

Article

Subcontractor Engagement in the Two-Stage Early Contractor Involvement Paradigm for Commercial Construction

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Abstract: Commercial construction projects (CCPs) in New Zealand contribute more to the economy than other project types. However, many face cost and time increases due to inadequate planning. Procurement pathways that involve contractors during design development provide more time to plan, collaboratively. Nevertheless, most projects are procured through traditional tender where contractors are only involved after detailed design. Through two-stage early contractor involvement (2S-ECI), contractors can provide design buildability advice for complex projects, contribute value management, carry out exploratory works, and order materials. The role of subcontractors in 2S-ECI can be significant. Six semi-structured interviews were conducted with clients, consultants, main contractors, and a subcontractor involved in large complex commercial construction projects. The findings build on the emerging body of knowledge about 2S-ECI by providing insight into subcontractor early involvement. Project complexity and market conditions were the main reasons for early subcontractor involvement. Common challenges include a lack of information sharing among the parties, non-competitive selection, and a lack of standard contract documentation. Opportunities for improvement include clarifying client expectations, educating stakeholders, and providing more equitable compensation for pre-construction services. Key drivers for subcontractor involvement include project complexity, market conditions, ordering long-lead-time systems, and performance specifications. Specialist early sub-trades include electrical, mechanical, structural steel, and façades. Subcontractors should typically be engaged as early as possible, often concurrently via main contractors to share performance risk. Pre-construction services provided by subcontractors include planning and sequencing; design buildability analysis; risk mitigation; value management; budget advice; systems procurement; design solutions; and document control systems. Advantages include obtaining specialist project knowledge and improving completion certainty. Producing a pre-construction services agreement (PCSA) for subcontractors may address challenges, as has been carried out for main contractors, but there is still a gap in the contractual framework for 2S-ECI for subcontractors.

Keywords: two-stage early contractor involvement; procurement; subcontractor; commercial construction projects; practices; New Zealand



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1. Introduction

Commercial construction projects (CCPs) contribute to 43% of the total number of projects and 44% of the total value of non-residential activity at NZD 11.1 billion in New Zealand (NZ) according to the National Construction Pipeline Report 2023 [1]. CCPs are prone to delays due to critical risk factors [2–4] such as unforeseen ground conditions; delays in producing design documents; late contract instructions; late client approval of design documents; unclear and inadequate drawing details; poor multi-communication channels; and inexperience of the project team. Contractual issues include the procurement method and contract type used [5]. The most common procurement strategy for CCPs is design–bid–build traditional tender, which tends to best suit simple and repeatable projects,

suggesting a scope for more collaborative procurement approaches [6]. CCP clients vary in their expectations [7], and tend to rely on external technical and legal advice [8], but there is a lack of supply chain management competency [9,10]. Therefore, a convenient procurement approach is needed for the successful completion of complex CCPs.

Like other countries, NZ has been hit with high inflation post-COVID-19 stimulus spending and supply chain disruption. This has subsequently resulted in higher interest rates which have no doubt negatively impacted the financial feasibility of some projects. Finnie et al. [11] found through interviews across NZ that the quality of drawings is felt to have declined over the past decade. This means more detailed drawings being released during construction. Incomplete drawings have been found to mean more contract variations and increased contractor tender risk among Australian contractors [12]. Furthermore, the standard terms in construction contracts have been heavily amended, often transferring contractual risk onto main contractors [11]. The risk transfer was described by professional bodies in 2018 as reaching 'inequitable levels' [13]. Standards NZ undertook a review of NZS3910:2013 Conditions of Contract for Building and Civil Engineering Construction and released NZS3910:2023. However, it is yet to be seen whether the changes will reduce the amendment of standard terms by clients and their lawyers. One of the benefits of 2S-ECI is enabling the contractor to order materials early to mitigate cost escalations and supply chain disruption. It also means the contractor can review the quality of drawings before agreeing to the lump-sum construction contract. Indeed, the pre-construction services agreement (PCSA) authored by Finnie et al. [14] stipulates that the main contractor cannot claim contract variations during construction after agreeing with the construction contract. This acknowledges that the contractor likely has considerably more time to analyze the drawings through 2S-ECI than the mere weeks when bidding through traditional tender.

Early contractor involvement (ECI) across project planning and design phases can reduce conflicts and improve cost and time certainty [15], significantly reducing the number of requests for information (RFIs) and subsequent contract instructions [16], and improve team integration [17]. Usually, the same contractor is awarded the construction contract, utilizing the more extensive early planning for a better-executed project [14]. Two-stage early contractor involvement (2S-ECI) refers to the combined pre-construction and construction-stage contracts as a procurement pathway, and the inter-disciplinary nature of the project leadership team aligns with alliance-oriented contractual arrangements [18] with integrated relationships [19] as a foundation, but 2S-ECI commonly features a traditional lump-sum construction contract, rather than more complicated gain share/pain share pricing [11]. Nevertheless, ECI can influence management processes and working relationships to potentially improve performance and ensure project success [20]. However, there is inconsistency in 2S-ECI implementation on construction projects [21] in the absence of proper available guidance documentation.

Common stakeholders involved in 2S-ECI include clients, consultants, and contractors [22]. However, 'subcontractors' also play a vital role in the success of this procurement strategy [14]. Subcontractors establish the supply chain from one sub-supply chain or the whole supply chain, depending on the services provided. Subcontractors are often contractually engaged through the main contractor to provide specialist trade knowledge integration, although their level of involvement can vary depending on the nature of their early involvement [23]. Early subcontractor involvement is different from that of nominated subcontractors by the client, as per clause 4.2 of NZS3910 [24] where the client (or Principal) nominates a specific subcontractor; they also share a proportion of contractual risk if issues eventuate during their appointment by the main contractor. Unlike for nominated subcontractors, there exists a lack of clarity around the time or cost incurred when involving domestic subcontractors through 2S-ECI [25]. Extending the time required for pre-construction planning can create additional costs to parties. Therefore, this makes clear that risk allocation is crucial [26]. Project management behaviors should align under collaborative procurement pathways [27]. However, the integration of subcontractors in alliance contracts is challenging if not managed well [28]. Sub-alliances between the

contractor and their subcontractors can affect the core alliances between contractors and clients, which are driven by innovation, strategic alignment, and collaborative ability [29]. Most stakeholders in the supply chain of projects in NZ have a good realization of the critical role of subcontractors or low-tier supply organizations [30]. Nevertheless, engaging subcontractors through 2S-ECI can help secure their resources in heated markets for such specialist works as piling, façade, and more.

