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## Innovative Subcontracting Models: Advantages, Disadvantages and Lessons Learned from their Use - A US Perspective

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# Outline

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## Introduction

- ❑ Premise
- ❑ What is subcontracting
- ❑ Research Objectives
- ❑ Literature Review

## Study

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- ❑ Interviews
- ❑ Findings

## Conclusions

- ❑ Conclusions
- ❑ Future work  
(interactive)

# Premise

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- The initial research questions for this study originated in 2013 when attending a presentation on a different topic.

Clevenger, C. and Kahn, R. (2014). "Impact of BIM-Enabled Design-to-Fabrication on Building Delivery," *ASCE Practice Periodical on Structural Design and Construction*, 19 (1), 122-128.

- Importance of descriptive research

- Prof. Raymond Levitt

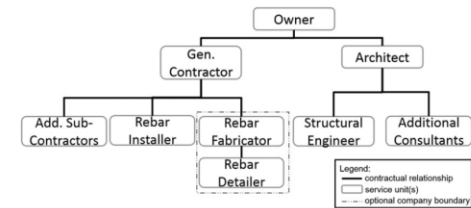


Fig. 1. Contractual relationships of a traditional design-bid-build project team as related to the design and delivery of concrete reinforcing in the foundation and structure

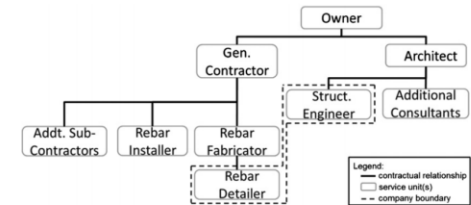


Fig. 2. Contractual relationships of the CM/GC-led project team on the fed building as related to the design and delivery of concrete reinforcing in the foundation and structure

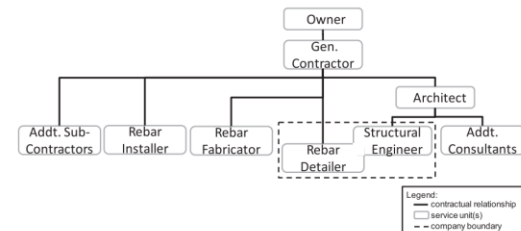


Fig. 3. Contractual relationships of the design-build project team on the med pavilion as related to the design and delivery of concrete reinforcing in the foundation and structure

# Premise

- Following up with the lead author (i.e. Prof. Clevenger), some initial research questions were formulated.
- This study was conducted in three phases
  - ▣ Osmanbhoy (2015) identified and evaluated subcontracting practices in Washington State.
  - ▣ Nagarimadugu (2016) evaluated owner involvement in subcontracting decisions in Washington State.
  - ▣ Fernandez (2019) expanded the research scope through surveys and interviews to participants from all over the United States.
- Acknowledgements:
  - ▣ Professors: C. Clevenger, S. Biancardo, R. Gebken.
  - ▣ Former Students: Natasha Osmanbhoy, Sravya Nagarimadugu, Rafael Fernandez

# What is subcontracting?

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**Prime contractors:** construction firms that contract directly with the project owner in opposition to *subcontractors* that do not have a direct contractual relationship with the project owner.

**Subcontractors:** construction firms that do not have a direct contractual relationship with the project owner in opposition to *prime contractors* contract directly with the project owner. Subcontractors are usually, but not necessarily, specialty contractors who contract with and are under the supervision of a prime contractor that is usually, but not necessarily, a general contractor.

Migliaccio, G.C. and Holm, L.A. (2018). *Introduction to Construction Project Engineering*, Routledge, Glossary.

