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Comprehensive partnering management model for highway construction projects delivered using traditional and alternative methods

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by

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The student author and the program of study committee are solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

I dedicate my dissertation to my beloved parents

Mariano Pinto Petrocelli and Lidia Arelis Nunez de Pinto,

Whose love, words of encouragement, sacrifice and prays make me able to get such success and honor.

And

To my wonderful daughter ***Nayheli***

For joining me in this adventure and being there for me with care and patience throughout the doctorate program.

You are indeed a treasure from the Lord.

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NOMENCLATURE

AASHTO	American Association of State Highway and Transportation Officials
AGC	Associated General Contractors of America
ACMs	Alternative Contracting Methods
PDM	Project Delivery Method
CMGC	Construction Manager General Contractor
COE	Corps of Engineers
DB	Design Build
DBB	Design Bid Build
DOT	Department of Transportation
P3	Public-Private Partnerships

ACKNOWLEDGMENTS

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ABSTRACT

This dissertation is designed to explore the use of partnering as a decision tool for improving highway construction project performance regarding the project delivery method used by the transportation agencies. Project partnering was implemented in response to project performance issues that are often caused by the adversarial relationships that characterize the industry. Partnering is a tool to improve relationships by providing a framework for open communication and joint problem solving whose goal is to obtain win/win outcomes. Despite the widespread use of partnering, the literature review did not reveal previous research that quantifies the costs and benefits of implementing partnering over an extended period of time.

The following three issues are of primary concern to all public transportation agencies during project development and delivery: (1) selecting the appropriate project delivery method, (2) maximizing project cost/time certainty while minimizing disruptions due to disputes, and (3) ensuring proactive project quality management while creating a safe environment for both workers and the traveling public.

The increased use of alternative project delivery methods has caused the above issues to become increasingly interrelated and created a project management challenge for state departments of transportation (DOT). Not only do these projects allow concurrent design and construction, but they also move at a faster pace, which demands a much higher degree of both integration and active collaboration to meet the demands of an aggressive schedule. Initially implemented by the Arizona DOT in 1996, partnering has been found to be an effective tool for creating the necessary atmosphere for honest, information-rich communication between the owner and its design consultants and construction contractors. However, the American Association of State Highway and Transportation Officials (AASHTO) Partnering Handbook

was published in 1998 based only on traditional low bid project delivery and as such does not include guidance for partnering projects delivered using alternative contracting methods (ACM).

This dissertation aims to contribute to the body of knowledge in partnering by extending the understanding of project level partnering, and documenting effective practice found in the research to the program level. This will be achieved by answering the following overarching research question: *Are there quantifiable benefits for implementing project level partnering practices that can be accrued by institutionalizing the principles of partnering at the program level?*

The research findings will also have practical implications for transportation agencies which will address that gaps in current knowledge through the following objectives: develop decision-making procedures to select projects to be delivered using partnering based on their project performance metrics; develop a framework procedure to measure the impact of partnering practices; developing guidance for partnering projects delivered using ACMs; and develop a partnering organizational maturity model to identify potential areas of improvements at program level.

CHAPTER 1. **GENERAL INTRODUCTION**

Research Problem

Figure 1-1 presents the timeline of partnering history including relevant milestones to give a brief review of the state of practice and partnering path over the years. When the Corps of Engineers (COE) first experimented with partnering in the late 1980s, its implementation was met with skepticism within its ranks as well as among the ranks of its construction contractors. The same reaction was found when partnering was brought to the highway construction industry by the Arizona DOT in the early 1990's. By that time, the Associated General Contractors of America (AGC) had embraced the concept and actively promoted its implementation throughout the nation. Unfortunately, the purveyors of the concept became evangelical proclaiming partnering as the cure for all that ailed the litigation-ridden highway construction industry. Early research was supported by the Construction Industry Institute (CII 1991) and measured the impact of partnering on projects completed by the COE (Weston and Gibson 1993) and the US Navy (Pina 1993; Schmader and von Rosenvinge 1994). Those early projects found that partnering appeared to have a positive impact on project performance (Grajek 1995). However, they were based on limited sample sizes of the agencies' initial group of partnered projects. As a result, there was a suspicion that the results were unintentionally biased by the pilot projects selected by the agencies.

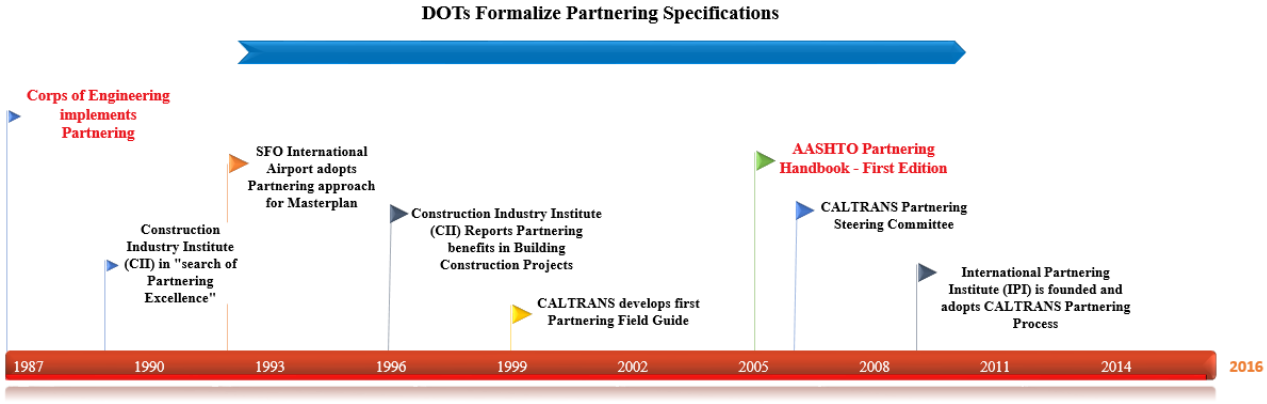


Figure 1-1. Partnering timeline (Adopted from International Partnering Institute, 2015)

Hence there was a pressing need for research covering project performance after the pilot programs were complete and partnering had been institutionalized. The Texas Department of Transportation (TxDOT) was the first DOT to step up in 1997and sponsor such a research project. After quantitatively analyzing the performance of over 400 design-bid-build (DBB) projects, evaluating the survey responses from over 500 TxDOT and contractor workshop participants, the results showed that the partnered projects outperformed non-partnered projects in each of the 11 metrics documented to make the comparison (Gransberg et al. 1999). The results were published in the American Society of Civil Engineer's *Journal of Construction Engineering and Management* and have been cited over 100 times by partnering researchers.

However, that research was based on project data that is over 20 years old and no longer reflects the current highway project delivery environment, creating a need to revisit the topic and determine if two decades of partnering practice have measurably altered DOT business practices at the program level in a manner that might making formal project partnering no longer necessary. In other words, has the wide-spread us of project partnering accomplished its objective of appreciably decreasing the adversarial environment that led to partnering's genesis in the 1990's.

The changes to DOT procurement practices, like implementing design-build (DB), construction manager/general contractor (CMGC) and public-private partnerships (P3), have appreciably increased the levels of both integration and collaboration in project delivery that must now be factored into calculating the costs and benefits of both formal and informal partnering.

The increased use of alternative project delivery methods has caused the issues to become increasingly interrelated and created a project management challenge for DOTs. Not only do these projects allow concurrent design and construction, but they also move at a faster pace, which demands a much higher degree of both integration and active collaboration to meet the requirements of an aggressive schedule. In response to such problems, construction research of the last two decades has repeatedly investigated the influence of project delivery strategies, and project team relationships as ways to improve project performance, overcome the obstacles of fragmentation, and conflict fueled by self-interested parties (e.g. Anvuur and Kumaraswamy 2007; Chan et al. 2004; Cheng et al. 2000). Trends such as partnering have been found to be a useful tool for creating the necessary atmosphere for honest, information-rich communication between the owner and its design consultants and construction contractors (Bresnan 2007).

However, little research has examined the role of multi-project delivery approach on team relationships, project performance, and partnering. While partnering is accepted as being more efficient for some transportation agencies across the country, others have offered critiques related to increasing price bids and not perceiving real benefits of using this tool, but with little empirical evidence. Additionally, few studies have given attention to how transportation agencies could apply partnering prioritizing their resources. This has resulted in a gap in the

knowledge about the proper application of this technique and the associated implications for project delivery approach and project success.

Research Hypothesis

Current methods for the selection of suitable projects for partnering are based on the scope of the projects. The lack of mechanisms to quantify the tangible and intangible benefits of partnering make it difficult for transportation agencies to assess the suitability of partnering from a financial perspective. Thus, transportation agencies may be unwittingly overstating or understating the benefits of partnering. Therefore, research seeks to test the following hypothesis:

The quantifiable benefits for implementing project level partnering are correlated with the intensity of the partnering practices regardless of the project delivery method applied by the transportation agency.

Purpose

In light of the above discussion, the research aims to identify, analyze, and understand existing models for successful partnered project delivery and, secondly, develop guidelines to implement them on highway construction projects delivered using the full suite of project delivery methods. As such, these are the objectives of the research plan:

- Develop decision-making procedures to select projects to be delivered using partnering based on their estimated benefit/cost ratio;
- Develop partnered project performance metrics;
- Develop a framework procedure to measure the impact of partnering practices; and,
- Developing guidance for partnered projects delivered using ACMs

Partnering Terminology and Key Definitions

Introduction of Key Terms

Partnering is defined for building construction projects as a process for relationship building in which each party understanding each other's obligations, maintain an attitude of goodwill and trust, work together without being adversaries. The partnering process aims to foster a team environment where challenges are addressed as a group and disputes are resolved early in order to create positive outcomes on project performance. Partnering on highway transportation projects is popular throughout the US and has been in use both formally and informally by state departments of transportation (DOTs) for over 20 years.

Because public sector and industry terminology of partnering can vary from agency-to-agency, this paper adopts the following definitions to define the major aspects and types of partnering for highway construction projects. The definitions are derived from the American Association of State Highway and Transportation Officials (AASHTO) except where indicated. The terms are listed below:

1- **Partnering:**

- "A process of collaborative teamwork to achieve measurable results through agreements and productive relationships." (AASHTO, 2005)
- "A commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources." (Construction Industry Institute – CII, 1987)
- Collaborative Partnering (International Partnering Institute – IPI, 2013) is a structured process in which construction project teams come together regularly throughout a project to:
  - Co-create project goals and strategies to meet them

- Measure the goals and hold the team accountable to those goals
- Build team momentum
- Identify barriers and opportunities for project success
- Resolve issues and disputes
- Improve project outcomes
- Gather lessons learned from the project upon closeout

2- **Disputes:** A disagreement between the agency and the contractor on a contract issue.

3- **Claims:** A disagreement that leads to each party having a difference of opinion on the matter and cannot be resolved at the project or district level.

4- **Partnering Agreement**—establish the responsibilities of each partner to achieve the projects goals. This agreement is not be binding in nature (AASHTO 2005).

5- **Stakeholder Level Partnering:** is a cooperative approach with other agencies like environmental, railroad, etc., to program management as an organizational policy for the purpose of achievement specific business objectives based on cooperative teamwork, trust, open synergism, and maximizing the effectiveness of each participant's assets.

6- **Program Level Partnering** is an industry outreach initiatives that provide a venue to jointly discuss and mutually resolve issues that potentially lead to problems like state-level joint specs committees, etc.

7- **Formal Partnering**: is a structured sequence of processes at project level initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics. Formal Partnering utilizes an

outsider facilitator, workshops, charter, and conflict resolution techniques in order to achieve the agreed performance metrics of the project.

8- **Semi-Formal Partnering**: is a sequence of processes initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics in order to achieve the agreed performance metrics of the project. Semi-Formal Partnering is conducted by Central Construction Division (UDOT, 2015)

9- **Informal Partnering**: is a sequence of processes initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics in order to achieve the agreed performance metrics of the project. Informal Partnering applies institutional construction manuals, dispute escalation ladders without the presence of an outsider facilitator, usually is conducted by the Resident Engineer of the Project.

10- **Preconstruction Partnering**: is a structured sequence of processes initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics and alternative project delivery method (CMGC, DB). This type of partnering may be formal with workshops, a charter, a facilitator or informal, involving an ongoing series of joint risk management meetings, a specific methodology for identifying and resolving conflicts that arise during preconstruction and involve information sharing aspects such as joint IT tools, shared cost models, design work breakdown structures, etc.

Partnering Purpose:

AASHTO Partnering Handbook (2005) describes the ultimate purpose of partnering as "…to create a multi-participant team in which all key participants are committed to a common purpose, goals, and work approach for which they hold themselves mutually accountable"

Partnering Pillars, Values, and Principles:

A principle can be defined as "a moral rule or belief that helps you know what is right and wrong and that influences your actions" (Merriam-Webster's dictionary, 2016). A value can be defined as something (as a principle or quality) intrinsically valuable or desirable (Merriam-Webster's dictionary, 2016). A pillar is the principle or foundation of something. Those three terms are interrelated when refer to partnering.

Bennet and Jayes (1998) proposed seven pillars of to achieve success partnering.

- Strategy
- Membership
- Equity
- Integration
- Benchmarks
- Project Processes
- Feedback

However the Arizona DOT credits the following terms as the seven partnering principles (ADOT, 2014)

- Trust
- Commitment
- Communication
- Cooperation, Teamwork, and Relationships

- Issue Resolution
- Measurement and Feedback
- Continuous Improvement
- And the Utah DOT outlines the following partnering values.
- Fairness
- Cooperative behaviors
- Teamwork
- Open and Honest Communication
- Joint Problem Solving
- Rapid Dispute Resolution at the Field Level

As can be seen, the pillars, values, and principles of partnering are based on "the way that the state transportation agency does business". The point is to institutionalize these "values" and overcome interference to the partnering process. Figure 1-2 shows the relationship of the key terms schematically.

Point of Departure

The point of departure for this study comes from NCHRP Project 19-10 (Gransberg et al. 2015). The research aims to evaluate effective partnering practices implemented by state DOTs across the country. The study begins with a comprehensive literature review to assemble relevant information not included in the current AASHTO *Partnering Handbook* (2005). Information to be collected is related but not limited to the cost and benefits of partnering, the state-of-the-practice, effective partnering practices, cost/benefit analyses for both partnered and non-partnered projects, as well as other information that identifies effective business practices that enhance DOT budget control and improve construction project performance.

