Closing The Contractual Circle: Investigating Emergent Subcontracting Approaches

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Abstract

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The construction industry is shifting away from the traditional paradigm, one that places users, planners, designers and contractors in different silos while performing design and construction services necessary to deliver construction projects. New contractual schemes, which rely on integration among contractual tiers, are emerging. Some of these schemes close the contractual framework at lower tiers by having multiple upper-tier parties subcontract work to the same lower-tier entity. In these instances, subcontractors have contractual relationships with more than one other upper-tier party in the same project. A previous study on Building Information Modeling (BIM)-enabled projects (Clevenger and Khan 2014) revealed the emergence of these types of contractual relationships. To date, however, little is known on these emergent approaches, their diffusion, criteria for adoption or expected advantages. Use of these emergent

models for building contractors was assessed using a survey. Data collection involved contractors in Washington State. After initial screening, several contractors were selected and interviewed regarding the nature of the adopted emergent subcontracting practices, the purpose for using them and their perceived outcomes. This research contributes to a greater understanding of the occurrence, reasons, and advantages and disadvantages of these emergent contractual schemes. A discussion of their impact on overall project performance is also included.

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CHAPTER 1 INTRODUCTION

1.1 Overview

Engaging subcontractors on a construction project continues to be important in the construction industry. Subcontractors are hired for many reasons including efficiency and economical reasons; however, with the increase in subcontracting, risks are shared and, at the same time, increased due to the multiple parties involved in a project. These risks are managed differently according to the type, size and complexity of projects.

While there are various practices in the hiring of subcontractors, it is commonly a vertical hierarchical system where the general contractor contractually engages the subcontractor without the influence of other project team members. With the growing complexity of projects over recent years, the organizational structures have begun to evolve in order to curb any anticipated issues.

These organizational structures include the modification of different project delivery systems, including the traditional Design-Bid-Build and Design-Build systems. One such outcome is the Integrated Project Delivery (IPD) method where there is a three-party agreement between the owners, designer and general contractor. With the growing trend of contractual structures modification, it is impossible to keep up with the latest and most efficient method of subcontracting as every individual manages risks differently. Studying the different approaches used by individuals in the industry will provide a better understanding of the existing practices used under different circumstances. This study focuses on projects with traditional approaches,

where the owner hires the designer and contractor under separate contracts, and excludes the Design-Build and IPD delivery systems.

1.2 Background

While general contractors hold the direct contractual relationship with the owners, they are usually not the only party involved in ensuring successful completion of the project (Elazouni & Metwally 2000). General contractors sublet a part of their contract to other companies, which are engaged on the project through a subcontract, to overcome project complexity considering most companies do not have sufficient expertise to carry out the full contract works awarded. These contractors are commonly known as subcontractors. Given that buildings have grown in complexity, particularly where mechanical and electrical services are involved, specialty contractors account for up to 90 percent of the value of work undertaken (Ndekugri 1988; Jamieson et al. 1996). According to Elazouni & Metwally (2000), subcontracting has also been used as a means for spreading risks. Upper-tier contractors may mitigate taking on responsibility for the supervision and motivation of the workforce by subcontracting most of the work (Beardsworth & Keil 1988). However, most contracts still require the upper-tier contractors to be fully responsible for all work they are contractually obligated to perform.

The classic or traditional view of a contractual framework for construction projects is one structured around a series of hierarchical tiers in order to provide a planning and control mechanism from contractors over subcontractors (Reich 1987). According to Shash (1998), the most prevalent approach in selecting subcontractors is where subcontractors submit a bid after being invited over the telephone by the general contractor. Upon further evaluation, thereafter

follows a negotiation exercise with all the shortlisted subcontractors and the award will be given to the preferred subcontractor, which is usually the lowest bidder. This is particularly true for public projects. Known as traditional subcontracting, this is the prevalent form in projects delivered through the Design-Bid-Build delivery method. Other approaches include GC/CM and Design-Build. Another common practice is establishing a strategic partnership between the project team members. A strategic partnership is when the parties build trust over a period of time through working together on a series of projects, which has implications on how subcontractors are hired.

Partnering may be motivated by the desire to establish a relationship based on trust, respect and honesty, as well as to reduce contracting problems, claims and litigation (Arditi & Chotibhongs 2005). Eom etc al. (2008) found that the parties' dedication to a common goal or mutual objective lead to a successful partnership, which in turn promotes a positive relationship between the project participants. It is a common belief that partnering should lead to a profitable job for both contractors and subcontractors, as well as quality and timely project completion for the owner (Lu & Yan 2007).

As with many other strategies in construction, subcontracting provides its own set of benefits and barriers. One of the biggest barriers is the added complexity and its weakened communication links, particularly between the upper- and lower-tier parties. The lack of communication skills may result in subcontractors being unaware of the owner's requirements, contributing to substandard work (Wong & So 2002). Other barriers include risks as earlier mentioned. According to Arditi and Chotibhongs (2005), a construction owner runs the risk that the general

contractor will not be able to complete the project on schedule, within budget, and in compliance with plans and specifications. Similarly, a general contractor runs the same risk vis-à-vis subcontractors; however, this can be countered to some degree using surety bonds or insurances.

Eom et al. (2008) found that subcontracting can also improve the performance on a project, rather than cause reduced productivity. To improve the project performance, the general contractor ensures that there are enhanced cooperative relationships between themselves and the project team to improve communication and collaborative work. Other benefits include being economical and efficient. The quality of the work will be improved as the work is done by subcontractors who specialize in their specific trades (Shimizu & Cardoso 2002).

The literature review explored the existing practices in subcontracting including its benefits and barriers. It is also noted that partnering is practiced extensively within the construction industry; however, these subcontracting strategies involved subcontractors sharing a contract with only one other project team member. This thesis explores the prevalence and emergence of subcontractors sharing more than one contractual relationship with project team members on a project.

1.3 Research Methodology

This research is intended to understand the common contractual strategies used in subcontracting within the industry as well as seemingly emergent methods, in particular, instances where a subcontractor shares multiple contractual relationships with different team members on a project.

The first step in this process is a survey. Based on the survey responses, and the consent of the respondents, interviewees were shortlisted based on a specified list of requirements.

The survey was designed as a background and screening process for the contractors currently in the industry in Washington. It was sent to a total of 271 contractors based on the list extracted from the University of Washington Construction Industry Advisory Council (CIAC) and the Associated General Contractors of America (AGC). The survey received a 33.9 percent response rate.

The questions in the survey were designed for both general contractors and subcontractors. All the survey respondents were asked questions related to their personal background, followed by questions regarding their companies in order to provide a general understanding of their size. The contractors were then asked questions related to subcontracting including their level of involvement in subcontract administration as well as their awareness of a subcontractor sharing multiple contractual relationships in a project. Based on the survey responses, it was found that the awareness of multiple contractual relationships on a project within the industry exists, even if it is uncommon.

Using the responses from the survey, 26 respondents were shortlisted for interview. Of these 26, 14 respondents located within the 45-mile radius of the University of Washington were interviewed, of which responses from 13 interviewees were analyzed. The interviewees were shown five subcontracting models: Traditional Subcontracting (TS), Traditional Subcontracting with Design Assist (TS-DA), Design-Build Subcontracting (DBS), Integrated Design

Construction Subcontracting (IDCS), and Integrated Specialty Work Subcontracting (ISWS). The interviewees were asked to describe the circumstances each of these models are used for and list the advantages and disadvantages.

1.4 Summary

This thesis includes a literature review to understand the background of subcontracting including its reasons, the types of subcontracting, and the benefits and barriers. Next, the research methodology explains the steps taken for this research, which includes the survey and interview. In data collection and analysis, the survey responses were organized to provide statistics of the answers to each of the questions. The interview responses were also organized according to the subcontracting models including the statistics of the interviewees' responses.

The interview responses were discussed establishing the circumstances and reasons for the use of each subcontracting model. These responses were evaluated and it was found that, while most projects use different subcontracting models, there are similar sets of variables used to determine when to use a particular subcontracting model. These variables include the project size, complexity, the culture of the companies, and most importantly, the relationship shared by the project team members.

Some of the thesis limitations include the size of the data set and its target audience. The survey was designed and distributed only to contractors in Washington, and the interviews were conducted with contractors whose offices are within a 45-mile radius of the University of Washington. It was found that during the interviews, some interviewees provided opinions from

an owner or designer standpoint. Therefore, for future development, it is suggested that the data set be increased to the whole of the United States and that a different survey be designed for owners, designers and contractors respectively.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Engaging subcontractors is essential in most construction projects. Subcontractors are typically hired by the general contractors to complete portions of the work in an efficient manner. Although traditional subcontracting practices are well known, new subcontracting approaches are scarcely discussed in literature – particularly the contracting practices of lower-tier subcontractors.

Clevenger and Khan (2014) conducted research on the impact of BIM-enabled design-to-fabrication on building delivery, and although the research focused on BIM, the case studies used had unique subcontracting strategies. While they showed project organization charts for the same trades in the projects, the contractual strategies used for each case differed depending on the project delivery method, such as Design-Bid-Build, Design-Build and GC/CM. Similar to Integrated Project Delivery (IPD), where the main parties of a construction project are contractually linked (usually the owner, design team and the general contractor), there are also circumstances where a lower-tier subcontractor shares contractual relationships with more than one upper-tier party, thus closing the contractual circle at the lower level of the organization chart.

The remaining section of this chapter includes a literature review that explores the necessities for new subcontracting practices, understanding the methods used, its benefits and barriers, and finally, comparing these practical methods to existing practices. It also serves as a guide to

explore the reasons for the differences between organizations in the same industry as well as the prevalence of the systems used.

With reference to Schaufelberger and Holm (2002), the term "general contractor" refers to the party of a construction contract who agrees to construct the project in accordance with the contract documents. "Specialty contractors" refer to construction firms that specialize in specific areas of construction work, such as painting, roofing or mechanical work. Such firms are typically involved in construction projects as subcontractors. The term "subcontractor" refers to specialty contractors who contract with, and are under the supervision of, the general contractor. "Prime contractors" refer to contractors who are directly employed by the owner. Prime contractors may also be general contractors or specialty contractors due to the nature of their work.

2.2 Reasons for Subcontracting

Although general contractors are usually hired directly by the owner, they generally sublet significant portions of their contract by hiring subcontractors to ensure the work is completed successfully (Elazouni & Metwally 2000). Given that buildings have grown in complexity, particularly where Mechanical, Electrical and Plumbing (MEP) works are involved, specialty contractors constitute up to 90 percent of the work undertaken in terms of value (Ndekugri 1988; Jamieson et al. 1996). Similarly, these subcontractors sublet part of their work to other specialized firms, thus forming multiple tiers of subcontracts. Subcontracting occurs due to the lack of sufficient expertise or resources within one company to carry out all of the contract work awarded. Subcontracting, including the multiple layers involved, was not originally practiced as

extensively as it is today due to the added complexity and size of projects over the past decades (Choudhry et al. 2012).

These subcontractors specialize in specific trades that not only supply the materials, equipment, tools and design involved, but also the labor required to complete the work (Shimizu and Cardoso 2002). They basically perform the complete scope of work contracted for the project, utilizing their skills and helping upper-tier contractors overcome problems related to the need of specialization (Elazouni & Metwally 2000).

However, according to Beardsworth and Keil (1988), subcontracting is similar to the logic of breaking down work tasks into smaller components, which in turn may reduce the skill level of upper-tier contractors. While this is true, it becomes an economical reason as it reduces labor costs and encourages efficient use of resources. Similar to entrepreneurs purchasing labor already embodied in a product, contractors choose to proceed with multi-level subcontracting by engaging those who possess the ability to produce the final product while providing their own labor and supervision, thus lowering the general contractor's risk factor.

Elazouni and Metwally (2000) agree that the use of subcontractors overcomes shortages in resources, as well as limitations in project funding. Sharing resources is both an economical and efficient means in allowing contractors to be able to afford sufficiently skilled workers and equipment for specialized trades. Since it is rarely viable for contractors to own, operate, and maintain specialized tools and equipment that are not fully utilized in a project, engaging these

subcontractors enables contractors to perform their work at a quicker pace and lower cost (Choudhry et al. 2012; Arditi & Chotibhongs 2005).

As subcontractors perform the actual work, Ulubeyli, Manisali and Kazaz (2010) believe that upper-tier contractors prioritize the management, planning and coordination aspects of the project. These upper-tier contractors ensure that working conditions for the subcontractors is suitable while monitoring the financial and technical progress in the long run.

According to Elazouni & Metwally (2000), subcontracting is also used as a means for spreading risks. Contractors may avoid taking on responsibility for the supervision and motivation of the workforce by subcontracting most of the work (Beardsworth & Keil 1988). However, most contracts still require the upper-tier contractors to be fully responsible for all work they are contractually obligated to perform, including the work assigned to their subcontractors.

2.3 Common Subcontracting Practices

Subcontractors are typically hired in two ways. The first is when the owner selects the subcontractor and mandates the general contractor to hire the selected subcontractor. The second way is when the prime contractor selects their subcontractor without the influence of any other project team members.

Interviews conducted by Choudhry et al. (2012) revealed that an owner-mandated subcontractor, or a subcontractor engaged under the influence of the owner or other project team members, shares a binding contract solely with the general contractor. These subcontractors are generally

specialty contractors in trades such as piling, Heating, Ventilation and Air Conditioning (HVAC), elevators and fireproofing. Subcontractors selected by the prime contractors or general contractors are not preselected by the owner, and in most cases, the owner is unaware of who these subcontractors are. These subcontractors are usually engaged directly by the general contractor for labor-intensive tasks such as excavating, formwork, rebar work and painting. Independent from the owner's role in subcontractor selection, subcontractors are usually specialty contractors who enter into contracts with prime contractors who act as general contractors. This is with exception to multi-prime contractual agreements where specialty contractors enter in direct contract with the owner.

Figure **2**.**1** below represents the organizational arrangement in a traditional Design-Bid-Build delivery method, and shows the contractual relationships between the project team members in the design and delivery of concrete reinforcements.

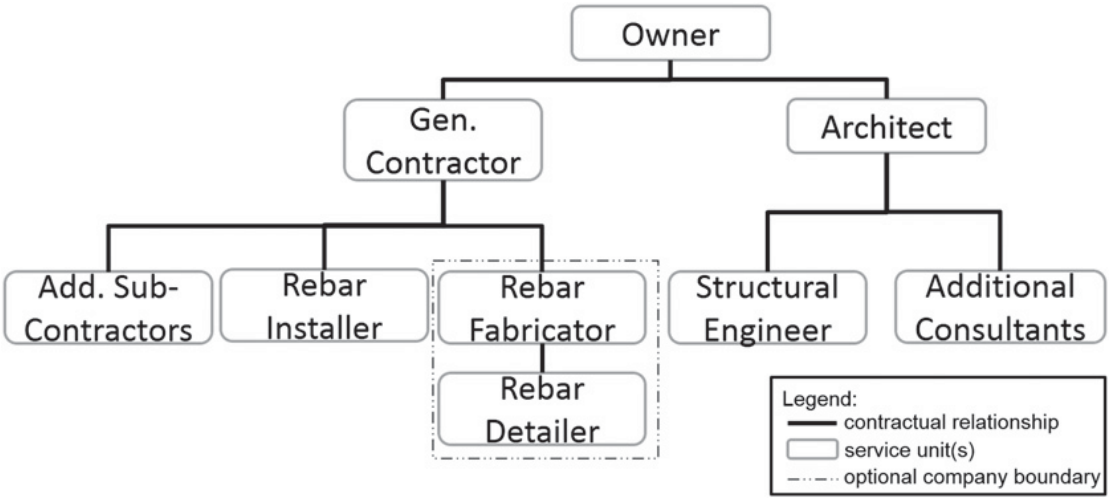


Figure 2.1: Traditional Design-Bid-Build Project (Clevenger et al. 2014)

The traditional view of a contractual framework for construction projects is one structured around a series of hierarchical tiers in order to provide a planning and control mechanism from general contractors over subcontractors (Reich 1987). As clarified by Ndekugri (1988), the owner and general contractor, who acts as the prime contractor, are bound by a contract. Then there will be a separate contract between the general contractor and various specialty contractors, who act as their subcontractors. In general terms, subcontractors are not governed by the terms of the main contract between the owner and the general contractor unless they are specifically incorporated, or passed through, into the subcontract. The extent of subcontracting is often so large that the general contractor can be viewed as an agent between the owner and the specialist firms in the industry.

According to Shash (1998), the most prevalent approach in selecting subcontractors is when subcontractors submit a bid upon invitation by the general contractor. Once evaluated, a negotiation exercise will be carried out with the shortlisted subcontractors and the preferred subcontractor, who is usually the lowest bidder, will be awarded the contract. This is known as traditional subcontracting, and is the prominent form in projects using the Design-Bid-Build delivery method.