Interestingly, the literature on subcontractor involvement through 2S-ECI is limited with no research conducted globally [31] and within the NZ context [14]. Nevertheless, almost 80% of most work done on CCPs is by subcontractors [32]. Subcontracting creates organizational and managerial flexibility [33]. However, main contractors can rely on repeat relationships with their subcontractors [34]. It is, therefore, important that subcontractor involvement is based on strategic capability [35], considering both relational and contractual obligations for collaboration. This helps maximize the contractor's commercial competitiveness and, therefore, financial performance [36]. This study explores subcontractor engagement through 2S-ECI on CCPs in NZ.

This article has been designed to provide insight into 2S-ECI with the subcontractor's perspective on possible engagement. The literature review section covered the literature on ECI extensively, followed by the benefits of ECI and its implementation. Moreover, subcontractor engagement in 2S-ECI has been discussed in detail for coverage in the current body of knowledge. Prime aims and objectives are then provided. The research method section covers the data collection process in detail. Findings cover the general implementation of 2S-ECI, including barriers and potential improvement. The last section is about the engagement of the subcontractor. The discussion section covers the explanation of the key findings regarding relevant studies. In the last section, the conclusion, research questions are addressed along with limitations and future research.

2. Literature Review

The section covers the literature review on 2S-ECI and subcontractor engagement.

2.1. Early Contractor Involvement

ECI is generally considered a concept that includes any procurement pathway that involves contractors during the pre-construction stages of projects. These include design and build, management contracting, construction management, or two-stage traditional [37]. ECI allows contractors to better foresee risks associated during the design stage and provide buildability advice, rather than traditional procurement, where contractors may have only a short time to bid on complete designs [22]. There has been little research specifically relating to 2S-ECI, an emerging research topic.

ECI was explored for transfield services with a large operation and maintenance contractor in Australia [38] but not adopted as an alternative procurement practice. ECI has been considered as a form of partnering but its practices vary in the public sector for countries like the USA, Australia, and NZ. In the United Kingdom, ECI is typically considered a form of partnering [39,40]. Hybrid models have been developed for infrastructure projects where the first stage is a form of partnering and the second stage is often a design and build contract [41]. Examples include South Australia's Department for Transport Energy and Infrastructure (DTEI) and Queensland's Department of Transport and Main Roads (TMR). In NZ, Finnie et al. [42] found that 2S-ECI is typically a two-stage process where main contractors are first employed using a form of pre-construction services agreement (PCSA) with pricing based on preliminary and general (P&G) fixed price and agreement margins for overheads and profit to apply to materials and subcontractors. Then, the successful first-stage main contractor works with the client's design team and prices the builder's work packages for carpentry and concrete, tenders the subcontractors, and agrees to a fixed-price construction-only contract, being the second-stage contract.

Finnie et al. [11] highlighted the benefits of the open-book pricing approach of 2S-ECI where only the successful main contractor appointed for stage 1 prices the second-

stage construction works, potentially reducing industry tendering costs, and how main contractors allocate lower margins for profit and overheads in heated markets while agreed margins are likely higher in recessionary markets, potentially helping address the other boom/bust cyclical nature of the construction market.

Finnie et al. [43] reviewed a range of pre-construction services agreements (PCSAs) for employing main contractors during the pre-construction stage, typically after concept design and some detailed design is complete, and, from this, drafted a standard-form PCSA currently used across NZ. Notably, the scope for further research included the need to explore contract terms used for employing subcontractors through 2S-ECI. Finnie and Smith [44] found through a case study that 2S-ECI improved the cost and time certainty on seismic upgrade works at Queenstown Airport, NZ. This supported the findings by Finnie et al. [42], after interviewing practitioners across NZ, that the best-suited projects for 2S-ECI are complex alterations and extensions where the client intends to continue using the building during construction, and the risk of disruption likely outweighs any potential premium incurred through the open-book approach of 2S-ECI compared with traditional procurement, or for securing construction companies in heated markets where they may not otherwise bid through traditional tender. Finnie et al. [45] found that the early planning of 2S-ECI may overcome many of the barriers found in adopting pre-fabrication and offsite manufacturing. These studies followed [40], that first argued the benefits of harnessing main contractor design buildability knowledge through 2S-ECI, using what was coined a 'conditional' pre-construction contract. Mosey [40] highlighted the advantages of traditional procurement. In traditional procurement, contractors typically have weeks to tender fixed-price bids competitively. They first see that the drawings, once fully detailed, have little input to design buildability, and often make pricing assumptions. Contract variations during the construction stage can be reduced by involving the main contractor during the design development and reviewing subcontractor quotes with the client's design team, to iron out issues before the construction stage contract is agreed.

Textbooks about procurement often discuss pathways such as design and build, management contracting, and construction management, under the broad concept of ECI that includes any pathway that includes contractors in the design stage. However, Finnie [46] argued that, ultimately, these might largely be defined as variants of the 2-stage process, i.e., 2S-novated design and build (where the client's design is novated to the main contractor), 2S-traditional (where the main contractor carries out builder's work trades), and 2S-management contracting (where the main contractor subcontracts all work packages), unlike pure design and build, or construction management (where there is no main contractor). Therefore, the primary question is whether the main contractor is to be involved during the design stage, with the remainder of the remainder being variations of the 2S-ECI process, or procurement may be through pure design and build or construction management where what would be a main contractor is employed as a consultant and the client employs trade packages directly. This is depicted in Figure 1 showing the 2S-ECI process with pathway variants, highlighting subcontractor engagement.

