

When to Engage the Contractor for Pre-Construction Services in New Zealand

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Abstract

Large and complex projects have become commonplace, increasing the need to engage contractors in pre-construction services (PCS). Clients now have a range of procurement options that can involve a contractor in any phase of the pre-construction process. This research investigated what factors are important when deciding how soon to engage the contractor. Furthermore, it investigated the issues of engaging the contractor too early or too late. This study collected results through structured explorative interviews with senior staff from client, consultant, and contractor organizations in New Zealand. The results are presented, compared, and discussed for each respective viewpoint. The results show that cost (scale) and complexity of the project, the reputation of the involved parties, and the nature of the relationships are the most crucial factors. However, the parties differ on the best timing for PCS. The contractor argued that PCS should occur in the concept design phase. The client opined that for some projects they would prefer involvement by the contractor in the project definition phase, while for others this should occur later, in the detailed design phase. Consultants recommended that the contractor should be included in the later phases before construction commences. It is interesting to note that the contractor does not always want to be involved early. Generally, the contractor does not want to be involved when the award of the project is still uncertain. Finally, it became apparent that a significant number of issues stem from the contractual arrangements of PCS, which poorly dictates who controls the design process.

Infrastructure projects are becoming larger and more complex, and as a result procurement models have evolved to include the contractor early in the project to provide constructability advice and cost certainty. Many procurement models include collaboration, like design and build (DB) (1). Recently, in the UK, Australia, and New Zealand, other forms of procurement models have emerged, such as early contractor involvement (ECI) (2, 3), performance-specified maintenance contracts (PSMC) (4, 5), public-private partnerships (PPP) (6, 7), and alliancing (8). In the United States, similar contracts have emerged that include the construction manager/general contractor (CM/GC) (9) and integrated project delivery (IPD) (10). These collaborative procurement models now provide the client with a range of procurement options (4).

All of these procurement models engage the contractor in different phases of the construction process (4). This research will investigate the factors that influence the client, contractor, and consultant on deciding in which pre-construction phase the contractor should be (or is preferred to be) involved. This can help parties to

decide which procurement method is best to deliver maximum value.

The objectives of this paper are:

1. Investigate the factors that influence the client, contractor, and consultant as to when the contractors should be involved within the pre-construction phase.
2. Identify common issues that arise from involving the contractor too late or too early within the pre-construction phase.

Pre-construction services (PCS) in this paper are activities that the contractor does in the project, before the

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construction phase. These activities could be provision of constructability advice, management of the design process, or engagement of the supply chain (2, 3) in a manner that permits it to have a substantive input in the final design. PCS discussed here can be tailored to suit any agreement between a client and a contractor, including all the procurement models mentioned earlier.

Literature Review

Many authors have investigated collaborative contracting internationally (2, 3, 11–14). It is often argued in the literature that collaborative contracting can provide better value to the client (13, 14). Of particular interest are the alliance contracts for extensive and complex projects (15). Allan et al. discussed the construction of the National Museum of Australia under an alliance contract. It was reported that significant added value was delivered to the client through many innovations that resulted from the collaboration of different parties (5, 14).

Alliance contracting often includes the contractor in the project definition phase (15). The Stronger Christchurch Rebuild Team (SCIRT) was a large alliance scheme to rebuild the damaged infrastructure following the Canterbury earthquake sequence. The client (the local council and central government) had limited understanding of the damage caused by the earthquakes (8, 15). Botha et al. compared 288 projects that were constructed with and without PCS input. Their results showed a significant improvement in cost accuracy and cost performance in the projects undertaken across the alliance program that had received PCS input (2). Scheepbouwer et al. investigated the issues with adopting ECI in procurement. Researchers concluded that the unfair allocation of risk between parties (client, contractor, and consultant) was a significant concern and recommended that responsibilities in areas of disagreement should be clarified (16).

Gransberg et al. discussed PCS in road maintenance contracts (performance-specified maintenance contracts [PSMCs]), and its implementation in New Zealand. Researchers recommend its implementation as a pilot program in the United States because of the number of advantages offered (4).

