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Emergent subcontracting models and owner involvement in selecting subcontracting strategies and participants in the U.S. construction industry

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Abstract

Prime contracting models for a wide variety of Project Delivery Methods (PDM) have been described with great detail in the practice-oriented and academic literature. However, the same depth of understanding about contractual relationships between general and specialty contractors is less known, especially as specialty contractors are being increasingly involved in earlier project phases. The objective of this research is to describe subcontracting models, owner involvement scenarios, and their variations across the United States. Results of a nationwide survey and follow-up semi-structured interviews with industry practitioners indicate many subcontracting models are currently in use and that project owner involvement is widely variable. Presentation attendees should expect to gain a greater understanding of each of the identified subcontracting models as well as to learn the advantages, disadvantages, regional variations, and owner involvement under each.

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Keywords: subcontracting model; nationwide; variations.

1. Introduction

Subcontracting practices greatly influence contractual responsibilities and construction activities as subcontractors generally execute 60 to 70 percent of the total project activity [1]. These subcontracting practices might vary depending on whether the project delivery method (PDM) and procurement policies selected allow for participants to be added to the project within a wide range of contractual options. Selecting the right subcontracting practice may promote the integration of the process deployed by contracting parties, increase reciprocal trust and achieve better project performance. Another possible improvement is the development of long-term associations between general contractors and subcontractors once they have contractually established the precise hierarchical structures for successful project performance.

Given these potential benefits, understanding the scope of emerging subcontracting practices is one way construction participants can try to improve project performance. To provide better information, this paper presents a brief synopsis of the findings from a U.S. nationwide survey and follow-up set of semi-structured interviews. The results are evaluated to identify the correlations between samples, to detect regional subcontracting patterns, and to identify potential new subcontracting practices.

2. Subcontracting practices

This research expands upon a previous study that identified and evaluated subcontracting practices in the state of Washington [2]. The previous study identified five different subcontracting practices. Figure 1 shows the following five subcontracting models found by Osmanbhoj: 1) traditional subcontracting (TS); 2) traditional subcontracting with design assist (TS-DA); 3) design-build subcontracting (DBS); 4) integrated design-construction subcontracting (IDCS); 5) integrated specialty work subcontracting (ISWS).

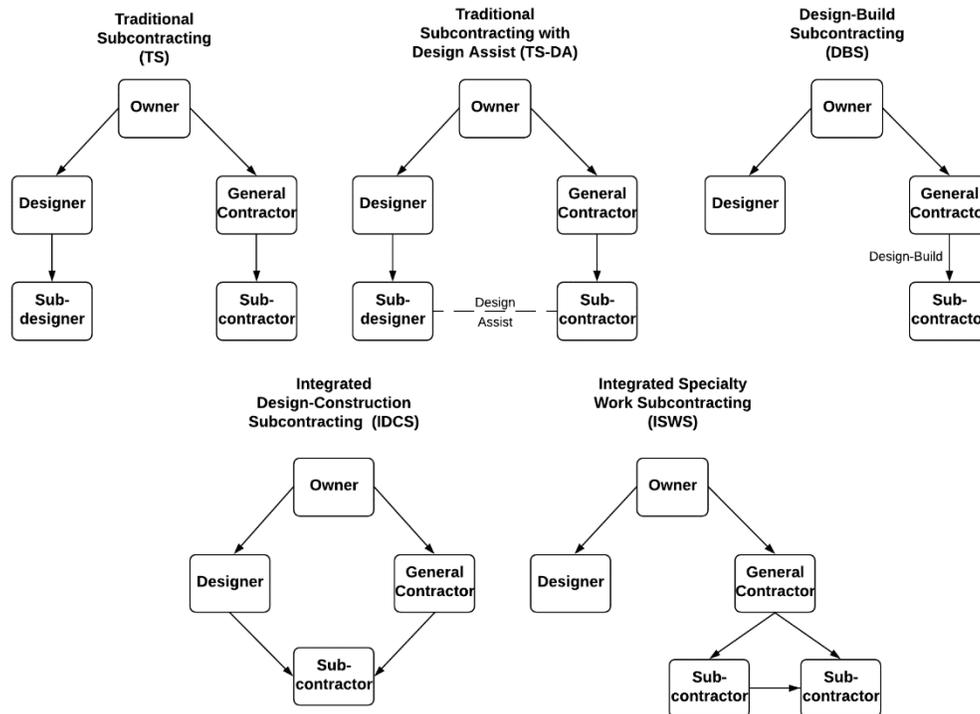


Fig. 1. Subcontracting practices.