The use of 2S-ECI on the right project type and the engagement of the right main contractor are crucial to its perceived benefits to the client. Finnie et al. [40] and Finnie et al. [11] found that 2S-ECI is best suited to projects that involve complex alterations and extensions, particularly where the client's operations are continuing throughout the project and the potential risk of disruption outweighs any potential premium paid for the open-book nature of 2S-ECI. 2S-ECI was also found to suit projects where clients and main contractors have a good relationship and use 2S-ECI to negotiate and agree on a fixed-price construction contract or to procure a main contractor in heated markets where main contractors might not otherwise submit bids through traditional competitive tendering. However, those interviewed by Finnie et al. [42] and Finnie et al. [11] also described how main contractors demonstrating clear added value during the pre-construction stage is key to 2S-ECI success and how 2S-ECI requires a different approach from contractors from simply pricing projects through traditional tender. Although measuring these benefits can be a

challenge, however, the other benefits associated with contractors adding value through pre-construction services may not be evident. Therefore, if 2S-ECI is used on the wrong project or with the wrong contractor, the client may pay more without realizing any real benefit. This impacts the subcontractor engagement as well, where the subcontractor has to deal with a not-suitable main contractor, or the subcontractor is not suitable for the project. Nevertheless, the cost is paid by the client for not using the 2S-ECI procurement properly.

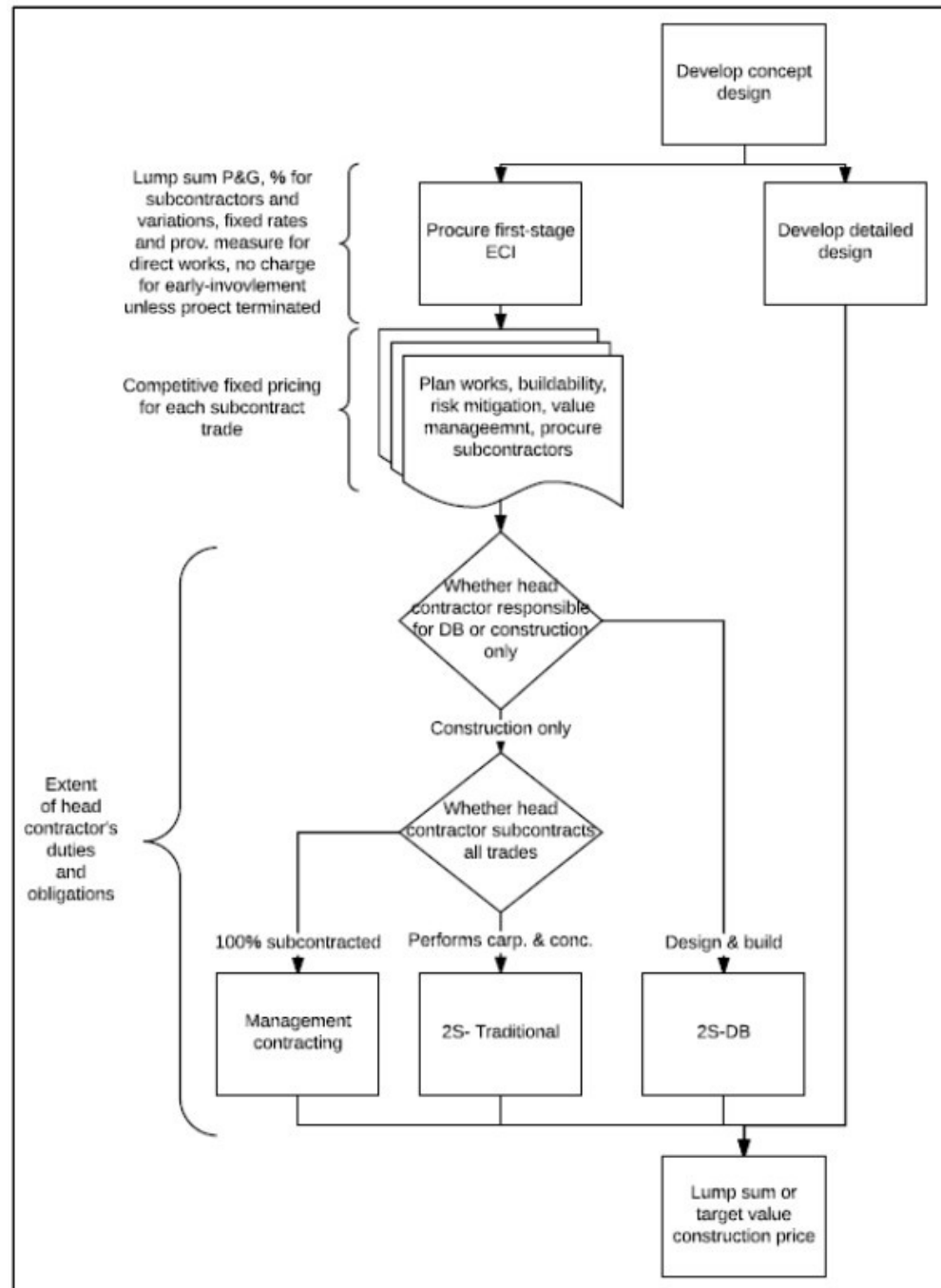


Figure 1. 2S-ECI process pathway variants (adapted from [44]).

2.2. 2S-ECI Benefits

The past literature shows that there has been resistance to the uptake of ECI on projects due to the lack of understanding of the concept and its benefits [47]. One of the reasons for the lack of understanding has been due to having no standard pre-construction services

agreements (PCSA) that support 2S-ECI in NZ, leaving parties to draft their own bespoke agreements. This is explored in a study by Finnie et al. [14] that evaluated PCSAs and their effectiveness including the JCT PCSA, NEC ECI Clause, and two bespoke PCSAs used in NZ, and subsequently drafted a standard-form PCSA which is now available freely to members of the Society of Construction Law NZ.

The past literature also shows that a key advantage of ECI procurement is that it provides the opportunity for contractors to work collaboratively with the consultant design team to improve planning and buildability [40,41,48,49]. However, past research has not yet shown how subcontractors are involved in the process nor the benefits they provide.

2S-ECI can also help support the relationships between the client and contractor, due to the more open-book approach to pricing [26]. Jorgensen and Emmitt [49] also found that ECI can better encourage partnering relationships and joint problem-solving through combining individual expertise and involving specialist contractors in the design stages of projects [50]. 2S-ECI relies on trust, but can also help build trust across the project team [37]. Another benefit of the more open-book pricing is that it can be used to secure resources in a heated market [41]. A good example of this is the construction market in Christchurch, NZ after the 2011 earthquake where demand exceeded supply, meaning traditional tender pricing might no longer achieve the best value for money [37].