Figure **1-2**

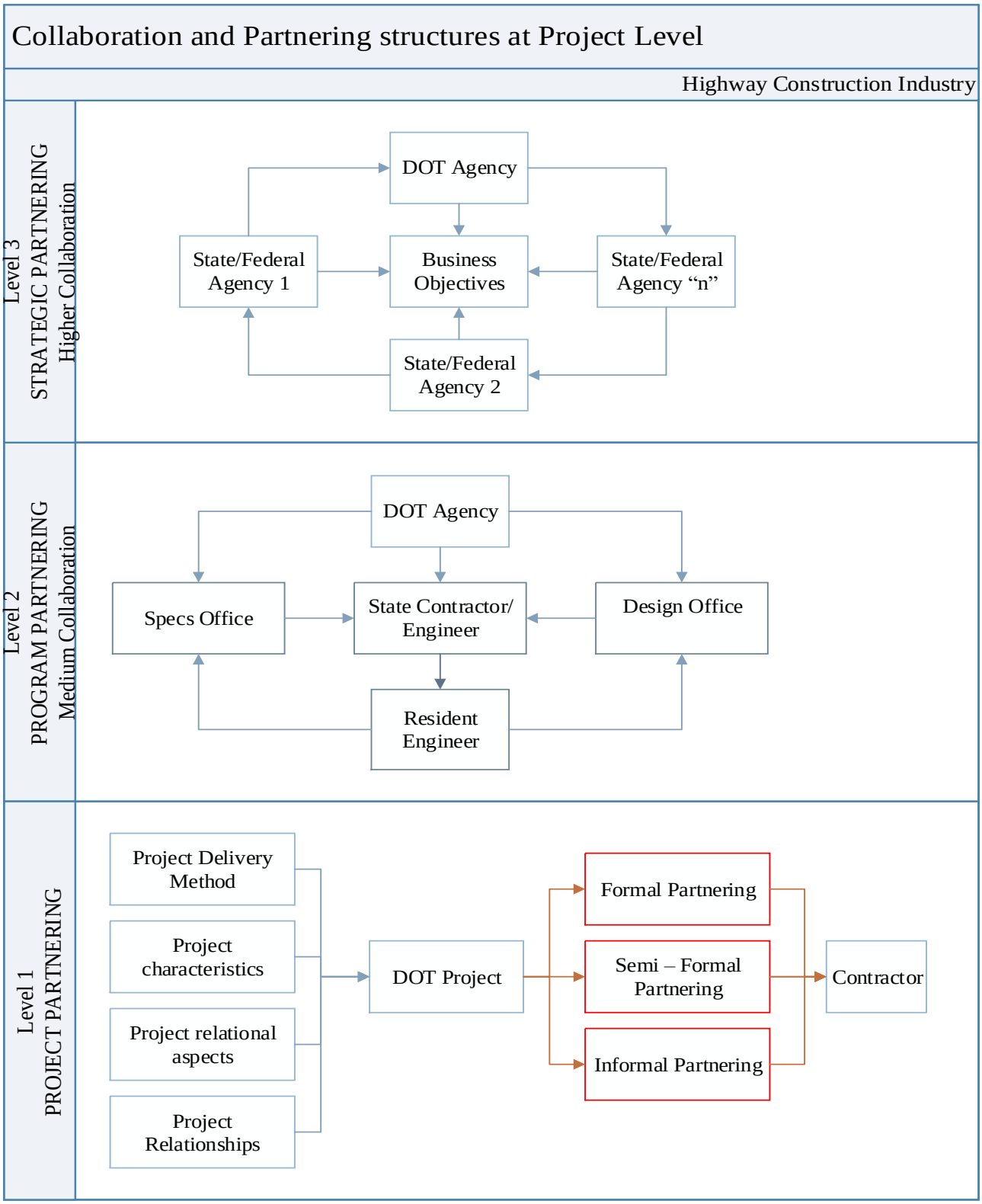


Figure 1-2. Types and structures of partnering

In light of existing literature, several gaps remain in the understanding of partnering. Despite the documented benefits identified in the literature, some DOTs are remain skeptical about the value of partnering practices. This suggests that a critical review of partnering from a highway construction project perspective is warranted. At least four areas related to partnering are ripe for examination, shown schematically in Figure 1-3.

Previous Work		Opportunities
Limited empirical studies	→	Empirical study of Partnering Performance
Case study work on commercial building sector	→	Focus on transportation sector / DOTs
Little work on partnering costs and benefits and project delivery methods	→	Quantify partnering benefits regarding the project delivery method
No analysis of institutionalization of partnering values in DOTs	→	Evaluate DOTs partnering institutionalization.

Figure 1-3. Point of departure

First, there are a few empirical studies of partnering performance. One is a formal research developed by Gransberg et.al. (1999) for Texas DOT that points out the benefits of using partnering at a project level, and Arizona DOT, using in-house software, has been revealing through surveys and reports partnering project performance in their projects. However, Arizona DOT reports are not peer-reviewed studies. On an international basis, it is known the study developed by Murdough, et.al (2007), Ali et.al. (2010), and Cacamis et.al. (2014), the last two are studies in Malaysia and the UK respectively. Even though those studies illustrate the partnering performance, they are focused on building construction projects instead of highway construction projects. Therefore, this research is both timely and will shed some light on the perceived advantages of partnering development practices through a survey of state DOT

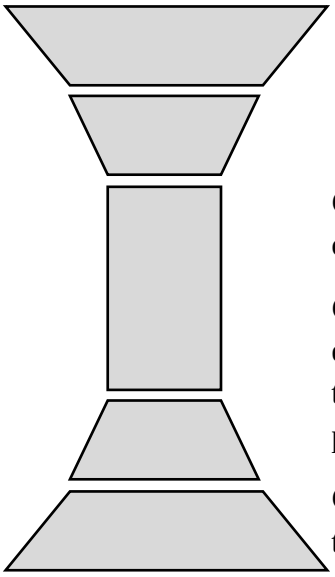
officials, which found that some DOTs believe that the costs associated with partnering no longer justified the benefits. Further research in other settings and scales is needed to expand, validate, and better quantify each of these findings.

Next, no research was found in the literature that measured the impact of partnering across the full suite of project delivery methods. This is a notable gap in the literature, given: a) the emphasis on project team relationships, partnering, and integration over the past three decades (Larson, 1997; Rogge et. al., 2002; Ibrahim, 2014), b) the widespread use of partnering (Drexler & Larson, 2000; Zack, 2016), and c) the potential benefits of partnering tools found in early published analyses (Lazar, 1997; Bayliss et.al., 2003). Examining the evolving interaction between partnering, project performance, and alternative project delivery methods over time, will examine whether the 2015 AASHTO survey perceptions that the business case for partnering is no longer attractive. As such, the proposed research will include case studies designed to capture DOT and contractor perceptions to identify previously unrecognized business strategies and risk management methods to address the notion found in the AASHTO survey results.

Research Questions and Content Organization

The final dissertation will be organized in a three-paper format. Figure 1-4 shows the format organization and Figure 1-5 shows the research questions for each paper. Chapter 1 describes the study's problem statement purpose, and the motivation. Chapter 2 provides the background and general literature review. Chapter 3 is a manuscript accepted for presentation and publication in the *Compendium* of the 2017 Transportation Research Board Annual Meeting. The paper hypothesizes that agencies that discontinued formal partnering have fully institutionalized the salient principles of partnering, such as increased collaboration, communication, and trust-building at the program level and no longer need to invest the resources needed to formally partner at the project-level.

Chapter 1: Problem and Purpose



Chapter 2: Background and Literature

Chapter 3: Paper #1. Institutionalization the principles of partnering.

Chapter 4: Paper #2. Comprehensive identification and evaluation of partnering intensity and their effect into the project performance of highway construction projects.

Chapter 5: Paper #3. Partnering Maturity Assessment tool at Program Level for transportation agencies.

Chapter 6: General Conclusions

Figure 1-4. Content organization based on hourglass shape for research formats. Adapted from Cargill et.al. (2009)

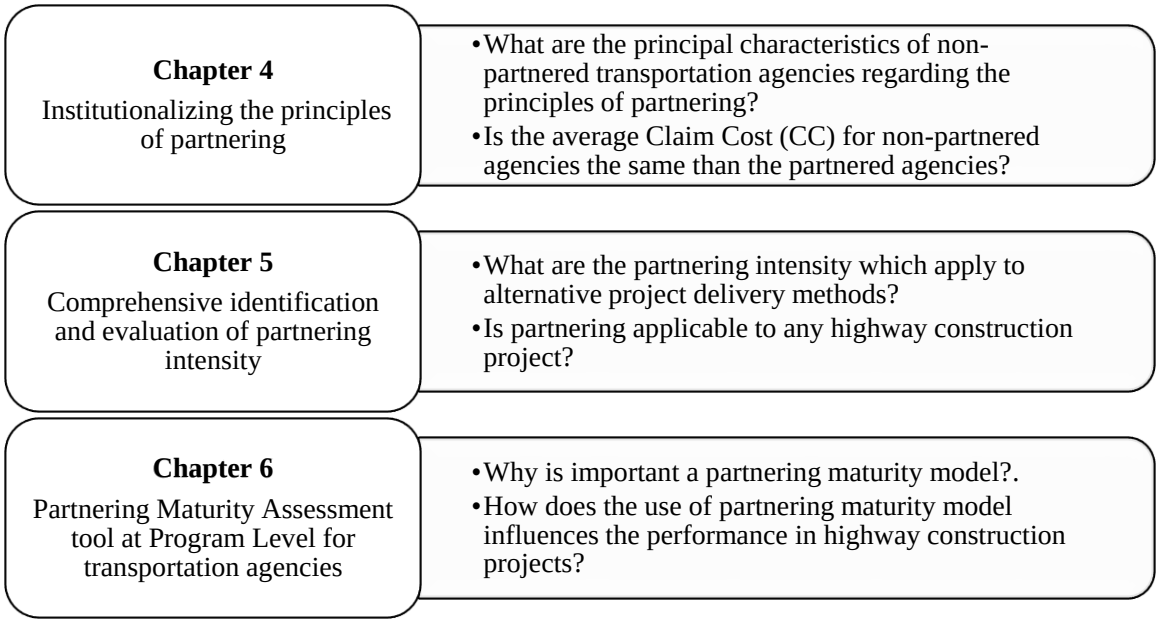


Figure 1-5. Research question for each paper.

The paper tests the assertion via an analysis of the claims history found in four state DOTs. The analysis compared the mean project claims cost of the two agencies that claim that they partner most major projects to the claims record of the two that no longer employ formal partnering. The findings of this paper also lay the groundwork for Chapters 4 and 5.

Chapter 4 is a manuscript which describes the elements to define partnering intensity regarding the project characteristics and partnering tool. It includes a statistical analysis of three common project performance metrics regarding the spectrum of partnering and the type of procurement methods. The conclusions of this paper indicate that there is no statistical evidence that suggests that the higher partnering intensity results in better outcomes on both traditional and ACM projects. The previous two papers are the basis for the development of the theoretical framework of the partnering maturity assessment decision tool for DOTs. Chapter 5 proposes a partnering maturity assessment tool for transportation agencies to help them to identify potential improvement areas in the partnering program. This proposal is based on analyzing performance metrics of highway construction projects from partnered and non-partnered agencies. Finally, Chapter 7 summarizes the findings in this dissertation and presents the general conclusions as well as further work.

CHAPTER 2. **BACKGROUND AND LITERATURE REVIEW**

Introduction

This chapter presents the analysis of information obtained through a comprehensive literature review on topics related to this study. The chapter's purpose is to document the state-of-the-practice on partnering, detailing the practices currently used by transportation agencies across the US. It will also discuss relevant concepts associated with the implementation of ACMs and the use of cost-benefit models in the development of decision tools for transportation construction projects.

Use of Formal Partnering for Highway Construction Projects

The practice of formally partnering projects delivered by DBB project delivery is well documented as being effective at reducing disputes that lead to both time and cost growth (CII 1991; Gransberg et al. 1999; Nyström 2008; Weston and Gibson 1993). However, there have been relatively little, if any, serious research into quantifying the costs and benefits of partnering of projects delivered using alternative methods (Hong et al. 2012). In fact, an interesting study of 131 peer-reviewed journal papers on the topic of partnering found that only 12 papers in that population had actually conducted a quantitative analysis of partnered project performance, and the majority of those papers (nine) were for projects constructed outside the US. Based on that study, the most recent quantitative analysis of US projects was published in 1999 by Gransberg, Dillon, Reynolds, and Boyd in the ASCE Journal of Construction Engineering and Management (Hong et al. 2012).

Therefore, it is high time to update the knowledge of how implementing formal partnering has impacted the performance of projects in the US transportation sector. It is also important to examine partnering's impact on projects delivered using alternative methods, and

lastly, the proposed research must look beyond the US borders for international approaches that enhance the level of collaboration among project participants for potentially innovative improvements to those models currently in use by US DOTs.

The debate on the efficacy of partnering can be boiled down to a simple question: Is the term partnering a noun or a verb? In other words, is it merely the name of a program (noun) or a behavior (verb)? Those that would answer "both" would be technically correct, but those that have actually experienced the process on real projects would probably opt for the latter choice because the object of the program is to alter project participant behavior with a goal of changing the business practices used on a given project when things do not go as well as originally hoped.

As a result, the research plan proposed later in this document will seek to measure partnering performance impact at both the program level and the project team behavior level. Research conducted by Gransberg, Scheepbouwer, and Loulakis on alliance contracting (2014) found that the New Zealand Transport Agency (NZTA) employs "behavior coaches" during the initial stages of assembling a team to form an alliance for a given project. The coaches function somewhat like a US partnering workshop facilitator, but are required to be highly qualified organizational psychologists and are given the authority to ban specific individuals from being allowed to participate on the project for exhibiting behavior contrary to that desired for a given job. It should also be noted that the final members of the alliance are contractually bound to the terms of the alliance, which include a clause that prevents dispute resolution outside the alliance's governing body: i.e., they agree to not sue each other. This is an interesting approach, which probably cannot be directly imported for immediate use in the US. Nevertheless, the notion of committing to speedy resolution of disputes outside of the court is a fundamental pillar of the US partnering model. Therefore, the use of "behavior coaches" to identify individuals

whose attitude does not lend itself to active collaboration would certainly add substance to the perennial administering of Meyers-Briggs and other personality tests as part of a partnering workshop. The idea of changing the non-binding partnering charter to a binding agreement to commit to a mutually agreed set of project-specific business practices is also worthy of exploration. In fact, most P3 concession agreements already contain provisions that are fairly similar (Lahdenperä 2012).

A 2007 study of partnering conducted in the U.K., eloquently summarized the issues regarding past partnering research. An excerpt from that paper is as follows:

"Partnering in the construction industry context (and perhaps elsewhere too) might be seen as, in many ways, a fragile phenomenon, often dependent on the convergence of a number of key commercial and organizational supporting conditions. As such and, in the continuing absence of systematic research that unambiguously points to its benefits, it still constitutes something of a leap of faith. To base such a faith on slim philosophical and empirical foundations is to court the possibility of that faith being undermined when problems are encountered and the complex reality of partnering is confronted. A more critically informed view, on the other hand, at least offers a clearer recognition of the challenges and dangers that lie ahead on the journey towards more effective partnering." (Bresnan 2007, italics added).

