent set of agreements with contractors (with an agreed cost-plus margin structure) with an independent construction manager charging 5% of total build cost to oversee the overall project. The construction manager would be responsible for ensuring each component of the build is completed to a satisfactory standard and for the overall quality of the home at the conclusion of the project.

4.3 Comparative summary of the 2015 and 2020 matrix scores

A summary of the comparative scores of the 2015 matrix and the interview findings of 2020 are presented in Table 6.

Numbers in **red bold** denote where a 2020 interviewee disagreed with the 2015 matrix score and their suggested rescore.

Where the 2015 matrix score was considered to remain an accurate reflection of conditions in the 2020 construction sector, no change was made.

Table 6. Matrix feedback – quality and timing.

	Direct managed	Design-bid-build	Construction management	Design-build	Design-bid-build-operate/maintain	Early contractor involvement	Alliance	Public-private partnership
QUALITY Which model provides the most…?								
Opportunity to innovate	1	1	1	2	3	4	4	3
Buildable designs	1	1	1	2	2	3	4	3
Demonstrable value for money	4	4	3 **2 (RC)** **2 (SC-VB)**	3	3	3	1 **4 (C)**	3
Flexibility to change design mid-project	0	0	1	2	2	3	4	2
Risk transfer – finance	0	0	0	0	0	0	1	4
Risk transfer – design	1	2	2	4	4	3	3	4
Risk transfer – construction	1	2	2	4	4	3	3	4
Risk transfer – maintenance	0	0	0	0	4	0	0	4
Risk transfer – operations	0	0	0	0	4	0	0	4
Risk transfer – traffic-revenue	0	0	0	0	2	0	0	4
Project owner control	4	3 **2 (HC)**	3 **1 (SC-VB)**	2	2	2	1	2
How well does the model deal with…?								
Complexity	1	1	2	2	3	4	4	4
TIMING Which model provides the most…?								
Timing and completion certainty	3	2	4 **1 (SC–VB)**	4	4	1	3	4
Flexibility to change timing mid-project	4	1	2	2	2	3	4	1
How well does the model deal with…?								
Long-term projects	1	1	2	3	3	4	2	4

RC – residential client, C – contractor, SC-VB – subcontractor residential volume build, HC – head contractor

5. Conclusion and next steps

The interviewees consulted during this project reported that they believe specific procurement methods, when tailored to the project, do deliver better quality.

While such methods may provide more long-term value in the form of higher-quality construction, these improved quality pay-offs come at a near-term cost, which is largely borne by the clients themselves.

While procurement approaches, such as construction management, theoretically provide incentives to achieve quality by contractually placing the clients' best interests at heart, clients expressed the strong view that construction managers also have a powerful commercial incentive to protect their ongoing relationships with subcontractors and other professionals associated with the project, given this will improve their chance of securing future joint projects.

Further summarising observations include the following:

- Alliance contractors interviewed believe planning is the key to quality and client education is paramount, whether that is self-initiated or delivered via a team of consultants and other advisors.
- The residential clients interviewed all believe they bore a disproportionate (and unequitable) share of the cost of achieving quality. A significant proportion of those costs emerged from variations during the build, contractual conflict and a misalignment between the agreed construction plan and the client's requirements for the building.
- Residential contractors and subcontractors interviewed believe a completely independent clerk of works-style project manager is required on residential projects (to oversee the total build and ensure quality), and an independent design/contractor consultant is required in novated projects to ensure the relationship between client-design-contractor is maintained and the contractor delivers what the design specifies. This should be covered by the design team, but that is rarely the case. Therefore, an independent consultant is critical to ensuring quality and fitness for purpose.
- Communicating how procurement methods improve quality in residential construction would help clients recognise the value of the process.

At the time of writing (April 2020), all non-essential segments of the construction industry remained in limbo (along with most other sectors) as government policies restricted movement in order to manage the COVID-19 pandemic.

Looking beyond the current circumstances, as construction activity resumes, there will be greater scope to assess the impact of the 4th edition of the Government Procurement Rules mentioned earlier in this report. Shortly after the Rules were implemented on 1 October 2019, BRANZ held discussions with eight key industry participants to garner initial views on their relevance and potential impact. Although each respondent had firm opinions about the key weaknesses in the previous guidelines and the underlying reasons for a lack of adherence (particularly by government departments), there was no desire amongst the group to comment in a public capacity nor provide data and/or case studies at that time, with respondents noting that any commentary could be perceived as being prematurely critical. BRANZ industry research related to the Rules was therefore postponed by 24 months in order

to allow time for the new policies to bed in and produce sufficient information to inform meaningful analysis of their impact upon the sector.