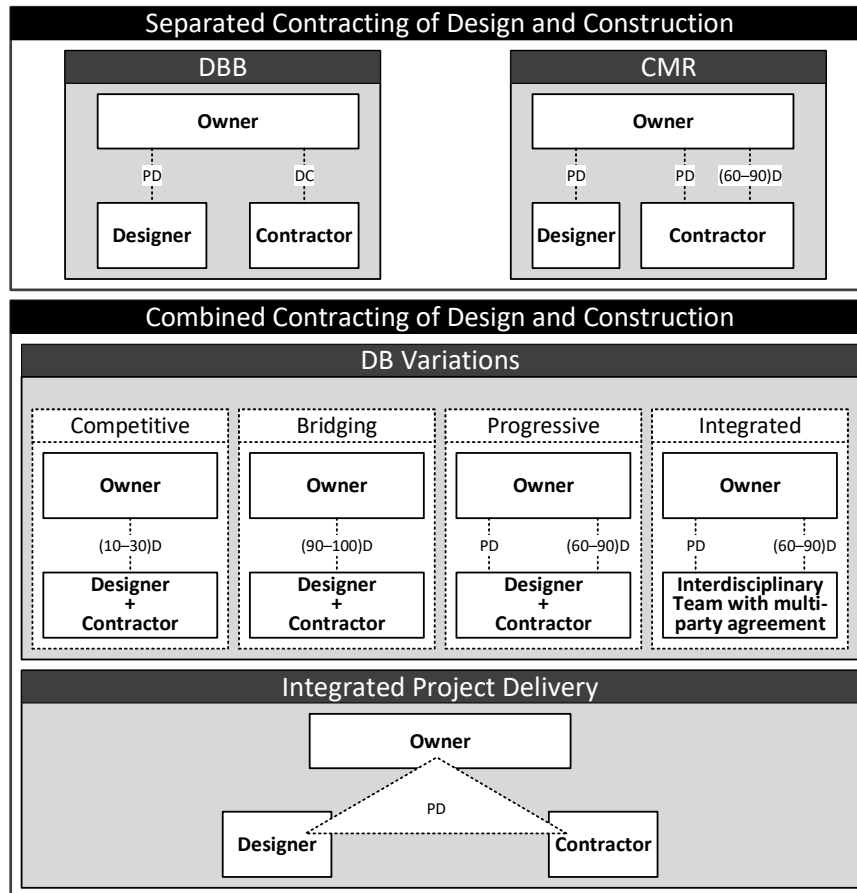
In the building sector, subcontractors often execute up to 60 to 70 percent of total construction budget (Maturana et al. 2007).

Why?

# Project Delivery Methods:

## Historically focused on Prime Contracting Models

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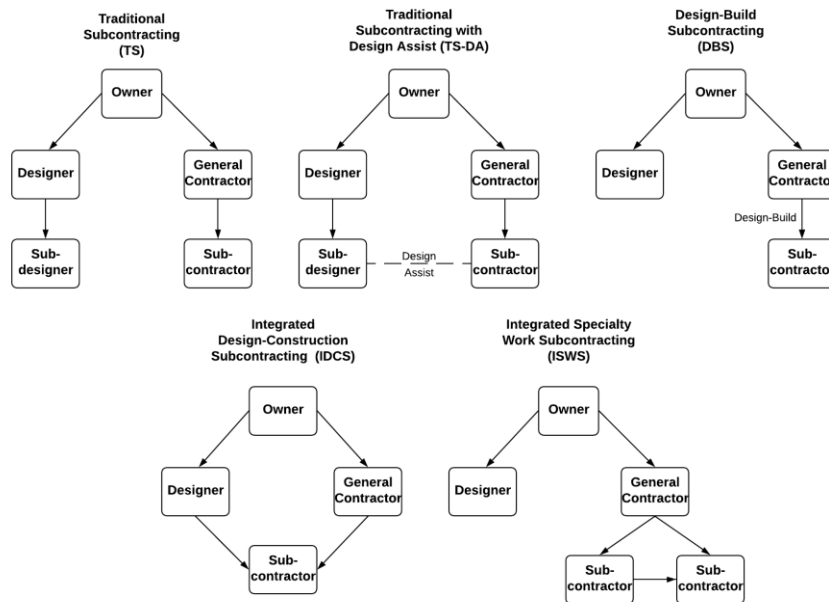


**Project delivery method:**  
“defines the relationships, roles, and responsibilities of project team members and the sequence of activities required to complete a project”  
(Gibson and Walewski 2001; pp.1)

# Project Delivery Methods:

## Placing subcontracting models under the spotlight

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(Osmanbhoy 2015)

### Research Objectives

- Identify emergent subcontracting models
- Evaluate owner's role in selecting subcontracting practices



# Literature Review

- Project Delivery Methods
  - ▣ PDM Role Description (Harper and Molenaar 2014).
  - ▣ Collaborative PDMs (El Asmar et al. 2013).
  - ▣ Subcontractor selection and partnering (Kumaraswamy and Matthews 2000).
  
- Collaborative practices in delivering projects
  - ▣ Five non-collaborative factors that match those found by Vaux and Kirk (Schaufelberger 2000).
  - ▣ The challenge of connecting the fragmented activities of each subcontractor into a more collaborative and efficient method (Kim and Ballard 2005).