A range of authors have reasoned that PCS success is predominantly because of the interconnectivity of knowledge from a range of disciplines. Therefore, communication plays a critical role in the successful implementation of PCS (17–20).

Limited research has been conducted on the issues of PCS. However, researchers in Australia have investigated issues associated with partnering arrangements (21). They investigated six failed partnering projects and

collected the contractors' perceptions. Results showed that the client was not willing to fully commit to the agreement. This caused friction between parties, which led to eventual failure. It was recommended that there should be more efficient monitoring of team goals to ensure that the different stakeholders' commitment to the agreement is active (21).

Rahmani et al. argued that for the contractor ECI could be beneficial as it offers information relating to the contractors' holistic viewpoint of nurturing trust with the client with the goal of retaining the client for future work (22). Christie et al. argued that ECI might result in less competitive pricing by the contractor. However, they also concluded that this could be minimized by the transparency that results from ECI (23).

Eadie et al. investigated the advantages and disadvantages of ECI scheme implementation in the UK. Researchers found that often there is little benefit on smaller or low-risk projects. Often the ECI schemes resulted in fewer time savings and higher costs (3, 24).

Researchers investigated the industry attitudes toward IPD (10). Results showed that there are concerns with regards to risk and reward sharing. Researchers found that there are still several cultural, procedural, and organizational barriers to the common implementation of IPD within the construction industry (10).

Trigunarsyah et al. investigated constructability practices among contractors in Indonesia. It was found from surveys that Indonesian contractors were already implementing constructability advice in the conceptual phase. It was reported that areas of high collaboration included construction methods and material, preparation of schedule, estimate, and budget (25).

From the literature review, the concept of PCS has been researched with the application of multiple procurement models. However, there is limited literature on the optimal time to involve the contractor within the pre-construction stage.

Method

For the analysis in this paper, the pre-construction stage of a project has been divided into four phases. Each phase contains a different set of activities that are essential to the pre-construction process. The phases and the activities undertaken within them are shown in Table 1. Information pertinent to the activities listed in the table was adapted from the New Zealand Construction Industry Council Guidelines (NZ-CIC) (26).

In procurement, research is commonly conducted through structured surveys (25, 27). While survey data can be useful to identify patterns and relationships, structured explorative interviews can better support the collection of data relating to nuances, holistic factors, and systematic understanding (28–30).

Table 1. The Pre-Construction Phases Adopted from NZCIC (26)

Phase	Activities
1. Project definition	<ul style="list-style-type: none"> Defining project goals Setting objectives
2. Concept design	<ul style="list-style-type: none"> The scope of the project Selection of the architect/consultant Initial consultation Preliminary designs and estimates
3. Detailed design	<ul style="list-style-type: none"> Preparation of consent applications Detailed design documents Final estimates and schedules Preparation of construction document
4. Procurement/ construction phase	<ul style="list-style-type: none"> Tender Approvals Pre-construction meeting Material procurement Construction

For this research, open questions were developed based on the literature reviewed and discussion with industry. Structured explorative interviews with 15 top management industry representatives, senior managers each with a minimum of 10 years of relevant experience, were conducted. Six staff from contractor organizations, four from client organizations, and five consultants from across New Zealand participated in the interviews. The interviewers asked the interviewees open questions relating to key factors of importance influencing their choice of whether to involve the contractor for each pre-construction phase shown in Table 1. They were asked to prioritize these factors based on personal experience and to elaborate on their reasoning. The second line of questioning related to possible consequences of involving the contractor too early or too late. Identified in the literature, project outcomes discussed included holistic goals and incentives, design, competition and cost tension, risk

allocation and risk to the project, cooperation, and selection. Conducted interviews were face to face (Skype if required) and voice recorded (with permission from the interviewees). Each interview lasted roughly 50 minutes.

On obtaining data from the interviews, a qualitative analysis was carried out. This established the PCS influencing factors for each party, analysis of their commonality of priority, and the extent of the implication that the chosen stage of PCS has on the overall performance of the project. It is noteworthy to understand the questions put forth to the industry are not based on the ECI contract as a procurement model, but rather the general principle of engaging the contractor within the pre-construction stage defined here as PCS.