2.3. 2S-ECI Implementation

While, globally, 2S-ECI is based on pre-construction, and then construction contracts, previous studies show variations in practices between different countries based on contractual obligations and pricing, such as target costing (UK), risk-adjusted price and novated design and build (Australia), integrated project delivery (USA) [51], or a two-stage process to arrive at a traditional lump-sum construction contract [42].

Suitability for 2S-ECI on CCPs should be based on the concept of “value for money” [52] compared with traditional procurement [53]; otherwise, clients may pay more for 2S-ECI for no real gain. Finnie et al. [37] found that projects involving complex alterations to existing buildings where the risk of disruption to the client’s operations outweighs any potential premium paid for the contractor’s early involvement, for example, work to hospitals or airports, or for new building design solutions that require complex construction methods, or when it is difficult to secure resources through competitive tenders because of heated markets, are best suited to the more open-book approach of 2S-ECI. Lessing et al. [2] found that the perceived quality of design documentation has declined in NZ, supported by Finnie et al. [42], who also found a decreased design documentation quality over the past 5 to 10 years, subsequently increasing contract variations and reducing price certainty [42]. 2S-ECI can reduce contract variations and help avoid delays and disputes during construction, therefore improving the time and cost certainty through better planning [40].

2S-ECI as an alternative to traditional procurement can also face implementation challenges and requires a different approach from contractors than simply pricing and tendering bids for fully designed projects. Rahmani [21] found inconsistent cultural harmony, relationship variabilities, difficulties demonstrating added value, and contractor remuneration inadequacy. Contractors’ competencies are not always fully realized [54]. Such fragmentations in information and knowledge sharing inhibit possible productivity gains otherwise possible [55]. As a collaborative process, misunderstanding relational obligations and expectations can impede the process [56]. Most importantly, a delay in client decision making can prolong both stages of 2S-ECI, ultimately impacting project outcomes [57]. To achieve innovative solutions, attempts are made to converge 2S-ECI with other systems approaches such as lean, which can exhaust the collaborative efforts to reach desired outcome [58].

The primary goal of 2S-ECI is to add value and improve the cost and time certainty through better planning and reducing contract variations [47]. Further, the improvement in 2S-ECI are better relationships among the parties [39] established on trust [59]. Initiatives to integrate ECI with other systems approaches helps improve productivity but this can

increase the required efforts from parties [60]. The client initiates 2S-ECI so a lack of competence [59] can mean that parties can struggle to understand project expectations. However, 2S-ECI application and the timing of contractor involvement [59] have been found to be core areas to improve practices, along with the proper [61] and appropriate [59] compensation to contractors for their contribution [62] and sharing knowledge [23], which influence the project outcomes.

The first consideration for those looking to implement 2S-ECI in other jurisdictions is the type of project. If 2S-ECI is used on a project that would not benefit from contractor input, then the client may perceive that 2S-ECI adds little value for the reduction in pricing competition (with the focus on reliable contractors over ‘cheap’ contractors). Finnie et al. [14] found that 2S-ECI is best used primarily on large complex alterations and extensions to existing buildings, particularly where the client intends using their buildings during construction, or for open-book pricing negotiation between client and contractor. 2S-ECI provides a flexible process where the PCSA can be used ahead of most standard-form construction contracts. The main contractor prices a fixed price for P&G and declares margins for overheads and profit, after concept design, and labor rates for negotiating builders’ work. Then, the main contractor works collaboratively with the design team, and secures subcontractor quotes as the design is finalized, to agree on a lump-sum construction contract. Anyone interested in obtaining the standard-form PCSA developed by Finnie et al. [43] should contact the author for a free copy. This may be adapted for other jurisdictions by updating the applicable laws.

2.4. Subcontractor Engagement in 2S-ECI Process

Subcontractors are selected for any builder’s work agreed upon, and what is generally a lump-sum construction contract agreed upon. However, a range of options exist for engaging subcontractors. Subcontractors may be employed directly by the client sometimes before the main contractor, such as for carrying out enabling works. Specialist subcontractors such as for cladding façades may provide a specification for the client to use when tendering for the cladding subcontract package. This provides the subcontractor with a competitive tender advantage as any other quotes would be based on an alternative to that specified. Subcontractors employed by the head contractor may provide design and build solutions. Alternatively, subcontractors may provide design solutions to the client directly, and then novate to the head contractor for the construction stage [22].

There has been little previous research specifically relating to 2S-ECI. Loosemore [63] studied construction productivity from a subcontractor’s perspective using focus groups and found that key ingredients for optimal subcontractor productivity included the opportunity for early involvement in the design stages of a project. Therefore, this suggests that a potential opportunity to improve 2S-ECI procurement is to involve specialist subcontractors in the process. Finnie et al. [37] found that pre-construction services provided by main contractors during 2S-ECI typically include design buildability advice, providing a construction program, contributing to value management, providing budget input, and risk management, which is often linked with design buildability. However, the previous research has not addressed the pre-construction services provided by subcontractors through 2S-ECI. Finnie et al. [37] also found that the main contractor’s pricing is typically based on fixed-price P&G and declared margins to apply to subcontractors and variations, then employs subcontractors on an open-book basis and that main contractors are generally involved after concept design and some detailed design. This is supported by Mosey [40] who found that an advantage of ECI is that the contractor and client’s consultants can review subcontractor quotes together and iron out any issues early in the project, decreasing the number of variations. Ashworth [64] suggests that this ‘should result in the least expensive cost for each of the trades and thus for the construction works as a whole’. However, research has not addressed subcontractor pricing or the timing of their involvement, nor has the form of contract been studied, despite Finnie [14]’s study evaluating different pre-construction services agreements (PCSA) used to employ main contractors.

In advanced construction, a greater amount of work is being designed and executed by subcontractors [50] and, in some situations, control the supply chain [65], having the least role of contractors. This is also explored by Song et al. [66] who suggest that, because the construction industry has become bigger, more complex, and more specialized, there is more of a need for early involvement from both head contractors and specialist subcontractors to achieve the projects that were previously unthinkable. Specialist subcontractors can be engaged directly through the head contractor as domestic or separately by the client's consultants to provide design and buildability input for things like façades, structural steel, lifts, and piling [14]. It is argued that the role of the nominated subcontractor is not relatable with the role of subcontractors in 2S-ECI, which is possibly another variation.