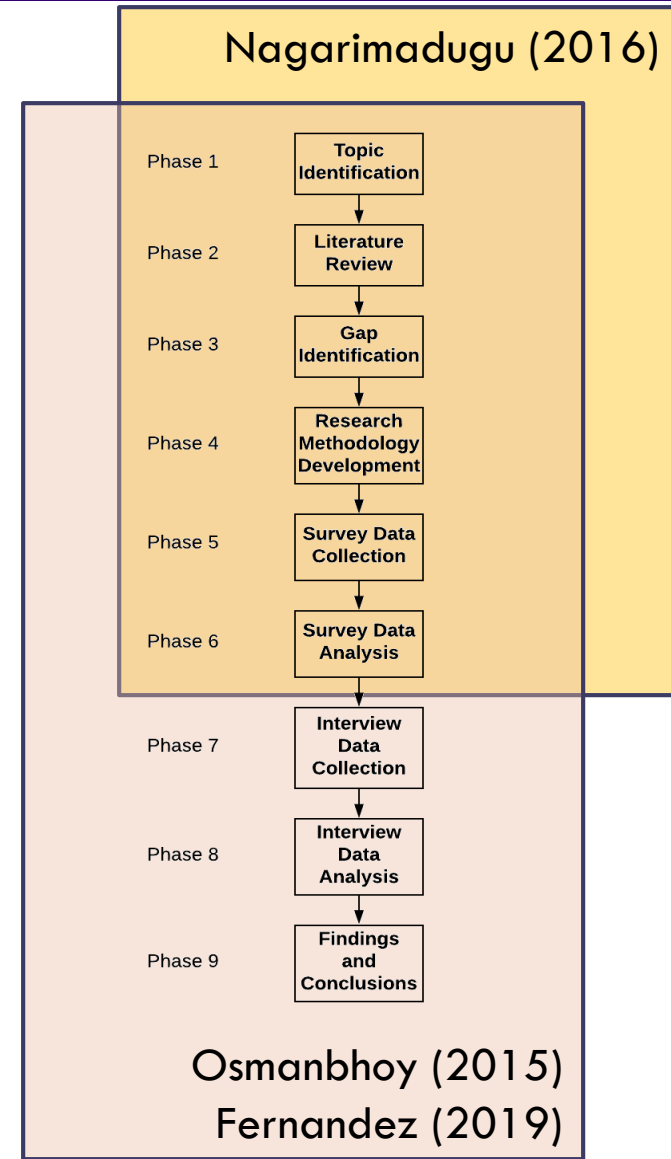
# Literature Review

- Subcontracting models
  - ▣ Positive and negative outputs in traditional subcontracting with design assist (Kelly 2014).
  - ▣ Design-build subcontracting different structures and nominated contractors (Gil et al. 2001).
  - ▣ The work-plan reliability (WPR) & contribution-based benefit-allocation (CBBA) benefits in integrated specialty work subcontracting (Javanmardi et al. 2018).
  - ▣ Team flexibility concept in cross-functional project team composition and evolution (CFPT) for IPD projects (Laurent and Leicht 2017).

# Research Process

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- Two phases
- Pilot studies
  - ▣ Geographically-narrowed scope: Washington State
- Follow-up
  - ▣ Expand dataset to incorporate information from other states