Results

This section presents the different viewpoints identified from the contractor, client, and consultant (designer). The influencing factors from the interviews are listed (Tables 2–4), and contextual information from the interviews accompanies each section.

Contractor's Viewpoint

The contractors reported that for PCS to be successful, it requires commitment from highly skilled staff. The business model of the contractors is based on delivering projects, supplying materials, and providing labor. Contractors would prefer to use key people on actual projects as opposed to billing out personnel by the hour. If a project does not proceed to construction, any PCS would mean under-utilization of their own key staff.

Contractors generally prefer not to be involved in the project definition phase as they can add limited value this early in the project. Also, this early, there is still the likelihood that the project will not go ahead. The contractor

Table 2. Influencing Factors Considered by Contractors to Provide PCS and Common Issues

Influencing factors for selecting input phase, contractor	Common issues when engaging PCS
<ul style="list-style-type: none"> Fit within their business model Market condition Available skill Nature of project Project complexity (technical) If project risk profile necessitates PCS Does the project require constructability input? Unique construction methods required Existing relationship with client The maturity level of the client Choice of consultant by the client Perceived ability to influence 	<ul style="list-style-type: none"> Too early <ul style="list-style-type: none"> Poorly/incompletely scoped project can result in friction Over-investment of crucial staff if not awarded the project Risk of project cost blow-out following unfair risk allocation Too late <ul style="list-style-type: none"> Adversarial relationship among involved parties Goals and objectives are not aligned Low influence on the design Limited opportunity for innovation Limited scope to mobilize the supply chain. Changes the risk profile to the contractor owing to limited knowledge.

Table 3. Influencing Factors Considered for Selecting PCS and Common Issues for the Client

Influencing factors for selecting input phase, client	Common issues when engaging PCS
<ul style="list-style-type: none"> • Complexity/cost (scale) of project • Constructability requirements • Nature of project • Relationship with the contractors • Sustainability of the industry • Organization's business model • Contractor's reputation • Time pressure • Need to control the pre-construction phase • In-house skill to do PCS • Resource availability in the market • Cost of PCS 	<p>Too early</p> <ul style="list-style-type: none"> • Loss of control over the design process • Selected contractor has inadequate expertise • Unwanted influence on the definition of goals and objectives • Increased cost • Improper risk allocation • Perceived unfairness against other competitors <p>Too late</p> <ul style="list-style-type: none"> • No innovation added to the project • Increased cost • Cost overruns (improper planning) • Inefficient use of time • Risk of adversarial relationships.

Table 4. Influencing Factors Considered for PCS and Common Issues for the Consultant

Influencing factors for selecting input phase, consultant	Common issues when engaging PCS
<ul style="list-style-type: none"> • Business model • Complexity/cost (scale) of the project • Relationship with the contractor • Relationship with the client • Fee recovery • Need for constructability advice • Need for design control 	<p>Too early</p> <ul style="list-style-type: none"> • May hinder design progress • Can influence the client in the wrong direction • Contractor may become adversarial when not awarded the project. <p>Too late</p> <ul style="list-style-type: none"> • Have little influence over the design • High overheads for the client with little value gained • Changes to scope or detail design can be expensive

therefore risks over-investment with a low likelihood of return.

Contractors prefer to be engaged after resource consents have been granted, but before the building consents have been approved. In New Zealand, the resource consent application process makes provisions for public consultation. This can cause significant delays especially where the Environment Court must rule over differences. Owing to the potential time delays and uncertainty, contractors prefer to get involved after the granting of the resource consents. However, once building consents have been granted, the consent conditions will limit innovation and therefore lower any value that the contractor could add as details have been finalized.

Contractors prefer to be involved in detailed design, especially when the client engages the designer and contractor under separate contracts. After detailed design, innovation from the contractor can be limited by the associated design cost of changes from a proposed solution. In addition, an inexperienced contractor may acquire an unfair risk allocation which may lead to cost blow-out where the construction cost estimate comes in higher than the client's budget.