Therefore, the framework for the proposed research will focus on providing "systemic research that unambiguously points" to both the costs and benefits derived from implementing partnering on all types of transportation projects.

Benefits and Limitations of Partnering

As with any contract tool or project strategy, partnering has advantages and disadvantages (or critiques). Much of this dissertation proposal serves as an approach to

evaluate these advantages and disadvantages in more depth, as most are based on opinion based research to date.

The major perceived advantages and disadvantages of partnering are shown in Tables 2-1 and 2-2, respectively. While a few of these findings are based on empirical analysis of project data (marked with an asterisk), many are based on the perceptions captured in owner surveys, case studies, or analysis of select lawsuits. From the owner's perspective, the benefits listed in Table 2-1 can make partnering an attractive option. Yet the critiques summarized in Table 2-2 make the benefits seem less certain. These tables provide a brief introduction to the previous work related to partnering agreements, and many of these benefits and concerns are revisited in the following chapters in more depth.

Table 2-1. Perceived benefits of partnering.

Perceived Benefit of Partnering	Source(s):
Improved relationship between owner and contractor	Weston and Gibson (1993)* Constructing Excellence (2005 Humphreys et al (2003) Larson (1995) Lazar (1998) Bresnen et.al (2000)
Reduced claims	Voyton et.al (2004) McFadden et.al (2004) Sakai et.al (2009) Anderson et.al (2011)
Positive impact on cost growth	Gransberg et.al (1999)* Grajek (1995) Chapin (1994)
Improved schedule performance (construction phase only)	Chen (2002)* Crane et.al (1997) Bresnen (2000)
Improved construction quality	Weston and Gibson (1993)* Basham et.al (1994)* Chen et.al (2002)* Ericksson (2010)
Assembling project teams	Harper et.al (2016)

* denotes conclusions based on empirical study of project data

Table 2-2. Concerns about partnering

Concern	Source(s):
No universal definition leading to confusion and ambiguity	Saad et al . (2002)
Difficulty for implementation	Ng (2002) Chan (2003) Lu et.al (2007) (Glagola and Sheedy, (2002); Chan et al. (2003).
Nonbinding partnering charter	Gransberg et.al (2015)
Partnered-Project performance with alternative delivery methods	Chan (2003)

Theoretical Frameworks

The problem of examining partnering structures lends itself to examination from four theoretical frameworks: paradox theory, performance metrics, alternative project delivery methods, and decision tools. Brief summaries are below, and additional detail is provided in the subsequent chapters.

Paradox Theory Understanding paradoxical benefits of partnering

Considering the above advantages, disadvantages, comparisons, and criticisms, the various views of partnering reflect the paradoxical benefits found in construction projects. The research uses the paradox theory to explain the findings from the content analysis in Chapter 4, as well as to frame the statistical claim cost in the same chapter.

Paradoxical findings have been used in organizational studies to "describe conflicting demands, opposing perspectives, or seemingly illogical findings" (Lewis 2000). Paradoxes emerge from elements that are related but seemingly contradictory due to underlying tensions in the system. In the case of organizational tensions, Lewis' seminal work (2000) characterizes the underlying tension as one between control and flexibility. Various management theories tend to

emphasize either control or flexibility, but paradox theory explains the presence of both simultaneously (Smith et al. 2010).

Analyzing the positive benefits of partnering, it should be expected that all transportation agencies applied partnering in their projects. Nonetheless, the survey results of the research shows a change in the partnering usage throughout the time. Figure 2-1 illustrates the states that participated in the survey.

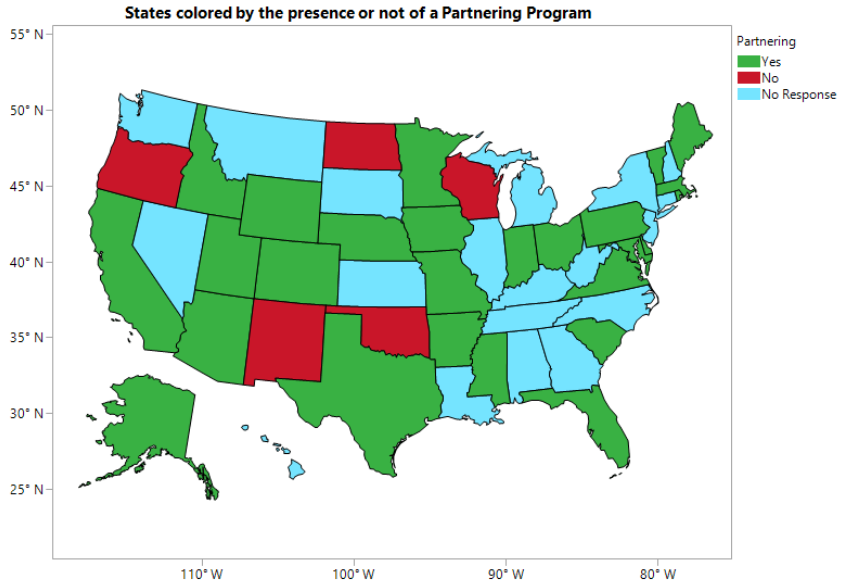


Figure 2-1. Participant states in NCHRP 19-10 partnering survey (Gransberg, et.al 2016)

Table 2-3. Comparison of partnering surveys over time.

State	2012 AASHTO Survey	2014 AASHTO Survey	2016 NCHRP 19-10	State	2012 AASHTO Survey	2014 AASHTO Survey	2016 NCHRP 19-10
Alabama	No	Yes	N/A	Nebraska	N/A	N/A	Yes
Alaska	No	No	Yes	Nevada	Yes	Yes	N/A
Arizona	N/A	Yes	Yes	New Hampshire	No	No	N/A
Arkansas	N/A	No	Yes	New Jersey	No	No	N/A
California	Yes	Yes	Yes	New Mexico	N/A	N/A	No
Colorado	Yes	Yes	Yes	New York	Yes	Yes	N/A
Connecticut	Yes	Yes	N/A	North Carolina	No	Yes	N/A
Delaware	No	N/A	Yes	North Dakota	Yes	No	No
District of Columbia	No	N/A	N/A	Ohio	Yes	Yes	Yes
Florida	Yes	Yes	Yes	Oklahoma	No	N/A	No

Table 2-3. (Continued)

State	2012 AASHTO Survey	2014 AASHTO Survey	2016 NCHRP 19-10	State	2012 AASHTO Survey	2014 AASHTO Survey	2016 NCHRP 19-10
Georgia	No	N/A	N/A	Oregon	Yes	Yes	No
Idaho	No	N/A	Yes	Pennsylvania	Yes	No	Yes
Illinois	No	N/A	N/A	Rhode Island	N/A	Yes	Yes
Indiana	Yes	Yes	Yes	South Carolina	Yes	Yes	Yes
Iowa	No	N/A	Yes	South Dakota	Both	N/A	N/A
Kansas	Yes	Yes	N/A	Tennessee	No	Yes	N/A
Louisiana	No	N/A	N/A	Texas	Yes	N/A	Yes
Maine	as a contractor option	Yes	Yes	Utah	N/A	Yes	Yes
Maryland	N/A	N/A	Yes	Vermont	No	No	Yes
Massachusetts	No	Yes	Yes	Virginia	Yes	Yes	Yes
Michigan	No	Yes	N/A	Washington	Yes	Yes	N/A
Minnesota	No	N/A	Yes	West Virginia	No	N/A	N/A
Mississippi	N/A	Yes	Yes	Wisconsin	No	N/A	No
Missouri	N/A	N/A	Yes	Wyoming	No	N/A	N/A
Montana	No	No	N/A				

Of the total received responses, 84% of the participants answered that they are currently using Partnering in highway construction projects and 5% answered that they are not using partnering. However, all those who answered no had partnered in the past. Comparing those results with two different surveys conducted for AASHTO in 2012 and 2014 regarding the use of partnering in transportation agencies. It is important to consider the variability through the years about the perception in the partnering effectiveness. The Table 2-3 shows the comparison between AASHTO Partnering and the results obtained from NCHRP 19-10 Partnering Project. The item N/A means that the answer was not collected or the participant didn't participate.

Table 2-3 the states are grouped by their actual use of partnering. First it is presented US states that start using partnering, but nowadays they are not. Second, the research reveals states that in 2012 they was not doing partnering but according to our survey, they are actually using it. Third, there are states that are continuing using partnering regardless the time.

Table 2-4. Change in partnering program usage.

Never used partnering	Used partnering in 2012 but stopped	Did not use partnering in 2012 but now do		Continuing use of partnering since 2012	
New Mexico Oklahoma Wisconsin	North Dakota Oregon Montana Vermont	Alaska Delaware Idaho Iowa	Massachusetts Minnesota	California Colorado Florida Indiana Ohio	Pennsylvania South Carolina Texas Virginia Utah

Those states who answered that their agency is not currently using partnering but that they partnered in the past were asked about the last time that they used partnering and causes or explanations about why partnering has not been continued by their agency. The causes and motivations to stop partnering varies from agency. Some of responses includes:

- Partnering is redundant for the agency
- Hard to measure tangible results from a partnering effort
- Concerns about settlement of claims or processing change orders
- Construction projects are filled with such paradoxical tensions.

Both Koppenjan et al. (2011) and Szentes and Eriksson (2015) used paradoxical tensions as part of a framework to examine organizations involved in construction megaprojects. They conclude that control and flexibility must be balanced and managed simultaneously at multiple interfaces by project managers to ensure project success. In this particular research, the paradox maintains that the very use partnering to eliminate claims is essentially means the parties do not trust each other and as such is fundamentally in conflict with the spirit of partnering. As will be discussed later in Chapter 4, this paradox leads to the practice of not recording project disagreements as they occur, depriving the agency of data regarding how successful its partnering program is in resolving the day to day project issues.

Performance Measurement

MAP-21 created a statutory mandate to conduct project performance measurement (Miller and Gransberg 2014). Doing so requires the development of key performance indicators (KPI) that communicate the level of performance that is being measured (Lahdenperä 2012). Figure 2-2 comes from an insightful analysis of three forms of relational contracting. Project partnering as practiced in the US is compared with project alliancing practiced overseas and the notional integrated project delivery method proposed by the American Institute of Architects (AIA 2007). The author has plotted a relative ranking of the three approaches in the 18 relational parameter categories shown by the solid and dotted lines around the inner hexagon.

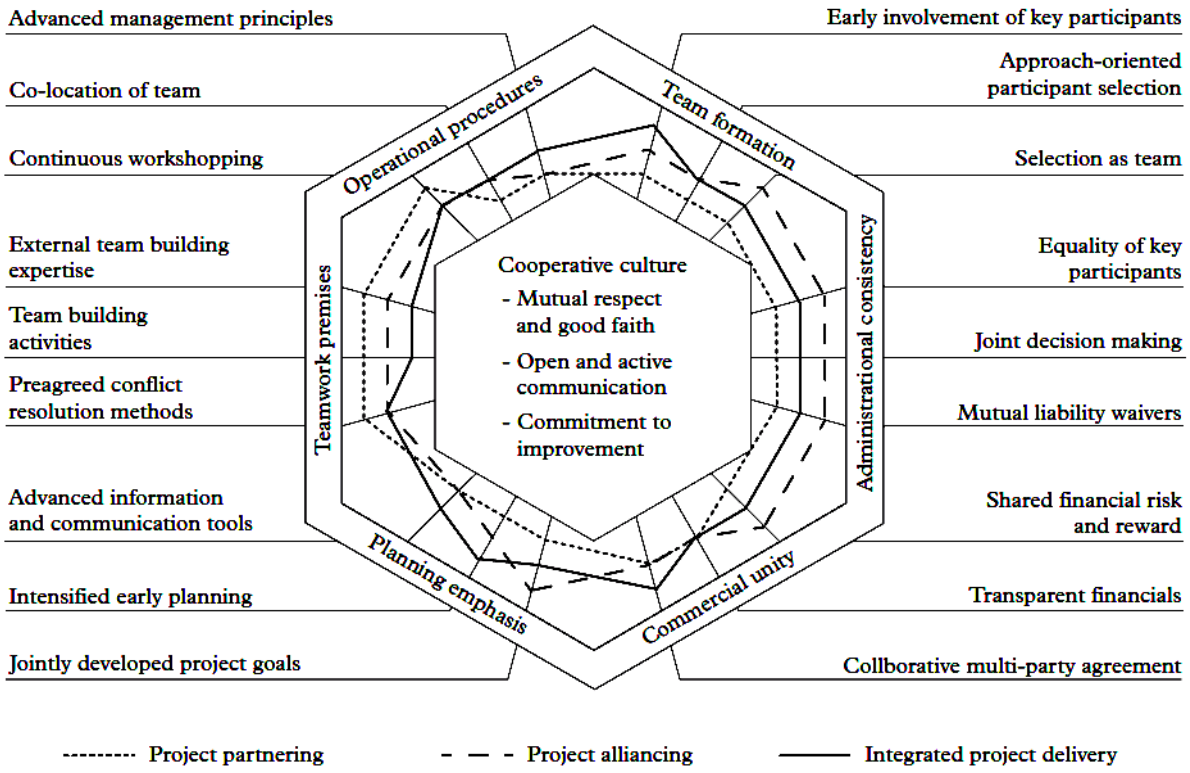


Figure 2-2. Relational contracting framework (Lahdenperä 2012).

While not scientific, if one tallies the relative rank with respect to each alternative as shown in Table 2-5, it shows that alliancing appears to bring more benefits to the project than the other two approaches to relational contracting. The paper states that the differences shown in Figure 2-2 and Table 2-5 are due to the "different degrees of integration between the relational project delivery arrangements."

Table 2-5. Ranking of alternative methods with respect to Figure 2-2.

Relational Parameters	Relative Rank – 1 is best.		
	Partnering	**Alliancing**	**Integrated Project Delivery**
Early involvement of key participants	1	2	3
Approach-oriented participant selection	1.5	1.5	3
Selection as team	2	1	3
Equality of key participants	2	1	3
Joint decision making	2	1	3
Mutual liability waivers	2	1	3
Shared financial risk and reward	2	1	3
Transparent financials	2	2	2
Collaborative multi-party agreement	1	2.5	2.5
Jointly developed project goals	2	1	3
Intensified early planning	1	2	3
Advanced information and communication tools	1	2.5	2.5
Pre-agreed conflict resolution methods	2.5	1	2.5
Team building activities	2	1	3
External team building expertise	2	1	3
Continuous work bidding	2.5	1	2.5
Co-location of team	1.5	1.5	3
Advanced management principles	1	2.5	2.5
Totals	**31**	**26.5**	**50.5**

Lahdenperä's 18 relational parameters provide an excellent framework for developing input KPIs to measure the amount of collaboration and integration achieved in a given DOT's partnering program. Table 2-6 contains the quantitative performance metrics used in the previous TxDOT study (Gransberg et al. 1999) and provides a good starting point for developing output KPIs, which can then be used to quantify partnering's costs and benefits. Table 2-6 is not an exhaustive list of potential project performance metrics. Scheepbouwer's study of alliance

contract performance also identified several additional metrics that might also be included in the research plan to measure both team-building success, level of collaboration, and output KPIs.