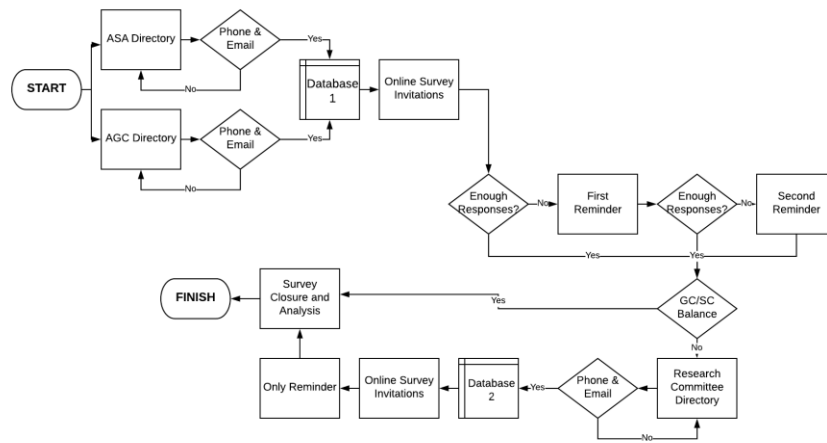
# Research Methodology

## Four Phases

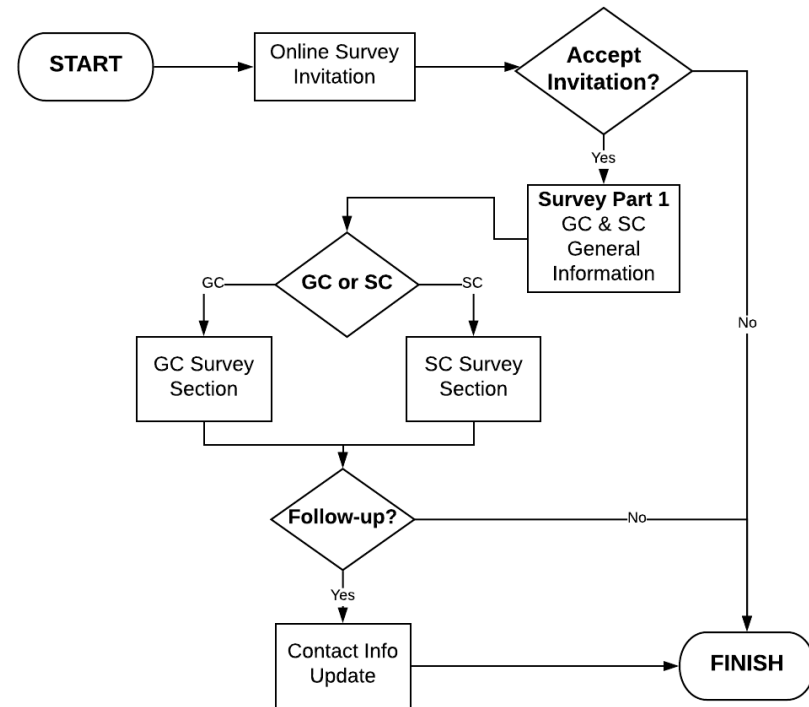
1. Selection of Participants
2. Online Survey Process
3. Interview Participant Selection
4. Follow-up Interview Process

# Research Methodology

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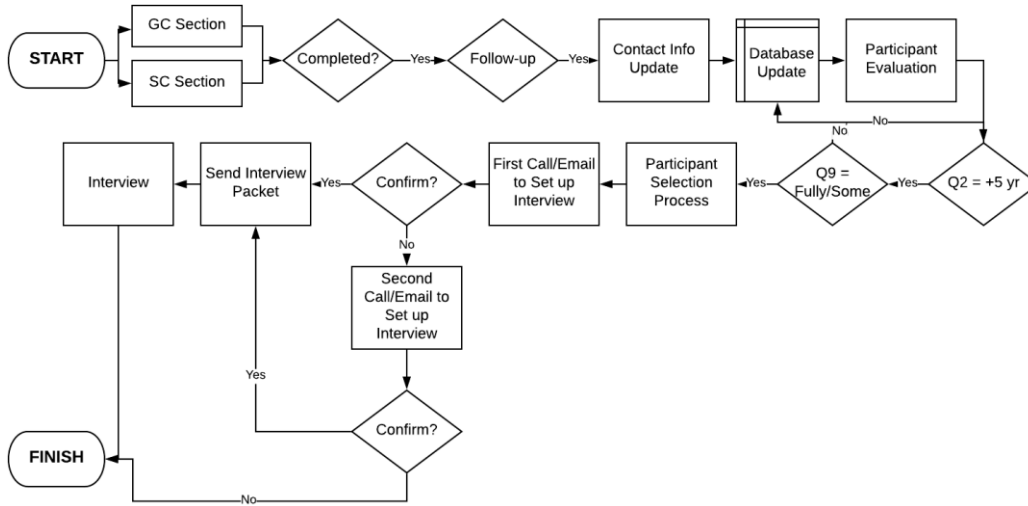