Focusing on the near term, research to explore the industry views captured in this report would leverage previous investment and create an opportunity to move from a discussion towards a plan for testing these procurement concepts in the sector. Potential approaches include the following:

- Analysing methods for reducing the expense of a high-quality construction secondary tier of management – such as a client representative who sits independently of the construction manager and subcontractors – to enable a greater number of clients to integrate this into their construction budgets. This can include, but is not limited to:
    - apps for reporting quality (such as Artisan)
    - check-in systems that sign off when an item has been inspected and passes
    - published LBP tribunal decisions each month and a searchable database when building consents are issued
    - building quality control into banking/finance to ensure that lending on construction is aligned with a quality asset.
- Examining how the effective procurement methods utilised on large-scale projects can be implemented on a miniaturised basis for smaller projects. The view that these forms of procurement are too timely and expensive was firmly expressed during the course of this project, with two interviewees essentially dismissing the potential for quality improvements to greatly outweigh the initial input of time and expenditure.
- Retrospective case studies exploring how a specific procurement approach could have affected outcomes on a smaller project would be useful to either dispel the conception that such a method is a poor use of time and financial resources or to show the potential positive returns of such an approach.

References

AECOM. (2019). *Sentiment: Infrastructure and buildings construction survey New Zealand 2019*. Auckland, New Zealand: AECOM. https://www.aecom.com/nz/wp-content/uploads/2019/06/Sentiment-NZ2019-WEB.pdf

Bennett, J. & Flanagan, R. (1983). For the good of the client. *Building 27,* 26–27.

Chan, A. & Tam, C. (2000). Factors affecting the quality of building projects in Hong Kong. *International Journal of Quality & Reliability Management*, *17*(4/5), 423–442. https://doi.org/10.1108/02656710010298445

CIOB. (2010). *Procurement in the construction industry*. London, UK: The Chartered Institute of Building. https://www.ciob.org/sites/default/files/CIOB%20research%20-%20Procurement%20in%20the%20Construction%20Industry%202010_1.pdf

CIOB. (2018). *Contract & procurement*. Retrieved from http://www.ciob.org/specialinterests/contract-procurement

Clark, P. (2017). *Industry insight: Residential building.* Auckland, New Zealand: Westpac.

Curtis, M. & Gordon, G. (2018). *Prioritising quality*. BRANZ Study Report SR398. Judgeford, New Zealand: BRANZ Ltd.

Curtis, M. & Page, I. (2014). *Small construction firms in New Zealand*. BRANZ Study Report SR315. Judgeford, New Zealand: BRANZ Ltd.

Eitelberg, B., Hutton, K., Harris, P. and Sutherland, J. (2010). *New Zealand construction client protocols*. Auckland, New Zealand: Construction Clients' Group. https://www.constructing.co.nz/files/file/19/Construction-Client-Protocols_March-2010.pdf

Eriksson, P. & Westerberg, M. (2009). *Effects of procurement on construction project performance: A survey of Swedish construction clients*. Paper presented at the 18th International Conference on Management of Technology, Orlando, Florida, 5–9 April.

Farmer, M. (2016). *The Farmer review of the UK construction labour model: Modernise of die: Time to decide the industry's future*. London, UK: Construction Leadership Council. http://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2016/10/Farmer-Review.pdf

Hardie, M. & Saha, S. (2012). Builders' perceptions of lowest cost procurement and its impact on quality. *Australasian Journal of Construction Economics and Building*, *9*(1), 1–8.

Howe, M., Knight, R., Pittleway, S., Dacre, I. & Jones, M. (2015). *Outcome led procurement: A common sense approach to construction procurement.* Frome, UK: Constructing Excellence South West. https://constructingexcellence.org.uk/wp-content/uploads/2016/01/CESW-Outcome-Led-Procurement-June-2015.pdf

Infrastructure New Zealand. (2019). *2019 infrastructure procurement survey Results*. Auckland, New Zealand: Infrastructure New Zealand. https://infrastructure.org.nz/resources/Building%20Nations%202019/Building%20Nations%202019%20Procurement%20Survey%20Presentation.pdf

Ismail, W. (2007). *Ideal procurement system for New Zealand private sector construction clients* (Master's thesis). Massey University, Wellington, New Zealand.