2.1. Traditional subcontracting (TS)

This subcontracting practice is based on the segregation of design and construction activities into two separate supply and contracting chains. This practice generates two linear phases where the first phase is the development of drawings and specifications by the designer without the support of the contractor. Once these documents are used to secure prices from competing contractors, the second phase is focused on implementing construction activities [3,4]. As a result of these practices, the specialty expertise on each side (design and construction) work under isolated conditions where the direct link is their prime.

2.2. Traditional subcontracting (TS-DA)

Design-Assist practice mediates the segregation typical of TS by creating a path for collaboration between specialty designers and specialty contractors. This new collaboration path is described as the improvement of design and constructability concerns throughout the early involvement of specialty contractors in design activities. Although the specialty contractor is participating during the design process, this practice is not intended to transfer design liabilities to specialty contractors [5]. Under this collaborative design agenda, construction participants are expected to achieve better project results in cost, time, and quality.

2.3. Design-Build Subcontracting (DBS)

Design-Build (DB) has been described extensively in the literature. However, DB has two different scenarios to involve specialty contractors during the project stages. The first scenario centers on the work of architects/engineers and general contractors; this joint-venture business association will design and provide the specification parameters to all specialty contractors to complete the design process together. This scenario sees the occurrence of DB integration at the prime contracting level and has been described in the literature. The second scenario focuses on the integration of DB principles at the subcontracting level and is novel; It relies on the selection of specialty contractors that will deliver both design and construction services within their specialty based on the specialty contractor's knowledge and solutions [6]. The last scenario resembles Osmanbhoy's DBS practice.

2.4. Integrated Design-Construction Subcontracting (IDCS)

The IDCS practice is one example of collaborative contracts and practices where the lead designer and general contractor have distinct contracts with the same specialty contractor who develops design documents and controls construction activities. IDCS practices have not been well-identified in the literature, but there are some insights which describe the potential links with this practice. For example, one case study details IDCS practices that were applied to a design-to-fabrication methodology for structural rebar using building information modeling (BIM) tools under a Construction Manager/General Contractor contractual strategy [7].

2.5. Integrated Specialty Work Subcontracting (ISWS)

The ISWS practice is focused on the development of collaborative methods to improve time and cost requirements. This development is created by all the specialty contractors using the detection of critical tasks that may quantify the correct amount of effort, participation, and resources in each construction activity for every subcontractor. This specialty contractor supportive agenda allows the existence of terms like reliability and contribution which generate revenue rewards that can be shared among team members [8].

3. Research methodology

A mixed methods approach was selected in order to provide a more nuanced view on subcontracting strategies and increase the generalizability of the results. The sample population for the study was obtained from multiple sources including the American Subcontractor Association (ASA), the Associated General Contractors of America (AGC), and from appropriate research team member contacts. A list of over 800 individuals was developed from these sources.

The first phase of data collection focused on obtaining information through an online survey instrument. The main goal of the survey was to establish contact with individuals in the dataset and to identify their key characteristics. The survey for both general and specialty contractors were both divided into two parts. The first part focused on obtaining general company information (i.e., type, size, market experience, and value), interviewee position, and professional contracting experience. The second part centered on gathering enough information to elucidate contractual approaches for each participant type.

In the second phase of data collection, semi-structured interviews were conducted. Based upon the response to whether or not respondents would like to be contacted for a follow-up telephone interview, the research team evaluated survey response data before selecting candidates. This allowed the research team to ensure interviewees would possess the required experience in and knowledge of subcontracting practices and models. The interviews were focused on obtaining all the insights from the participants related to the five key subcontracting practices, potential variations, and owner involvement.

4. Data collection and analysis

4.1. Online survey

The survey was sent to 847 participants from 598 different companies; a total of 170 participants completed the survey representing a 20.07% participation rate. We excluded from the analysis seven survey response sets because they were incomplete. Tables 1, 2, and 3 show the survey top three answers from all the participants in three different sections: general information, general contractor, and specialty contractor segments. The online survey information was categorized following US Census Bureau Divisions.

QUESTION	FIRST RESPONSE	SECOND RESPONSE	THIRD RESPONSE
<i>Location</i>	West North Central (46%)	West South Central (18%)	South Atlantic (14%)
<i>Participants' Experience</i>	More than 15 years (61%)	Between 5 and 15 years (18%)	Between 2 and 5 years (13%)
<i>Participants' Position</i>	Executive (51%)	Project Manager (17%)	Estimator/ Project Eng (13%)
<i>Current Position Experience</i>	From 0 to 5 years (41%)	More than 15 years (35%)	Between 5 and 15 years (23%)
<i>Largest Contract Size</i>	Between 1 and 10 M (43%)	Between 10 and 50 M (27%)	Between 50 and 250 M (11%)
<i>Contractual Role</i>	Prime Contractor (61,37%)	Subcontractor (102, 63%)	N/A
<i>Participants' Involvement</i>	Fully (54%)	Somewhat (38%)	Aware (6%)
<i>Participants' Company Size</i>	Between 10 and 50 M (33%)	Less than 10 M (21%)	Between 50 and 250 M (17%)

Table 2. General contractor segment.