According to Reich (1987), the command and control structure of the traditional Design-Bid-Build delivery method is slowly being replaced by contractual structures that encourage communication and coordination. Contracting methods, such as Management Contracting and Construction Management, provide the ability to subcontract all work and services except the provision of vital machinery and site facilities (Ndekugri 1988). The change in the nature of

construction-related activities has increased the awareness of the need to reduce internal barriers and organizational layers (Humble et al. 1994). For example, a Design-Build project requires the owner to enter into a single contract for both design and construction services with a design-builder. In this situation, the design-builder will be evaluated based on best value, which aims to reduce the risk of poor project performance to the owner by selecting contractors based on technical and management skills as well as price. This includes factors such as excellent technical and management capabilities, previous performance and qualifications of the relevant personnel, unlike Design-Bid-Build where the lowest bid is the sole means for selection (Anderson and Russel 2001).

Another method of selecting subcontractors includes the level of understanding and trust between the contractual parties. Trust between contractors and subcontractors can be fostered by longevity in contractual relationships. The more the contractors work together, the better the understanding will be between them. With the continuation of work by a single subcontractor for multiple contracts, the contractual parties form a healthy relationship that produces a better working environment as compared to fulfilling the contract with priority from solely financial implications (Beardsworth & Keil 1988). The preference for known and familiar subcontractors parallels relationships found in stable work organizations. This is in contrast to owners and contractors who are primarily concerned over technical issues or efficiency.

Bid shopping is another way of acquiring subcontractors in the industry even if it's strongly discouraged. This is where the general contractor uses the bids received from one subcontractor and tries to solicit a better deal for the same project from another subcontractor. This happens

after the general contractor has been awarded the contract by the owner, and often, it results in consequences (Stockenberg 2001). While bid shopping may benefit the contractor in the short term, it is detrimental in the long term. Contractors who tend to bid shop damage their reputation. It was reported that a quarter of subcontractors interviewed refused to submit bids to contractors who were known for practicing bid shopping. There is also a tendency for the contractor to award the project to an unqualified subcontractor, thus jeopardizing the project quality (Arditi & Chotibhongs 2005; Hinze & Tracey 1994).

2.4 Partnering

There are many forms of relationships between project team members; one of these relationships is characterized as partnering and is widely adopted throughout the United States. This method may be encouraged by the awareness of the necessity of trust, respect and honesty in establishing a successful relationship, as well as to mitigate problems including claims and litigations (Arditi & Chotibhongs 2005). Kumaraswamy and Matthews (2000) pointed out that general contractors and subcontractors are aware of the benefits of partnering arrangements. A project with an improved management approach leads to the reduction of resources, efficient schedules and economical benefits. It is also believed that partnering between project team members provides improved quality and timely project completion, which in turn leads to a profitable outcome (Lu & Yan 2007).

Partnering can be classified either as project partnering, where the partnership exists on a single project, or strategic partnering, which spans over several years and projects necessitating long-term commitment (Maturana et al. 2007). Project partnering can sometimes be referred to as a

strategy to mitigate issues with potential disputes. Strategic partnering is a management strategy where the parties build trust over a period of time through working together on a series of projects, which has implications on how subcontractors are hired. Collaborative teamwork and high productivity may be obtained if the contractor is hired through a relationship- and performance-based approach, encouraging an amicable environment rather than a price-based selection (Rahman and Kumaraswamy 2004).

In a typical project, the identity of the general contractor is unmistakable, as they are the one who is bound in a contract with the owner. However, in the case of joint venture projects where several team members share the same role, the identity of the members may get convoluted. These identities are linked at two levels: the contractual relationship and the behavioral linkage, also known as functional relationships (Hsieh 1998). Hinze and Tracey (1994) conducted a survey with subcontractors to understand general information about the working relationship with general contractors. When asked how the subcontractors' relationships with other subcontractors were handled, 39 percent of the respondents stated that the general contractor handles the relationship, while 21 percent stated that it was handled directly with the other subcontractors. The remaining 40 percent of the subcontractors felt that the relationships were handled differently depending on the general contractor. Similarly, when the subcontractors were asked how well the general contractors represented their interests, the responses were mixed depending on the general contractor. This shows that the perception of the general contractor-subcontractor relationship varies according to subcontractors and greatly depends on the experience the subcontractor had with the general contractor.

Hsieh (1998) acknowledges that more than 80 percent of general contractors felt that establishing continuous working relationships with subcontractors and material vendors is a necessity; however, instead of establishing a joint ownership, the contractors preferred financial independence. Due to the increased dependence on long-term relationships, unless required to exercise open bidding on public works, fewer general contractors hire new subcontractors or material vendors from the market. Financial capabilities and ownership of resources are not the main criteria for subcontractor selection, contrary to popular belief.

Partnering has also been considered a preventive avoidance technique for conflicts, claims and disputes. A variety of reasons have been brought forward as consideration to the decision of partnering. For example, due to the increased complexity of the project, there is a heavy reliance on subcontracting particularly where specialization is required. Due to independent designing by multiple parties involved, in order to avoid negative project outcomes such as cost overruns, project team members must recognize the need for greater collaboration (Burr & Jones 2010; Kelly 2014). The understanding that relationships in the construction industry very often lack trust, respect and honesty between project team members, including the general contractor and the subcontractor, has given rise to the adoption of partnering in the United States, Australia and the U.K., thus avoiding problems such as claims, litigation and dissatisfied owners (Kumaraswamy and Matthews 2000).

As Eom, Yun and Paek (2008) explained, most partnering accomplishments were attributed to the mutual goals and objectives among project team members, which resulted in a successful relationship. A strategy, developed by Bennett and Jayes (1998), provided an estimate of

potentially 40-50 percent savings of cost and time. This was achieved by creating undefined relationships based on the willingness between project team members to collectively improve performance.

Black, Akintoye and Fitzgerald (2000) found that all parties agree that mutual trust is crucial for success in the partnering relationship between contractors and owners – ranking it even higher in importance than consultants – which is encouraging considering traditional relationships between the owner and contractor typically lack trust. Although organizations that have yet to experience partnering reported a slightly lower rating for the trust factor, it is still their most important one. The results also show that the expectation from most parties is improved relationships rather than benefits such as improved design and quality or cost efficiency. This can be equated to the fact that improved relationships lead to project-based benefits, which may be the reason why the respondents had not rated it as highly.

Kumaraswamy and Matthews (2000) conducted interviews with contractors who experienced partnering relationships with subcontractors. It was found that the subcontractors consciously reduced their price by an average of 10 percent due to the expectation that an improved working relationship would lead to savings. This is due to the expectation of enhanced operational efficiencies that arise from the partnering arrangement. As quoted by Kumaraswamy and Matthews (2000), the confidence in such direct and tangible benefits from partnering were possibly inspired by:

1) Acceptance of the main contractor's philosophy that the industry needed a radically changed approach to doing business;
2) Increased acceptance of partnering principles in the industry in general;
3) Benefits that were seen to have emerged from such owner–main contractor partnering; and
4) Commitment to main contractor–subcontractor partnering demonstrated by this main contractor in the preliminary meetings and throughout the entire selection process.

2.5 Benefits and Barriers of Subcontracting

As with many other strategies in construction, subcontracting provides its own set of advantages and disadvantages. Early on in this literature review chapter, while benefits such as efficiency and cost effectiveness were mentioned, there are also other factors to consider in subcontracting, including the barriers.

Subcontractors subletting part of their work to a lower-tier or third-tier subcontractor increases complexity and weakens communication links, particularly between the upper- and lower-tier parties. The general contractor may not have a direct communication line with subcontractors who perform the actual work, nor do they know the identity of these subcontractors, particularly the lower-tier subcontractors (Choudhry et al. 2012). While there are cases where the interest of the contract explains the confidentiality, it obviously causes weak communication links. The lack of communication skills may result in the lower-tier subcontractors being unaware of the owner's requirements, which in turn lowers the quality of work achieved (Wong & So 2002).

The introduction of multiple parties into the contractual relationship is also discouraged since the difference in opinions and expectations may end up jeopardizing the relationship between the team (Macneil 1977).

Issues such as the limited involvement and integration between the general contractor and the third-tier subcontractor throughout the planning process, including the lack of formal, enforceable contracts, applies to both the general contractor and subcontractors (Maturana et al. 2007). It was also found that another issue faced by subcontractors was the lack of designated space on site. Design problems and last minute changes affected the quality of the project, and it was found that one of the causes was the lack of appropriate coordination, planning and cooperation with the subcontractor.

Subcontracting spreads project risks; however, spreading the risk is a risk on its own. According to Arditi and Chotibhongs (2005), the owner accepts the risk that the general contractor may be unable to complete the project in accordance to the schedule within the set cost and in full compliance with the contract. Similarly, a general contractor faces the same risk vis-à-vis subcontractors. However, this can be countered to some degree using a surety bond or insurance to manage the financial risks of the project.

Among the barriers to subcontracting found by Hsieh (1998) is reduced or irregular productivity. The project may lack uniformity and be of unpredictable quality. Some barriers to productivity are found when the general contractor and the subcontractor have limited interaction. Considering the general contractor functions as a coordinator, it is crucial that the construction

resources, including the subcontractors, are converted into the completed project. As there are many different trades and level of subcontractors involved in a project, the relationship between the contractors can get complicated. For example, the relationship changes depending on whether there is a contract involved between the parties or if they share a functional relationship. The different relationships shared, particularly where there are many different parties involved, may prevent the contracting parties from coordinating as a team, thus causing productivity barriers (Hsieh 1998; Beardsworth & Keil 1988).

Contrary to findings by Hsieh (1998) and Beardsworth and Keil (1988) cited above, Eom et al. (2008) believes that subcontracting can also improve the performance on a project rather than cause reduced productivity. To improve the project performance, the general contractor ensures that there are enhanced cooperative relationships between themselves and the project team to improve communication and collaborative work. Based on the succinct difference in opinions between the authors, it is fair to believe that there are other variables to consider when measuring the productivity levels of the subcontractors' involvement.

Subcontracting incurs lower costs due to the availability of resources by the company, thus being economical, which is another benefit. The hiring of subcontractors also allows flexibility to market conditions as the contracts are established early on in the project. The quality in construction can also be improved as work is done by subcontractors who specialize in their specific trades (Shimizu & Cardoso 2002). The use of the subcontractors' detailed design expertise, together with the general contractor's management experience, is the synergy that can

lead to the growth of individual companies. In return, this provides the owner with an improved level of service and product or building delivery (Jamieson et al. 1996).

2.6 Conclusion

This literature explored the existing practices in subcontracting, including its benefits and barriers. Partnering is also practiced extensively within the construction industry; however, subcontracting strategies traditionally have subcontractors sharing a contract with only one other project team member. While subcontracting is considered beneficial in some instances, it may be a barrier from a different parties perspective. There are many variables that determine whether these benefits or barriers arise from subcontracting. A study done by Clevenger et al. (2014) involving a subcontractor sharing a contractual relationship with more than one team member on a project (as shown in Figure **2.2** below) may have overcome these barriers.

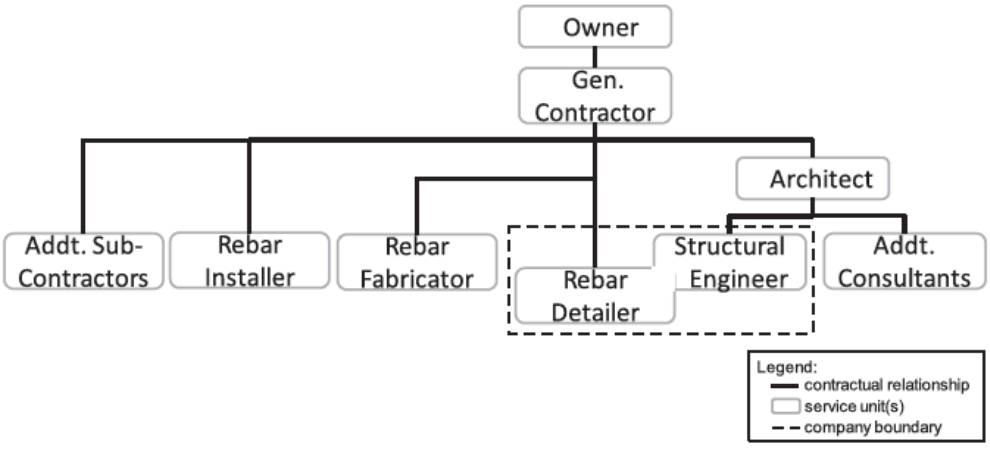


Figure 2.2: Design-Build Project (Clevenger et al. 2014)

This thesis explores the prevalence and emergence of subcontractors sharing more than one contractual relationship with project team members on a project. It also strives to understand the common subcontracting strategies currently practiced within the industry, as well as the benefits and barriers.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Research Design

The objective of this thesis is to address the following research questions:

- What are the existing and emerging subcontracting practices in the industry?
- How often are subcontractors sharing multiple contractual relationships in a project?
- Who are the parties involved, and when and why are such methods used?
- What are the opportunities and challenges?

In order to address these research questions, the process involved an online survey and on-site interviews. The online survey was performed in order to provide a current overview of emerging contracting practices among contractors in Washington. It also included questions to provide an understanding of the occurrence of multiple contractual relationships of subcontractors within a construction project. Intended as a screening exercise, it was used to identify potential candidates for follow-up interviews. The surveys were completed by November 2014.

Following the survey process, interviews were conducted with the shortlisted candidates. The candidates were selected based on their level of involvement in subcontract administration and their awareness of multiple contractual relationships with one party in a project. Following the first interview, the five contractual frameworks, shown in Figure **3**.**1**, were developed. These frameworks were then shown to the remaining interviewees to measure their understanding of the frameworks' frequency and the circumstances where each one was used, as well as the opportunities and challenges they presented. The interviews were completed in January 2015.

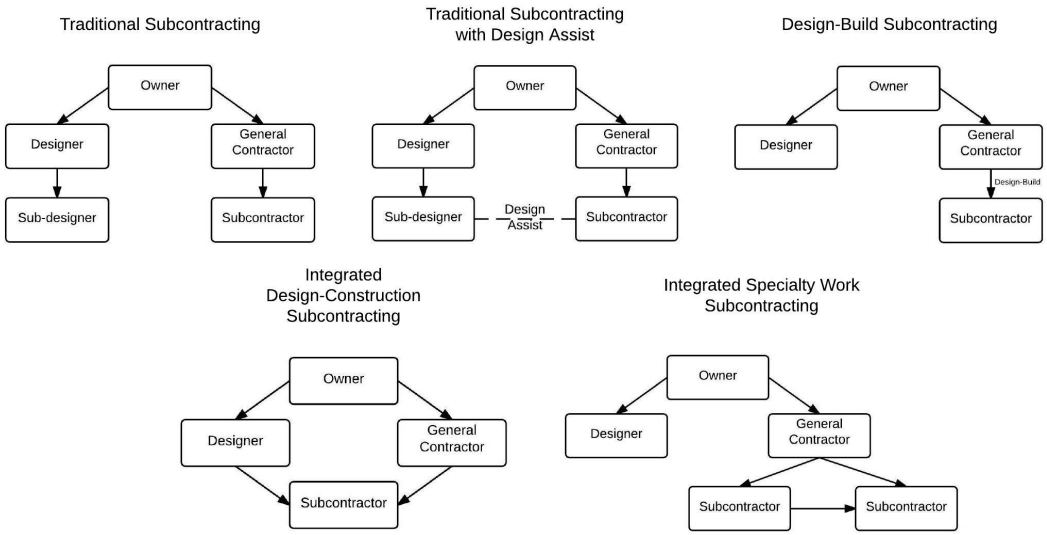


Figure 3.1: Five Contractual Frameworks

An approval from the Institutional Review Board (IRB) at the University of Washington (UW) was required prior to conducting any research involving human subjects. Since this thesis only involves the use of a survey and interview, which poses little to no risk for the human subjects, it qualifies for an "exempt status." The application involved a brief description of the research, the survey and interview questions. Since the interview questions were not drafted at that point, an interview guide was submitted. The intention of this application was to ensure that the research posed no risk and ensured the privacy and confidentiality of the respondents. This research obtained an exempt status from the IRB on Nov. 3, 2014.

3.2 Online Survey

The survey was created using a web-based service called QuestionPro (www.questionpro.com). The target audience included contractors and subcontractors in Washington. The contact information was obtained through the Associated General Contractors of America of Washington (AGC-WA) and the University of Washington (UW) Construction Industry Advisory Council (CIAC). Prior to conducting the survey, a pilot survey was carried out with students and faculty with existing or prior experience in the industry of the construction management department at UW. The survey was then modified to incorporate feedback from the pilot survey before it was sent to the target audience.

The survey consisted of three parts. Participants were initially informed about the survey via email. An email generated by QuestionPro was then sent along with the survey link. Both the email and the invitation placed emphasis on the confidentiality of the survey responses. The first part focused on the individual's background and personal experiences in the industry. This included the following questions:

- How long have you worked in the construction industry?
- What position do you presently hold in your company?
- How long have you been in this position with your company?
- What is the approximate value of the largest construction contract you have worked on in the last three years?

These questions provide a better understanding of the individual in terms of level of experience and the credibility of their responses. The next part of the survey addressed information on the individual's company. This included questions such as:

- Does your company mostly work as a general contractor or as a specialty contractor?
- Does your company mostly act as a prime contractor or as a subcontractor?
- To what extent are you involved in the administration of work subcontracted out by your company?
- To understand the general size of your company, what is the estimated average annual revenue (in U.S. dollars) of your company for the past three years?