The primary ones of interest for the research are as follows:

- "Safety in the work place
- Legacy- Skill Development: How the alliance was making a contribution to the industry (developing their staff, training people and raising the bar for people in the industry, etc.)
- Legacy-External recognition: Delivering a project that was receiving awards across a variety of categories both nationally and internationally (i.e., Technical, Human, Environmental, etc.)
- Wider Community: Engaging community and neighbors, coupled with media perception.
- Follow-up times: How long it took the alliance to respond to letters and feedback and engaging the key stakeholders" (Gallagher 2008).

Table 2-6. TxDOT partnering project performance output metrics (Gransberg et al. 1999 Gallagher 2008)

Output Metric	Symbol	Formula
Cost Growth	CG	CG = Final Contract Amount – Original Contract Amount / Original Contract Amount
Average cost per change order	AC/CO	AC/CO = Final Contract Amount – Original Contract Amount / Number of Change Orders
Average percent increase per change order	A%/CO	A%/CO = Cost Growth (%) / Number of Change Orders
Average total change orders per project	ATCO	ATCO = Total Number of Change Orders – Administrative Change Orders
Time Growth	TG	TG = Days Charged - (Total Days Allowed +Additional Days Granted) / Total Days Allowed + Additional Days Granted Where: Days Charged = Actual contract duration Total Days Allowed = Original contract duration Additional Days Granted = Number of days added by change order
Average Percentage of Additional Days	AD%	AD% = Additional Days Granted / Total Days Allowed
Average liquidated damages	ALD	ALD = Liquidated Damages Cost / Total Contract Cost
Percentage of Projects with LDs	%LD	%LD = Number of Projects with LDs / Total Number of Projects
Percentage of Projects with Deducts	PPD	PPD = Number of Projects with Negative Cost Growth / Total Number of Projects
Claims Cost	CC	CC = Total Cost of Claims / Original Contract Cost
Disputes cost as a percentage of original cost	DC	DC = Total Cost of Disputes / Original Contract Cost

The above discussion clearly demonstrates that the literature is rich with respect to potential project performance measures. The research team, with the assistance of the industry advisory panel, will have no trouble narrowing down the list of potential metrics to those that will be of most value to communicating the effectiveness of partnering for the projects collected in the study population. Lastly, the importance of including ***both input and output measures*** must be emphasized. Most of the previously conducted studies focus only on output measurements, which while instructive, creates an analytic bias toward partnering's benefits without evaluating the cost to achieve those benefits. In other words, the studies, by and large did not correlate the agencies' gained value.

The following list presents the output metrics for the evaluation of tangible costs and benefits. Five categories of metrics have been selected.

1. Cost-Time: These are classic project performance metrics with regard to changes in budget and schedule.
2. Legal-Regulatory: These are metrics associated with the cost and time to resolve disputes and claims. This category also includes violations of environmental and other applicable codes.
3. Safety-Quality: These metrics measure the performance of project safety and quality management plans and programs.
4. Project Perception: These metrics gauge the project's "public image" as well as its value to the agency with regard to providing the necessary experience for growing the agency's work force. It also accounts for awards and other recognition.
5. Project Communications: These metrics attempt to quantify the level and quality of the communications that are developed within a project delivery team.

Table 2-7. Proposed tangible output metrics

Cost-Time Metrics	Output Value	Legal-Regulatory Metrics	Output Value	Safety-Quality Metrics	Output Value
Cost growth	%	Disputes cost as a percent of original cost	%	Lost time accidents/ total labor hours	#/hr
Average cost/ change order	$	Average claims cost	$	Lost time accidents/ total contract value	#/$
Average percent increase per change order	%	Claims cost as a percent of original cost	%	Work zone accidents/ closure period	#/hr
Average total change orders per project	#/ project	Average # claims/ total program volume	#/$	Average NCRs	#/project
Time growth	%	Average time to final close-out	Days/ project	Average NCR correction times	days/ project
Average percentage of additional days	%	Environmental citations	#/project	Average quality incentive pay	$/ project
Average liquidated damages	$/ project	Environmental citations/ total program volume	#/$	Average quality disincentive pay	$/ project
Average incentive payments	$/ project			Average warranty call-backs	#/project
Percentage of Projects with LDs	%				
Percentage of Projects with Deducts	%				

The results of this analysis are presented as part of Chapter 4 framework.

Project Delivery Methods (PDM) and Partnering

For many years, traditional Design-Bid-Build (DBB) contracting techniques were considered as a single one-size-fits-all procurement tool for the acquisition of construction services (Rueda et. al 2015). However, some limitations and deficiencies observed in DBB procurement systems have encouraged federal and state agencies to develop and implement alternative delivery methods and contracting approaches intended to “enhance quality, decrease cost, and compress the delivery period for public projects” (Gransberg et.al 2010). For the last decade, public owners have been expanding their procurement toolboxes and increasing their

contracting capabilities with flexible sets of alternatives to adjust acquisition procedures to the unique needs of each project.

By definition, a delivery method is a system used by owners to organize and coordinate planning, design, and construction activities such as DBB, Design-Build (DB), and Construction Manager/General Contractor (CMGC), also called Construction Manager-at-Risk or CMR), and Public-Private Partnership (P3). Which are commonly used in highway construction projects (Gransberg and Shane 2010). On the other hand, contracting approaches are tools such as A+B (Cost+Time) bidding, lane rental, and guaranteed maximum price (GMP), used to support procurement procedures stated by the selected delivery method (Walewski et al. 2001). In other words, delivery methods are intended to coordinate pre-construction, construction, and even post-construction (as required) activities, while contracting approaches are aimed to address more specific aspects or cycles within project life cycle.

Even though partnering is not a contract procurement method, it is integrated in the project delivery process in different stages of project execution. The first edition of the AASHTO *Partnering Handbook* provided guidance on how to implement partnering within the traditional low bid DBB delivery method. However, survey information collected for the NCHRP Project 19-10 showed that only 26 DOTs actually using partnering. However, it is also important to know the project delivery method that they are applying in order to measure benefits and outcomes regarding this feature. **Table 2-8** summarizes the partnering actual practice according to the state.

Table 2-8. Partnering use and project delivery methods (Gransberg, et. al 2016)

State	Design Bid Build (DBB)		Design Build (DB)		Public-Private Partnerships (P3)		Construction Manager/General Contractor (CMGC)	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
Alaska	x	x	x					
Arizona	x	x	x		x		x	
Arkansas	x	x						
California	x	x	x			x	x	
Colorado	x	x	x	x	x	x	x	x
Delaware	x	x	x	x			x	x
Florida	x	x	x	x	x	x		
Idaho							x	x
Indiana	x	x	x	x		x		
Iowa		x						
Maine	x	x	x				x	
Maryland	x	x	x	x				x
Massachusetts	x	x	x	x				
Minnesota	x	x	x	x			x	
Mississippi	x	x	x	x				
Missouri	x	x	x	x				
Nebraska	x	x						
Ohio	x	x	x	x		x		
Pennsylvania	x	x	x	x	x	x		
Rhode Island	x							
South Carolina	x	x	x	x				
Texas	x	x	x	x				
Utah	x	x	x	x			x	x
Vermont		x		x				x
Virginia	x	x	x	x	x	x	x	x
Wyoming	x	x						
Total =	**23**	**24**	**19**	**16**	**5**	**7**	**9**	**7**

In order to measure the effectiveness and impact of partnering with respect to the project delivery method used, the responses are grouped into four comparison groups. Each group portrays a different comparison regarding partnering in highway construction projects and the perceptions of the transportation agencies as related to its impact on project outcomes. The description of each group is presented below:

Group 1: Each project delivery method is compared to all other project delivery methods. (DBB vs DB vs P3 vs CMGC)

Group 2: Partnering's impact on the traditional project delivery method (DBB) is compared against alternative project delivery methods taken as a group (CMGC, P3, and DB).

Group 3: A comparison of project delivery methods in which the owner or its consultant is the project's designer-of-record (DBB and CMGC) versus those where designer of record responsibilities are transferred to a contractor (DB and P3)

Group 4: A comparison is made between project delivery methods where the owner provides the project financing (DBB, DB, and CMGC) and P3 in which the contractor provides the finance resourcing for the project.

The results of this content analysis is presented as part of Chapter 4 framework. DBB, DB, and CMGC and P3 are further described below in order to provide an idea of how the partnering agreement works and differ within the alternative project delivery methods.

Partnering and Design-Bid-Build

In this method, design must be fully accomplished by either in-house or consultant designers before proceeding with the advertisement and award of a separate construction contract (Gransberg and Shane 2010). In other words, design and construction activities are contracted separately, so that, there is no contractual relationship between the designer and the contractor as shown in Figure 2-3.

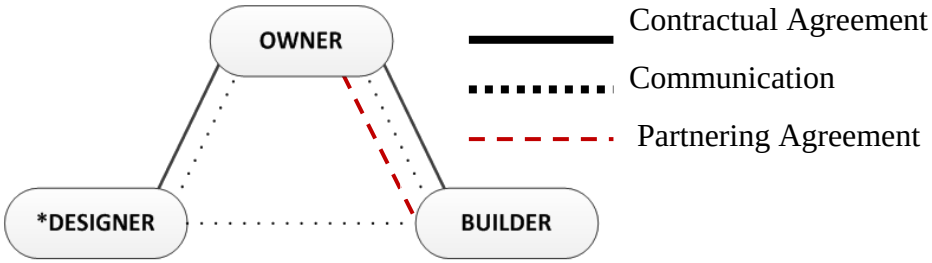


Figure 2-3. Partnering and Design-Bid-Build (Adapted from Gransberg et al. 2014).

Even though DBB contracts are usually awarded to the low bid responsive contractor, they can also be awarded on a best-value or negotiated basis in order to mitigate risks related to the selection of a contractor who has submitted a low price proposal inconsistent with the construction documents (Gransberg and Shane 2010; Scott et al. 2006).

Partnering and Design-Build

In this type of contracts, the contractor (usually referred as the design-builder) is in charge of furnishing design services and performing construction activities under the same contract. This substantial alteration in traditional relationships among contract participants (see Figure 2-4) is intended to overcome some DBB limitations such as the lack of ability to overlap contract phases, absence of constructability reviews, and lack of contractual incentives for contractors to minimize costs (Dunston and Reed 2000, Rueda 2013).

DB procurement methods are usually advertised and awarded to the design-builder that represents the best-value alternative identified through request for qualifications (RFQ)/request for proposals (RFP) procedures. By allowing the contractor great flexibility in the selection of design, materials, and construction methods, it is willing to increase its risk tolerance. Design builders submit fixed price proposals, making themselves liable for all design and construction costs (Graham 1997; Ibbs et al. 2003; El Wardani et al. 2006), including potential cost overruns resulted from design inconsistencies discovered during the construction period.

Figure 2-4 illustrates the partnering relation, level of collaboration, and interaction among different contract participants under DB contracts. DB contracting decreases owner's responsibilities and increases design builder's control over the project delivery process, allowing the reduction of project delivery periods and making DB a great alternative for "fast-track" projects (Alder 2007).

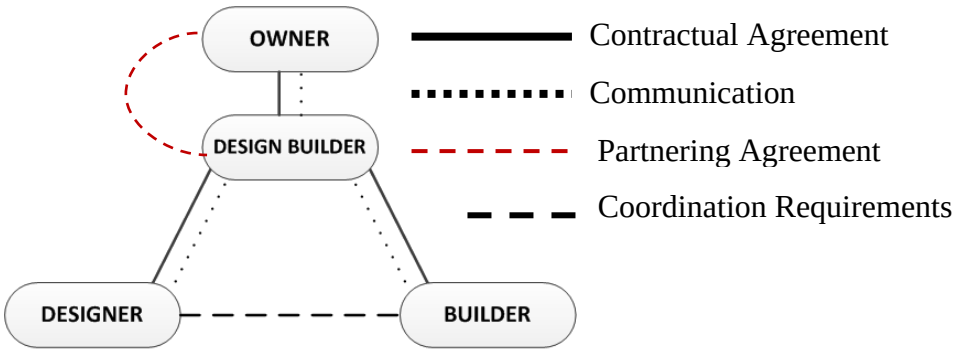


Figure 2-4. Partnering and Design-Build (Adapted from Gransberg et al. 2014).

Partnering and Construction Manager/General Contractor

The original purpose of allowing an early involvement of a construction manager during the design phase of a highway project and the posterior furnishing of construction services by the same person or entity was to improve procurement procedures by incorporating knowledge and capabilities lacking within the owner's organization (Strang 2002). In CMGC project delivery, design and construction services are furnished through two separate contracts. The first contract is aimed to obtain construction manager's input during the preconstruction phase on designs developed by either in-house or external designers. Most of the times, the second contract for construction services becomes effective after a full completion of design and construction documents.

CMGC contracts often stipulate a Guaranteed Maximum Price (GMP), which is a not-to-exceed sum (dollars) to be paid by the owner to the CMGC for all work contained in the contract documents. Thus, the contractor is liable for cost overruns, unless they were the result of changes in the project's scope (authorized by the owner), in which case the GMP would be modified (Gransberg and Shane 2010). Frequently, these contracts also include incentive clauses to encourage the CMGC to complete the project below the GMP by sharing with the contractor any

cost savings. Figure 2-5 illustrates the partnering structure among CMGC contract participants. It also shows how this relationship remains unchanged between the owner and the designer (in-house or consultant) allowing the agency to maintain direct supervision and control over all preconstruction activities. This type of delivery method allows the implementation of Pre-cons-Partnering discussed in Chapter 1.

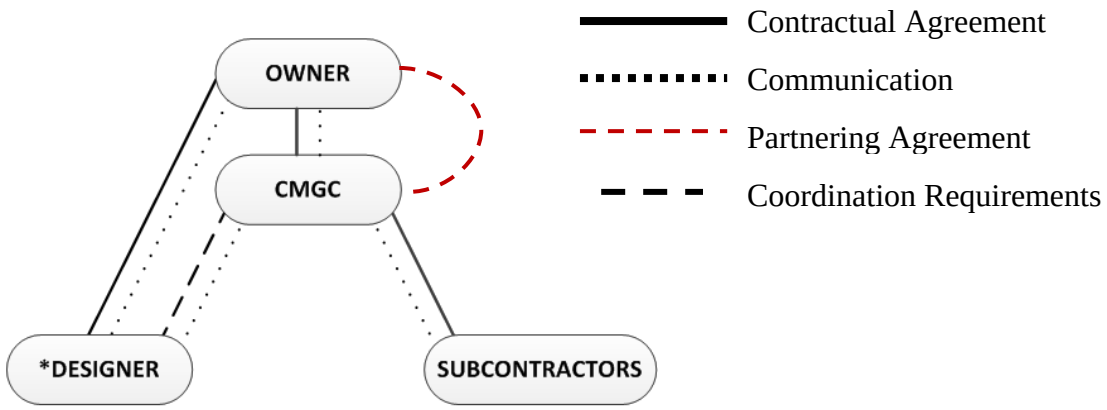


Figure 2-5. Partnering and Construction Manager/General Contractor (Adapted from Gransberg et al. 2014).