QUESTION	FIRST RESPONSE	SECOND RESPONSE	THIRD RESPONSE
<i>Adopted PDM^M</i>	Design-Build (65%)	Design-Bid-Build (63%)	CM at Risk (62%)
<i>Subcontracting Selection Criteria</i>	Lowest Responsible Bid (85%)	Best Qualifications (82%)	Business Relationships (67%)
<i>Multiple Contractual-Relationship</i>	Yes (57%)	No (24%)	Unsure (19%)
<i>Other Contractual Parties</i>	Prime Contractor (70%)	Owner/Client (49%)	Designer (45%)

Table 3. Specialty contractor segment.

QUESTION	FIRST RESPONSE	SECOND RESPONSE	THIRD RESPONSE
<i>Subcontractor Selection Criteria</i>	Business Relationships (62%)	Best Qualifications (54%)	Lowest Responsible Bid (51%)
<i>Procurement Approach from GC</i>	Business Relationships (72%)	Lowest Responsible Bid (71%)	Best Qualifications (60%)
<i>Contractual Bounded Parties</i>	Prime Contractor (95%)	Owner/Client (65%)	Specialty Contractor (39%)
<i>Multiple Contractual-Relationship</i>	Yes (50%)	No (47%)	Unsure (3%)

4.2. Follow-up interview

Based on the selection participants criteria from the Research Methodology chapter, the expected response for the follow-up interviews was set at 36 interviews - 13 General Contractors and 23 Specialty Contractors. After three invitation cycles, 20 participants (13 General contractors and 7 Specialty Contractors) confirmed and completed the follow-up interview, resulting in a final response rate of 55.55 percent. Table 4 and 5 summarize all the key comments from the follow-up participants about the subcontracting practices, variations, and owner involvement.

The subcontracting models that have were explained to the participants were generally accepted and widely used by most participants. For this reason, the interviewees did not introduce any new subcontracting practices as expected in the research objectives. In contrast, the research identified small variations that can be used to augment existing models in several ways. These include four variations to Integrated Specialty Work Subcontracting strategy and modification to the Design-Build Subcontracting strategy. Table 4 indicates these modifications where all the secondary bullets are placed. Figure 2 graphically illustrates these five variations.

Table 4. Follow-up interview subcontracting model and variations findings.

SUBCONTRACTING MODEL	FINDINGS
Traditional Subcontracting (TS)	<ul style="list-style-type: none"> • Public Projects: 80 to 100% use • Private Projects: reduction from 80 to 50% use • Industry standard • GC complete control over SC • Lack of involvement in design stages • Low bid mentality
Traditional Subcontracting Design-Assist (TS-DA)	<ul style="list-style-type: none"> • It represents 10 to 15% use • Related to a pre-selected piece of equipment • Increase building coordination • Few SCs are capable of performing this method • Command chain issues • Risk of shifting design liabilities to SC
Design-Build Subcontracting (DBS)	<ul style="list-style-type: none"> • It represents 10 to 15% use • Under traditional DB increases to 30% use <ul style="list-style-type: none"> ◦ Lead designer inclusion in DB entity • SCs are fully committed to design process • Design flexibility to start construction faster • Better design and cost control • Design stage could be time-consuming
Integrated Design-Construction Subcontracting (IDCS)	<ul style="list-style-type: none"> • Less than 10% use • Participants limited knowledge • Participants pointed to the West Coast as the zone where this method happens • Highly specialized products and early design associations among construction parties • Collusion and communication issues.
Integrated Specialty Work Subcontracting (ISWS)	<ul style="list-style-type: none"> • GCs have a 50% acceptance rate • SCs have a 100% acceptance rate • Allows few responsibilities points due to the avoidance of bringing external contractors • Risk of delaying activities due to scope interference • GCs develop solutions to avoid this supportive agenda <ul style="list-style-type: none"> ◦ Strict contractual arrangements ◦ GC control over repetitive activities using specific specialty trades • SCs develop solutions to execute specialized tasks <ul style="list-style-type: none"> ◦ Inclusion to sub-subcontractors (third tiers) to one subcontractor ◦ More than one link among subcontractors using sub-subcontractors

Table 5. Follow-up interview comments for IPD and owner involvement findings.