Selection of Participants

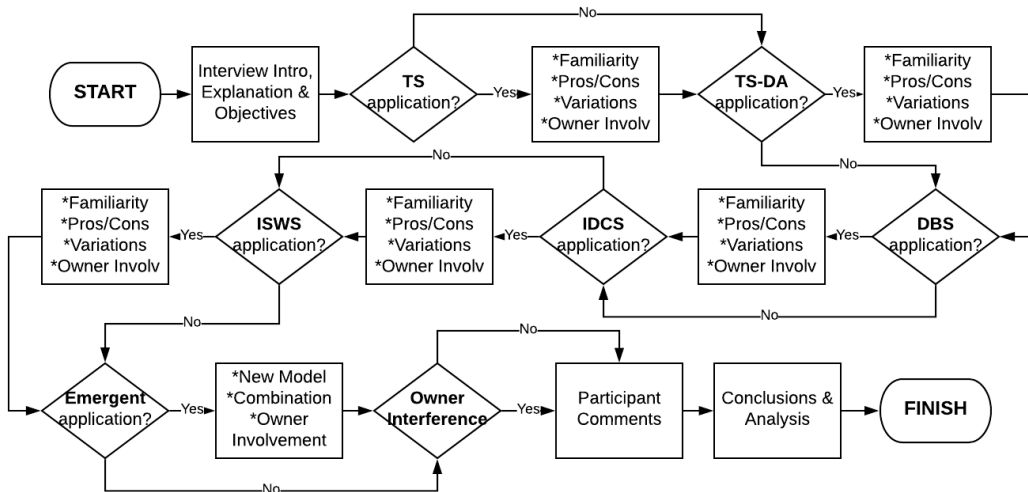


Online Survey Process

# Research Methodology

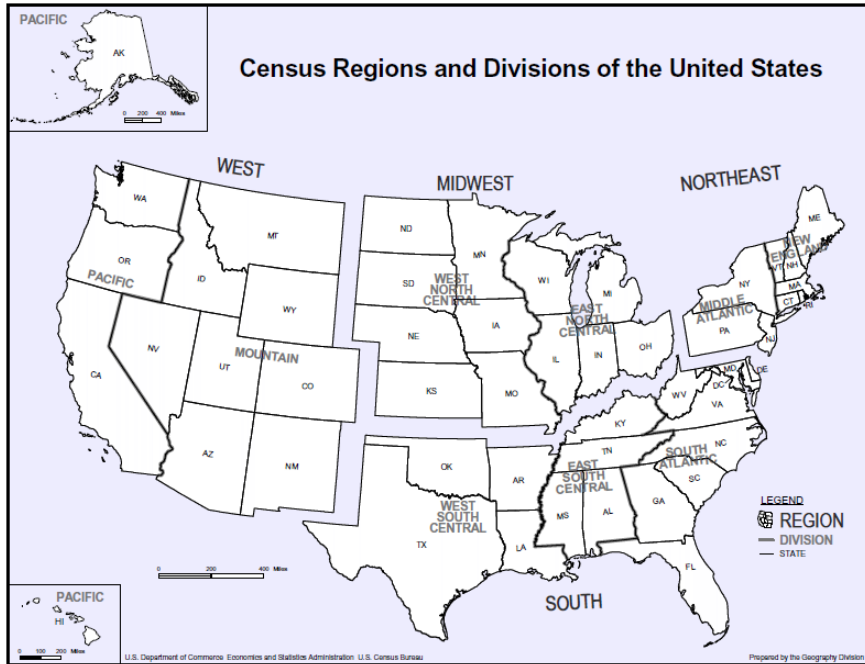


Interview Participant Selection



Follow-up Interview Process

# Survey Data Collection & Categorization

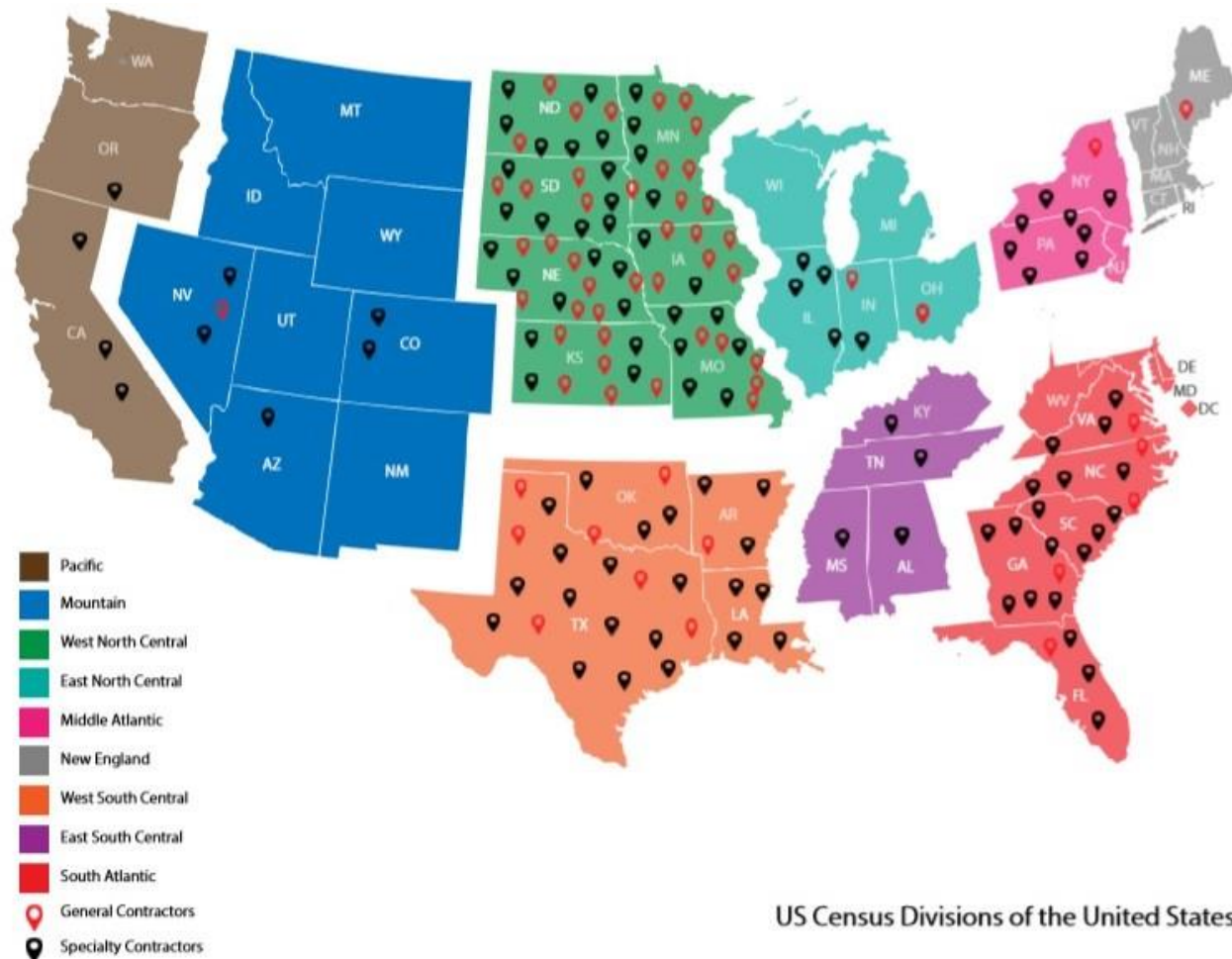


(US Census Bureau 2010)

Survey Results	
Survey Sent	847 individuals
	598 companies
Responses	170 individuals
	~170 companies
Incomplete Responses	7 individuals
Response Rate	19.2%
Respondent Group	61 General Contractors
	102 Specialty Contractors

# Survey Responses (Fernandez 2019)

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# General Information (N=163)

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QUESTION	FIRST RESPONSE	SECOND RESPONSE	THIRD RESPONSE
<b>Experience</b>	More than 15 years (61%) <sup>S</sup>	Between 5 and 15 years (18%)	Between 2 and 5 years (13%)
<b>Job Title</b>	Executive (51%)	Project Manager (17%)	Estimator/Project Engineer (13%)