According to the Associated General Contractors of America (AGC) (2004), there are two principal characteristics that define CMGC and differentiate this method from other delivery methods: Unlike DB, the owner advertises and awards separate contracts for the designer and the CMGC, and as opposed to DBB, the CMGC is usually selected based on qualifications, past experience, or through best-value procedures (FHWA 2014). Besides transferring risk related to cost overruns and construction delays to the CMGC, owners see in this delivery method an opportunity to enhance "constructability, real-time construction pricing capability, and speed of implementation" (Gransberg and Shane 2010).

Partnering and Public-Private-Partnerships (P3)

Public Private Partnership has been loosely used both in academia and practice. As a result, practitioners often claim not to be so clear about what it exactly means. In the literature, Weihe (2006) outlines five exclusive approaches towards P3. Those are listed below:

- Local regeneration P3 approach,
- Infrastructure-P3 approach,
- Governance-P3 approach,
- Policy P3 approach, and
- Development-P3 approach.

Amongst these five approaches, this research uses the term to indicate infrastructure-P3 approach. This model enables public-sector actors to deliver high standard infrastructure that is claimed not to appear on the public-sector balance sheet, it has become a politically popular tool across the globe, extending its geographical spread to the global South (Akintoye and Beck 2009, Baindur and Kamath, 2009, Jefferies and McGeorge 2009, Mia et al., 2007 and Noumba and Dinghem, 2005).

Within P3, the state's basic role is transformed from that of a provider of development to a facilitator of it, focusing on an investment-friendly environment, which includes both the physical environment, such as land for development and infrastructure, and the social environment, such as the legal and policy framework encouraging private-sector investment and assuring returns from it (Miraftab, 2004). Figure 2-6 illustrates partnering agreements regarding P3. As can be seen in Figures 2-3 to 2-6, the use of partnering with DBB, DB, CMGC, or P3 does not alter the conventional contractual/communication structure of these delivery methods.

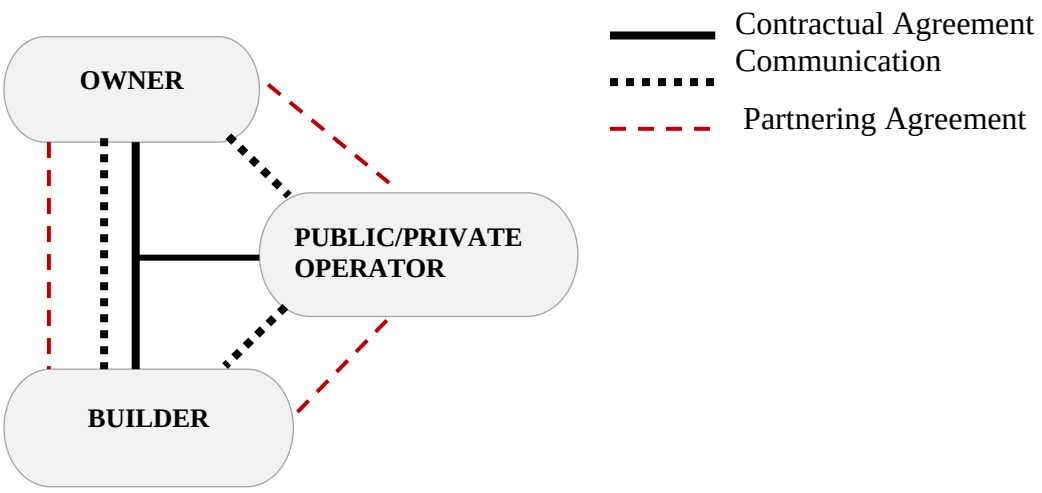


Figure 2-6. Partnering and P3 (Adapted from Federal Highway Administration. 2016).

It means that in DBB-Partnered Project, the owner is still responsible for finishing the design in order for the contractor to proceed with construction; in DB-Partnered Project a single firm is selected to furnish most of the design services and complete construction activities for each project (each work order); in CMGC-Partnered Project, a firm is engaged to provide input during the design of each project to subsequently perform as the general contractor during the construction phase, and in P3-Partnered Project allow for greater private participation in the delivery of transportation projects. Typically, this participation involves the private sector taking on additional project risks, such as design, construction, finance, long-term operation, and traffic revenue. The common characteristic among those project delivery methods is the basis of those agreements the principles and values of partnering. However, the correct time for this implementation is fundamental to achieve partnering agreements and project goals.

Since the use of partnering practices with any of these delivery methods seems to not change the fundamentals of these contracting methodologies, and despite the lack of research on this matter, the study found no reason to believe that combining partnering procedures alters the

advantages or disadvantages commonly attributed to these delivery methods. But, the different methods and tools that partnering offers can improve the project performance, take advantage of shorter delivery periods, greater flexibility in delivery scheduling, and other benefits provided by each alternative contracting method (Gransberg et al. 2015). Decision tools are further described below in order to provide an idea of how the three papers are integrated in an overall decision tool framework.

Decision Tools

The fourth theoretical framework for exploring is the Partnering Maturity Model (PMM). An organizational partnering maturity/intensity model patterned off the one also in use in the SHRP2 R-10 implementations (Gransberg, et. al., 2015) will be developed and used as part of all agency-level case studies. Its purpose is to gauge the level to which Partnering has been institutionalized within the given agency. For example, a DOT that partners every project over a pre-established value as a matter of policy would have a high level of organizational maturity. Whereas, an agency that is new to the program would show a low level of maturity. Comparing the maturity levels with the project performance output is expected to result in information regarding the efficacy of agency policies and regulations on Partnering. Upon completion of the case studies, the data will be reduced an analyzed in order to identify trends and disconnects, gaps in the body of knowledge, needs for contract clause guidance, examples of successful practices, and lessons learned. The primary focus will be to matrix specifics of the partnering model used for each case study. The details of that effort are contained in Chapter 5. Overall, the output from the qualitative and quantitative analyses combined with the maturity model output will allow to draw conclusions regarding the benefits of the partnering program in DOTs.

CHAPTER 3. **INSTITUTIONALIZING THE PRINCIPLES OF PARTNERING.**

Modified from a paper submitted to the Transportation Research Board, published by *Compendium* of the National Academies of Sciences

Pinto-Nunez, Milagros.[1] and Gransberg, D. Douglas.[2]

Abstract

The benefits that formal partnering on commercial building construction projects in terms of reduction of claims are widely recognized. However, there is no recent formal studies that describe the overall impact of formal partnering in terms of minimizing legal disputes in transportation sector. A recent AASHTO survey found that a number of public agencies have dropped formal partnering because they found that the costs longer were offset by the value of minimizing the legal conflicts. Using classic organizational management theory as its backdrop, this paper hypothesizes that those agencies that discontinued formal partnering have fully institutionalized the salient principles of partnering, such as increased collaboration, communication, and trust-building and no longer need to invest the resources to perpetuate a formal project-level partnering process. The paper bases this assertion on the analysis of the claims history found in four state departments of transportation. The study compared the mean project claims cost of the two agencies that formally partner most major projects to the claims record of the two that no longer employ formal partnering. The analysis finds that there is no

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statistically significant difference in the cost of claims between the two groups. Hence, the paper concludes that the two agencies that stopped using formal partnering had successfully institutionalized the precepts of partnering.

Introduction

Partnering in the transportation sector is a program that is about two decades old. Most public agencies and contractors agree that partnering has beneficial aspects that have been found to improve project performance. While the literature is seemingly rich with papers on partnering ((McFadden and Ernzen 2004), (Ali et al. 2010), (Black et al. 2000), (Anderson and Polkinghorn 2011), (Basham et al. 1994),Gransberg et.al 1994), the few large scale rigorous research studies in the record are all over 10 years old. Organizational management theory maintains that once a new business practice, such as partnering, is adopted that it takes a period of years before it becomes "institutionalized" (Campbell, 2006; (Meyer and Rowan 1977). This status is first defined by the organization having codified the practice in its policy and procedure documents, implemented the practice on a wide-scale, and then revised those documents based on lessons learned in field. Full institutionalization of a practice is achieved when working-level members of the organization accept it as standard operating procedure (Meyer and Rowan 1977). In the book *Seven Pillars of Partnering* (9), the authors detail the benefits of what they call "second generation partnering" (i.e. projects partnered after full implementation) predicting that with time "third generation partnering" will transform the "building process into a cycle of fundamental activities linked by co-operative decision-making activities." Partnering is one of those business practices that one might argue has been thoroughly institutionalized in the highway construction industry and in the two decades since *Seven Pillars of Partnering* was published that the US highway construction industry has probably reached its "third generation" state. So the present

question then becomes what does the "third generation" of partnering look like and does it still include the formal partnering workshops initiated as the catalyst to culture change in partnering's "first generation?"

A survey of the members of the AASHTO Subcommittee on Construction in 2014 found a number of state departments of transportation (DOT) had tried and after a period decided to not continue formal partnering (AASHTO 2014). The majority reason given was the inability to make a compelling business case for investing already limited resources to hire a professional facilitator, gather the members of the project delivery team, and engage in teambuilding workshops when many of the business relationships, both good and bad, were well-established and longstanding. The same respondents pointed to program-level initiatives such joint DOT/industry specifications review panels, etc. as having sufficiently provided the opportunity to identify systemic issues and resolve them before they devolved into project-level disputes. Thus, despite authoritative research touting the potential benefits of partnering, there remains a group of state DOTs that do not believe that those benefits outweigh the costs based on their own experience. Hence this paper will explore the idea that partnering principles can potentially be institutionalized without the requirement to engage in formal project partnering workshops, and that agencies that institutionalize partnering's precepts can accrue similar project performance benefits.

Background

Partnering lays the foundation for building trust, establishing common expectations, aligning each party's interests, communicating effectively, and resolving issues as they arise. The practice of formally partnering projects delivered by traditional project delivery is well documented as being effective at reducing disputes that result in claims (Darko et al. 2012);

(Bresnen 2007); (Crane et al. 1997); (Hong et al. 1995). An analysis performed on 131 peer-reviewed journal papers on the topic of partnering found that only 12 of those papers actually quantitatively measured project performance in partnered projects, and 9 of them were for projects constructed outside the US. Therefore, a gap in the body of knowledge exists with regard to how implementing partnering has impacted the performance of projects in the US transportation sector, specifically in terms of claims history. Most of the literature posits that partnering is a successful technique for reducing claim costs. Chan et al. (2002) conducted a study in Hong Kong and discovered that the number of claims on partnered building construction projects equal to or less than number of claims on an average project 86.8% of the time. On the other hand, a survey conducted among Canadian provincial ministries of transportation and US state DOTs found that very few agencies employ partnering specifically to minimize claims (Kildeer et.al 2015) because of a perceived paradox. That paradox maintains that the very use partnering to eliminate claims is essentially means the parties do not trust each other and as such is fundamentally in conflict with the spirit of partnering. As will be discussed later in the paper, this paradox leads to the practice of not recording project disagreements as they occur, depriving the agency of data regarding how successful its partnering program is in resolving the day to day project issues. Table 3-1 illustrates the change is partnering program usage for DOTs that answered surveys in 2012 and again in 2015.

Table 3-1. Change in partnering program usage (AASHTO SOC surveys from 2012 – 2015).

Never used partnering	**Used partnering in 2012 but stopped**	**Did not use partnering in 2012 but now do**		**Continuing use of partnering since 2012**	
New Mexico	North Dakota	Alaska	Massachusetts	California	Pennsylvania
Oklahoma	Oregon	Delaware	Minnesota	Colorado	South Carolina
Wisconsin	Montana	Idaho		Florida	Texas
	Vermont	Iowa		Indiana	Virginia
				Ohio	Utah

As result of this comparison, twenty-six state DOTs currently use formal partnering. Documented motivations for stopping partnering vary by agency. However, the responses seem to merge in a common denominator which the difficulty is measuring a positive return attributed to the partnering investment.

Short History of Partnering

In 1993, the US Army Corps of Engineers (USACE) compared 19 partnered building construction projects to 28 similar projects where no form of partnering agreement was used (Weston 1993). The study found that partnered projects tend to perform better than non-partnered projects. For example, it found that claims cost on partnered projects averaged 0.67% of the contract amount versus 5.01% on non-partnered projects. The USACE study quantifies and appears to verify the overall perception of the federal sector, but it is not directly translatable to the state sector because of the diversity of state-level procurement laws. The information available from public transportation agencies is diverse and inconclusive. For example, a 1999 Texas DOT partnering study of over 400 design-bid-build (DBB) highway projects (Gransberg 1999) found a much smaller range than USACE in claims cost percentages: 0.17% vs. 0.88% in partnered vs. non-partnered. Some agencies as Caltrans, Utah, Ohio, and Maryland report claims using different units of measurements, which makes direct comparison impossible. Caltrans measured claims according to the number of arbitrations that resulted from their dispute resolution process (Caltrans 2013). However, Utah and Ohio DOT measure the number of claims over a specific period of time and compare this value with the total number of projects completed (UDOT 2015; ODOT 2000). Finally, Maryland DOT applies the ratio between the number of claims and the cost of claims (Maryland 2016).

Most agencies use the number of claims as a unit to measure formal partnering benefits. However, there is not a standard policy among the agencies. The literature review for this study identified the use of formal partnering practices in twenty-six state DOTs. However, making a direct comparison is challenging due to the lack of standardization in partnering tools across the nation. To address the difficulty, the research team turned to those reported in DOT construction manuals. The study found that agencies have neither created key performance indicators nor performance objectives regarding claims reduction. This leads one to infer that formal partnering is assumed to eliminate claims or disputes through the improvement of working relationships and dispute resolution (Murdough et al. 2007; Eriksson 2010).

Two agencies that have unquestionably institutionalized partnering are the Utah and Ohio DOTs. UDOT bases its program on the following premise: "For contractors, unresolved claims mean fewer funds to reinvest in other enterprises, and, in extreme cases, may even threaten their companies' existence. Affecting both owners and contractors, beyond money and often even more damaging, are the negative attitudes and damaged working relationships that result when issues and claims remain unresolved" UDOT 2015). Hence, UDOT sees the practice as a means to not only reduce disputes but to also create healthier working relationships for future projects.