Subcontractor engagement investigation includes several key aspects. The drivers [26] to engage subcontractors in 2S-ECI are linked with the incapability of main contractors; if there is more specialized work, then input from the subcontractor is critical for the project's success. It is not the case for all the speciality trade [14] that subcontractors need to be involved in 2S-ECI; it depends on the scope of the subcontract work and the influence on the cost and management. The involvement of subcontractors before and after the main contractor is also a crucial aspect and reliant on the focus of the project towards subcontract work as an integral component. However, the pre-construction intervention [67] needs to benefit the 2S-ECI process from the client's perspective. It is common for the subcontractor to engage through a contractor unless consultants pose unique constraints. Most importantly, the responsibility of the subcontractor input in the design phase goes to the contractor as an employer [68]. However, there is the possibility of a separate contract between the subcontractor and client or consultant for the services acquired in 2S-ECI; in this case, the contractor is not accountable. It is expected that a range of services [45] will be provided by subcontractors to demonstrate their capability and competency in specialized work. It is essential that we evaluate the performance of subcontractors [60] in 2S-ECI to glean to what extent clients could benefit from subcontractor engagement.

The literature review has established that there is a gap in the existing body of knowledge about subcontractor involvement in 2S-ECI. Further studies focusing on subcontractor involvement was something recommended by Finnie [37]) who focused on main contractors, clients, and consultants. Therefore, the interview questions have been adapted from Finnie [37] to focus on subcontractor perceptions (see research methodology).

3. Aim and Objectives

The research aim is to evaluate the optimal ways in which the subcontractors are involved in the 2S-ECI procurement process through the perceptions of key stakeholders on commercial projects in NZ.

This study primarily focused on the following two research objectives comprising key engagement facets:

- Evaluate 2S-ECI implementation: Suitability determinants, key benefits, barriers, and potential improvements.
- Critically analyze subcontractor engagement in 2S-ECI processes in terms of key drivers for involvement, type of specialist subcontractors involved, pre-construction services provided, contractual pathway, immediate employer, and form of contract type.

4. Research Method

The role of subcontractors in 2S-ECI is an emerging topic and has not been investigated to date. Hence, this study opts for an exploratory research [69] approach towards discovering the industry practices [70]. There is wider potential to generate the insights and concepts, and expand the understanding through qualitative interviews using open-ended questions [71] appropriate for this study [72]. The questionnaire developed for this study comprised four sections: 1—Demographics (4 Qs); 2—2S-ECI experience (6 Qs); 3—Selected Project data (8 Qs); and 4—Subcontractor role in 2S-ECI (8 Qs).

Purposive sampling [73] was implemented to meet the recruitment criteria for participants having 2S-ECI experience on commercial projects in the NZ context. Further, the participant must have direct involvement with decision-making authority in the 2S-ECI procurement process. Table 1 shows the demographics of the selected participants for this study. All the participants are senior construction practitioners, having decades of experience in commercial projects and representing construction or consultancy stakeholders. All the participants were operating from South Island during the time of interviews. However, they shared experience of projects located in other parts of the country. All participants have more than ten projects on which they experienced 2S-ECI, except P6. The value ranges for the selected projects are from NZD 4 million to \$100,000, focusing on the construction of commercial facilities.

Table 1. Demographics of participants.

#	Affiliation	Location	Exp (Years)	No. of Project	Value of Project (\$M)
P1	Director at subcontractor company	Dunedin	>40	10	>100
P2	Senior associate at cost consultancy firm	Dunedin	>40	10	500–100,000
P3	Quantity manager at a construction company	Alexandria	>20	30	30–10,000
P4	Director at construction consultancy	Dunedin	>40	20	5–40
P5	ECI manager for a construction company	Dunedin	>17	20	4–100
P6	Director at project management consultancy	Queenstown	>41	03	60–200

The interview questionnaire was adapted from Finnie [37]’s doctoral thesis that developed a contractual framework for 2S-ECI in NZ construction. The questions were adapted for subcontractors as the doctoral thesis focused on clients, consultants, and main contractors. This helps ensure a consistent approach to studying 2S-ECI perceptions across various stakeholders while also ensuring the relevance to each. The questions focused on interviewees reflecting on the overall advantages, challenges, and opportunities to improve 2S-ECI from a subcontractor experience. Moreover, like Finnie [37], the questions also gathered details on the 2S-ECI process, such as when subcontractors were engaged, by whom, what pre-construction services they provided, and whether they received remuneration for their early involvement. The data collection process enabled interviewees to provide rich responses using examples to explain their experiences in detail. This suits exploratory research. Further research may then test and expand on the interview findings through a survey questionnaire to provide a wider sample relative to the population.

Table 2 shows the list of projects which participants selected to report the 2S-ECI experience. All the projects were large-scale commercial facilities, presenting a wide range of usability. All the projects are in significant cities in NZ and have impact on regional economy. The level of complexity has been defined based on the complex design and methodology of execution. For example, E6 includes all the key elements essential for a typical hotel building. However, E7 is comparatively very complex as there is need for designing and installing engineering system by using lifting equipment, along with requirement of active concurrent business activities at site. The cost of the projects ranges from \$4 million to \$500 million. On average, the duration of the projects is more than a year, and, for E7, it is seven years as the project needs to be stopped for technical reasons and is still in progress. Only P6 reported projects from E6–E8; rest of the participants addressed features of most unique projects in terms of 2S-ECI implementation. However, overall, sample represents the perspective of all key stakeholders.

The data collected for this study was through face-to-face and online meetings. The data have been transcribed to compile all the response content from participants for each section of the interview questionnaire. Most frequent aspect in the response content has been identified using summative content analysis [30,74]. Initially, the responses were compiled for five participants, and, for validation, another participant was interviewed, which results in the saturation of the responses about critical concepts [75]. Participants’ statements were included to attain conceptual alignment with frequent aspects within the

reported content [73]. Although the responses provide rich findings, this is still a small sample size. Further research could conduct more interviews and test and expand on interview findings using survey questionnaire to provide a larger sample size.