The contractors reported that PCS can most often provide value to the client if the project is significantly

complex and of high value. The overheads of procured PCS can be high because of the number of people involved. If the project is not of significant complexity, generally the consultant requires very little or no input from the contractor. The contractors believe that there is very little value they can add if a project is of a repetitive and straightforward nature.

The consultant's and client's maturity (knowledge and experience with PCS) has a significant impact on whether a contractor would engage in PCS. Clients must have knowledgeable staff in place to implement PCS successfully. The contractor stated that knowledge and relationships are key for successful implementation of PCS.

Some contractors stated that they have moved away from early involvement in favor of tendering for work under traditional DBB (design-bid-build) contracts with finite award dates. In a few cases, PCS was stretched out for years with no return. An extreme case concerned a dredging project in which senior staff of a contractor were engaged for over seven years before the project was canceled. Although the contractor did receive compensation for their billable hours, the contractor did not receive the expected return on resources invested.

The contractors reported that clients sometimes engage with PCS when their scope has not yet been

adequately defined. Although this allows for maximum innovation to be achieved, often fixed deadlines and budgets can cause friction between parties and sour the relationship, which impacts on the success of the project. Some participants have reported that if clients have not clearly defined the scope, they will not engage with PCS as this may impact future work.

On the other hand, if the contractor is engaged too late, this can significantly hinder any value and innovation that may have been created if they had been involved earlier. In addition, project goals and outcomes are sometimes not realistically set by the client, which are hard to change in later phases as resources have been allocated. When PCS occurs too late, it can increase the risk to the contractor as they have limited knowledge of the project and limited time to mobilize the supply chain.

Client Viewpoint

Participants from client organizations mentioned the following reasons that PCS could be of advantage to them:

- Possible reduction in overall project cost
- Sustainability of the industry is increased through the sharing of knowledge
- Increased cooperation
- Can drive strategic forward work planning
- Results are more in line with the desired outcomes
- A better understanding of the project.

Table 3 shows a list of influencing factors when the client is deciding to engage with PCS. Some client organizations reported that PCS can encourage the flow of information among different disciplines. This is in line with their strategic goals of educating the industry, thereby improving the sustainability of the industry.

According to client representatives, in a DB contract, contractors are incentivized to optimally design to maximize their profit. In other collaborative contracts, like alliancing, it is common to negotiate the price after the design is completed. In the latter, the incentive for the contractor is to minimize risk, which could lead to over-design. Therefore there is a potential for an overpriced product.

Client organizations reported that when engaging with PCS, cost certainty can often not be achieved early in the project lifecycle. Cost certainty for a client is one of the most critical aspects of a project. Clients would like to understand the economic efficiency of engaging in the activity. Commonly, clients use a benefit–cost ratio to quantify economic efficiency. If a project has a marginal benefit–cost ratio, PCS overheads could decrease the benefit–cost ratio with the result of the project no longer being economically efficient.

If a contractor is involved in the design phase as an observer (non-contractual agreement), another contractor may raise probity concerns during the tendering phase. They may argue that the PCS contractor has an unfair advantage. In response to this, the industry has seen multiple “PCS consultancy startups” offering pre-construction advice as a standalone service.

The client organizations also argued that involving the contractor too early may prompt a sense of ownership of the project. This can result in unwanted disagreements when the PCS contractor is not engaged as the constructor. Whenever a contractor or consultant dominates the pre-construction phase, the client may not get the best outcome. Clients who do not have expertise within the construction industry can be adversely influenced by a contractor. An example of this is when a contractor only offers solutions to the client that require their own intellectual property or proprietary equipment to implement, where other viable options may be available. One method mentioned to acquire healthier PCS is a more rigorous pre-qualification method based on reputation within the industry, among other variables. Many larger clients have invested in knowledge and experience to help in this regard.

Consultant Viewpoint

Consultants also reported that if a contractor is involved early within the pre-construction phases, the contractor often becomes confrontational when the client decides to engage a different contractor for construction.

Consultants also stated that contractors’ innovative ideas could have high associated design costs, therefore mitigating any value created. Commonly, when the contractor is engaged through PCS, the client has a tendency to change the scope more often. This can hinder the detailed design and increase the overall cost of the project.