The Ohio DOT (ODOT) has established a *Partnering Handbook* (2000) to promote quality and consistency in its statewide partnering program. It uses a three-step dispute resolution and administrative claims process as follows:

Step 1 - written on-site determination.

Step 2 - district level determination by a District Dispute Resolution Committee.

Step 3 - central office level determination, using either a Director's Claim Board or a dispute resolution board or a dispute resolution advisor.

In this process, it is mandatory that the partnering facilitator assist both parties in the process of avoiding and resolving the claims, “but not to act in lieu of or as a member of the dispute resolution board or dispute resolution advisor” (Ohio DOT Partnering Handbook, 2000).

On the other hand, the Montana DOT (MDT) has a formal an issue resolution process that is documented in the MDT Local Agency Guidelines (LAG) Manual (2015). The details of the process are shown in Figure 3-1. This an example of institutionalizing partnering’s principle of dispute escalation by codifying a standard process in an agency policy document. MDT experimented with partnering in the late 1990’s and determined that the time an expense was not justified in a market where longstanding relationships existed and where construction claims litigation was infrequent (Montana DOT 2015).

The Oklahoma DOT also used formal partnering on its projects in the 1990's, but eventually reached a point where upper management felt it had become redundant to other ongoing industry outreach initiatives. The agency credits its close relationship with the construction industry for it enviable history of low contract cost growth. Oklahoma reported that it annual average contract cost growth has been less than 4.0 % every year for the past two decades (Gransberg et.al 2009). A major contributor to this outcome is the fact that very few claims reached litigation. Hence, this agency is another example of how the principles of partnering have been institutionalized into the Oklahoma DOT culture without the need to perpetuate formal project partnering activities. The above discussion is not meant to cast doubts on the reliability of formal partnering process but rather to indicate the importance of understanding the key tools, components, and practices of partnering that need to be addressed in order to have a successful internal dispute resolution process that preempts the appearance of claims in transportation projects.

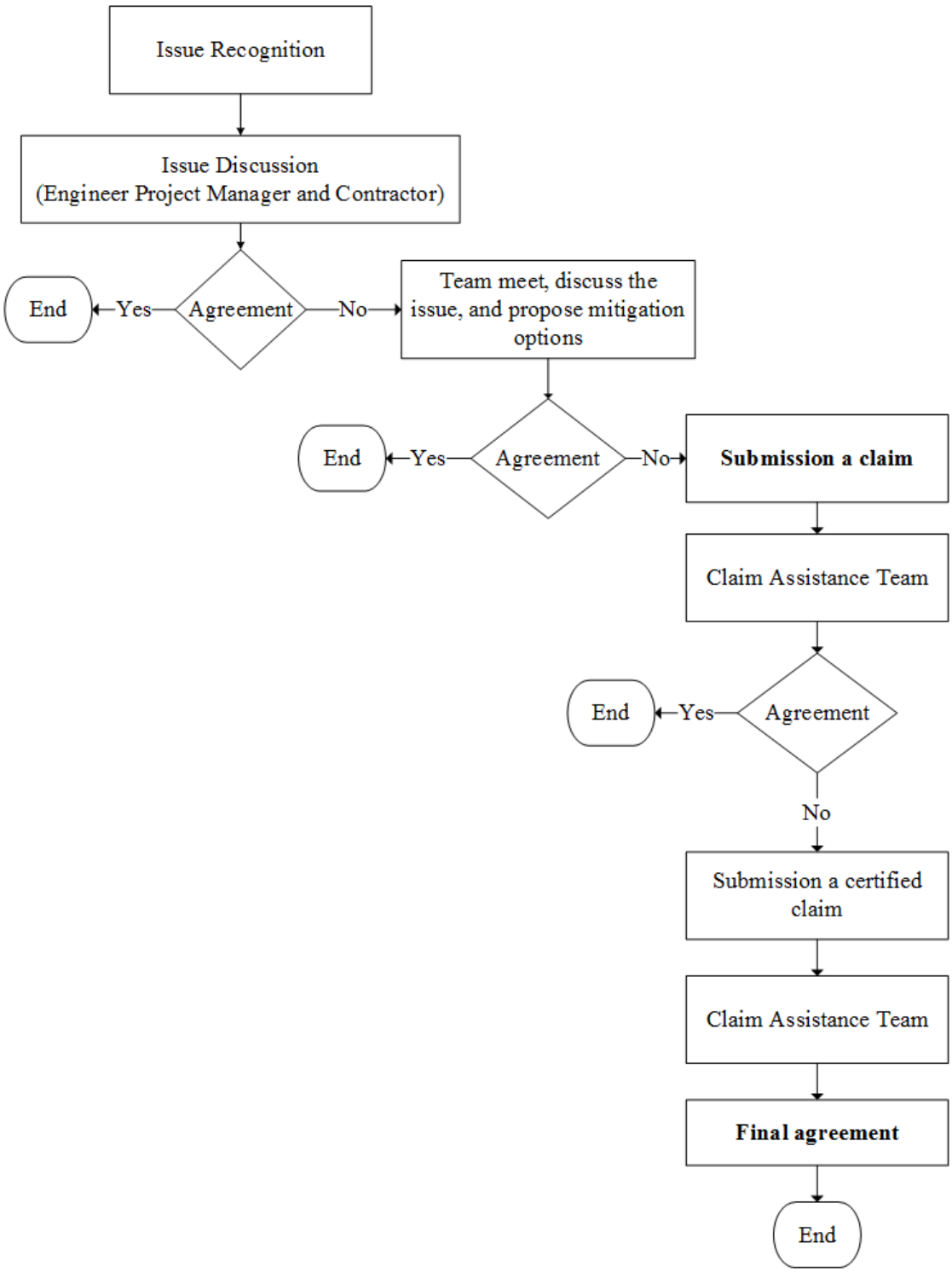

Figure 3-1. Montana DOT claim resolution process chart (Adapted from MDT LAG Manual 2013)

Construction Claim Avoidance

While the literature is full of examples of the benefits that a successful partnering program generates, the functional objective of a partnering program has to ultimately be resolving the many disagreements, issues, and disputes without resort to the courts (Kululanga et.al 2001). As stated by Naoum (2003), "The construction industry has identified the principles of an agreed dispute resolution process as being a systematic approach to problem solving based upon *the ''win–win'' philosophy inherent in the partnering process* [italics added]." Therefore, since this one aspect is easily measured, the remainder of the paper will be devoted to evaluating partnering's impact on reducing construction claims litigation. The question essentially becomes one of whether or not a formally facilitated workshop is required to create the necessary business cultures that actively resolve disputes at the lowest possible level, the key partnering principle. Meyer and Rowan (1977) put this question into its theoretical context

"Institutionalized products, services, techniques, policies, and programs function as powerful myths, and *many organizations adopt them ceremonially*. But conformity to institutionalized rules often conflicts sharply with efficiency criteria and, conversely, to coordinate and control activity in order *to promote efficiency undermines an organization's ceremonial conformity* and sacrifices its support and legitimacy… building gaps between their formal structures and actual work activities [italics added]."

To put Meyer and Rowan's quote in the context of this paper, formal partnering workshops represent the 'institutionalized program' that has been 'ceremonially adopted' and the idea that regularly performing the ceremony minimizes or eliminates claims is potentially the 'powerful myth.' The experience gained by the Montana and Oklahoma DOTs with formal partnering is an example of the ceremony conflicting with efficiency criteria to the point where

those agencies stopped practicing the ceremony. The issue to be addressed in the remainder of the paper is whether or not perpetuating the ceremony has created a gap between the institutionalized principles of partnering and the actual performance of partnered projects.

Very little research has been done in transportation projects to specifically measure the impact of minimizing claims. For this study's purposes, claims are defined as "contract disputes that are settled above District level" (Gransberg et.al 1999). A change in attitude towards the relationship among partnering and claims may be warranted as increasing evidence in the practice shows that some agencies have recorded measurable positive impacts on the claims costs by reforming their business culture instead of a formal partnering project program.

In formal partnering, one of the key elements is the dispute resolution ladder (Black et al. 2000). This tool is created during the partnering workshop. Each agency has the opportunity to develop its own methodology but essentially the rungs of the ladder escalate up through parallel agency and contractor organizations. At each level, representatives with an increasing level of authority attempt to resolve the issue if possible. The escalation plan is among the two primary parties to the contract. The process is designed to be both swift and equitable, avoiding having to divert both parties' resources from be expended on litigation with its attendant distractions and emotions.

However, the concept of dispute resolution through organizational escalation is not necessarily specific to formal partnering. A number of DOTs have appropriated the strategy of issue escalation without the benefit of a formal partnering charter as a result of lessons learned regarding the potential negative impact of claims and the result has been positive. It is logical that a state agency should do its best to expend its annual budget on improving the transportation system rather than unproductively defending itself against contract claims.

The remainder of the paper will compare the claims history of DOTs that actively utilize formal partnering to those that do not. The information comes from the Ohio and Utah DOTs who formally partner, most, if not all, their projects and the Montana and Vermont DOTs who do not. The analysis seeks to determine if there is a statistically significant difference in the cost of claims between the two types of programs.

Methodology

A number of research instruments were used to elicit information on how formal partnering could impact the reduction of claims. A comprehensive literature review was first conducted. It found that there are few established protocols for quantifying partnering's impact construction claims. It also found that there seems to be no standard definition for key terms like issue, dispute, claim, etc. Since each agency has its own terms, it is difficult to compare the information contained in each report in the literature to a common base-line with reasonable confidence.

Interview Findings

The second research instrument was structured interviews performed in accordance with the protocols specified by the US Government Accountability Office (1991). The information gathered during interviews with staff formed the current state-of- practice on formal and informal partnering at AASHTO Subcommittee of Construction. This was used as validation to evaluate the usefulness of the proposed methodology in this research. Key points of information gathered included:

Some of the perceptions found in the survey for choosing to not use formal partnering are: lack of familiarity with the process, limited resources to commit to a formal partnering program, and the difficulty in measuring tangible results from partnering.

The term claims varies between public agencies. Current practices used to evaluate the claim costs are not standard and often rely only on the claims register kept at the project work site.

Agencies that do formally partner projects don't always enter every potential claim brought to their attention, because they perceive that the very act of recording every issue violates the spirit of partnering. This paradox was confirmed in the literature (Bresnen 2007).

Weekly partnering meetings are held at Utah DOT to review current project status and to evaluate the partnering work effort. According to them, this meeting can help the parties to understand the schedule, coordinate work, identify and resolve issues, discuss the status of the project, and plan the week ahead.

The partnering workshop training helps teams work together in an amiable way. The formal partnering process causes teams to proactively make commitments to each other. They collectively decide to put the project first and to resolve all project issues as a team in a timely manner. According to the workshop participants, partnering does not eliminate claims, but the majority perceived that formal partnering does help to reduce them.

Case Studies

The case study selection procedure considered the size of the DOT's geographic area of responsibility, its typical annual construction budget, and the number of heavy highway general contractors (GC) in the state. From an original list of 22 proposed states, four DOTs were selected. All four case studies furnish examples of the successful reduction of claims using one common component: a formal dispute resolution process. Data was collected on the agencies' formal partnering procedures and summary of claims history were obtained. Table 3-2 summarizes the demographics of the four case studies. The table attempts to demonstrate that

annual construction budget for each state expressed as a function of population, land area, and most importantly for this topic, as a function of the number of different contractors with which the DOT is able to do business. A state with a large land area and relatively small population, like Montana, has a relatively low dollar ($) per number of contractor. Since highway construction costs are a function of the mobilization distance, this differs greatly from smaller states with denser populations, for instance Utah with higher dollar per number of contractors.

Table 3-2. Population, land area and highway contractor information (U.S. Census Bureau 2015 & AGC of America)

Part-nering	Agency	Annual Budget ($M)	Popu-lation (M)	Budget per capita ($M)	Land area (SM)	Budget per SM ($M)	GCs	GC Density (SM/ GC)	Budget / GC ($M)
Formal	Utah	$1,400	2.99	$0.47	82,170	$17.04	45	1826	$31.11
Formal	Ohio	$3,100	11.6	$0.27	40,948	$75.71	123	333	$25.20
None	Vermont	$685	0.63	$1.09	9,249	$74.06	40	231	$17.13
None	Montana	$667	1.03	$0.65	145,55	$4.58	50	2911	$13.34

M = million; SM = square miles; GC = highway general contractor

Current Practices to Reduce Claims

Structured interviews with case study DOTs and survey responses indicate that not all DOTs use a formal partnering process to resolve contractual disagreements with general contractors in transportation projects. In the cases where the agency does not partner, a special process based on lessons learned from settled or closed claims to improve contracts and specifications is put in place to expedite dispute resolution. The study collected dispute data that was statistical analyzed measure the effectiveness of partnering in reducing claims costs in the case study DOTs. The process relies on trend analysis between the claims costs and the final cost of completed projects using descriptive statistics. The following hypothesis is tested:

Claims costs are lower for agencies that partner than those that do not.

Data was collected from four state DOTs. Because of differences in agency internal policies and procedures, each agency is evaluated as a stand-alone case, and no attempt is made to aggregate the total pool of projects to avoid the potential for missing unrecognized factors between agencies such as the project delivery method or the complexity of the project, and to relieve the need to test for skewing of the results due to unequal sample populations. The researchers also felt that in doing so it would allow a loose comparison between this study and previous ones in the literature (Gransberg et.al 1999); (Weston et.al 1993).

Data over a period of 10 years was collected from each of the agencies in the sample. The interviews found that the process to a construction claim typically begins when the agency rejects a contractor's change order request. The claims cost (CC) is the ratio between the total cost of claims and the original contract cost as shown in Equation 3-1.

CC = Total Cost of claims / Original contract cost **[Eq. 3-1]**

Data Analysis

Previous research finds that award price of $5,000,000 is a threshold to group claim costs. Projects that are lower than this value are highly sensitive to the amount of claim cost when expressed as a percentage of the original cost in partnered projects (Gransberg et. al, 1999), which introduces unintended skewing of the sample output.

The Montana and Vermont DOTs have a history of claims of roughly the same magnitude as the Utah and Ohio DOTs who partnered most projects over the past 10 years. A statistical analysis was conducted with the T-test and One-way ANOVA test to identify and confirm the trends found in the data. The Tukey-Kramer formula are used to permit the multiple comparison of results having unequal observations in the samples (DeVeaux et.al. 2008). Table 3-3 shows the descriptive statistics of the data. The Montana DOT had the highest mean claim

cost is and the lowest value is from Utah DOT. Nevertheless, the data with the highest standard error is from Utah DOT. The mean claim cost for the four agencies are in the same range, for that reason, it was tested the following null (H_o) and alternative hypothesis (H_A):

H_o: *The mean claim cost for Ohio Dot is the same as the mean claim cost from Utah DOT, Montana DOT, and Vermont DOT. There is no difference in the quality evaluation requirements*

H_A: T*he mean claim cost is not the same across the four agencies.*

Table 3-3. Mean and standard error of the claim cost of the case study agencies.