These questions provided more information on the background of the types of projects the respondents worked on, the size of their company and the size of the projects they commonly deal with. Depending on their response about whether they're a prime contractor or a subcontractor, they were led to a series of questions that were related to their actual scope of work. The set of questions designed for the prime contractors and subcontractors can be found in Appendix A and Appendix B respectively. In the last part of the survey, the participants were asked a different set of questions, depending on whether they act primarily as a prime contractor or a subcontractor.

The prime contractors were asked the following:

- Over the last three years, what delivery methods were commonly used in the projects for which your company acted as a prime contractor?
- Over the last three years, your company selected subcontractors based on: [a selection]
- Over the last three years, have any of your subcontractors also signed contracts with any other project team members?
- Which of the following parties have a direct functional relationship with any of your subcontractors?

The subcontractors were asked:

- How do you select your subcontractors?
- How is your company usually selected as a subcontractor?
- Over the last three years, which of the following parties have had a direct contractual relationship with your company on a single project: [a selection]
- Over the last three years, did your company sign more than one contract on a single project?

All the respondents were asked if they could be contacted for a brief follow-up interview. This is the most important part of the survey where, depending on their responses and subject to their consent, the relevant participants were chosen for an interview.

3.3 On-Site Interviews

On-site interviews were conducted to understand and discuss reasons for, and results of, existing and emerging contracting practices. These interviews were conducted with survey participants who were selected based on their expertise, level of experience and familiarity with subcontract administration. The prospective interviewees were first contacted via phone to request an interview. For those participants who were unable to be reached, a voicemail was left along with a follow up email to explain the purpose of the call. Appendix C includes samples of these emails and voice messages.

The first interview was set up with a retired vice president of a renowned construction company who had 37 years of experience in the industry. As part of the interview, contractual frameworks from the three case studies done by Clevenger et al. (2014), shown in Figure **3**.**2**, were shown to him, in which case he reviewed and provided examples and instances of where and why such situations occurred. Through this first interview, five contractual frameworks addressing the different subcontracting strategies were generated as shown in Appendix D, Figures A to E respectively. These figures are further elaborated below.

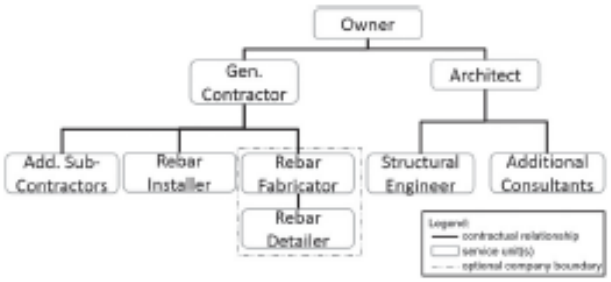


Fig. 1. Contractual relationships of a traditional design-bid-build project team as related to the design and delivery of concrete reinforcing in the foundation and structure

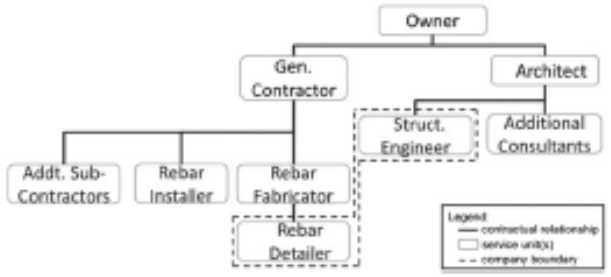


Fig. 2. Contractual relationships of the CM/GC-led project team on the fed building as related to the design and delivery of concrete reinforcing in the foundation and structure

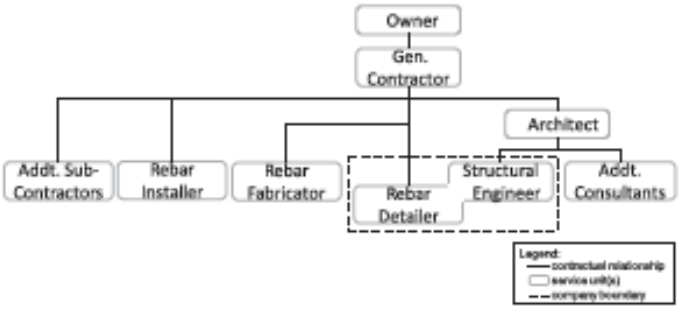


Fig. 3. Contractual relationships of the design-build project team on the med pavilion as related to the design and delivery of concrete reinforcing in the foundation and structure

Figure 3.2: Case Studies by Clevenger et al. 2014

After this initial interview, following interviewees were shown the five contractual strategies shown in Figure **3**.**1**. The strategies were explained carefully to each interviewee to ensure a fair comparison and similar level of understanding of the different approaches. The interviewees were asked their familiarity with the different contractual strategies and how often they have been encountered. The interview guidelines can be found in Appendix D. The results obtained will be discussed in the next chapter.

CHAPTER 4 DATA COLLECTION

4.1 Survey Data Analysis

Data described in this section was collected from the construction industry participants in Washington State. The survey was sent to a total of 271 participants based on the contact list extracted from AGC of Washington and CIAC. These participants were given a time period of 14 days to respond to the survey, and an additional email was sent on the 10^{th} day as a form of reminder.

Out of the 271 questionnaires sent out, a total of 92 participants (33.9 percent) completed the survey. Black et al. (2000), whose questionnaire response rate was 26.7 percent, found that their response rate was not unusual for a survey in the construction industry. In fact, Shash (1998) and Ndekugri (1988) achieved a response rate of 28.3 percent and 27 percent respectively. Therefore, a response rate of 33.9 percent is considered above average. The following table summarizes the responses of each question of the survey, and the figures that follow provide further explanations.

Table 4.1: Summary of Survey Responses – Background

Survey Questions and Response Options		Number of Responses
BACKGROUND		
Q1.	How long have you worked in the construction industry? (N=92)	
	Less than 2 years	0
	Between 2 and 5 years	3
	Between 5 and 15 years	8
	More than 15 years	81
Q2.	What position do you presently hold in your company? (N=92)	
	Executive	65
	Project Manager	15
	Superintendent	2
	Other	10
Q3.	How long have you been in this position with your company? (N=92)	
	Less than 2 years	3
	Between 2 and 5 years	16
	Between 5 and 15 years	36
	More than 15 years	37
Q4.	What is the approximate value of the largest construction contract you have worked personally on in the last 3 years? (N=92)	
	Less than 1 Million	2
	Between 1 and 10 Million	30
	Between 10 and 50 Million	32
	Between 50 and 250 Million	20
	More than 250 Million	8

Survey Questions and Response Options		Number of Responses
Q5.	Does your company mostly work as a General Contractor or as a Specialty Contractor? (N=92)	
	General Contractor	63
	Specialty Contractor	23
	Other	6
Q6.	Does your company mostly act as a Prime Contractor or as a Subcontractor? (N=92)	
	Prime Contractor	65
	Subcontractor	27
Q7.	To what extent are you involved in the administration of work subcontracted out by your company? (N=92)	
	Fully involved	43
	Somewhat involved	43
	Aware but non involved	5
	Not aware/Not involved	1
Q8.	To understand the general size of your company, what is the estimated average annual revenue (in US dollars) of your company for the past 3 years? (N=91)	
	Less than 10 Million	14
	Between 10 and 50 Million	32
	Between 50 and 250 Million	21
	Between 250 and 500 Million	8
	Between 500 Million and 1 Billion	3
	More than 1 Billion	12
	I don't know	1

Table 4.2: Summary of Survey Responses – Prime Contractor

Survey Questions and Response Options		Number of Responses
PRIME CONTRACTOR		
Q9.	Over the last 3 years, what delivery methods were commonly used in the projects for which your company acted as a Prime Contractor? (check all that apply) (N=65)	
	Design-Bid-Build	35
	Design-Build	39
	GC/CM, CM/GC, CM@Risk, GMP	39
	Cost Reimbursable/Cost Plus	38
	Other	9
Q10.	Over the last 3 years, your company selected subcontractors based on: (check all that apply) (N=65)	
	Owner/client mandate	24
	Design requirements	26
	Best qualifications	53
	Lowest responsible bid	56
	Established business relationships with project team members	48
	Other	0
Q11.	Over the last 3 years, have any of your subcontractors also signed contracts with any other project team members? (N=65)	
	Yes	29
	No	29
	Unsure	7
Q12.	Which of the following parties have a direct functional relationship with any of your subcontractors? (check all that apply) (N=65)	
	Owner/Client	34
	Prime Contractor	41
	Specialty Contractor	23
	Designer	31
	Other project team members	17

Table 4.3: Summary of Survey Responses – Subcontractor

Survey Questions and Response Options		Number of Responses
SUBCONTRACTOR		
Q9.	How do you select your subcontractors? (check all that apply) (N=26)	
	Owner/Prime Contractor mandate	1
	Design requirements	7
	Best qualifications	15
	Lowest responsible bid	16
	Established business relationships with project team members	19
	Other	3
Q10.	How is your company usually selected as a Subcontractor? (check all that apply) (N=26)	
	Owner/client mandate	5
	Design requirements	7
	Best qualified	16
	Lowest responsible bid	22
	Established business relationship	17
	Other	1
Q11.	Over the last three years, which of the following parties have had a direct contractual relationship with your company on a single project? Please refer only to projects for which your company acted as a subcontractor. (Check all that apply) (N=26)	
	Owner/Client	17
	Prime Contractor	27
	Specialty Contractor	6
	Designer	4
	Others project team members	1
Q12.	Over the last 3 years, did your company sign more than one contract on a single project? (N=26)	
	Yes	13
	No	12
	Unsure	1

4.1.1. Introduction

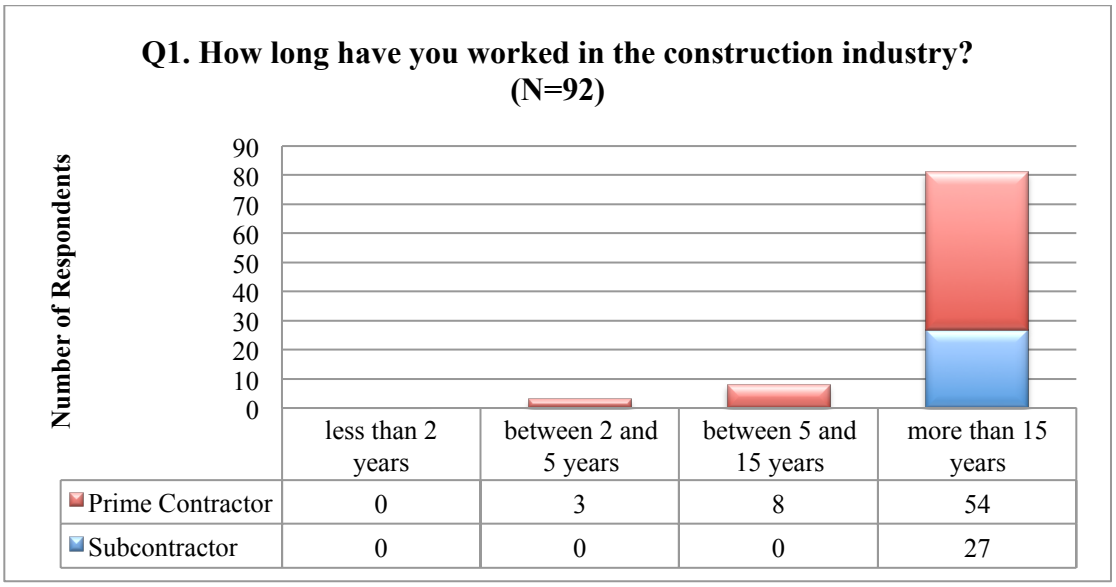


Figure 4.1: Industry Experience

Industry Experience: To understand the respondents' level of experience in the industry, they were asked how long they have worked in the construction industry. As shown in Figure **4.1** above, none of the respondents have less than two years of working experience. All of the subcontractors and 83 percent (54) of the prime contractors surveyed have at least 15 years of experience in the construction industry. Only 11 respondents of the 92 surveyed have less than 15 years of experience. This suggests that the survey was responded to by a sample of very experienced individuals.

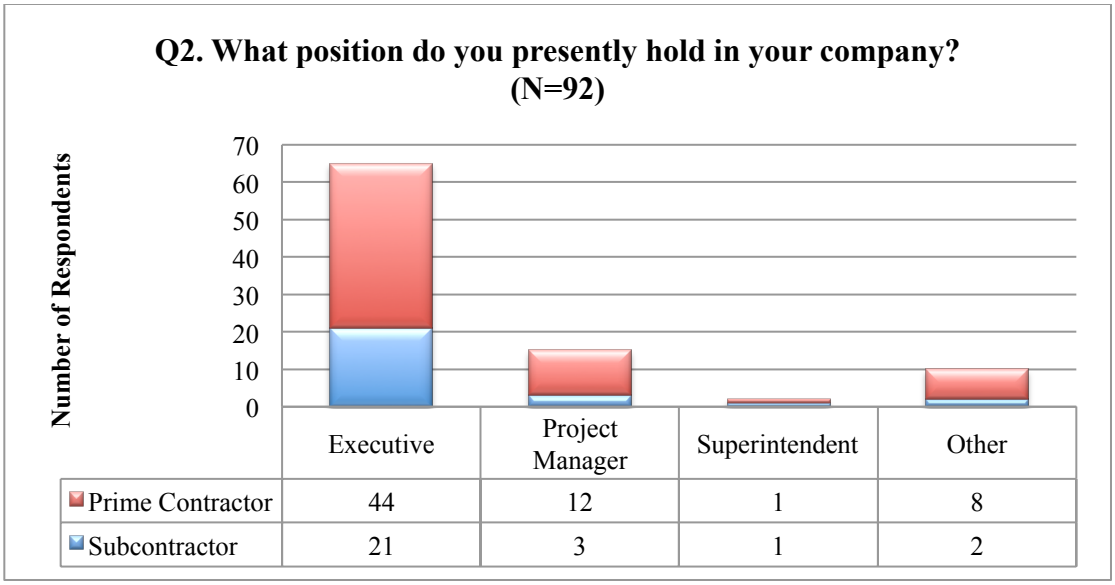


Figure 4.2: Job Title

Job Title: The respondents were then asked the position they currently hold in their company. This provides a better understanding of their role in the industry to determine whether or not they can relate to the research. Based on Figure **4.2** above, 71 percent (65) of the respondents are executives while 16 percent (15) are project managers. The 10 respondents who are classified as "Other" were found to be estimators, while only two respondents are superintendents. Although the estimators are classified as "Other", they may have relevant experience in subcontracting and will be able to relate to the research. The large pool of executives hints that the responses are based on the experience of accomplished individuals, who have worked on multiple projects.

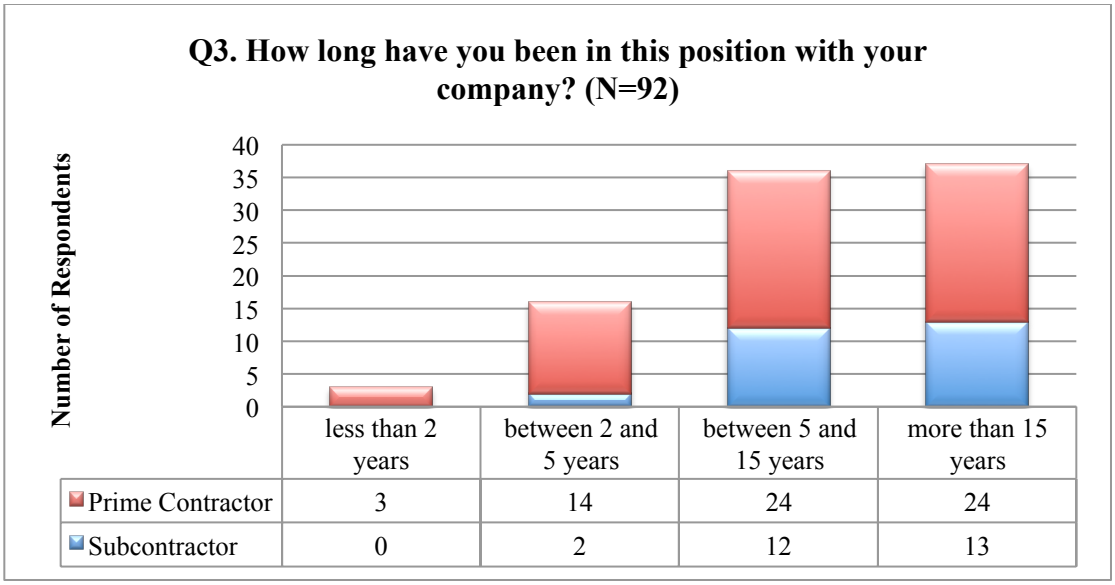


Figure 4.3: Experience in Current Position

Experience in Current Position: By asking the respondents how long they have been working in their current position, there will be a better understanding of how experienced they are in their existing role. Figure **4.3** above, shows that 40 percent (37) of the respondents have been in the same position with their company for more than 15 years, while 39 percent (36) of the respondents have been in the same position between five and 15 years. Only three respondents have held the same position with their company for less than two years. This reinforces the responses from the earlier questions, which confirms that most of the respondents are experienced individuals.