Table 2. Information about the selected 2S-ECI projects.

#	Type	Location	Complexity Level	Cost (\$M)	Dur (Years)	Perspective
E1	Hybrid public facility	Milton	High	500	3	Subcon
E2	Large scale stadium	Dunedin	High	500	>2	Client
E3	Distillery establishment	Cromwell	Moderate	5	>1	Contr.
E4	Retail store	Christchurch	Moderate	25	>1	Client
E5	Retail store	Auckland	High	12	<1	Contr.
E6	Hotel building	Queenstown	Moderate	60	2	Consult.
E7	Recreational facility	Queenstown	High	200	7	Consult.
E8	Multi-purpose public facility	Invercargill	Moderate	120	>2	Consult.

5. Findings

This section covers the key findings of the study in two parts.

5.1. 2S-ECI Implementation

In this part of the study, participants were questioned about 2S-ECI implementation procuring commercial projects in NZ. Implementation is driven from suitability determinants, critical barriers, and potential improvements.

5.1.1. 2S-ECI Suitability Determinants

The most frequently reported determinants by participants included “project complexity” and “market conditions”. Two participants mentioned “project duration” and complexity as determinants. Only one participant indicated that 2S-ECI can be applied to any project regardless of determinants.

“Project complexity” refers to design complexity and methodology. The complexity increases if there are time constraints and uncertain ground conditions based on geotechnical accessibility studies. 2S-ECI can have less competitive pricing. In P6’s opinion, it “[s]hould be used when there is enough complexity which cannot be handled through traditional procurement. There is money involved and who will bear the money due to less profit margin. To understand the quantum of work from the subcontractor”. Clients may therefore perceive little benefit using 2S-ECI on straightforward projects, leaving them disappointed, having sacrificed pricing competition. That said, contractors may price lower through 2S-ECI in heated markets because they declare their margins [11].

The second top determinant was “market conditions”. Subcontractors describe market conditions in terms of open-book negotiation. This provides the flexibility to procure subcontractors based on their ability and reliability and to support equitable industry turnover. The open-book negotiation can support ongoing partnering-type arrangements. P3 mentioned in E3, “Client looking for a local long-term partner, wanted good design and construction advice, clients consultants recommendation”. P5, as indicated, described the open-book pricing approach based on fixed-price P&G and declared margins, similar to main contractors: “Client looking for an ECI partner, P&G and margin was tendered”. The client used the open-book pricing to allocate equitable turnover to local providers. He mentioned, “Engage three large precast suppliers of the region to boost local economy and gain price certainty through shop drawings”. Similar to experiences with main contractors, Finnie et al. [14] found that the open-book pricing of 2S-ECI can be used to attract contractors who would otherwise not invest the time and effort to bid for projects through traditional tender. And market conditions have been heated across NZ due to COVID-19 stimulus spending by government. 2S-ECI also supports early ordering materials to mitigate cost escalation or supply chain disruption. Open-book negotiation gets around the issue of subcontractors

contributing considerable design knowledge through competitive tender when they might not win the job.

5.1.2. 2S-ECI Critical Barriers

In this section, participants were asked about the critical barriers towards 2S-ECI implementation. Three main barriers were reported in ascending order.

“Information sharing” related to cost, time, and technical aspects is essential in order to gain benefits from 2S-ECI. The exchange of information helps in open communication, which leads to trust among the stakeholders for a long-term relationship. Main contractors want to know the client’s budget and have an honest stance with subcontractors to streamline the efforts towards successful 2S-ECI implementation. P1 mentioned, *“Getting clients to open up with their information, and sharing of knowledge between all parties”*. Moreover, P4 mentioned, *“Trying to get open and honest main and subs”*. Clients may have constraints on sharing some relevant information, but subcontractors should be open if there is surety of engagement in the second stage.

“Competition” refers to the competitive tendering, in traditional contract, where clients always want to have authority to select the lowest bidder. P2 indicated, *“Client wanting competitive tenders”*. However, in 2S-ECI, it is highly possible that the same contractor will be selected for the second stage, considering the amount of effort spent already on the project. Despite lacking competition, if the contractor has been pre-qualified, then there will be no issue regarding capacity, but this creates a controlling position for contractors.

“Documentation” in 2S-ECI is doubled up as there are two separate stages of the procurement process. In reference to P6, *“Consultant does not want ECI due to huge documentation involvement”*. However, both contractors and subcontractors must provide extended or the duplication of documentation for both stages. However, this is the least critical barrier and well-addressed with proper administration of the contract.

5.1.3. 2S-ECI Potential Improvement

In this section, participants were asked about the potential improvements for 2S-ECI implementation. Three aspects were reported as potential improvements. “Realization of client expectations” should be the prime goal. P5 highlighted that *“Setting client expectations at the start”* is the prime objective of all the stakeholders involved in 2S-ECI. The realization of expectations should be qualified to ensure the deliverability of the project. However, the changes in the scope in any stage of the project increase the cost of the project significantly and the intention should be curtailing cost from all the avenues.

“Understanding of the complexity” is another improvement which refers to including a proper mechanism to deal with the complexity of the project. P6 mentioned, *“Understand the complexity of the project clearly”*. This points out the importance of understanding the project drawings, specification, and contractual agreement, and also addresses if there is any ambiguity involved with the request for information. Most importantly, the specialist subcontractor engagement is also crucial, and their opinion supersedes, so taking them onboard through main contractors should be considered in 2S-ECI. Furthermore, the regulatory requirements also enhanced the project complexity, as per P5: *“Insulation had to be fire rated added a massive cost to the project”*. Hence, awareness of the information from subcontractors or suppliers is crucial along with regulatory requirements.

Construction is the business with the lowest profit margin, and, often, stakeholders are reluctant to share the cost of their actual expenses or overheads. In this regard, “Upfront stance” is desirable from the stakeholders. P3 focused on *“Being upfront and honest”*, but sharing the commercial sensitive information requires contractual support to deal with legalities. However, the parties involved in 2S-ECI should be transparent and secure their positions transparently, especially the subcontractors who depend on their specific service where they are also facing inbound competition.