Program	Agency	Mean Claim Cost	Std Error Claim Cost
Formal Partnering	Ohio (ODOT)	2.70%	1.223%
	Utah (UDOT)	1.70%	2.446%
None	Montana (MDOT)	4.13%	1.934%
	Vermont (VDOT)	3.69%	2.233%

As can be seen in Table 3-4, since the P-value for the seven comparisons are higher than the significance level (0.05), we failed to reject the null hypothesis. There is not enough evidence that suggest that the mean claims costs are statistically different among the four agencies.

Table 3-4. Mean claim cost comparisons using Tukey-Kramer HSD method**.**

Level	- Level	p-Value
MDOT	UDOT	0.8647
VDOT	UDOT	0.9313
MDOT	ODOT	0.9244
ODOT	UTAH	0.9832
VDOT	ODOT	0.9796
MDOT	VDOT	0.9989

A second statistical analysis grouping the agencies by the type of program was conducted. It compared the mean claim cost of the two agencies that formally partnered with the mean claim cost of the two that do not. The results are shown in Table 3-5. Because p value > 0.05, there is enough evidence that suggest that the main claim cost for both groups of agencies is the same.

Table 3-5. T-test results for partnered and non-partnered mean claim cost (p = 0.05).

Factor	Value
Difference	-0.01437
Std Err Dif	0.01780
t Ratio	-0.80762
DF	37
Confidence	0.95
Prob > |t|	0.4245

The statistical analysis shows that the cost claims for the four agencies is not significant different (p =0.05) for the same range of projects Implementing a process to encourage collaboration, facilitation and negotiation skills for small agencies who do not partnered is same effective that for large agencies a formal partnering process in order to reduce the claim costs. This is because these methods are highly structured and do not rely primarily on personal judgment.

Conclusion

The research attempted to determine if the presence of formal partnering led a statistically significant difference in mean claims costs. The statistical data were drawn from four agencies, and as such, the results only apply to those agencies. The literature review found that some DOTs have stopped formal partnering because they do not perceive it has having a direct, measurable impact in reducing of claims. The statistical analysis showed that since there was not a significant difference in claims costs that both Montana and Vermont had institutionalized the

precepts of partnering to the point where the investment in the catalyst provided by a formal partnering workshop was no longer justified.

The option of not using formal partnering to minimize claims in transportation sector is only viable after an agency has institutionalized the principles and values of partnering. The results suggest that a continuing investment in negotiation and facilitation training may be necessary to leverage achieve a desirable project performance rather than implement a formal partnering process at project level. Changing the construction business culture from an adversarial environment to a collaborative one requires the agency codify that change in its policies, procedures, specifications, and contracts. Once the culture shift is truly made, the need for ceremonial adoption of rituals like the formal partnering workshop is overcome by the need to more efficiently use available capital on practices that generate a measurable return on investment. While this study is by no means comprehensive, it does lead one to infer that both Montana and Vermont may transcend to Bennet and Jayes (1998) "third generation" of partnering.

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CHAPTER 4. COMPREHENSIVE IDENTIFICATION AND EVALUATION OF PARTNERING INTENSITY AND ITS EFFECT ON HIGHWAY CONSTRUCTION PROJECT

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Abstract

The literature demonstrates that partnering has been proven to be an effective management technique to improve project performance. Moreover, it has changed the business behavior of a number of transportation agencies. As a result, partnering has evolved into a multifaceted practice that has different intensity levels to permit its effective application on projects delivered by alternative contracting methods (ACMs). However, there are few, if any, authoritative studies that validate the purported improvement on partnered project performance in conjunction with ACMs. This paper describes the elements that define the partnering intensity regarding the project characteristics and partnering tools. The paper hypothesizes that a higher partnering intensity results in better project outcomes concerning cost, time and claims. The paper bases this assertion on the analysis of cost and time growth and claims costs from 20 partnered highway construction projects located in seven transportation agencies. The projects are grouped into two categories: partnering intensity and the type of contracting method. The

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paper finds that higher partnering intensity is generally associated with complex ACM projects that require collaborative procurement practices. The paper's primary contribution is to define partnering intensity for the first time as well as relate partnering intensity organizational maturity modeling as a means to achieve improved partnering management practices.

Keywords: partnering intensity, organizational maturity, alternative contracting methods, and performance metrics.

Introduction

Formally partnering highway construction projects began two decades ago and was generalized by the publication of the AASHTO Partnering Handbook in 2005. The handbook's purpose was to provide mechanisms to improve project performance by incorporating teamwork skills within an atmosphere of honest and information-rich communication between the agency and its contractors in an effort to overcome the traditional adversarial environment (Wilson et al. 1995; Cheung et al. 2003; Chan et al. 2003; Woien et al. 2016). Partnering was first used in commercial building construction projects, and the literature contains much discussion of partnering's values and principles, as well as examples of evaluation mechanisms that attempt to validate its benefits (Crowley and Karim, 1995; Naoum, 2003; Nystrom, 2005; Erickson 2010). One of the key issues of implementing partnering in other industries remains the ability to visualize and understand its multidimensional character as well identify the level of organizational partnering maturity with respect to institutional policies, procedures and strategies that fit the needs of each project (Cheng and Li 2002).

Transportation agencies have adopted varying levels of partnering to meet the needs of their construction projects, ranging from informal partnering led by project personnel to formal levels led by external partnering facilitators (AASHTO Survey 2014). However, the presence of

a formal partnering program may not always be the ultimate indicator of success. The literature demonstrates that some partnered projects do not achieve their desired performance outcomes (Bresnen and Marshall 2000). Research performed by Ng et al. (2002) found that the principal causes for an unproductive partnering process are the lack of continuous and open communication, lack of a "win–win" attitude, and unwillingness to compromise; all core values of partnering that need to be adopted among the team project members and stakeholders.

The practice of partnering is well documented as being effective at reducing disputes that lead to both time and cost growth (CII 1991; Gransberg et al. 1999; Nyström 2007; Weston and Gibson 1993). However, there have been relatively little, if any, serious research into strategies, methods, and tools for partnering projects delivered using alternative methods (Li et.al. 2013). Moreover, implementing design-build (DB) and construction manager/general contractor (CMGC) has created challenges for the highway construction industry due the demand for higher levels of both integration and collaboration in ACM project delivery over traditional design-bid-build (DBB) to meet the demands of aggressive schedules and the need to better optimize resources (Anderson and Polkinghorn 2011, Bresnen 2007). However, little specific information is known about the impact of partnering on the approaches, methods, and tools used by transportation agencies to achieve critical project success factors (Pinto and Gransberg, 2017).

Therefore, the purpose of this paper is to fill that gap in the body of partnering knowledge by analyzing the statistical significance of three common project performance metrics: claims cost, time growth, and cost growth of seven transportation agencies' partnered projects implementing different partnering intensities delivered using both traditional and alternative delivery methods in an extended multidimensional approach. The information comes from a rigorous content analysis of case study agency construction manuals, standards, specifications,

special provisions as well as structured interviews with case study project personnel. The paper defines the term "partnering intensity" for the first time and applies it to tools that can be adopted to achieve project performance goals based on the specific conditions of each ACM procurement method. Finally, the parametric and non-parametrical statistical analysis techniques are used to identify trends in the data, draw conclusions, and make recommendations based on trends found in the data.

Background

Partnering: Scope and Tools

This paper uses the widely cited Construction Industry Institute's (CII) definition of partnering. Partnering is defined as "…a long-term commitment between two or more organizations for the purposes of achieving specific business objectives by maximizing the effectiveness of each participant's resources…" (CII, 1991). The key components in a partnering relationship are trust, common goals, honesty, communication, cooperation, teamwork and deep sense of commitment (Naum, 2011). As these elements are realized, other subsidiary benefits will accrue, and the benefits to all members of the project team will be maximized (Ericksson, 2009). The commitment to make partnering work must originate with top management and generate an atmosphere of constant improvement, allowing team members to build on successes (Black et al. 2000). Mutual trust must be established to a much greater degree than is common in traditional contracting relationships. The first step in this process is to trust in terms of the partnering agreement (Mohr and Spekman, 1994). Through the partnering process, the parties identify individual goals which are common to all members of the project team. Typical examples of jointly developed, mutually agreed common goals include completing the project ahead of schedule, expediting technical review turnaround, containing costs, no lost-time

injuries, reducing paperwork, or any other goals that are specific to the nature of the project. Continuing partnering process improvement involves two key elements. First, all parties to the partnering agreement must realize that it is an evolutionary process. All must work toward continuous improvement if the program is to succeed and the team members should contribute to improving project performance and are encouraged to give contributions about any technical issues (Bessant and Francis 1998). Secondly, evaluating project performance is crucial to both the agency and its contractor.

Bennet and Jayes (1998) described the starting point of partnering as seven pillars to be constructed.

1. Strategy
2. Membership
3. Equity
4. Integration
5. Benchmarks
6. Project Processes
7. Feedback

The pillars provide the foundation for a successful partnering process and can be found in some form in most agency construction partnering manuals. Each pillar has a deliverable and tangible outcome that allow measuring the impact and effectiveness of this technique. The concepts of growth and continual improvement are basics to the partnering process (Ellram and Edis 1996). The sharing of common goals can result in a positive work environment that promotes innovation and high productivity (Bresnen, 2007).

To accomplish these principles, various partnering tools have been developed, including training, workshops, follow-up meetings, team-building exercises, dispute resolution ladder, and incentives. The main purpose of these tools is to align the parties' and the project's objectives with a common overarching goal and thereby, create a more cooperative and effective project

team. The literature posits that trust and mutual understanding are the two most important components of partnering, and that teambuilding activities, conflict resolution techniques, and feedback information system are necessary to attain better outcomes in project performance metrics (Nyström, 2005; Cheung et al. 2003b; Bayliss et al. 2004).

Partnering Intensity

The research conducted for the new edition of the AASHTO Partnering Handbook found that both DOT and construction industry employees perceived that the principles of partnering were indeed valuable and that practicing them did improve overall project performance, but the improvement was difficult to quantify in terms of a classic benefit/cost ratio (Gransberg et. al. 2017). Therefore, recognizing that all the reasons listed above were valid, many DOTs chose to employ partnering without the benefit of an externally facilitated workshop, a practice that became known as "informal partnering." A 1998 TxDOT study of over $2.0 billion worth of partnered and non-partnered projects recommended that three elements of the formal partnering process be included in TxDOT preconstruction conferences for those projects where formal partnering was deemed to be unnecessary: issue identification, issue resolution, and dispute escalation ladder (Gransberg et. al 1999).

The term “semi-formal partnering” partnering was coined by the Utah DOT (2015) and involves training state employees to facilitate partnering workshops for projects in which they have no personal involvement. At the same time, with the encouragement of the construction industry, DOT upper management began formally including partnering principles in policy documents, standard operating procedures, construction administration manuals, and state-level partnering handbooks. Additionally, enterprise-level initiatives that employed fundamental partnering principles were instituted to resolve systemic issues that had led to or could to lead to

disputes. Typical examples are state-level joint specifications review committees, regular periodic industry outreach activities, and joint partnering steering groups. This type of activity is termed "institutional partnering" (Bayes and Hanes 1998), and it involves adopting partnering principles as routine agency business practices and codifying them in a manner where all DOT employees are required to administer construction contracts in the same way. In other words, partnering becomes the way the agency does business regardless of whether partnering events are applied to a given project.

The result of partnering's evolution is a spectrum that ranges from informal partnering to formal partnering, beneath the umbrella of institutionalized partnering principles and will be called "partnering intensity." Figure 4-1 graphically illustrates the concept of increasing project-level partnering intensity as the complexity and cost of the given project increases. The intent of the figure is to illustrate that as the stakes assigned to project success rise, the partnering intensity should also increase. It also strongly advocates institutional partnering as a mechanism for codifying partnering principles as routine business practices.

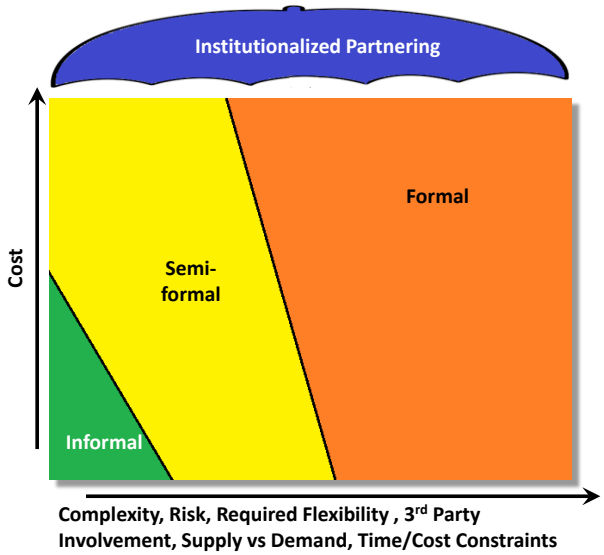

Figure 4-1. Partnering intensity spectrum

The partnering intensity is defined regarding the tools and type of facilitation that includes. Each intensity level is explained as follows.

- Informal Partnering: a sequence of processes initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics to achieve the agreed performance metrics of the project. Informal partnering applies institutional construction manuals, dispute escalation ladders without the presence of an outsider facilitator, usually is conducted by the resident engineer.
- Semi-Formal Partnering: a sequence of processes initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics in order to achieve the agreed performance metrics of the project. Semi-formal partnering is conducted by a trained internal facilitator whose duties are not related to the given project.
- Formal Partnering: a structured sequence of steps initiated at the starting point of the project that is based on mutual objectives and applies specific tools and techniques as well as project characteristics. Formal partnering utilizes an outsider facilitator, workshops, charter, and conflict resolution techniques in order to achieve the agreed performance metrics of the project.
- Institutional Partnering: the incorporation of the principles and values of partnering into organizational documentation that prescribes the manner in which construction contracts will be administered, transforming the construction administration "process into a cycle of fundamental activities linked by co-operative decision-making activities." (Bennett and Jayes 1998)

Research Objective

To the best of the authors' knowledge there has been no previous research specifically aimed at investigating time, cost and claims impacts on project performance when different partnering intensities are applied to ACMs. Hence, this study focuses on metrics such as cost growth, time growth and claims cost observed on 20 partnered projects categorized with respect to the contracting strategies and levels of partnering intensity. In this research, the following three types of partnered projects were compared:

- Cost growth on partnered projects in contrast to partnering intensity, procurement methodology, and level of maturity of the agency,
- Time growth of partnered projects in contrast to partnering intensity, procurement methodology, and level of maturity of the agency,
- Claim Cost on partnered projects in contrast to partnering intensity, procurement methodology and level of maturity of the agency.

Within this context, the primary objective of this study is to investigate if there is any statistical significance between the metrics previously mentioned with the outcomes of the partnered projects.