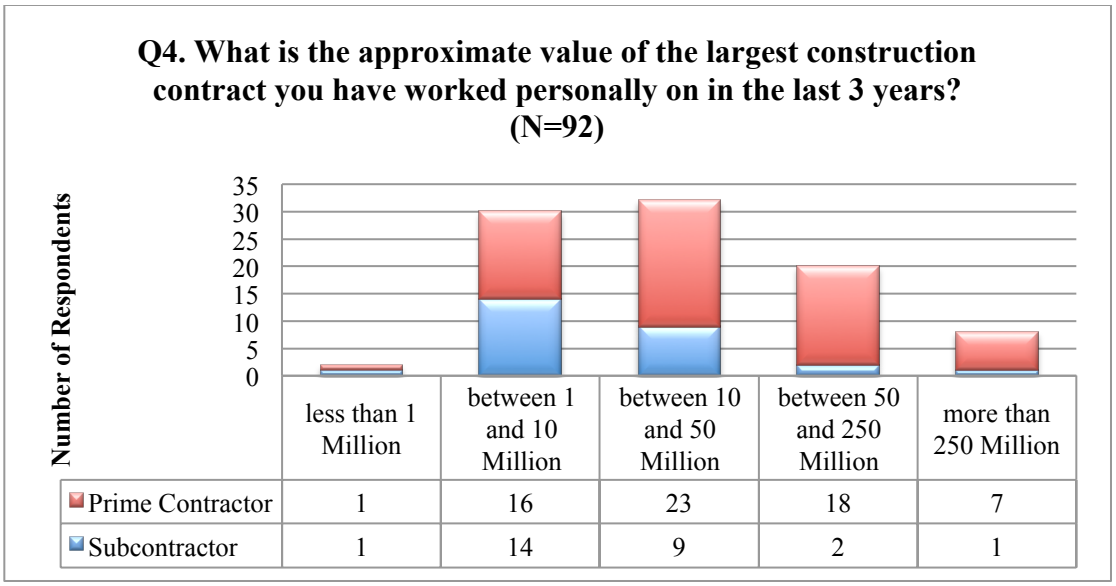


Figure 4.4: Size of Recent Contracts

Size of Recent Contracts: The respondents were asked the approximate value of the largest construction contract they have worked on in order to understand the size of projects they have worked on. Figure **4.4** above, reflects the largest contract value of a project the respondents have personally worked with. Out of the 92 respondents, 35 percent (32) have worked on contracts worth between 10 to 50 Million, and 32 percent (30) have worked on contracts worth between 1 to 10 Million. Among the remaining respondents, 22 percent (20) have worked on contracts worth between 50 to 250 Million and 8 respondents have worked on contracts worth more than 250 Million. Only 2 respondents worked on contracts less than 1 Million. This shows that the majority of the respondents have worked on projects worth between 1 and 50 Million.

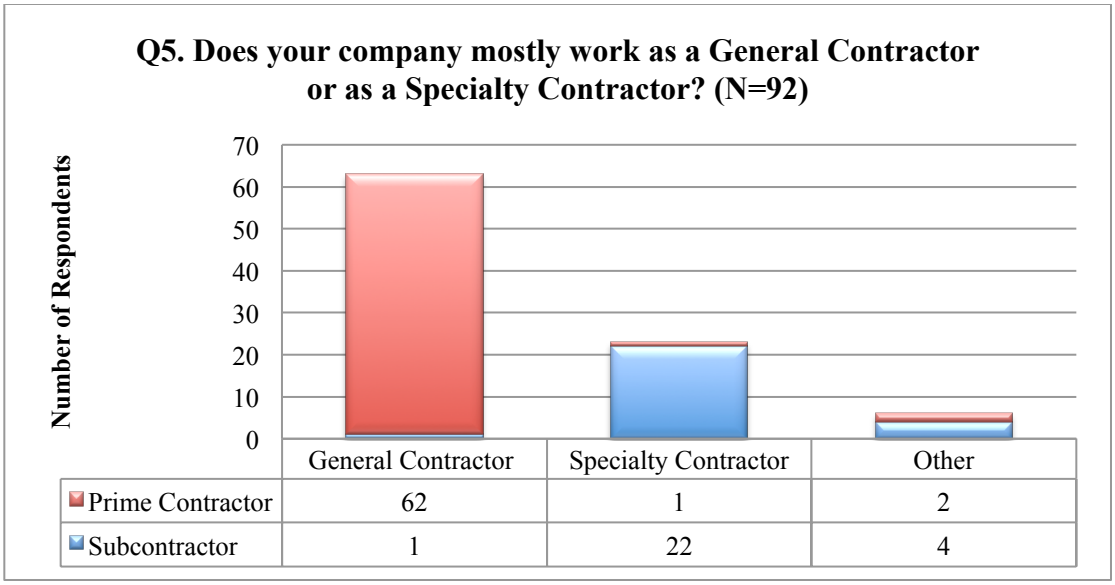


Figure 4.5: Functional Role

Functional Role: To understand the scope of work undertaken, the respondents were asked if their company works mostly as a general contractor or specialty contractor. General contractors are contractors who carry out general construction work, while specialty contractors are contractors who specialize in a certain area in construction. As shown in Figure **4.5**, it was found that 68 percent (63) of the respondents work as general contractors while 25 percent (23) worked as specialty contractors. The six respondents classified as "Other" included suppliers and owners' representatives. There was also one respondent who felt that his company was classified as both a general contractor and specialty contractor. This classification is different from the following question in which the respondents were asked if they work as a prime contractor or a subcontractor.

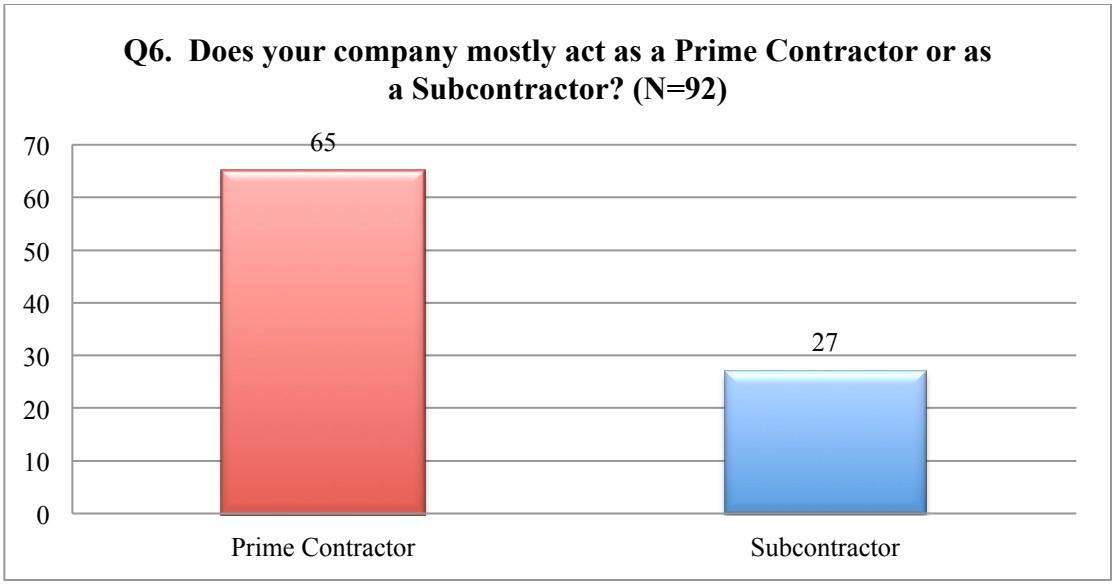


Figure 4.6: Contractual Role

Contractual Role: Based on the understanding that a specialty contractor may also be a prime contractor if they are engaged directly by the owner, the respondents were asked if they act mostly as a prime contractor or subcontractor. Figure **4.6** reflects that the prime contractors constitute 71 percent (65) of the respondents while subcontractors constitute the remaining 29 percent (27). Their responses determine the set of questions asked at the later stage of the survey, as a different set of questions will be asked to prime contractors as compared to subcontractors. According to this, the survey respondents consist mostly of prime contractors.

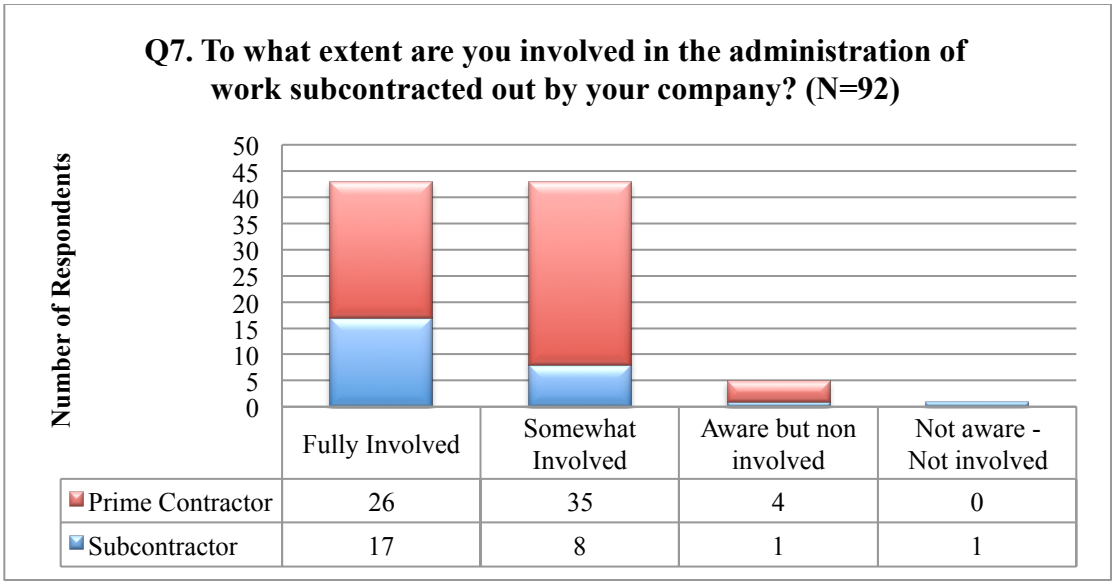


Figure 4.7: Respondents' Involvement in Subcontracting

Respondents' Involvement in Subcontracting: To determine the extent of knowledge and experience of the respondents, they were asked about their level of involvement in the administration of subcontracts. Figure **4.7** shows that 94 percent (86) of the respondents were either fully involved, or somewhat involved. Five respondents were aware, but not involved, and 1 respondent was not aware or involved. The survey was designed to terminate should the respondent be unaware and uninvolved. Therefore, the responses for the following questions are based on 91 respondents. The response to this question was used as the main criterion in shortlisting the interviewees.

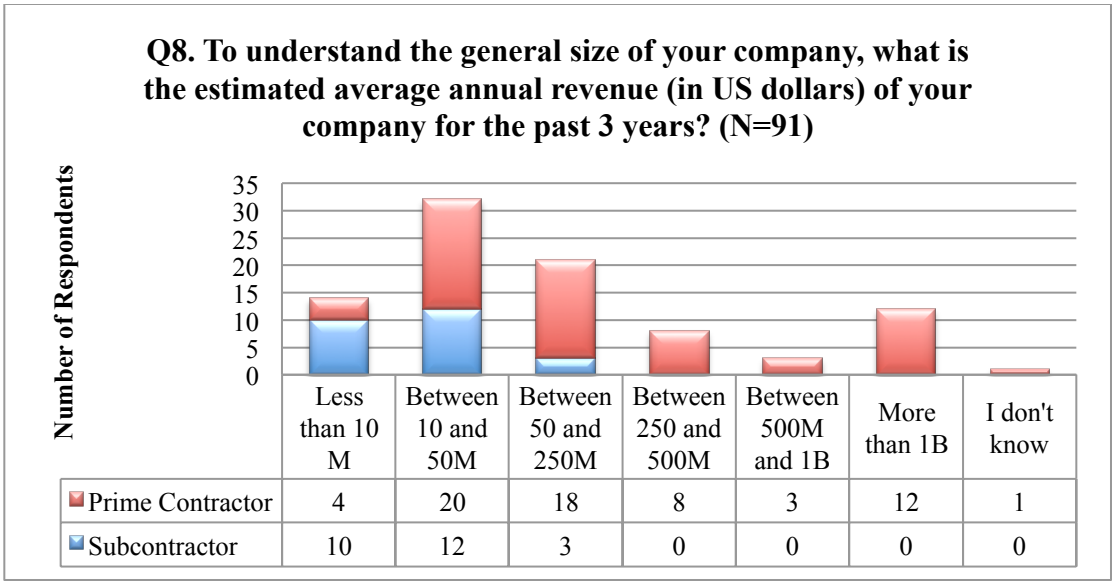


Figure 4.8: Company Size

Company Size: To understand the size of the respondents' company, they were asked their estimated average annual revenue for the past three years. As shown in Figure **4.8** above, the estimated average annual revenue of 35 percent (32) of the respondents is between 10 to 50 Million. Among the remaining respondents, 23 percent (21) have estimated annual revenue of between 50 to 250 Million while 16 percent (14) have revenues less than 10 Million. Thirteen percent (12) had companies with annual revenues of more than 1 Billion, 9 percent (8) had between 250 to 500 Million, 3 percent (3) had between 500 Million and 1 Billion, and only 1 percent (1) did not know. While most company average annual revenues range between 10 to 50 Million, all the respondents classified as subcontractors have revenues that are below 250 Million.

The upcoming questions were split between the respondents depending on their responses in Figure **4.6**, where the respondents were asked their contractual role. All the respondents were asked similar questions phrased according to that role.

4.1.2. Prime Contractors

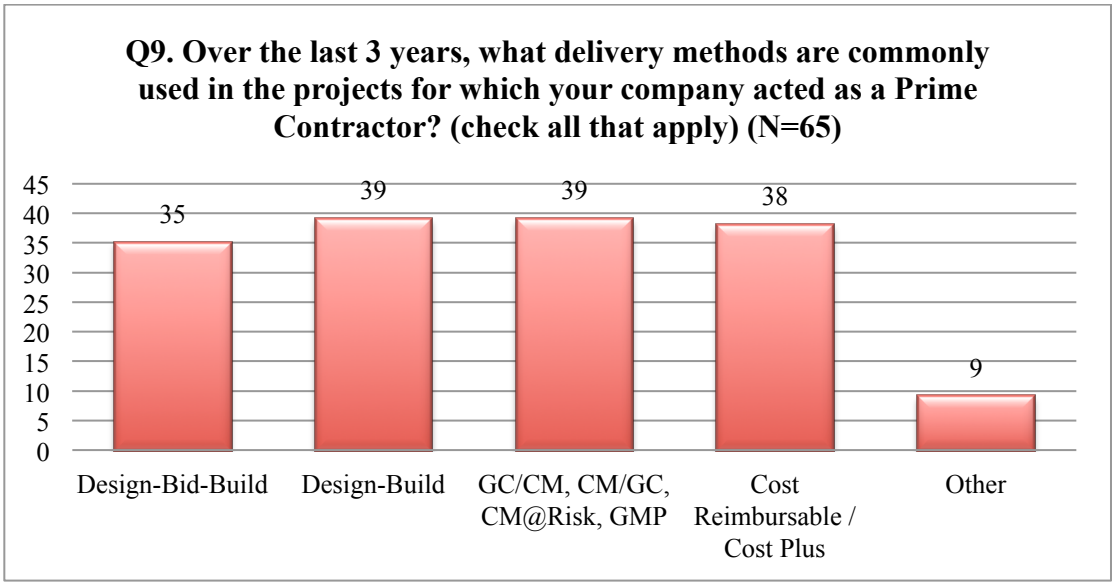


Figure 4.9: Adopted Project Delivery Method

Adopted Project Delivery Methods: For an understanding of the common delivery methods used in the industry, the respondents were asked to select the methods they commonly use as a prime contractor. In Figure **4.9**, it was found that the frequency of the different project delivery methods used is equally common. The Design-Build, CM@Risk and Cost Reimbursable approaches are commonly used by approximately 24 percent (38-39) of the respondents. The traditional Design-Bid-Build delivery method is used by 22 percent (35) of the respondents while the remaining nine respondents use other types of approaches. These approaches include Negotiated GMP, Stipulated Sum, Public Works Contract, IPD and Team Build, and an approach similar to Design-Build as explained by one of the interviewees.