SUBCONTRACTING MODEL	FINDINGS
Integrated Project Delivery (IPD)	<ul style="list-style-type: none"> • IPD practices in Missouri and Colorado • Revenue based on sharing contingency of saving and losses • The revenue sharing is the incentive to improve coordination and collaboration • Successful IPD projects have the right combination of people • Owners must keep the economic factor alive to make IPD projects attractive
Owner Involvement	<ul style="list-style-type: none"> • GCs have more opportunity to participate in the owner selection process of PDM and procurement • SCs could participate if owners select them early in the process • Owners' request to be taught is the opportunity to create sophisticated owners who understand the construction industry better

5. Conclusions

The ability to generalize the research finding to all regions of the U.S. is somewhat limited due to regional bias. Analysis of the online survey and follow-up interview data show that the majority of survey participants were from the West North-Central and West South-Central regions while interviews were generally concentrated in the central region of the United States. Nevertheless, the online survey and the follow-up interviews both exhibited a strong participant understanding of project delivery methods. In addition, research participants were adept at differentiating between various subcontracting strategies. However, within each PDM and procurement strategy, regional variations did exist. Divisional samples had some degree of equilibrium among traditional practices (i.e., DBB, lowest responsive bid, and no multi-contractual arrangements) and more collaborative techniques (e.g., DBB, CM/GC, business

relationships, and best value), some regions were found to work with more traditional methods than others. Participants from the Pacific, Mountain, and West North Central divisions of the U.S. Census Bureau reported using more collaborative and multi-contractual practices. The other regions demonstrated a more equilibrated sample, with a tendency toward traditional methods. Given the regional bias, the research can infer two conclusions. First, all five subcontracting models studied to address the most common scenarios, and characteristics are familiar to the nationwide participant sample. Second, the need to find better contractual arrangements creates effective variations from the original models, and as such subcontracting practices are dynamic by nature.

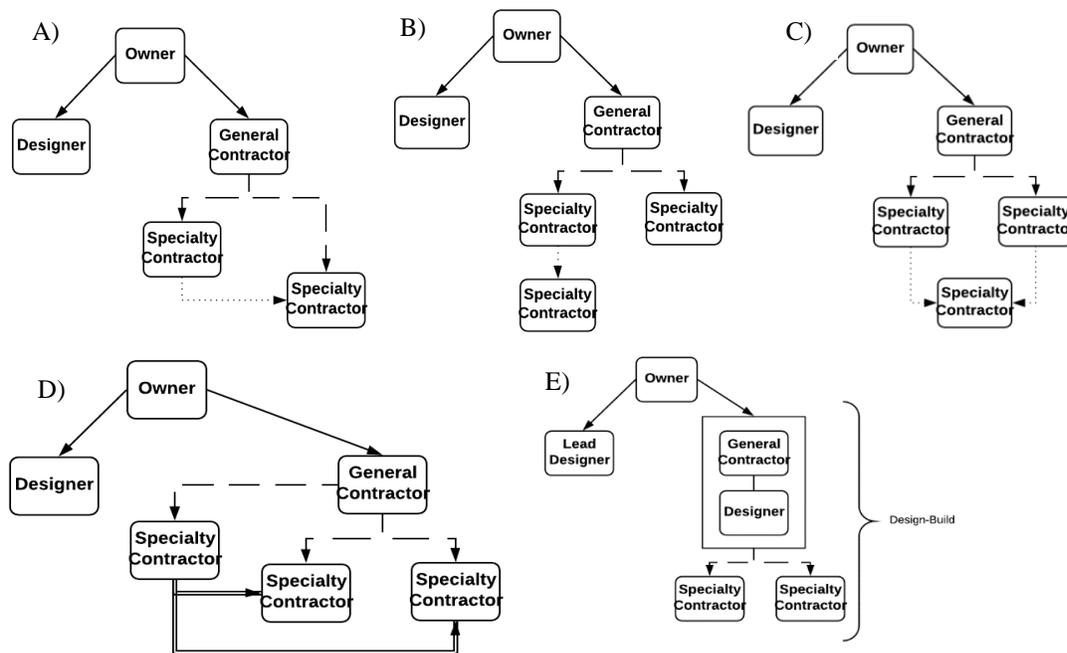


Fig. 2. A) ISWS variation 1; B) ISWS variation 2; C) ISWS variation 3; D) ISWS variation 4; E) DBS variation-confirmation 1.

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