<b>Involvement in Subcontracting</b>	Fully (54%)	Somewhat (38%)	Aware (6%)
<b>Company Size</b>	Between 10 and 50 M (33%) <sup>S</sup>	Less than 10 M (21%) <sup>S</sup>	Between 50 and 250 M (17%) <sup>G</sup>

**S = Most respondents being Specialty Contractors**

**G = Most respondents being General Contractors**

# General Contractor Responses (N=61)

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<b>QUESTION</b>	<b>FIRST RESPONSE</b>	<b>SECOND RESPONSE</b>	<b>THIRD RESPONSE</b>
<b>Adopted PDM<sup>M</sup></b>	Design-Build (65%)	Design-Bid-Build (63%)	CM at Risk (62%)
<b>Subcontracting Selection Criteria<sup>M</sup></b>	Lowest Responsible Bid (85%)	Best Qualifications (82%)	Business Relationships (67%)
<b>Multiple Contractual-Relationship</b>	Yes (57%)	No (24%)	Unsure (19%)

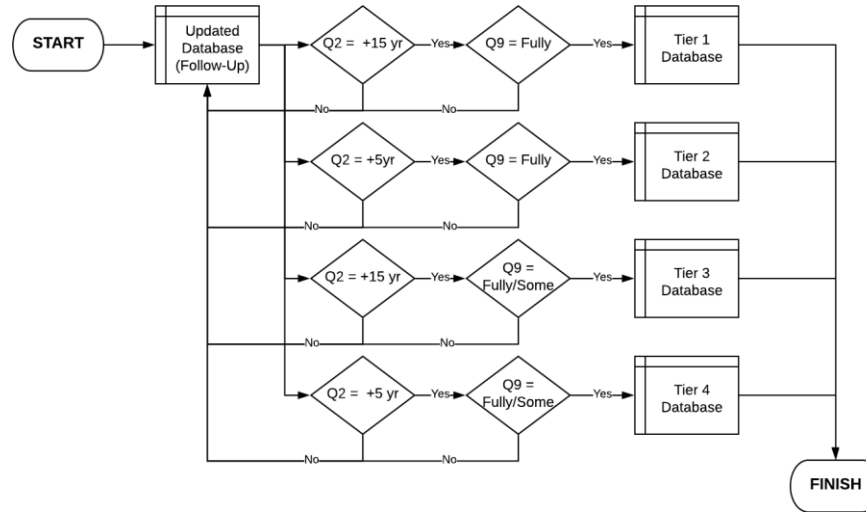
**M = Participants could select all options that may apply to them.**