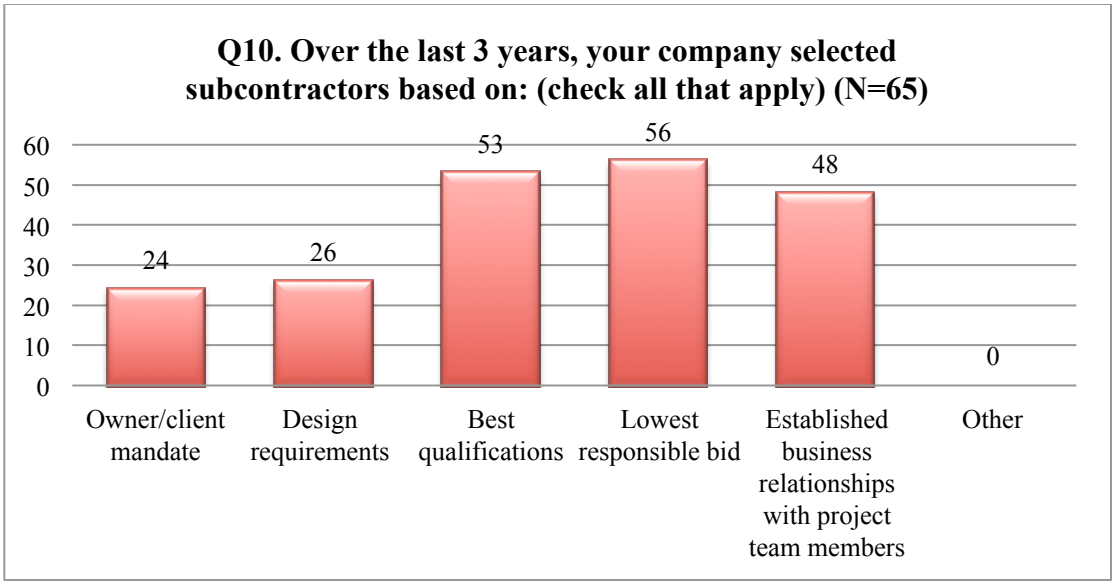


Figure 4.10: Subcontractor Selection Criteria

Subcontractor Selection Criteria: The respondents were asked the question above to understand how the respondents' company typically selected their subcontractor. As shown in Figure **4.10**, 27 percent (56) of the respondents selected their subcontractors based on the lowest responsible bid and 26 percent (53) selected their subcontractors based on best qualifications. At 23 percent (48), almost a quarter of the respondents selected their subcontractors based on established business relationships with project team members. Among the remaining respondents, 26 respondents selected their subcontractors based on design requirements and the other 24 respondents have owner-mandated subcontractors. The variety of reasons for the selection method could be based on whether the project is a private or public company, the size and complexity of the project, and the type of owner involved.

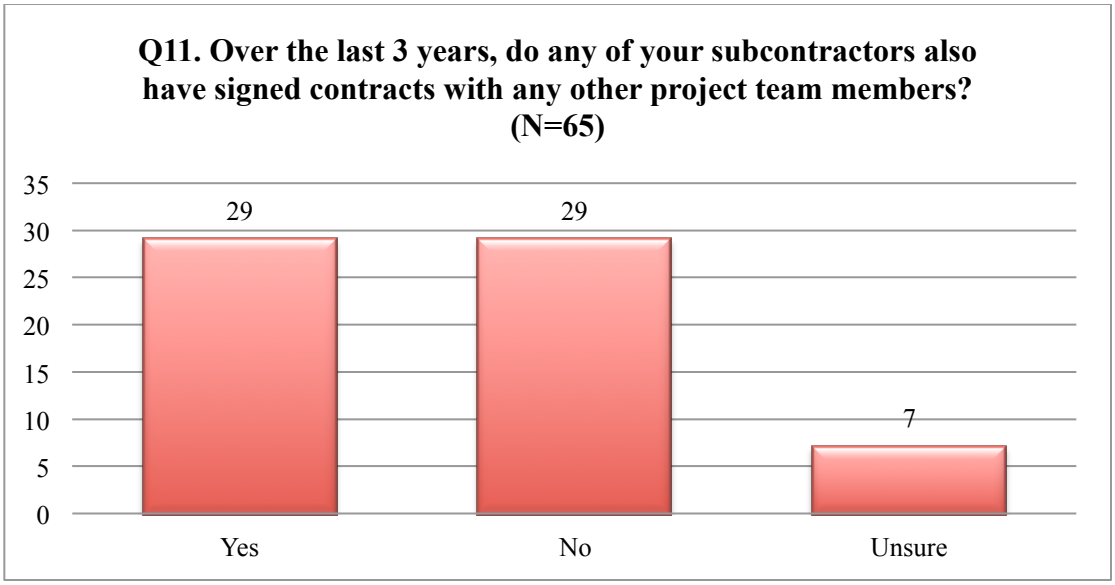


Figure 4.11: Occurrence of Subcontractors with Multiple Contractual Relationships on the Same Project

Occurrence of Subcontractors with Multiple Contractual Relationships on the Same Project: This question was asked in order to understand if the respondents faced situations where their subcontractors shared contracts with any other project team members. In Figure **4.11**, it was found that 44 percent (29) of the respondents have faced this situation, while 45 percent (29) of the respondents have not. Only seven respondents were unsure of such arrangements. The response to this question forms the next criteria in shortlisting the interviewees. It also shows that the existence of subcontractors sharing multiple contractual relationships in a project is occurring in the industry, even if it is uncommon.

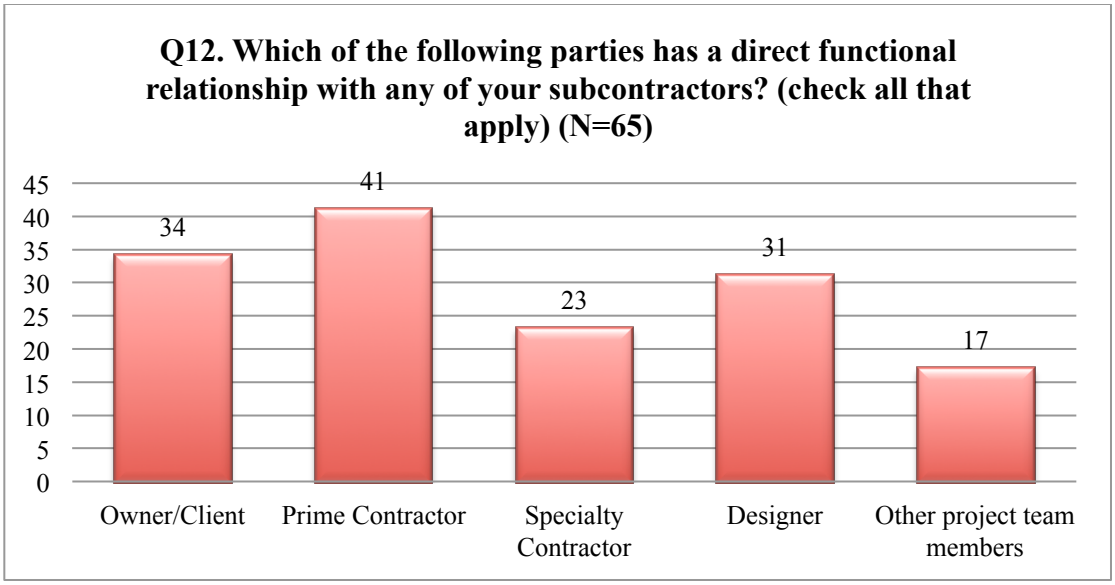


Figure 4.12: Other Contractual Parties with Contractual Relationship with Subcontractors

Other Contractual Parties with Contractual Relationship with Subcontractors: The question above was asked to understand whom subcontractors typically share contractual relationships with. As shown in Figure **4.12** above, 41 out of 65 respondents reported that the prime contractors share a direct functional relationship with the subcontractors, which is typical, while 34 respondents responded that the owner shared a functional relationship with the subcontractor. The respondents who reported that the designers shared a functional relationship with the subcontractors constituted 21 percent (31) while 16 percent (23) responded that the specialty contractor shared the functional relationship. The remaining 12 percent (17) responded that the other project team members shared a functional relationship with the subcontractors.

4.1.3. Subcontractors

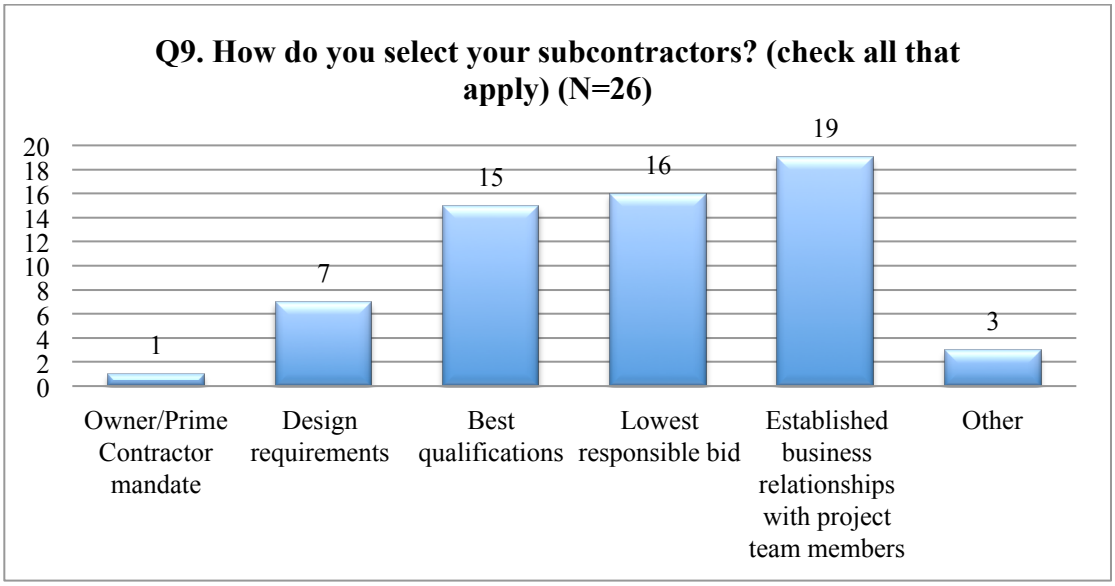


Figure 4.13: Subcontractor Selection Criteria

Subcontractor Selection Criteria: Based on the understanding that there may be multiple tiers of subcontractors; the respondents were asked how their subcontractors were selected. Unlike the prime contractors, 31 percent (19) of the respondents selected their subcontractors based on established business relationship with project team members, as shown in Figure **4.13** above. Sixteen respondents used the lowest responsible bid selection method, while 15 respondents selected their subcontractors based on best qualifications. Subcontractor selection based on design requirements was used by seven respondents, and only one respondent selected them based on owner mandate. Three respondents used other methods to select their subcontractors.

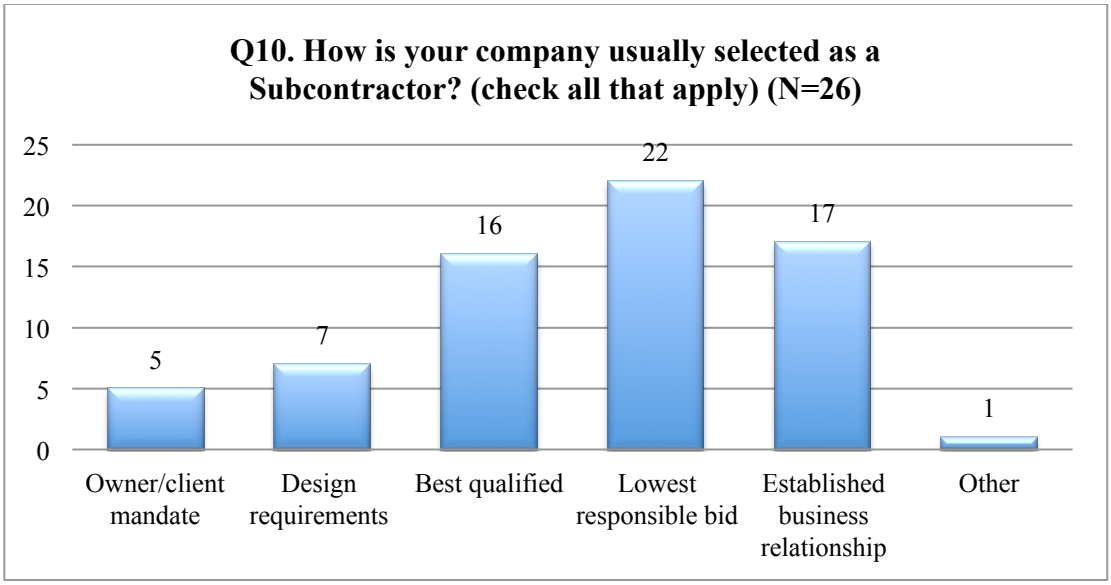


Figure 4.14: Procurement Approach

Procurement Approach: To understand the basis for subcontractor selection, the respondents classified as subcontractors were asked how their companies are usually selected. As shown in Figure **4**.**14** and corresponding to the responses by the prime contractors, the majority of the respondents, at 32 percent (22), were selected through lowest responsible bids and 25 percent (17) of the respondents were selected through established business relationships. Respondents who are selected through the "best qualified" process constitute 24 percent (16), while 10 percent (7) are selected through design requirements. The remaining 7 percent (5) are owner mandated, while one respondent was selected through "Other" means. This shows that subcontractor selection through the lowest responsible bid is the most common form of selection among the survey respondents, followed closely by best qualified and established business relationships.

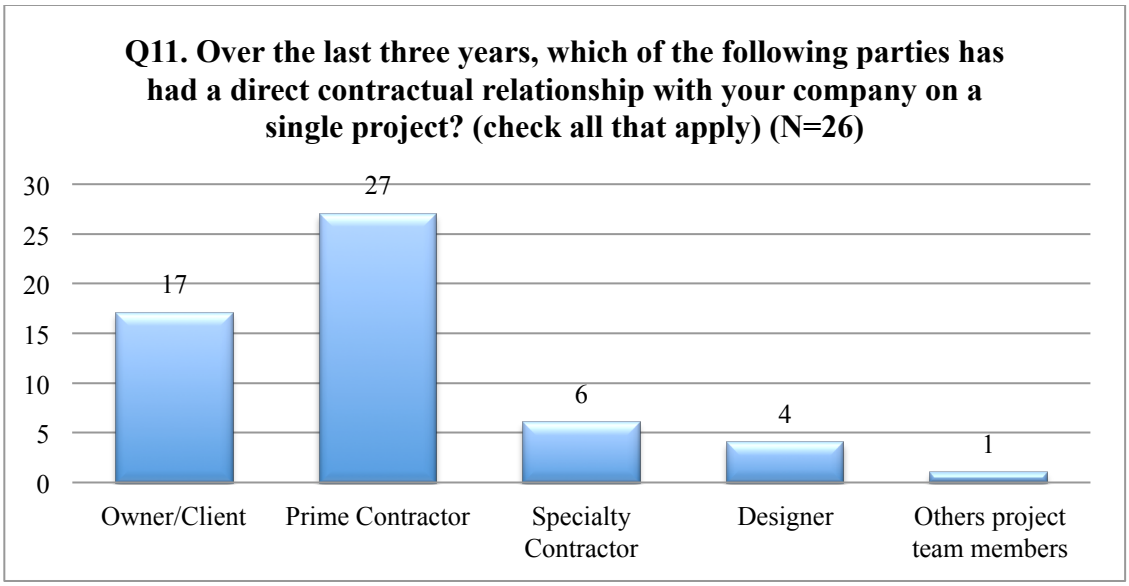


Figure 4.15: Contractually Bounded Parties

Contractually Bounded Parties: This question was used to understand who the subcontractors typically share contractual relationships with. Figure **4.15** shows that 49 percent (27) of the respondents shared a contractual relationship with the prime contractors and 31 percent (17) shared them with the owner. Among the remaining respondents, 11 percent (6) shared them with a specialty contractor and 7 percent (4) share them with a designer. Only one respondent shared a contract with other project team members. While the most typical contractual relationship is shared with the prime contractors, it was found that the likelihood of the subcontractors sharing contractual relationship with the owner is also high.

Figure 4.16: Occurrence of Subcontractors with Multiple Contractual Relationships on the Same Project

Occurrence of Subcontractors with Multiple Contractual Relationships on the Same Project: Similar to the prime contractors, the subcontractors were asked if they have encountered situations where they share more than one contractual relationship in a project. As shown in Figure **4.16**, 50 percent (13) of the respondents have signed more than one contract on a project while 46 percent (12) have not encountered this circumstance. Only one respondent was unsure of such arrangements. This question forms the criteria for the shortlisting of interviewees who are subcontractors.