Consultants reported that the relationship between the consultant and the contractor is the most critical for the success of the project when the contractor is engaged in the pre-construction phase. If the client has forced the consultant and contractor to work together, this can cause issues as no previous rapport is present.

Analysis

From the results, Table 5 shows the similarities and differences between the three parties’ priority rankings. The priorities were established by identifying the commonality and agreement by a majority within each group from the interviews.

Both the contractors and designers indicated that the most critical factor to engaging with PCS is acquiring

Table 5. Prioritization of Factors When Selecting to Engage in the PCS

Priority	Contractor	Client	Designer
1	Get the work/does it fit with my business model?	Potential value	Get the work/does it fit with my business model?
2	Cost (scale)/complexity of the project	Cost (scale)/complexity of the project	Relationship–reputation
3	Relationship–reputation	Relationship–reputation	Cost (scale)/complexity of the project
4	Market condition	Sustainability of the industry	Need for design control
5	Resource consent	Resource consent	Need for constructability advice
Preferred phase for PCS	Concept design phase	Project definition Concept design phase Detailed design phase	Detailed design phase Procurement/construction phase

work. Equally important for both the contractor and designer is whether the project and PCS fits with their business model. For example, if a contractor would like to expand their business into a particular area, they might be incentivized to engage in PCS to gain client trust, as mentioned by Rahmani et al. (22). For the client, the top priority is the possible value creation of PCS.

Cost (scale) and complexity of the project are the second priority for contractors and clients. Both clients and contractors agree that often formal PCS require additional resources. The value added by PCS must outweigh the invested resources. The majority of interviewees agree that this favorable situation is more often achieved on larger and more complex projects. Relationships and reputation are also of high priority for all three parties. This agrees with the key findings from the literature, where communication and information are critical for the success of PCS (17–20). Reputation plays a significant role in New Zealand. All parties agreed that enhanced methods of preselection to engage in PCS should be investigated. The majority of participants agree that this would limit costly confrontation later in the project. Sustainability of the industry is an important factor for the client organizations, but was not mentioned by the contractors or consultants. Better sustainability of the industry results in enhanced competitive pricing and options for clients, driving value.

Resource consents are a priority for contractors and clients. From the contractor's viewpoint, if the resource consent application has not been granted, there is a genuine risk that the construction of the project might not go ahead or might be significantly delayed. Therefore, the contractor might not fully commit to the project as it might be a sunk cost. Here, parties have to balance between over-commitment of PCS and the risk of limited input and value creation.

From Table 5 it is evident that the contractor would like to conduct PCS early in the concept design phase, after resource consent. Clients' opinions vary. For some

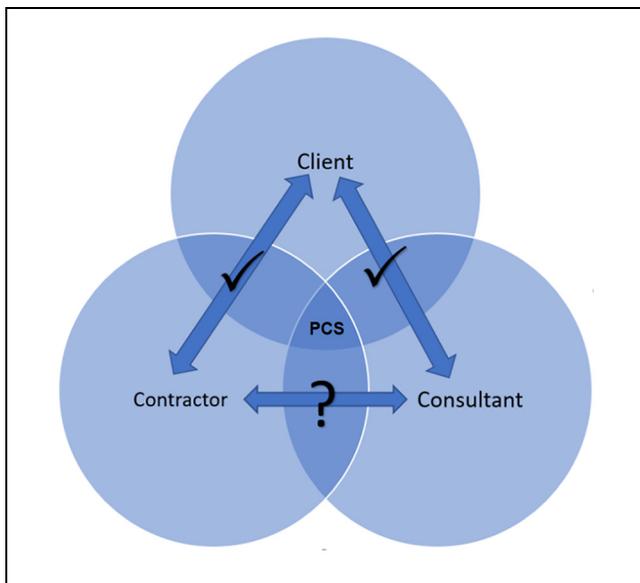
projects, they would prefer PCS in the project definition phase, for others later in the detailed design phase. Consultants would like PCS to start latest. This trend can be explained by the need to control the design process. Contractors would like to lead and engage early as this could foster a better relationship with the client and allow more control over the design. The opposite is true for the consultants; they prefer PCS to occur as late as possible so they can best develop a relationship with the client and control the design.