# Specialty Contractor Responses (N=61)

<b>QUESTION</b>	<b>FIRST RESPONSE</b>	<b>SECOND RESPONSE</b>	<b>THIRD RESPONSE</b>
<b>Subcontractor Selection Criteria<sup>M</sup></b>	Business Relationships <b>(62%)</b>	Best Qualifications <b>(54%)</b>	Lowest Responsible Bid <b>(51%)</b>
<b>Procurement Approach from GC<sup>M</sup></b>	Business Relationships <b>(72%)</b>	Lowest Responsible Bid <b>(71%)</b>	Best Qualifications <b>(60%)</b>
<b>Multiple Contractual-Relationship</b>	Yes <b>(50%)</b>	No <b>(47%)</b>	Unsure <b>(3%)</b>

**M = Participants could select all options that may apply to them.**

# Interview Participants & Categorization Process

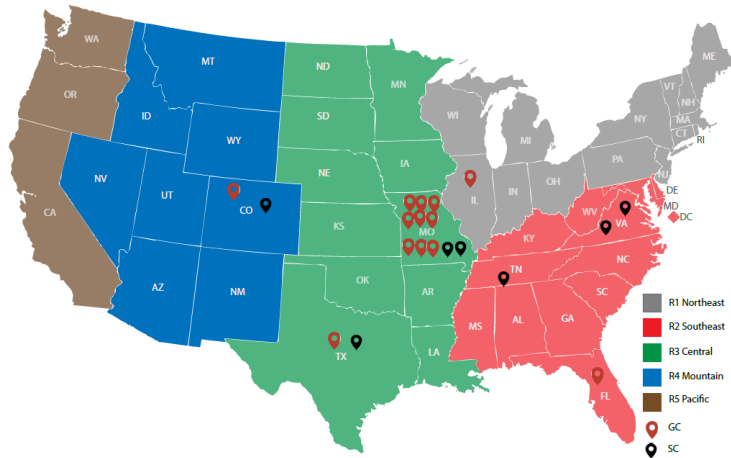


**SUMMARY TABLE**

TYPE	Accept Follow-Up		Construction Experience		Involvement in Administering Subcontractors							
			YR>5	YR>15	Fully & Somewhat				Full			
					YR>5		YR>15		YR>5		YR>15	
GC	41	R1 - R4*	26	13	25	R1 - R3	13	R2, R3	19	R1 - R3	10	R2, R3
SC	67	R1 - R5	63	55	56	R1 - R5	49	R1 - R5	28	R1 - R5	24	R1, -R4
<b>TOTALS</b>	<b>108</b>		<b>89</b>	<b>68</b>	<b>81</b>		<b>62</b>		<b>47</b>		<b>34</b>	
*R4 with less 2 yr					Tier 4		Tier 3		Tier 2		Tier 1	

# Interview Data Collection & Location

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- 13 General Contractors (10 fall within Tier 1)
- 7 Specialty Contractors (6 fall within Tier 1)
- 20 Interviews = 55.55%

NEW REGION		CONTAINS
R1	NORTHEAST	EAST NORTH CENTRAL + MIDDLE ATLANTIC + NEW ENGLAND
R2	SOUTHEAST	EAST SOUTH CENTRAL + SOUTH ATLANTIC
R3	CENTRAL	WEST NORTH CENTRAL + WEST SOUTH CENTRAL
R4	MOUNTAIN	MOUNTAIN
R5	PACIFIC	PACIFIC