4.1.4. Conclusion

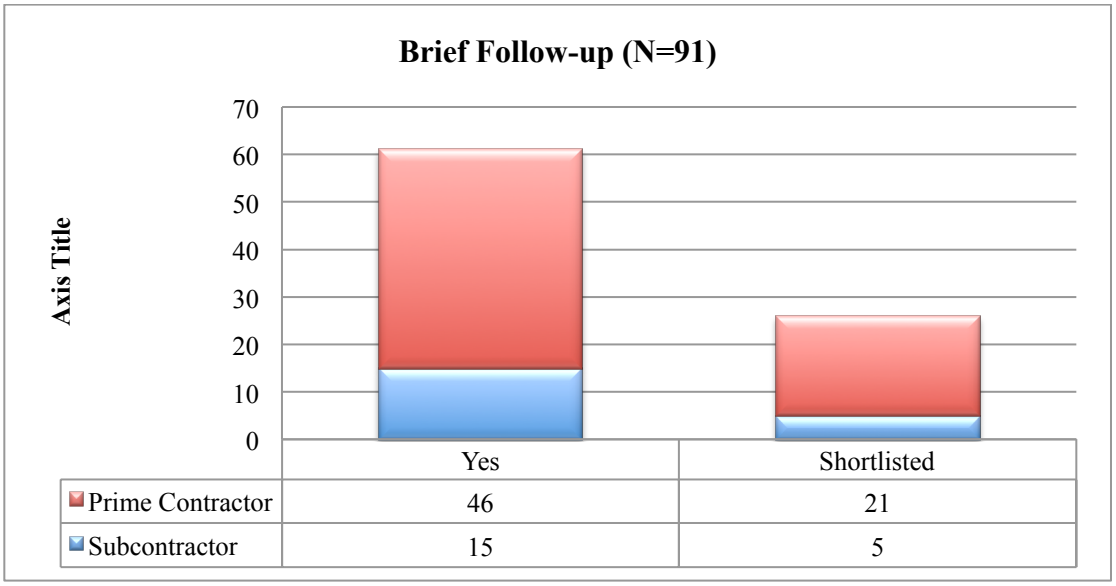


Figure 4.17: Brief Follow-up

Brief Follow-up: The respondents were asked if they would agree to a follow-up interview to obtain further understanding of their industry practices. As shown in Figure **4.17** above, 66 percent (61) of the respondents agreed to a follow-up interview while 33 percent (30) preferred not to. Among these 61 respondents, 75 percent (46) are prime contractors and 25 percent (15) are subcontractors. These respondents were then filtered based on their responses; in particular, their level of involvement in subcontracting and project administration and their encounters or awareness of a project team member with multiple contracts in a project. Based on their responses, 26 respondents were shortlisted, of which 21 are prime contractors and five are subcontractors.

4.2 Interview Data Analysis

Individuals to be interviewed were selected based on two criteria. Regardless of whether the respondents' worked primarily as a prime contractor or subcontractor, the first criterion referred to the respondent's level of involvement in the subcontract administrative work. The next criterion referred to respondents that encountered team members who had signed contracts with more than one project team member on a project or the respondent's company had signed more than one contract in a project.

Among the 61 respondents who agreed to be contacted for a follow-up interview, 26 respondents met the two criteria – 21 were prime contractors and five were subcontractors. However, only 18 of these respondents were contacted due to travel constraints, which included 13 prime contractor and five subcontractors. The driving distance of the respondents' offices was limited to within a 45-mile radius of the University of Washington. In the end, 14 willing respondents, made up of 11 prime contractors and three subcontractors, scheduled an interview. Of these respondents, 10 were in the executive level and the rest were retired, project managers, estimating managers or safety managers. Each interview lasted between 30 to 50 minutes.

Of the 14 contractors who were interviewed, data collected from 13 of the respondents was considered valid due to the level of understanding of the particular subject. The one interview deemed invalid, it was due to the discovery, during the interview that the interviewee only had a limited involvement in subcontracting and was unable to relate to the five contractual frameworks shown in Figure **3.1** above. The respondents were asked to describe which contractual strategies were commonly used and under what circumstances.

4.2.1. Traditional Subcontracting (TS)

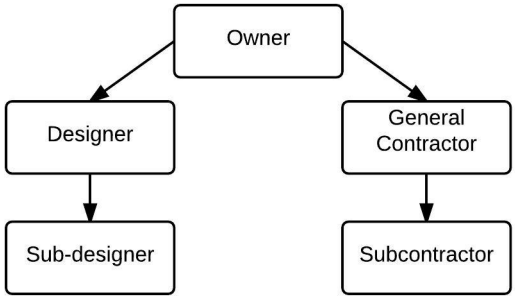


Figure 4.18: Traditional Subcontracting

The Traditional Subcontracting (TS) model, as shown in Figure **4.18** above, reflects the traditional contracting approach where the owner engages the general contractor and the designer in two separate contracts. The designer refers to the lead consultant, who may be the architect or the engineer depending on the type of project. The designer will then engage their own sub-designers, while the general contractor will engage their own subcontractors. There are no mandated functional relationships between the sub-designer and subcontractor.

All 13 interviewees described the TS model above as the most common and traditional form of procuring subcontractors and sub-consultants in Washington. One interviewee mentioned that TS is used particularly for public projects where legal requirements are designed to ensure that the bidding exercise is fair. In this case, the designer and sub-designer provide the complete set of drawings and specifications to the owner, who then puts the bidding package together. This package is issued to the potential bidders. The successful bidder will be required to comply with the documents and drawings provided. These contractors are then selected based on the lowest

bid, and not on established relationships, which may be deemed bias. One of the interviewees stated that the TS model is commonly used in a lump sum bid work while another mentioned that it is more commonly used for "cookie cutter projects." As quoted by the interviewee, this refers to projects, "where something's been done a 100 times before and it's not as unique – obviously every project is different, but the construction method is similar enough."

Two interviewees referred to TS as a method that has been more commonly used in the past. As quoted by one of the interviewees, "3 to 4 years ago, we were 90% traditional subcontracting. Today, which I like, we're doing TS-DA and DBS a lot. We've switched." The industry has changed and other forms of contracting, such as the Design-Build and GC/CM, are getting more popular. Another interviewee also stated the need to have sub-designers to ensure the applications and requirements for permits are met. In addition, a sub-designer, who is usually an architect or engineer, also has the ability to provide structural feedback. While TS may seem inefficient from a communication standpoint due to the long line of communication, most contractors curb the inefficiency by taking the initiative to ensure direct communication between parties by organizing combined meetings.

4.2.2. Traditional Subcontracting with Design Assist (TS-DA)

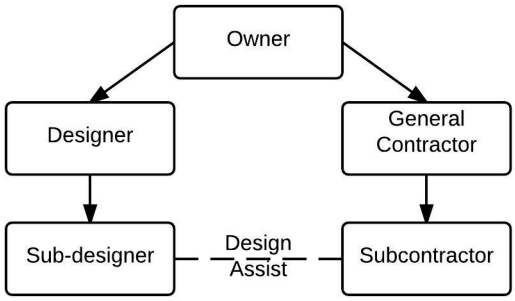


Figure 4.19: Traditional Subcontracting with Design Assist

With reference to Figure **4**.**19** above, the Traditional Subcontracting with Design Assist (TS-DA) model is similar to TS except for the presence of a mandated "Design Assist" functional relationship between the sub-designer and the subcontractor. "Design Assist" may also occur between other project team members such as the designer and subcontractor directly. However, there is no contractual relationship between the sub-designer and the subcontractor. This usually occurs in a late contractor involvement situation.

All the interviewees agreed that the TS-DA model is the next most common subcontracting model. It is referred to as a modified approach from TS, where even if the owner does not mandate design assisting, the sub-designers and subcontractors may collaborate to ensure coordination in the project. An interviewee felt that this was a "common sense approach" in which collaboration is the most logical solution to ensure that the project is coordinated in the most efficient manner. This is particularly true when the contractor is brought onboard at a later stage, which requires the sub-designer to produce preliminary drawings to include in the bidding

documents. The selected general contractor will contractually require the subcontractor to establish a "Design Assist" relationship with the sub-designer with the purpose of facilitating collaboration on the production of detailed design documents.

Whereas the TS model is more common with public projects, at least one interviewee felt that TS-DA is widely practiced in private projects due to its flexibility. Private projects are usually not governed by legal requirements like engaging the lowest bidder. Most of the time, private entities are able to select their contractors using other preferred methods, such as previously established relationships. Two interviewees mentioned that it's more common on GC/CM or negotiated work contracts. At least two interviewees believe that the TS-DA approach is more popular within larger trades, especially the Mechanical, Electrical and Plumbing (MEP) industries. One interviewee provided an example where a structural engineer (sub-designer) lead the design process and stamped the drawings submitted by the subcontractor. The structural engineer then applied for permits and provided structural feedback on the design.

The TS-DA approach also avoids issues with the constructability of the design and works well in construction projects; however, it is important to keep the general contractor in the loop. The sub-designer then provides a check and balance for the subcontractor. TS-DA also works well for subcontracting companies who do not employ individuals that are qualified and licensed to be engineers of record, and therefore, cannot use the formal Design-Build subcontracting model.

4.2.3. Design-Build Subcontracting (DBS)

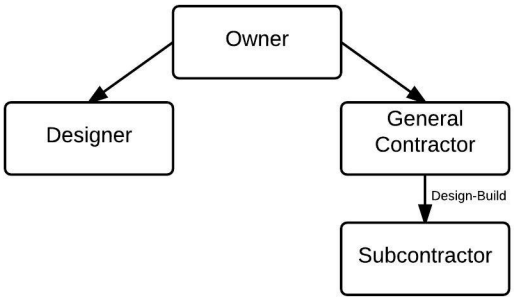


Figure 4.20: Design-Build Subcontracting

The Design-Build Subcontracting (DBS) model in **Figure 4.20** above, reflects the owner engaging the designer and the general contractor at an early stage known as early contractor involvement. Only the general contractor will engage a subcontractor in a Design-Build contract for the design and construction phases.

According to most of the interviewees, the DBS model is not as common as TS or TS-DA. While all interviewees encountered this approach, only four felt that it was a common and preferred approach. These interviewees felt that DBS is dependent on the trade of the contractor, and while two of the interviewees felt that the MEP contractors are likely to use this approach, another two felt that it works better with smaller trades or trades where separate sub-designers are typically not needed. One interviewee said that DBS works better than TS-DA as there is only one engineer to stamp the drawings, and the parties would not have to face problems with one engineer stamping over another engineer's drawings.

An interviewee who did not prefer DBS felt that it depended on how far along the design was, and that typically, the engineer who is a sub-designer should lead the design process. Five interviewees felt that it was preferred and more common to proceed with the traditional Design-Build approach, where even the designer would be under the design-builder and the owner only holds one contract with the design builder as shown in Figure **4**.**21** below. This depends on the technicality of the project, and is commonly used for MEP and curtainwall contracts.

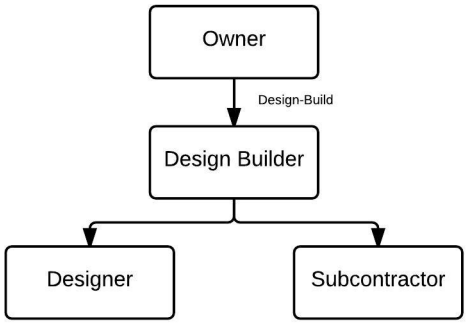


Figure 4.21: Traditional Design-Build

4.2.4. Integrated Design-Construction Subcontracting (IDCS)

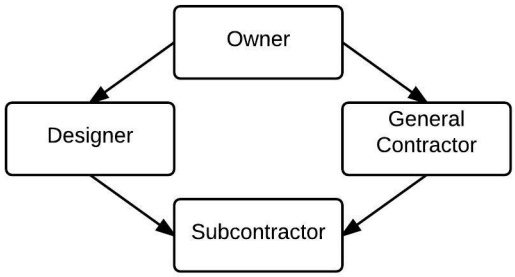


Figure 4.22: Integrated Design-Construction Subcontracting

The Integrated Design-Construction Subcontracting (IDCS) model, reflected in **Figure 4.22** above, refers to the designer and the general contractor both engaging the same subcontractor. Whereas the designers and general contractors do not hold a contractual relationship, the subcontractor is engaged for design work by the designer and engaged for construction work by the general contractor. Therefore, the subcontractor holds a contractual relationship with both the designer and general contractor concurrently. This is unlike IPD where the multi-party agreement creates a web of mutual contractual relationship among the main contractual parties.

Ten interviewees had either encountered, or were aware of, the occurrence of IDCS. However, this model is less used than the others previously described. Among these 10 interviewees, one interviewee said, “It happens frequently, but only for contracts with small values”, while others felt that it works for larger jobs. This contradiction is due to the differences in opinion based on the IDCS model. The contract value of a subcontract is related to the risk associated with a failure of performance by the subcontractor with smaller contract values leading to lower risk.

Since most of the interviewees perceived the IDCS model as bearing more risks by itself, they stated that using it on smaller subcontracts could counterbalance the heightened risk level.

One interviewee felt that this model was used for more specialized work such as sewage treatment plants or where there is a barrier of entry due to highly specialized work, which usually requires a higher contract value. Three interviewees described the situation where the designer contracts the design to the subcontractor and the contractor contracts the construction. An example of such a situation is when there are civil works involved in a project. Another interviewee describes the possibility of the situation where the architect directs the design to the general contractor and they both engage the same engineer. Therefore, in this case, instead of a subcontractor sharing multiple contracts, the engineer or sub-designer will share multiple contracts with the architect and the general contractor; however, this interviewee felt that most of the time, they engage someone different. Two interviewees felt that the same outcome of this approach is frequently achieved through functional relationships rather than contractual, but they also confirmed that multiple contractual relationships happen.

Three interviewees who have not observed this situation were asked to provide their own opinions and feedback. One interviewee described the situation as being more collaborative in order to avoid constructability conflicts and spread risk management. It is similar to having divisions within one company – therefore, subcontracting in-house. Another interviewee had a lot of experience in design assist and found that the subcontractors don't always get along with the sub-designer, which is a possible issue in IDCS. Another interviewee felt that a functional relationship is sufficient to curb inefficiency and a contractual relationship is not required.

Two interviewees felt that this strategy is most likely used in public sector projects, while at least nine felt that private sector projects are more likely to use this strategy. In public sector projects, one interviewee believes that, although it should not be the case, there are more funds allocated to the project and, due to the additional funds, there is more freedom to explore new methods. This contradicts the other interviewees who felt that private sector projects are more likely to use this strategy due to its flexibility. Private owners are not required to adhere to the public sector requirements in terms of hiring subcontractors and have the freedom to hire their subcontractors using their preferred method. As such, this flexibility allows private projects to experiment with alternative contracting strategies.

The interviewees were then asked about the possible reasons and situations where a project would decide to use IDCS. Almost half the interviewees felt that the designer or sub-designer may not have the in-house engineering disciplines or capabilities to undertake the design works and the subcontractor is better qualified to do the work. These subcontractors have become very specialized and are required to develop their own workforce, tools and resources. It is also believed that the party who installs the work will naturally be better at designing it, and at the same time, will take constructability into account, which enhances cost-effectiveness and efficiency. The subcontractors have the ability to design a more efficient system as compared to a conventional designer and they can bring the whole design and construction together. In other words, what is drawn and what is constructed are real and the price quoted will be accurate. As quoted by one of the interviewees, “One of the biggest risks in our business is interpretation and constantly trying to figure out what is the intent of the designer. You eliminate that if you choose the right subcontractor.”

IDCS is also used for economic reasons, as there is a sharing of resources, and time and money can be saved. Another interviewee said that the cost would be more expensive if one party designed and another party provided the cost estimate, which is the traditional approach. The project would be better off if the subcontractors who are capable of installing the system also designed it. This way, the design will be efficient to build. Another interviewee felt that the end users are also taken into consideration before the decision of contractual strategy is made. An owner who is building for their own use would prioritize long-term efficiency as well as if they will be getting a reasonable return on investment. As such, IDCS may be used to gain more control over the design requirements through the designer. Two interviewees felt that it was a matter of convenience, where it is more convenient for the same party to undertake all the work rather than have a separate designer. As for proprietary items, only the subcontractor would be able to provide the appropriate design for the work.

One interviewee felt that a relationship established from a past project might influence the use of IDCS as a level of trust had already been established. Two interviewees felt that IDCS was used to accommodate schedules for long lead items as the subcontractor may be hired by the designer at the early stage to procure the necessary items. Since the subcontractor already had some background knowledge of the project, the general contractor may engage the same subcontractor to complete the installation of the rest of the works to eliminate lost time spent from a separate firm understanding the project. One of the interviewees said, “It is an advantage because they [the subcontractor] already have the knowledge of the project and they came up with the original information, so they can just translate that to the construction layout information as well.”

Seven interviewees felt that the decision to use IDCS is due to the complexity and size of the project. A complex system requires a higher level of expertise and may require specialized subcontractors to complete the work. Based on his experience, one of the interviewees said that due to the size of the development, the owner dictated the structural steel subcontractor to the general contractor. Due to the owner-mandated subcontractor, and to lower the risk for the general contractor, the subcontractor shared a contract with both the general contractor and the owner as shown in Figure **4.23** below. This is where the owner pays, controls and owns the design while the general contractor pays for the structural component and the installation of the work.

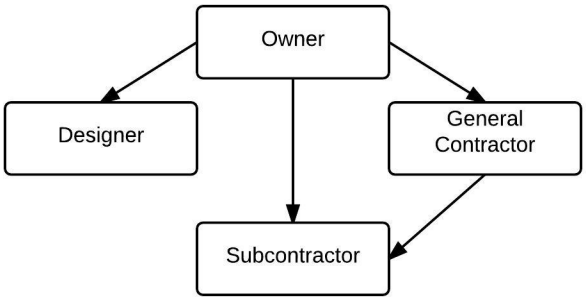


Figure 4.23: Contractual Relationship Between Owner, General Contractor and Subcontractor

In another case, where the interviewee had prior experience with IDCS, the decision to contract the same subcontractor was based on a joint decision between the designer and the general contractor, in order to provide the best solution for the project. This is when the designer will contract the subcontractor to do the design work, and the general contractor will contract the subcontractor for the construction work.

The interviewees were then asked who would be the likely parties involved in an IDCS model, and Figure **4.24** below summarizes their responses.