5.2. Subcontractor Engagement in 2S-ECI Procurement

In this part of the study, participants were questioned about the role of subcontractors in 2S-ECI. The findings related to subcontractors from selected projects were reported, focusing on the drivers, specialty, pre-construction intervention, channel, offered services, immediate employer, contract type, and key advantages.

5.2.1. Drivers

Drivers for involving subcontractors through 2S-ECI determines the reliance on the subcontractors for the successful completion of both the stages. The most common drivers reported are project complexity, market conditions, lead time, performance specifications, and procurement. Project complexity and market conditions have already been mentioned as suitability determinants for 2S-ECI, in a holistic way. However, lead time and performance specification are more stressed, considering subcontractor intervention. Taking subcontractors early onboard helps to determine the lead times for the procurement of materials and services. This mainly helps contractors to realize the program execution. However, understanding the performance specification is not possible without the support of subcontractors which includes the buildability aspects of the buildings, based on technical knowledge. The least addressed drivers are client advantage, job scrutiny, and cost which are the reasons for subcontractor engagement in 2S-ECI.

5.2.2. Trade Specialty

The most common trade specialty of subcontractors, for 2S-ECI on the pre-construction phase of commercial projects, reported in this study are electrical, mechanical, structural steel, and façade (including curtain wall and cladding). However, hydraulics, piling, precast, and passive fire are also key trade specialties of the subcontractors reported in case studies. Most trade specialties involve intense engineering works including design and construction for which the subcontractors' knowledge and experience are critical. Further, there is need for the quantification of material to determine the cost certainty. However, the most important parameter is the quantum of the work.

5.2.3. Pre-Construction Intervention

In all selected projects, it was reported that subcontractors must be involved as early as possible, preferably, in the conceptual design stage when the scope of the work has been defined. The value to be gained from subcontractor intervention is reduced as we move to the developed design stage and onwards. There is a requirement of shop drawings from subcontractors and determining the design conflict through clash deduction to avoid future re-work.

5.2.4. Channel Source, Employer, and Contract

In all the selected projects, subcontractors were engaged and employed through head contractors. This is the opposite to nominated subcontractors who are nominated by clients and share the proportionate performance risk. Subcontractors in 2S-ECI are contractually related with the main contractor, and provide services with the intention to get the work in stage two. However, there is a possibility that subcontractors are involved before the main contractor because of the design and technical requirements. In this case, there is a separate contract between the subcontractor and client. Most subcontractors are not paid for their services in 2S-ECI, but there is a possibility of fixed payment only when there is minimal input or they are likely not involved in stage two. This is because most subcontractors provide the services they are considering covering later from the profit.

5.2.5. Offered Services

Subcontractors are engaged in 2S-ECI for several engagement services, which helps to improve the performance of the project. These include planning and sequencing; buildabil-

ity; risk mitigation; value management; budget advice; procurement; design; document; and software control. However, subcontractors may be involved in a liaison with local authorities.

5.2.6. Key Advantages

Two prime advantages were reported for the subcontractors' early involvement. This includes "Knowledge of the project" and "Completion certainty". Subcontractors have vast experience of similar projects and know the technical aspects of the project. They helped clients and contractors to understand and realize the critical aspects of the project. Subcontractors not only help to avoid ambiguity and untap the opportunities—most importantly, when subcontractors are on board, then there is job security in terms of the certainty for the completion of the project.

6. Discussion

Innovative procurement methods potentially improve the performance of complex commercial construction projects utilizing the bottom-up initiative. However, there is a need for procurement methods such as 2S-ECI to be taken to the next stage for implementation through a 'top-down' policy [76]. This study investigated the 2S-ECI implementation and subcontractor engagement for commercial construction projects in NZ.

The implementation of 2S-ECI depends on the level of project complexity and critical market conditions. Projects with complex designs and methodologies should be procured through 2S-ECI. However, understanding the project's complexity is a key responsibility of the main contractor and subcontractor. However, on commercial projects, consultants are also engaged beforehand, and prospective contractors are involved as per recommendations. There is a proportionate sharing of complexity comprehension with consultants who claim to be experienced in similar projects. Reliance only on the contractor and subcontractor is not good practice as in 2S-ECI; all the stakeholders should work in a team to make the project successful.

Construction is uncertain, and establishing the 2S-ECI paradigm is often challenging. Clients are searching for reliable parties to develop the team for projects where 2S-ECI could be applied. However, most commercial projects are not started even after having the financing for several years, as competent parties are not available. This is ideal if the client can find the desired consultant, contractor, and subcontractor. Hence, most clients depend on the parties with whom they have worked earlier, even on arrangements that are non-ECI but on which they developed a good relationship [39]. 2S-ECI procurement helps clients to establish or strengthen long-term relationships based on alliances. Nonetheless, the compatibility of working practices is essential in order to benefit from 2S-ECI.

The top three critical barriers to 2S-ECI implantation are information sharing, competition, and documentation. Parties involved in the 2S-ECI arrangement need to be open and honest in sharing information and knowledge. This is the foundation of the 2S-ECI. However, there is an obligation involved as clients have to rely on the capability of the consultant, contractors, and subcontractor, but competitive selection should be the criteria. There is still a provision that the level of involvement of the parties still does not reach the full degree. There should be an accountability mechanism where parties could verify or obtain an endorsement for the input of other parties. In the worst-case scenario, the parties involved in stage 1 may not be called for stage 2, due to the poor performance of the parties. There is more communication through meetings and correspondence in 2S-ECI relative to the traditional approach. There is a need for a proper documentation control system to record and utilize the information and knowledge for project documentation, including drawings, specifications, and contracts.

Despite alternatives to traditional procurement, there is still a provision to improve 2S-ECI practices. Most importantly, the client's expectations should be well-understood by the parties. However, each party in 2S-ECI intends to influence the project, but the prime goal is to gain the value of money and cost certainty. This leads to making the project more complex or making efforts to understand the complexity and provide innovative

solutions that help to complete the project successfully. Information about market and regulatory practices is really helpful in making necessary changes in the project. However, parties may have researched and forecasted the changes which may have influenced the project's success. For example, there are big changes happening to construction contract NZ3910 [77], so the involved parties should share how these changes impact the project. Another practice whose adoption in the 2S-ECI framework is essential is compensation to the parties involved. For example, compensation of the services provided by the contractor and their subcontractor should be justified considering the amount of time used during the process [62]. It is vital, as the client wants to address all the uncertainties to the project, and deep early involvement is the only way to realize the buildability of the project.