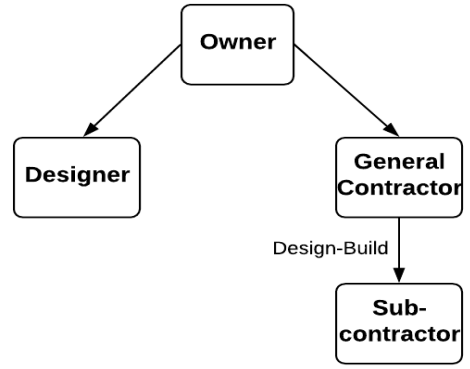







# Interview Data Analysis

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SUBCONTRACTING MODEL	FINDINGS
<p data-bbox="183 374 697 476"><b>Design-Build Subcontracting (DBS)</b></p>  <pre data-bbox="200 508 672 873">graph TD; Owner[Owner] --&gt; Designer[Designer]; Owner --&gt; GC[General Contractor]; GC -- Design-Build --&gt; SC[Sub-contractor]</pre> 	<p data-bbox="765 374 931 411"><b>Adoption</b></p> <ul data-bbox="765 425 1881 514" style="list-style-type: none"><li>• This approach is present on 10 to 15% of projects, but under DB Prime Method, it can rise to 30%.</li></ul> <p data-bbox="765 576 954 614"><b>Comments</b></p> <ul data-bbox="765 628 1881 1276" style="list-style-type: none"><li>• Known advantages include<ul data-bbox="861 679 1881 968" style="list-style-type: none"><li>• Trading partners and SCs are fully committed to the project due to contractual arrangements.</li><li>• Design flexibility provides the opportunity to start construction faster than normal methods.</li><li>• Performance requirements allow better design and cost control for GC and SC.</li></ul></li><li>• Known issues include<ul data-bbox="861 1033 1881 1276" style="list-style-type: none"><li>• GC awareness of over cost risk due to design iteration.</li><li>• Design stage could be time-consuming if this isn't planned correctly.</li><li>• Some participants noted the importance of including a lead designer inside the DB entity.</li></ul></li></ul>

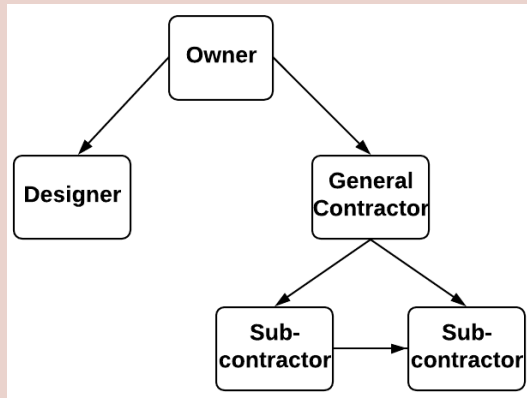


# Interview Data Analysis

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## SUBCONTRACTING MODEL

### *Integrated Specialty Work Subcontracting (ISWS)*



## FINDINGS

### Adoption

- This approach is present on most projects even if is often implemented without a formal agreement between subcontractors.

### Comments

- SC noted only benefits using the model.
- Participants identified more elaborated vertical hierarchies where third tiers are introduced.
- Some GCs have developed solutions to avoid mutual help among SCs.
- Known advantages include
  - The method allows projects with fewer people in on-site activities; few responsibility points.
  - Avoidance of bringing external participants or additional resources.
- Known issues include
  - SCs keep the same resources when their scope increase, producing delays.
  - Scope interference among SCs due to the activity merge.

# Interview Excerpts

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- Traditional subcontracting (TS)
  - “It was just straightforward [...] this is your work, here's what you've excluded, here's what we expect with [to receive], you're intended to cost [these concepts]”
- Traditional subcontracting with design-assist (TS-DA)
  - “The general contractor chooses a specialty subcontractor [that] can influence the design, which allows that specialty subcontractor as well as a general contractor to have some input regarding constructability, and ultimately constructability can affect cost and schedule.”
- Design-build subcontracting (DBS)
  - “The standard practices that can be implemented in specific construction activities [...], and allow the contractor to think out of the box for better solutions.”

# Interview Excerpts

- Integrated design-construction subcontracting (IDCS)
  - “The design team, their agreement with them [specialty contractors] to assist overall design, all the interior storefront, all the doors, and hardware to the project. Then, on the general contractor side, they are the fabricator, and they install all these storefront doors and hard work”
- Integrated specialty work subcontracting (ISWS)
  - “Usually are very specialized because they do these activities for a living, so they are the best candidates.”
- Owner involvement in subcontracting
  - “I want to competitively bid the electrical package of work because I want more than one price, but I would like to work with ABC electric at all possible.”

# Conclusions - Survey

- Analysis of the online survey data showed that all nine divisions participated in the process, but most respondents were based in the West North Central and West South Central divisions.
- Most used approaches
  - PDM: DBB, DB & CM@Risk.
  - Procurement: Best Value, Low Responsible Bid, and Business Relationships.

# Conclusions – Interviews

- The results confirmed the outputs from the online survey where the major number of participants came from central follow-up region generating a regional bias again.
  - Regional bias will be mitigated by merging data from Fernandez (2019) with Osmanbhoy (2015).
    - Working on it for a journal submission
- Respondents from Western and Central regions seem comfortable experimenting with the most progressive contracting models to find the best solutions; those in the Atlantic region tend to rely on traditional methods without questioning their effectiveness.



# Conclusions – Interviews

- Western and Central regions reported being motivated to take more risks to discover contracting methods.
- The five subcontracting methods cover the most common scenarios.
- Subcontracting practices have a dynamic nature due to the constant improvement in construction practices.

# Future Research



# Summing it Up

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## Introduction

- ❑ Premise
- ❑ What is subcontracting
- ❑ Research Objectives
- ❑ Literature Review

## Study

- ❑ Survey
- ❑ Interviews
- ❑ Findings

## Conclusions

- ❑ Conclusions
- ❑ Future work  
(interactive)

# Questions ?

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