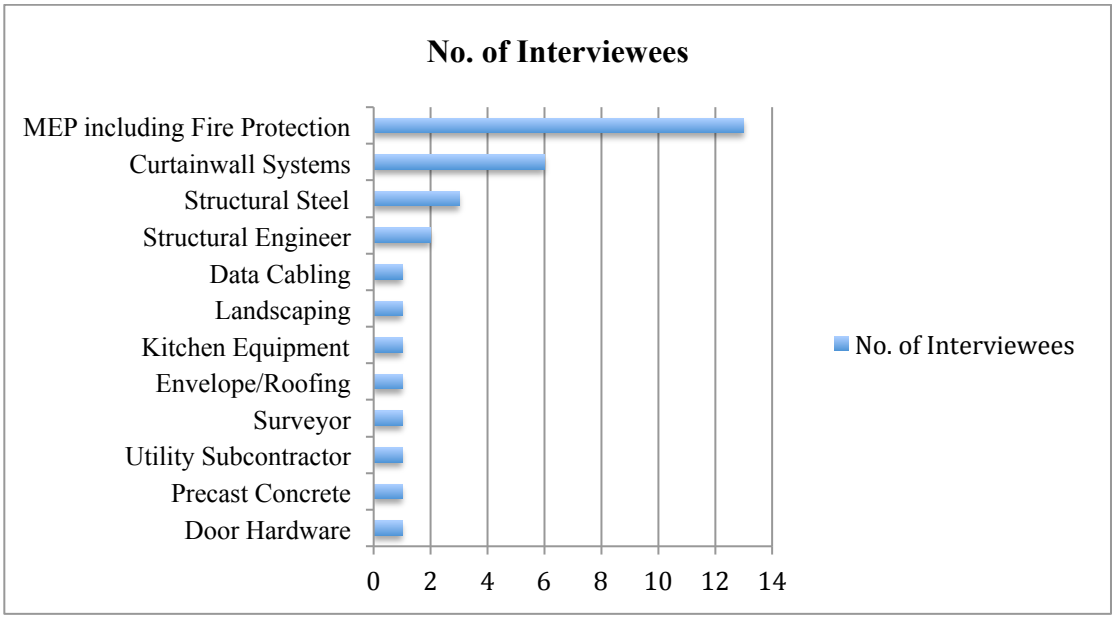


Figure 4.24: Trades Most Likely Involved in IDCS

4.2.5. Integrated Specialty Work Subcontracting (ISWS)

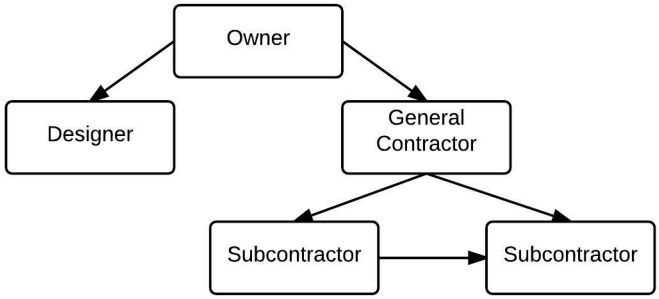


Figure 4.25: Integrated Specialty Work Subcontracting

The Integrated Specialty Work Subcontracting (ISWS) model in Figure **4.25** above is similar to the TS model in Figure **4.18** at the upper-tier. However, in this case, the general contractor engages two different subcontractors. One subcontractor sublets a portion of their work, thus forming a contractual relationship with the other subcontractor in the same project.

Eight of the 13 interviewees claimed that ISWS "happens all the time", as it is a common form of resource sharing. Of these eight, one interviewee said, "It leverages the true strength of the subcontractors. You have the advantage of the best resource doing the job they should be doing." In other words, it ensures that the subcontractors with the right set of skills and resources are doing the right work. A common example among the interviewees is the electrical contractors, who hire either earthwork or utility contractors to do trenching for them. Another interviewee, representing a general contractor, felt that the ISWS model occurs unintentionally, as he preferred to issue a change order to the subcontractor rather than have them share an additional contract. Thus, he does not see the need for this model. Another interviewee, who is also a general contractor, agreed and prefers to do a change order instead because if any problems

occur, the general contractor has to get involved. Although the general contractor does not have any responsibility in the contract between the two subcontractors, if a dispute occurs, the general contractor has to step in and smooth out any issues to ensure that project work is successfully completed. Such issues include late payments or unsatisfactory work. The general contractors also tend to lose control of the subcontractors and their scope in the ISWS model. One interviewee felt that ISWS is advantageous due to the "free market scenario, where once they're under contract for their prime scope, they are free to do what they want, as far as sub-tiers are concerned. This occurs very often." Ultimately, it does not affect the general contractor, as the subcontractors are still responsible for their full scope.

Three interviewees felt that ISWS happens from time-to-time due to efficiency reasons. This situation occurs for small scopes of work and generally does not affect the general contractor. At least four of the interviewees said that there are plenty of instances where there are no contracts involved, and these works are done based on a trust and relationship basis. In such a scenario, subcontractor 'A' helps subcontractor 'B' on a project and subcontractor 'B' returns the favor on another project they work on together. Among the interviewees representing subcontractors, one interviewee preferred contract involvement when dealing with payment and warranty issues, while the other two felt that the lack of contracts provided less paperwork to deal with, saving time and effort. Most general contractors encourage this approach as it shows a collaborative relationship between their subcontractors, which in turn provides a better quality project.

CHAPTER 5 DISCUSSION

Considering 88 percent of the survey responses were from respondents who have been in the industry for more than 15 years, it is reassuring to note that these conclusions stand on a reliable pool of knowledgeable individuals. While the survey served as a screening process for the interview, it is noteworthy that 44 percent of the prime contractors and 50 percent of the subcontractors were aware of or had encountered situations where a subcontractor signed more than one contract on a project. This shows that the practice of multiple contractual relationships on a project, represented by the Integrated Design-Construction Subcontracting (IDCS) and Integrated Specialty Work Subcontracting (ISWS) models, occurs in the industry even though it's fairly uncommon.

Out of the 13 interviewees, six personally encountered the situation where the subcontractor shared multiple roles in a project – in particular, IDCS – and all the interviewees personally encountered ISWS. The decision to use one of these contractual strategies is usually decided by the relationships the different parties share. For example, the designer and the general contractor agree to use the same subcontractor when they share a strong relationship with each other as well as the subcontractor. At least seven interviewees placed emphasis on a strong relationship. This decision also depends on the complexity of the project; as a bigger, more complex project will be likely to include a strategy when it comes to its contracting model. The use of IDCS or ISWS is encouraged for proprietary or specialized projects where the engineer or architect is not familiar with the system and would require a higher level of expertise.

The project delivery method used impacts the decision to proceed with either the IDCS or ISWS models. In a Design-Build project, the parties have greater flexibility in contracting as compared to traditional Design-Bid-Build projects. Design-Build projects are usually private sector projects and the contractual strategies used are not governed by requirements such as the public sector. The contractors can be hired based on other requirements besides price. Design-Bid-Build projects are often public projects and tend to proceed with traditional approaches such as TS (**Figure 4.18**) or TS-DA (Figure **4**.**19**). In GC/CM however, the choice of subcontracting models varies depending on the complexity of the project, as it is more likely to proceed with DBS (**Figure 4.20**).

The interviewees were asked about the advantages of the IDCS model. The advantages suggested by the interviewees included, but were not limited to, the following:

- **Triggers economic efficiencies** in terms of cost and resources because it encourages labor and cost-efficiency due to the sharing of resources.
- **Promotes communication efficiencies** because it forces good communication between the parties due to the contractual binding. It is also more efficient as it eliminates the "back and forth" communication between the subcontractor and the designer; it eliminates the learning curve by having parties work together while generating detailed designs due to the specialty designer under the subcontractor having a better knowledge of the construction phase, as they are essentially the same team.
- **Facilitates lean construction**, as the designers are more knowledgeable and take constructability into consideration when designing.

- **Provides consistency** throughout the project, as the party who is designing is also performing the installation and construction. There are fewer chances of scope gap, as one party will be in charge of the whole system and they can uncover any gaps.
- **Improves price prediction** as all parties have a better understanding of the construction and installation process.
- **Improves project quality** by reducing the amount of design and construction rework.

The interviewees also raised some concerns and provided some disadvantages of the IDCS model. The disadvantages suggested by the interviewees included, but were not limited to the following:

- **Misalignment between designer and general contractor**: The subcontractor may be subject to discarding instructions from the designer and the general contractor due to the different expectations and intent. For example, the general contractor may be primarily focused on cost driven approaches while the designer will expect better design quality. Whose instructions take precedence? There is also the potential for the subcontractor to be bias towards one party – usually the one who they share a better relationship with. Therefore, any influence over the subcontractor is less as it is split between two parties. Interviewees identified this risk factor as high.
- **More paperwork and risk of contractual complication**: The "who pays for what" issue between the general contractor and the designer. There is also a liability issue, as there is less control over design. If a part of the project is not designed correctly, besides the

subcontractor, who will be responsible contractually? Will it be the designer or the general contractor? There is a risk of blaming the other party.

- **Internal coordination failures**: Potential of a subcontractor who has different teams to do the design and construction within the same company to not coordinate as expected; therefore, the expected results may not be achieved.

While all the 13 interviewees mentioned one or more of these disadvantages, eight of the interviewees felt that these issues could be overcome by establishing of a collaborative team that shares a relationship involving trust. This strategy works well if the contractual implications are explicit in the contract and all the parties have a clear understanding of the objectives, intentions and risks involved in this strategy. As quoted by an interviewee, the project parties should "go in with their eyes open."

Eight of the 13 interviewees highly encouraged this model as long as there was no increased risk for them. This is measured by having the right team with good, honest and collaborative relationships with everyone being clearly aware of the contract and the factors involved in the contractual strategy. Some interviewees felt that having the owner fully aware of the situation benefited the project, while some felt that it was better for the owner not to be involved. Three interviewees felt that IDCS is not ideal, as a single point of contract is preferred to avoid liability issues. These interviewees feel that there is a need to have one responsible party be in charge of the on-goings of the project rather than split responsibility. To the remaining two interviewees, the approach does not matter as long as all the project team members are fully aware of their scope and responsibilities.

CHAPTER 6 CONCLUSIONS AND LIMITATIONS

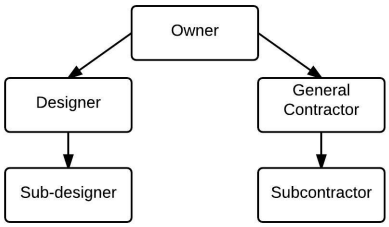
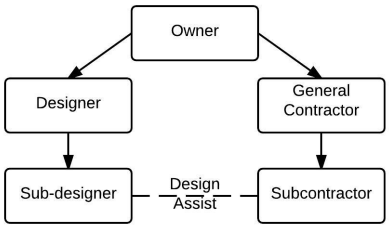
6.1 Conclusions

The findings of this thesis are based on the surveys received by the 92 respondents and the interviews held with the 13 interviewees. Based on the surveys and interviews completed, it was found that the subcontracting model used on a project is primarily situational and there are many factors involved in the decision of selecting a contractual strategy. The interviewees confirmed that all of the subcontracting models presented to them are used throughout Washington, although most of the methods used are shifting away from traditional approaches. All models are relatively common except for the Integrated Design-Construction Subcontracting (IDCS) model**.**

Such results expand upon previous findings by Clevenger and Khan (2014) that first identified the occurrence of IDCS. Since that study had linked this model to the increasing use of BIM, this issue was briefly explored with the interviewees. When asked about the impact of BIM, it was found that, although it had not had a direct impact on the changes of the contractual strategies over recent years, it did play a role as it may have triggered and/or accelerated the emergence of new subcontracting models. The general consensus of the interviewees (nine of 13) is that BIM is just another tool used in construction – yet it forces collaboration and a functional relationship between the project team members involved. In short, they believe that BIM provides an overall advantage to the industry.

Table 6.1 below, summarizes the main points for each of the contractual frameworks to provide a better understanding of their uses, opportunities and challenges.

Table 6.1: Summary of Contractual Frameworks

Contractual Framework	Description
 Figure 4.18: Traditional Subcontracting	• Most traditional form of subcontracting • Most common in public projects • Used for conventional projects • Opportunities: o Most common approach – familiar • Challenges: o Inefficient from communication standpoint
 Figure 4.19: Traditional Subcontracting with Design Assist	• Second most common subcontracting model – modified from TS • Common in private projects due to flexibility • Popular in larger trades such as MEP • Opportunities: o Avoids constructability issues o Direct communication between sub-designers and subcontractors, encouraging collaboration o Works well for subcontractors who do not have engineers of record and cannot use DBS o Works well as long as general contractor is in the loop • Challenges: o Requires an engineer to stamp over another engineers' drawings

Contractual Framework	Description

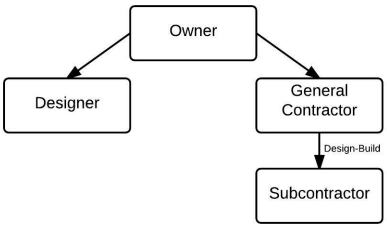


Figure 4.20: Design-Build Subcontracting
	• Not as common as TS and TS-DA, but getting increasingly popular
	• Encountered by all interviewees; a quarter of them classified it as common and preferred
	• Highly dependent on trade and project
	• Opportunities:
	  o No problems with engineers stamping over another engineers' drawings
	  o More common to proceed with the traditional Design-Build approach
	• Challenges:
	  o Need for subcontractors to retain licensed engineers
	  o Sub-designer usually necessary to lead design process

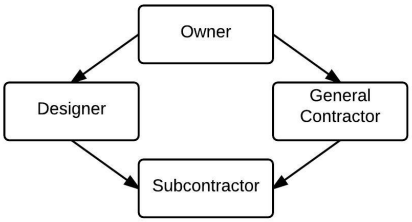


Figure 4.22: Integrated Design-Construction Subcontracting
	• Ten interviewees claim that it is rarely adopted, but present in industry
	• Mostly in private sector
	• Most likely to occur in highly specialized work such as MEP or curtainwall
	• Opportunities:
	  o Triggers economic efficiencies
	  o Promotes communication efficiencies
	  o Facilitates lean construction
	  o Provides consistency
	  o Improves price prediction
	  o Improves project quality
	• Challenges:
	  o Misalignment between designer and general contractor
	  o More paperwork and risk of contractual complication
	  o Internal coordination failures

Contractual Framework	Description

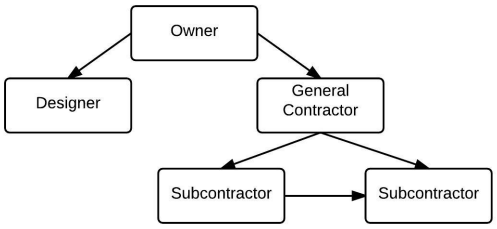


Figure 4.25: Integrated Specialty Work Subcontracting
	• Commonly used to share resources
	• Leverage true strength of subcontractors
	• Smaller scope of work
	• Often occurs without the use of contracts
	• Opportunities:
	  o Collaboration between subcontractors results in efficiency
	  o Reduction of administrative work for general contractors
	  o Reduces risk factor through contract binding
	  o Free market scenario
	• Challenges:
	  o Potential loss of control over subcontractor scope of work
	  o Additional paperwork for subcontractors

First of all, the use of each contractual framework is dependent on whether the project is public or private. The TS model frequently occurs in public projects, as it is the most traditional form of subcontracting. The process of selecting these subcontractors is governed by legal requirements, which are less flexible compared to private projects. The remaining models are less conventional and are frequently used in private projects, with the exception of the IDCS model, which is uncommon in the industry.

The project team involved, subcontract trade, project complexity and the type of building (residential, commercial, industrial, civil, etc.) also determine the strategy used. The TS-DA model is considered the next most common model due to the addition of the mandated “Design Assist” function. “Design Assist” encourages direct communication, which increases

collaboration. It was also found that in projects that apply the TS model, although it is not mandated, design assisting is initiated within the project team to curb communication inefficiencies. The use of the DBS model is highly dependent on the trade and the complexity of the project. This model is frequently used within larger trades, such as MEP. Although it is increasingly popular, it was found that most interviewees preferred to use the traditional Design-Build approach.

The use of IDCS relies on many factors, one of which is the trade of the subcontractor. For example, while the larger trades like MEP and curtainwall frequently practice this approach, trades with less complex scopes of work, such as concrete, do not. Another factor is the complexity of the project. A larger, more complex project is more likely to explore these different strategies as compared to smaller, more conventional projects. It was also found that while most interviewees encouraged the approach of closing the contractual circle on the lower levels, the projects success depends on a collaborative team with a good relationship, and a clear contract. ISWS on the other hand, occurs frequently throughout the industry, but may not always involve a binding contract. It is a common form of resource sharing, which promotes cost and time efficiency. While some subcontractors prefer the use of a binding contract to ensure commitment, others prefer not to have any form of paperwork. Similarly, while some general contractors prefer ISWS as it promotes collaboration between their subcontractors, others choose to issue a change order to ensure they do not lose control over their subcontractors' scope of work.

A major finding is that, in all the non-traditional contractual frameworks, the MEP trade is most likely to experiment with the newer strategies. All the 13 interviewees agreed that the MEP trade is complex and will require a higher level of collaboration. This shows that the industry is constantly looking for better ways to deal with the complexity of MEP in order to minimize the related issues and risks such as coordination and communication.