Subcontractor engagement is as significant as contractor involvement in the 2S-ECI process. Parties need to understand that subcontractors are more relevant when it comes to understanding the complexity inherent to the project. Therefore, subcontractors need to be given proper consideration for their input. Subcontractors are only involved if the main contractor is willing to involve them, as their role becomes secondary in the interaction with other parties for complex projects. Similar to main contractors, it is important to understand the level of involvement and willingness of the subcontractors. It is ensured that subcontractors are only involved when there is a certainty for engagement in stage 2. The compensation to subcontractors for their services in stage 1 is covered in the margin for work awarded in stage 2, unless subcontractors are hired by the client; then, there is a separate contract. The procurement of the materials and services [78] are one of the crucial aspects for project performance, and subcontractors help to understand the lead times, which is the input for the project schedule.

It has been found that the most critical specialty trades of subcontractors for the 2S-ECI arrangement are structural steel, façade, and engineering system (electrical and mechanical). The selection is driven by the subcontractor's knowledge for these specialty trades, which is not accessible otherwise to main contractors [9]. Any specialty trade which involves the strong engineering, market knowledge, or relatively large scope should be involved as early as possible for a contractor in the 2S-ECI arrangement. However, if there is an engagement of subcontractors in the planning, designing, and installation phases, then early involvement, even before the main contractor, through separate contract for services is the most viable solution. However, to manage the liability of the capability of the subcontractor, the client should encourage the contractual arrangement between the contractor and subcontractor.

A wide range of services are provided by subcontractors in the 2S-ECI arrangement, which depends on the level and spread of the involvement. However, the full potential of the subcontractor should be utilized to avoid the engagement of other subcontractors [79]. Reliance on domestic subcontractors is risky for main contractors as they are responsible for their performance and the workmanship of subcontractors. However, subcontractors in NZ opting for innovative prefabricated technologies are facing critical performance challenges [65]. The knowledge of subcontractors is not comparable with contractors, which makes their involvement integral for 2S-ECI. Furthermore, along with the constructability of the project, the cost certainty is the main output of the subcontractor's engagement in 2S-ECI.

7. Conclusions

This study took a qualitative approach to study the 2S-EC procurement implementation and subcontractor engagement for CCPs in NZ. The findings pave the way as a foundation to a conceptual framework for subcontractor involvement in 2S-ECI.

Project complexity and market conditions were the main reasons for early subcontractor involvement. A key focus of market conditions is the ability to negotiate on an open-book basis based on reliability, capability, and supporting sustainable local supply chains. Common challenges include the lack of information sharing among the parties, non-competitive selection, and the lack of standard contract documentation. Opportunities

for improvement include clarifying client expectations, up-skilling in market and industry regulations, and providing more equitable compensation for pre-construction services. Key drivers for subcontractor involvement include project complexity, market conditions, ordering long-lead-time systems, and performance specifications. Specialist early sub trades include electrical, mechanical, structural steel, and façades. Subcontractors should typically be engaged as early as possible, often concurrently via main contractors to share the performance risk. Pre-construction services provided by subcontractors include planning and sequencing; design buildability analysis; risk mitigation; value management; budget advice; systems procurement; design solutions; and document control systems. Advantages include obtaining specialist project knowledge and improving time and cost certainty.

2S-ECI has been found to considerably improve time and cost forecasting through better planning and reducing contract variations during construction. It also provides an open-book pricing methodology for transparent negotiations between the client and contractor. If 2S-ECI were more widely adopted, the transparent pricing approach likely helps mitigate the construction industry's boom/bust economic cycles by contractors declaring the profit margins.

One of the key outputs of the doctoral research by Finnie [37] was to produce a standard form of pre-construction services agreement (PCSA) as detailed in this study [14]. This formalized the contractual approach for engaging contractors through 2S-ECI and addressed a key challenge identified by interviewees across NZ [14]. The interviewees of this study also highlighted the lack of any standard contract document when engaging subcontractors through 2S-ECI. Subcontractors in commercial construction need to adopt integrated performance approaches to remain competitive in the construction business [80]. Finnie et al. [14] had a range of PCSAs to evaluate in producing a standard form for NZ. However, no PCSA appears to exist for subcontractors. Therefore, drafting a subcontractor PCSA and evaluating it through stakeholder feedback could help to address a gap that still exists in the 2S-ECI contractual framework. This could benefit NZ and be adapted globally, as could the PCSA produced for main contractors. Anyone interested in obtaining a copy of the main contractor PCSA should contact the author for a free copy.

The findings of the study are significant in educating construction practitioners about the 2S-ECI procurement strategy as an alternative to traditional procurement. Moreover, the 2S-ECI procurement strategy helps in avoiding anti-competitive behavior [81], which leads to uncertainty for the time and cost of the commercial construction projects, and also in attaining the value for money for clients. This study also helps subcontractors, especially in specialized trades such as prefabricated construction companies, to gain knowledge about the engagement pathways in the 2S-ECI procurement process through the main contractors. The Commerce Commission in NZ has recommended the all-of-government strategy [82] to increase the use of offsite manufacturing through prefabricated construction products on public projects ranging from 10% to 20% annually, for different government agencies. This will create opportunities for prefab subcontractors to engage in the mainstream of NZ construction. However, this also applies globally for both developed and developing countries, which, ultimately, enhances the reliance on subcontractors more than the main contractor, and 2S-ECI is potentially a suitable procurement strategy to achieve the project goals.

This study portrays the perspectives of practitioners involved in 2S-ECI from clients, consultants, main contractors, and a subcontractor, focusing on general implementation to subcontractor engagement specifically. Further studies could focus more on subcontractors' own perspectives of 2S-ECI towards the development of a guidance framework for engagement. This could improve 2S-ECI team integration which directly impacts team relationships and project outcomes [83]. The interview sample size could be expanded for specific stakeholders for future studies. However, a quantitative approach could be used to test and expand on interview findings through survey questionnaires to provide a statistical representation of industry-wide perceptions, with a focus on subcontractor engagement.

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