Kashiwagi, D. (2016). *Best value approach*. Mesa, AZ: Kashiwagi Solution Model (KSM).

Langford, D., Martines, V. & Bititci, U. (2007). Best value in construction: Towards an interpretation of value from client and constructor perspectives. *Journal of Construction Procurement*, *9*(1), 56–67.

Latham, M. (1994*). Constructing the team: Joint review of procurement and contractual arrangements in the United Kingdom construction industry*. London, UK: HMSO.

Masterman, J. (2002). *Introduction to building procurement systems* (2nd ed.). London, UK: Spon Press.

MBIE. (2019). *Developing your construction procurement strategy: Construction procurement guidelines*. Wellington, New Zealand: New Zealand Government Procurement.

McDermott, P. (1999). Strategic and emergent issues in construction procurement. In S. Rowlinson & P. McDermott (Eds.), *Procurement systems: A guide to best practice in construction* (pp. 3–26). London, UK: E & FN Spon.

Naoum, S. & Egbu, C. (2016). Modern selection criteria for procurement methods in construction: A state-of-the-art literature review and a survey. *International Journal of Managing Projects in Business*, *9*(2), 309–336. https://doi.org/10.1108/IJMPB-09-2015-0094

NZTA. (2019). *Procurement manual for activities funded through the National Land Transport Programme.* Wellington, New Zealand: New Zealand Transport Agency.

Oyegoke, A., Dickinson, M., Khalfan, M., McDermott, P. & Rowlinson, S. (2009). Construction project procurement routes: An in-depth critique. *International Journal of Managing Projects in Business*, *2*(3), 338–354.

Page, I. & Gordon, G. (2017). *What is quality in buildings?* BRANZ Study Report SR380. Judgeford, New Zealand: BRANZ Ltd.

PwC. (2016). *Valuing the role of construction in the New Zealand economy*. Auckland, New Zealand: PwC.

Rashid, R., Taib, I., Ahmad, W., Nasid, M., Ali, W. & Zainordin, Z. (2006). Effect of procurement systems on the performance of construction projects. Paper presented at the International Conference on Construction Industry, Padang, Indonesia, 21–24 June.

Rowlinson, S. (1999). A definition of procurement systems. In S. Rowlinson & P. McDermott (Eds.), *Procurement systems: A guide to best practice in construction* (pp. 27–53). London, UK: E & FN Spon.

Russell, K. (2019). *Fragmented procurement for BIM* (Master's thesis). Victoria University of Wellington, Wellington, New Zealand.

Singer, L. (2018a). *Creating value through procurement: A report into public sector procurement of major infrastructure projects*. Wellington, New Zealand: Entwine. https://infrastructure.org.nz/resources/Documents/Reports/Infrastructure%20NZ%20Procurement%20Study%20Report%20FINAL.pdf

Singer, L. (2018b). *Improving government procurement of architectural services*. Wellington, New Zealand: Entwine. http://www.nzia.co.nz/media/5563723/entwine-improving-govt-procurement-of-architectural-services.pdf

Taylor, R., Norval, G., Hindle, B., Rwelamila, P. & McDermott, P. (1999). From conventionally oriented to developmentally oriented procurement systems: Experiences from South Africa. In S. Rowlinson & P. McDermott (Eds.), *Procurement systems: A guide to best practice in construction* (pp. 163–183). London, UK: E & FN Spon.

Tookey, J., Murray, M., Hardcastle, C. & Langford, D. (2001). Construction procurement routes: Re-defining the contours of construction procurement. *Engineering, Construction and Architectural Management*, *8*(1), 20–30. https://doi.org/10.1108/eb021167

Wilkinson, S. & Scofield, R. (2003). *Management for the New Zealand construction industry.* Auckland, New Zealand: Prentice Hall.

Wilkinson, S. & Shestakova, Y. (2006). Collaborative procurement on the rise. *Build*, *97*, 70–71.

World Economic Forum. (2016). *Shaping the future of construction: A breakthrough in mindset and technology*. Geneva, Switzerland: World Economic Forum. http://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Construction_full_report__.pdf

Zuo, K. (2010). *Procurement and contractual arrangements for post-disaster reconstruction* (PhD thesis). University of Auckland, Auckland, New Zealand.