6.2 Limitations

A major limitation of this research is that the data collection was restricted to respondents whose offices are located within a 45-mile radius of the University of Washington. This reduced the data set extensively, as among the respondents who agreed to an interview, only 26 had the perceived knowledge and experience required for this research.

Another limitation faced was the target audience. This research only targeted general contractors and subcontractors. Considering owners and consultants (i.e. designers such as architects and engineers) also have a role in the decision of contractual strategies, a separate survey should be designed suited to these potential respondents in order to understand the whole industry's point of view and not just the contractor's. Some interviewees expressed that designers may have a resistance towards the IDCS model due to a variety of reasons, including liability. Therefore, interviews with other consultants are necessary to validate this theory.

As an attempt to externally validate the research, a smaller study was concurrently conducted with contractors in Colorado. This survey was conducted in collaboration with Professor Caroline Clevenger at the University of Colorado Denver. With a similar method used, three respondents of 13 were shortlisted for an interview. These interviews will be conducted for future development, and its process and results are not included in this thesis. The intention of these interviews in Colorado is to cross-validate the responses of the interviewees in Washington.

In addition to the above, a survey should be developed to address a larger nationwide pool of participants to collect an extensive and geographically diverse data set. This survey will be designed using information received from the interviewees, and it will be expanded to include owners and designers to fully understand the acceptance and resistance of this contractual approach.

CHAPTER 7 REFERENCES

Anderson, Stuart D., and Jeffrey S. Russel. *Guidelines for Warranty, Multi-Parameter, and Best Value Contracting.* National Cooperative Highway Research Program, D.C: National Academy Press, 2001.

Arditi, David, and Ranon Chotibhongs. "Issues in Subcontracting Practice." *Journal of Construction Engineering and Management* 131, no. 8 (August 2005): 866-876.

Beardsworth, A.D., and E.T. Keil. "Management, Transience and Subcontracting: The case of the Construction Site." *Journal of Management Studies* (Blackwell Publishing Limited), November 1998: 603-625.

Black , Carolynn, Akintola Akintoye, and Eamon Fitzgerald. "An Analysis of Success Factors and Benefits of Partnering in Construction." *International Journal of Project Management*, June 1999.

Burr, Kevin L., and Chad B. Jones. "The Role of the Architect: Changes of the Past, Practices of the Present, and Indications of the Future." *International Journal of Construction Education and Research* 6, no. 2 (May 2010): 122-138.

Choudhry, Rafiq M., Jimmie W. Hinze, Muhammad Arshad, and Hamza F. Gabriel. "Subcontracting Practices in the Construction Industry of Pakistan." *Journal of Construction Engineering and Management* (ASCE), December 2012: 1353-1359.

Clevenger, Caroline M., and Ricardo Khan. "Impact of BIM-Enabled Design to Fabrication on Building Delivery." *Practice Periodical on Structural Design and Construction* (ASCE), February 2014: 122-128.

Elazouni, Ashraf M., and Fikry G. Metwally. "S-Sub: Decision Support System for Subcontracting Construction Works." *Journal of Construction Engineering and Management* (EBSCO Publishing), May/June 2000: 191-200.

Eom, Creed S.J., Seok H. Yun, and Joon H. Paek. "Subcontractor Evaluation and Management Framework for Strategic Partnering." *Journal of Construction Engineering and Management* 134:11 (November 2008): 842-851.

Hinze, Jimmy, and Andrew Tracey. "The Contractor-Subcontractor Relationship: The Subcontractor's View." *Journal of Construction Engineering and Management* 120, no. 2 (1994): 274-287.

Hsieh, Ting-Ya. "Impact of Subcontracting on Site Productivity: Lessons Learned in Taiwan." *Journal of Construction Engineering and Management*, March/April 1998: 91-100.

Humble, John, David Jackson, and Alan Thomson. "The Strategic Power of Corporate Values." *Long Range Planning* 27, no. 6 (1994): 28-42.

Jamieson, M.J., A. Thorpe, and A. Tyler. "Refocusing Collaboration Technologies in the Construction Value System." *Construction Informatics Digital Library*, 1996.

Kelly, David. "Examination of Design-Assist Subcontracting." *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction* (ASCE) 6, no. 3 (2014): 04514001-1-04514001-7.

Kumaraswamy, Mohan M., and Jason D. Matthews. "Improved Subcontractor Selection Employing Partnering Principles." *Journal of Management in Engineering*, May/June 2000: 47-57.

Lu, Shaokai, and Hong Yan. "A Model for Evaluating the Applicability of Partnering in Construction." *International Journal of Project Management* 25, no. 2 (2007): 164-170.

Macneil, Ian R. "Contracts: Adjustment of Long-term Economic Relations Under Classical, Neoclassical and Relational Contract Law." *Conference of Polish and American Jurists.* Lancut: Heinonline, 1977. 854-905.

Maturana, Sergio, Luis Fernando Alarcón, Pedro Gazmuri, and Mladen Vrsalovic. "On-Site Subcontractor Evaluation Method Based on Lean Principles and Partnering Practices." *Journal of Management in Engineering*, April 2007: 67-74.

Ndekugri, I.E. "Subcontractor Control: The Key to Successful Construction." *The Chartered Institute of Building*, 1988.

Rahman, Motiar M., and Mohan M. Kumaraswamy. "Contracting Relationship Trends and Transitions." *Journal of Management in Engineering*, October 2004: 147-161.

Reich, Robert B. "Entrepreneurship Reconsidered: The Team as Hero." *Harvard Business Review*, May-June 1987: 77-83.

Schaufelberger, John, and Len Holm. *Management of Construction Projects: A Constructor's Perspective.* Upper Saddle River, N.J: Prentice Hall, 2002.

Shash, Ali A. "Bidding Practices of Subcontractor in Colorado." *Journal of Construction Engineering and Management* (EBSCO Publishing), May/June 1998: 219-225.

Shimizu, Julio Y., and Francisco F. Cardoso. "Subcontracting and Cooperation Network in Building Construction." *10th Conference of the International Group for Lean Construction.* Brazil: Cooperation network in housing, 2002.

Stockenberg, Richard A. "The Perils of Bid Shopping." *Building Design and Construction*, March 2001.

Ulubeyli, Serdar, Ekrem Manisali, and Aynur Kazaz. "Subcontractor Selection Practices in International Construction Projects." *Journal of Civil Engineering and Management* 16, no. 1 (2010): 47-56.

Wong, Francis, and Lawrence So. "Restriction of Multi-layers Subcontracting Practice in Hong Kong - Is it an Effective Tool to Improve Safety Performance of the Construction Industry." *3rd International Conference of CIB Working*, 2002: 229-235.

APPENDIX A

Survey for Prime Contractors

Q1. How long have you worked in the construction industry?

- o Less than 2 years
- o Between 2 and 5 years
- o Between 5 and 15 years
- o More than 15 years

Q2. What position do you presently hold in your company?

- o Executive
- o Project Manager
- o Superintendent
- o Other

Q3. How long have you been in this position with your company?

- o Less than 2 years
- o Between 2 and 5 years
- o Between 5 and 15 years
- o More than 15 years

Q4. What is the approximate value of the largest construction contract you have worked personally on in the last 3 years?

- o Less than 1 Million
- o Between 1 and 10 Million
- o Between 10 and 50 Million
- o Between 50 and 250 Million
- o More than 250 Million

Q5. Does your company mostly work as a General Contractor or as a Specialty Contractor?

- o General Contractor
- o Specialty Contractor
- o Other

Q6. Does your company mostly act as a Prime Contractor or as a Subcontractor?

- o Prime Contractor
- o Subcontractor

Q7. To what extent are you involved in the administration of work subcontracted out by your company?

- o Fully involved
- o Somewhat involved
- o Aware but non involved
- o Not aware - Not involved

Q8. To understand the general size of your company, what is the estimated average annual revenue (in US dollars) of your company for the past 3 years?

- o Less than 10 Million
- o Between 10 and 50 Million
- o Between 50 and 250 Million
- o Between 250 and 500 Million
- o Between 500 Million and 1 Billion
- o More than 1 Billion
- o I don't know

Based on your responses to the previous questions, we know your company acts mostly as a Prime Contractor. Therefore, kindly respond to the following questions referring to projects for which your company acted as a Prime Contractor over the last 3 years.

Q9. Over the last 3 years, what delivery methods are commonly used in the projects for which your company acted as a Prime Contractor? (check all that apply)

- o Design-Bid-Build
- o Design-Build
- o GC/CM, CM/GC, CM@Risk, GMP
- o Cost Reimbursable / Cost Plus
- o Other

Q10. Over the last 3 years, your company selected subcontractors based on: (check all that apply)

- o Owner/client mandate
- o Design requirements
- o Best qualifications
- o Lowest responsible bid
- o Established business relationships with project team members
- o Other

Q11. Over the last 3 years, do any of your subcontractors also have signed contracts with any other project team members?

Note: Even if it is unusual, in addition to a contract with the prime contractor, some subcontractors may also have a contract for a separate scope of work with the owner or other project party. By asking you this question, we want to know if you have experienced this approach. Answer yes if you have observed this approach

- o Yes
- o No
- o Unsure

Q12. Which of the following parties has a direct functional relationship with any of your subcontractors? (Check all that apply)

Note: Functional relationships refer to relationships between entities with a direct communication, but without a direct contract

- o Owner/Client
- o Prime Contractor
- o Specialty Contractor
- o Designer
- o Other project team members

Q13. May we contact you for a brief follow-up conversation on this questionnaire?

- o Yes
- o No

APPENDIX B

Survey for Subcontractors

Q1. How long have you worked in the construction industry?

- o Less than 2 years
- o Between 2 and 5 years
- o Between 5 and 15 years
- o More than 15 years

Q2. What position do you presently hold in your company?

- o Executive
- o Project Manager
- o Superintendent
- o Other

Q3. How long have you been in this position with your company?

- o Less than 2 years
- o Between 2 and 5 years
- o Between 5 and 15 years
- o More than 15 years

Q4. What is the approximate value of the largest construction contract you have worked personally on in the last 3 years?

- o Less than 1 Million
- o Between 1 and 10 Million
- o Between 10 and 50 Million
- o Between 50 and 250 Million
- o More than 250 Million

Q5. Does your company mostly work as a General Contractor or as a Specialty Contractor?

- o General Contractor
- o Specialty Contractor
- o Other

Q6. Does your company mostly act as a Prime Contractor or as a Subcontractor?

- o Prime Contractor
- o Subcontractor

Q7. To what extent are you involved in the administration of work subcontracted out by your company?

- o Fully involved
- o Somewhat involved
- o Aware but non involved
- o Not aware - Not involved

Q8. To understand the general size of your company, what is the estimated average annual revenue (in US dollars) of your company for the past 3 years?

- o Less than 10 Million
- o Between 10 and 50 Million
- o Between 50 and 250 Million
- o Between 250 and 500 Million
- o Between 500 Million and 1 Billion
- o More than 1 Billion
- o I don't know

Based on your responses to the previous questions, we know your company acts mostly as a Subcontractor. Therefore, kindly respond to the following questions referring to projects for which your company acted as a Subcontractor over the last 3 years.

Q9. How do you select your subcontractors? (Check all that apply)

- o Owner/Prime Contractor mandate
- o Design requirements
- o Best qualifications
- o Lowest responsible bid
- o Established business relationships with project team members
- o Other

Q10. How is your company usually selected as a Subcontractor? (Check all that apply)

- o Owner/client mandate
- o Design requirements
- o Best qualified
- o Lowest responsible bid
- o Established business relationship
- o Other

Q11. Over the last three years, which of the following parties has had a direct contractual relationship with your company on a single project? Please refer only to projects for which your company acted as a subcontractor. (Check all that apply)

- o Owner/Client
- o Prime Contractor
- o Specialty Contractor
- o Designer
- o Others project team members

Q12. Over the last 3 years, did your company sign more than one contract on a single project?

Note: Even if it is unusual, in addition to a contract with the prime contractor, some subcontractors may also have a contract for a separate scope of work with the owner or other project party. By asking you this question, we want to know if you have experienced this approach. Answer yes if you have observed this approach.

- o Yes
- o No
- o Unsure

Q13. May we contact you for a brief follow-up conversation on this questionnaire?

- o Yes
- o No

APPENDIX C

Email to Respondents Without Contact number/ No Voice Mail

Hello again Mr. XX,

I am the graduate student from the Construction Management department in UW who had contacted you last month regarding my research on the Emergent Subcontracting Practices. Thank you for completing the survey sent by my academic advisor, Prof Giovanni Migliaccio. We really appreciate your support in contributing to our research.

As you had agreed to follow up with us, we would like to arrange for an interview with you to explain the purpose of our research. We also wish to understand your and your company's practices regarding subcontract procurement.

Kindly let us know a convenient date and time between January 7 and January 17 for us to conduct this interview. (We would also appreciate if you could provide us a contact number for ease of arrangement.)

Thank you for your valuable time!

Regards,
Natasha Osmanbhoy

Email to Respondents with Voice Mail

Hello again Mr. XX,

I tried to contact you *yesterday* and left a voice message on your phone. Hope this email reaches you well.
I am the graduate student from the Construction Management department in UW who had contacted you last month regarding my research on the Emergent Subcontracting Practices. Thank you for completing the survey sent by my academic advisor, Prof Giovanni Migliaccio. We really appreciate your support in contributing to our research.

As you had agreed to follow up with us, we would like to arrange for an interview with you to explain the purpose of our research. We also wish to understand your and your company's practices regarding subcontract procurement.

Kindly let us know a convenient date and time over between January 7 and January 17 for us to conduct this interview.

Thank you for your valuable time!

Regards,
Natasha Osmanbhoy

Email to Successfully Contacted Respondents

Dear Mr. XX,

We really appreciate your support in contributing to our research. As discussed over the phone, based on your availability, we suggest conducting our interview at the following date and time: -

Date:
Time:
Location:

Do let us know if the abovementioned is convenient for you.

Kindly note that my academic advisor, Professor Giovanni Migliaccio, and my research partner, Salvatore Biancardo will be joining me for this interview.

Thank you for your valuable time!

Regards,
Natasha Osmanbhoy

Voicemail Script

Hello Mr. XX. My name is Natasha from the University of Washington and I had recently contacted you for a survey on the Emergent Subcontracting Practices. I would like to arrange a follow up interview with you. Please give me a call back at (832) 982-2689. Thank you!

Calling Script

Hello Mr. XX, my name is Natasha from the UW and you had recently completed a survey for my research on the Emergent Subcontracting Practice. Do you remember me?

Great! Do you have a couple of minutes to spare?

Thank you! Based on your responses for the survey, we felt that you have the experience and information we need for this study. We would like to set up an interview at your convenience. Depending on your response, this interview may be between 30 to 50 minutes. May we know your availability between 7 and 9* January? Where would be a convenient place for you?

Thank you! I will be sending you a confirmation email including the date, time and location. See you then! Have a great week ahead.

APPENDIX D

Interview Guidelines

Fig. A

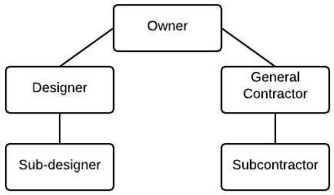


Fig. B

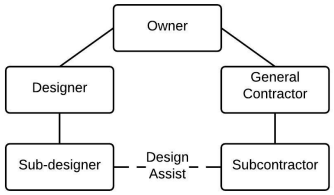


Fig. C

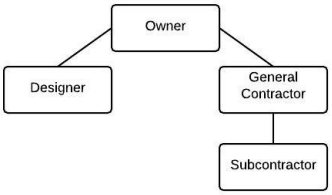


Fig. D

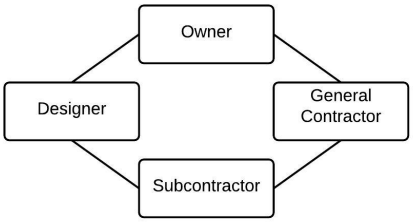
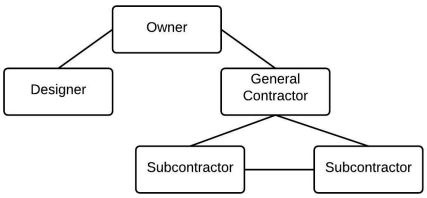


Fig. E



We want to know more about the emergence of the situation where a subcontractor shares a contractual relationship with more than one other party in the project.

Have you ever experienced or heard of such a situation or anything similar?		
Yes		No
How often have you encountered this situation? Can you briefly explain the parties involved?		Given this situation, who do you think are the likely parties involved?
Why was such a strategy was used?		Why do you think such a strategy was used?
Who shared the contractual relationships? Were there instances where a single company had multiple roles in a project?		Who are likely to share contractual relationships? Do you think there are instances where a company had multiple roles in a project?
Did the Project Delivery Method and Procurement Method affect the decision?		Do you think the Project Delivery Method and Procurement Method affects the decision?
What were the advantages?		What do you think are its advantages?
What were the disadvantages? Were there any major problems encountered?		What do you think are the disadvantages? Do you anticipate any major problems?