Table 6 shows the consequences of conducting PCS before or after the award of the project based on a holistic interpretation of all interviewed participants. If PCS is implemented before the award of the project, the contractor carries risk that they can mitigate by over-design. If PCS occur after the award of the project, the contractor is now trying to maximize profit. Similarly, before the award of the project there is less contractor competition, but more collaboration, whereas after the award of the project there is more competition but less collaboration. These consequences are often not talked about and can have significant implications for the value creation of PCS.

PCS will achieve the best value if all parties have balanced input, as shown in Figure 1. Imbalance will result in an unstable project that will not achieve its maximum value. Often with PCS, the client will engage the contractor and client under two separate contracts, as shown in Figure 1. There is no contractual agreement or relationship between the consultant and contractor. This can be a problem as a significant amount of the PCS value is created from the collaboration between the consultant and contractor. The design phase has a significant influence on the final project cost. If disagreements between these two parties occur, PCS can hinder project performance and the value creation expected. Further research needs to be conducted to identify how risk is managed in the relationship between contractors and consultants.

Table 6. Consequences for Conducting PCS before or after the Award of Project

Project outcomes	Before award of project (for example, ECI contracts)	After award of project (for example, DB)
Goal	Contractor seeks to lower their risk	Contractor seeks to maximize profit
Design	Over-designed	Optimized design
Competition	Lower competition	Market competition
Cost	Negotiated	Lowest bid tender
Design control	Client-controlled	Contractor-controlled
Risk to project	Lower residual risk	Higher residual risk
Collaboration	Higher	Lower

**Figure 1.** PCS relationships with contractual agreements.

Conclusion

All parties agree that engaging the contractor early can be beneficial to the outcomes of a project. The factors different parties use to decide when to engage in PCS have been investigated. Common issues with engaging the contractor too early or too late have also been discussed. Results show that cost, complexity, the reputation of other parties, and relationships are of high priority for all parties involved. Results show that there is a difference between the optimal time for PCS for different parties. Generally, the contractor believes PCS should occur in the concept design phase. The client's opinion varies. For some projects, they would prefer PCS in the project definition phase, for others later in the detailed design phase. The consultant would like PCS to start the latest. These conclusions are closely tied to the different parties' incentives. This is especially the case for the contractor and consultant, where acquiring work and maintaining trust with the client is of the highest priority.

After reviewing the results, it became apparent that a significant number of PCS issues stem from the contractual arrangement with the client. Often no one party is responsible for the PCS process. This can result in ambiguity and inaccuracy surrounding the soft costs related to PCS. In addition, this can lead to miscommunication issues and relationship breakdown, which can hinder value creation.

Furthermore, PCS implementation occurring before or after the award of the project has a significant impact on the motivation of different parties, especially with regards to the tension between collaboration and competition, and the tension of fair risk allocation and risk mitigation. Further research is recommended.

Recommendations

The following recommendations are made:

- Clients should consider the ramifications when they engage the contractor and designer under separate contracts. This can lead to ambiguity on ownership of the PCS process. It is recommended that further research be conducted in this area.
- Further research should be conducted into the order of activities within the pre-construction phase. The pre-construction phases are currently based on traditional procurement models. Activities where the contractor is most valuable could be identified and the pre-construction phases restructured to enhance the value that PCS can bring.
- Qualitative tools could help practitioners decide the optimal time for PCS. This could come in the form of a design matrix.

Author Contributions

The authors confirm contribution to the paper as follows: study conception and design: J.D. van der Walt, P. S. Botha and E. Scheepbouwer; data collection: J.D. van der Walt, P. Botha;

analysis and interpretation of results: J.D. van der Walt, P. Botha, and E. Scheepbouwer; draft manuscript preparation: J.D. van der Walt, P. Botha, and E. Scheepbouwer. All authors reviewed the results and approved the final version of the manuscript.

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