Research Assumptions

The study is based on the following four assumptions:

1. Independence among the sample projects was assumed, and accordingly, all project data were assumed to be statistically independent.
2. It was assumed that time and cost growth, as well as claims cost, were neither in synchrony nor related. The main focus of this study is to investigate the isolated impact of partnering intensity and ACMs on partnered projects. It was assumed that external and internal factors

that affect the project performance such as labor productivity do not have a considerable impact on the project outcome.

3. The bias from departments of transportation (DOT) time, cost, and claims estimating were assumed to be minimal, thus having no effect on project performance.
4. DOTs were assumed to be unbiased in selecting ACMs.

Methodology

This research employed a multiple-case study design (Eisenhardt 1989; Yin 2009) and selected twenty partnered projects for analysis. A case study research approach was selected for multiple reasons, including a limited sample size, the research question's focus on explaining and exploring how partnering intensity influences project performance outcomes (Yin 2009). Given the conditions that characterize the highway construction management domain (i.e., uniqueness of projects, duration, and complexity), case studies allow researchers to answer questions of how and why, and to contextualize a phenomenon and then define how it plays out under different contexts (Taylor et al. 2009). Studying multiple cases allows the researchers to observe if emergent findings are distinctive to one case or replicated by the others, something commonly referred to as replication logic (Taylor et. al 2009). Generalizability thus increases with replication logic.

The overall methodology is illustrated in Figure 4-2. Phase 1 refers to the data gathering. The case studies were selected to represent a varied sample of partnered projects in DOTs. Partnered case studies were selected based on four factors: (1) projects differed in partnering intensity; (2) projects varied in size, scope complexity, and location; (3) projects varied in procurement types, and (4) agencies with a difference in partnering experience. The data initially collected was verified by structured interviews. If any discrepancy appeared, then the data was

dropped. Finally, in Phase 3, the initial analysis of the data includes normality test of the metrics (i.e. cost growth, time growth, claims cost) using a suitable statistical probability distribution. An ANOVA test was performed including parametric and non-parametric tests in order to compare the results.

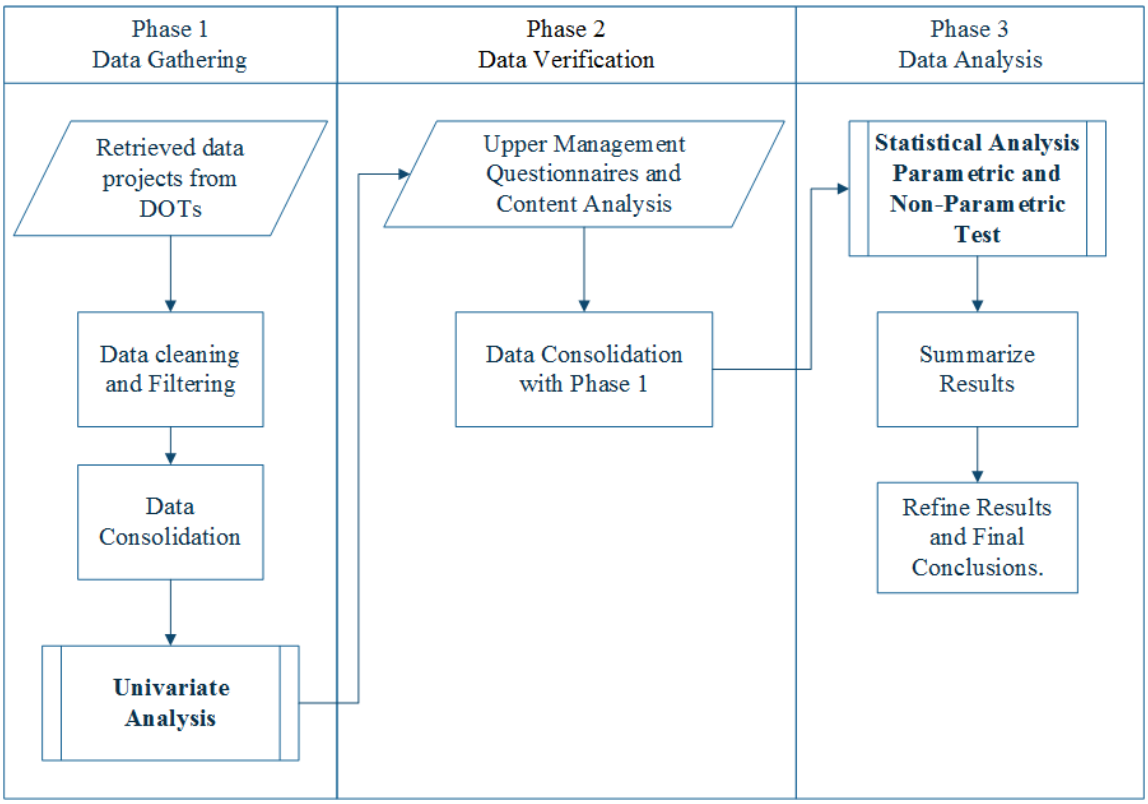

Figure 4-2. Research methodology

Data Collection

The case studies were collected using a protocol based on Yin's methodology for case study research data collection (Yin, 2014). The structured interviews were developed using the protocol prescribed by Oppenheim (2000) and further elaborated by Government Accountability Office procedures (GAO 1991). Once a case study interview was completed, the raw information collected was reduced and integrated with data from the literature review. Therefore, the

information derived from the case studies is coupled with information collected in the literature review to validate any conclusion drawn from the case studies. The 20 case studies were jointly selected based on agency experience with project partnering and availability of formal documentation regarding traditional and alternative project delivery methods. All of the agencies were experienced with formal partnering tools such as workshops, charters, dispute resolution process, etc. The primary purpose was to better understand the state-of-the-practice in transportation partnering techniques. Additional program-specific information was obtained such partnering evaluation form, and agendas of follow-up partnering meetings provided by each agency. Table 4-1 and Table 4-2 show information about the case study categorized by traditional and alternative delivery methods including the partnering intensity.

Table 4-1. Case studies for traditional procurement method (DBB)

No.	State	Agency	Delivery method	Project Initial Contract Amount ($)	Partnering Intensity
1	Missouri	MoDOT	DBB with ATCs	229,450,505	Formal
2	Ohio	ODOT	DBB	132,063,941	Formal
3	Ohio	ODOT	DBB	119,988,187	Formal
4	Louisiana	LaDOTD	DBB with A+B	82,861,116	Formal
5	Pennsylvania	PennDOT	DBB	61,043,688	Formal
6	Louisiana	LaDOTD	DBB with A+B	39,888,687	Formal
7	Louisiana	LaDOTD	DBB	35,331,982	Formal
8	Texas	TxDOT	DBB	35,161,388	Formal
9	Louisiana	LaDOTD	DBB	16,366,661	Formal
10	Utah	UDOT	DBB	12,222,077	Informal
11	Utah	UDOT	DBB	9,786,432	Informal
12	Utah	UDOT	DBB	6,643,597	Informal
13	Utah	UDOT	DBB	3,813,793	Semi-formal
14	Utah	UDOT	DBB	3,597,024	Semi-formal

Table 4-2. Case studies for alternative contracting methods (ACMs)

No.	State	Agency	Delivery method	Project Initial Contract Amount ($)	Partnering Intensity
1	Colorado	CDOT	CMGC	72,000,000	Formal
2	Utah	UDOT	DB	60,890,833	Formal
3	Louisiana	LaDOTD	DB	60,000,000	Formal
4	Louisiana	LaDOTD	DB	36,240,000	Formal
5	Utah	UDOT	DB	29,030,716	Formal
6	Colorado	CDOT	CMGC	17,100,000	Formal

Qualitative Agency Maturity Context

Since partnering is applied with both traditional and alternative delivery methods in many agencies, it is important to understand the organizational context in which each of the case study projects was implemented. All agencies have legislative authority to use alternative project delivery methods. Both Colorado and Utah have experience with construction manager/general contractor (CMGC) and design-build (DB) project delivery. Therefore, the twenty cases also portray a range of project delivery experience from Colorado to Utah with experience in all alternative project delivery methods.

A content analysis was conducted to identify partnering features that reflect a cultural change for agencies with experience in partnered projects. As a result of this analysis. The organizational partnering maturity was described as a measure of the number of partnering features that has been institutionalized as evidenced by being found in agency documentation, policies, and expressed business objectives. At the end 14 features were identified and describes as follows without any specific order: Partnering values, collaboration, training, alignment, leadership, workshops, risk plan, communication, issue resolution plan, partnering performance metrics, resource accountability, follow-up process, documentation plan, and improvement process. These partnering features evolved to become partnering strategies, the basis for a

partnering maturity model. For purposes of this paper, each agency was classified on a five level maturity scale from A to E using the number of the 14 partnering strategies found in their documents as a measurement. This categorization does not indicate the real level of maturity, and it is merely a qualitative category to evaluate the performance metrics. Table 4-3 indicates the category according to the number of those partnering strategies.

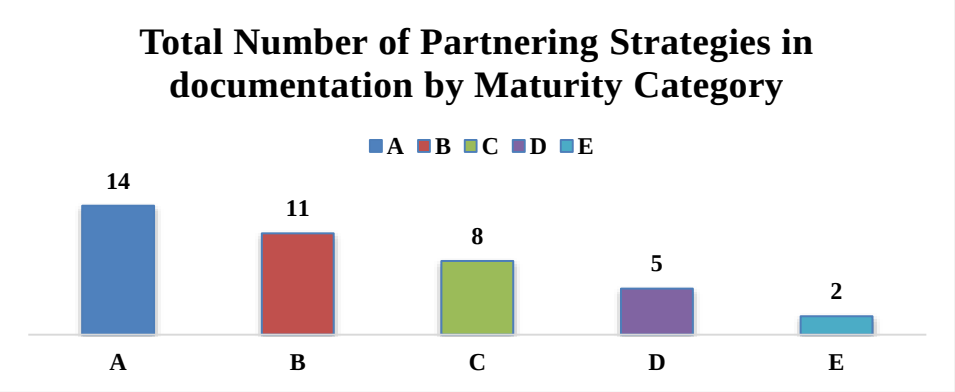

Figure 4-3. Qualitative maturity category vs. the total number of partnering strategies**.**

Table 4-3 summarizes the actual partnering practice according to the state for each agency and the maturity category. The information regarding the partnering use came from the survey responses to a questionnaire issued to the members of the AASHTO Subcommittee on Construction in 2015 (Gransberg et. al. 2017).

Table 4-3. Case study partnering use by project delivery method.

State	Design Bid Build (DBB)			Design Build (DB)		Construction Manager/General Contractor (CMGC)		Maturity Category
	Formal	Semi-Formal	Informal	Formal	Informal	Formal	Informal	
Colorado	x		x	x	x	x	x	B
Louisiana	x		x	x	x			D
Missouri	x		x	x	x			D
Ohio	x		x	x	x			A
Pennsylvania	x		x	x	x			A
Texas	x		x	x	x			C
Utah	x	x	x	x	x	x	x	A

Data Analysis

Analysis of the data collected permitted the calculation of three separate project performance parameters. Those metrics were taken from the research developed by Gransberg et. al. (1999) in which each parameter mathematically describes some performance measure in terms of cost, time, and legal aspects of partnered projects. The intent of this effort is to compare means and identify trends that suggests partnering intensity influence in the outcome of the project.

Metric 1 – Cost Growth

Cost growth (CG) is a standard measure of project performance and defined the change in the contract amount concerning the original contract amount. This can be described by equation 4-1:

$$CG = \frac{\text{Final Contract Amount-Original Contract Amount}}{\text{Original Contract Amount}} \quad \textbf{[Eq. 4-1]}$$

This parameter is converted to a percentage of growth over original contract amount. The comparison of this parameter between partnering intensity, type of delivery method and maturity category should permit the determination of whether partnering has any impact on subsequent cost growth within a project.

Metric 2 – Time Growth

Time growth (TG) is the change in time on the original contract completion date. Time growth is generally a result of changes in the scope of the project. Positive values of time growth mean that the project is completed later than the original completion date and negative values refer when the project is completed earlier than the original completion. Time growth is calculated using equation 4-2:

$$TG = \frac{\text{Days charged - (Total Days Allowed + Additional Days Granted)}}{\text{Total Days allowed + Additional Days Granted}} \quad \textbf{[Eq. 4-2]}$$

Metric 3 – Claims Cost as percentage of original cost

For the purpose of this paper, claims are defined as reclamation for contractors compensation of work performed that the contractor believes outside the scope of the contract. The scheme of the claims is based on the dispute resolution process and usually begin as contractor requests for a change order and become claims when it escalates from owner rejections and is above project level. A traditional tangible output of the partnering workshop is an issue escalation ladder to deal with disagreements and to attempt to keep them from becoming claims (Voyton and Siddiqi, 2004). Claims cost (CC) is determined using equation 4-3:

$$CC = \frac{\text{Total cost of Claims}}{\text{Original Contract Cost}} \qquad \textbf{[Eq. 4-3]}$$

Table 4-4 and Table 4-5 shows a statistical breakdown of the project parameters previously discussed for the 14 traditional partnered projects and six alternative partnered projects respectively. These groupings were ordered regarding the project contract amount.

Table 4-4. Statistical breakdown of case study. Traditional delivery method

No.	Maturity Category	DOT	PI	CG (%)	TG (%)	CC (%)
1	D	MoDOT	Formal	0.010%	0.000%	0.000%
2	A	ODOT	Formal	0.560%	0.000%	0.000%
3	A	ODOT	Formal	0.000%	0.000%	0.000%
4	D	LaDOTD	Formal	14.040%	75.980%	0.000%
5	A	PennDOT	Formal	12.160%	-0.700%	0.000%
6	D	LaDOTD	Formal	-3.730%	5.830%	0.000%
7	D	LaDOTD	Formal	2.730%	5.300%	0.000%
8	C	TxDOT	Formal	0.190%	- 0.590%	0.000%
9	D	LaDOTD	Formal	16.790%	2.130%	0.000%
10	A	UDOT	Informal	-10.740%	-2.690%	0.000%
11	A	UDOT	Informal	2.330%	0.000%	0.000%
12	A	UDOT	Informal	-11.270%	-0.000%	0.000%
13	A	UDOT	Semi-formal	-1.300%	8.210%	0.000%
14	A	UDOT	Semi-formal	1.490%	2.410%	0.000%

Table 4-5. Statistical Breakdown of case study. Alternative delivery methods

No.	Maturity Category	DOT	PI	CG (%)	TG (%)	CC (%)
15	B	CDOT	Formal	-5.560%	0.000%	0.000%
16	A	UDOT	Formal	8.190%	3.370%	0.000%
17	D	LaDOTD	Formal	1.950%	20.210%	0.000%
18	D	LaDOTD	Formal	1.330%	14.690%	0.000%
19	A	UDOT	Formal	11.620%	-3.090%	0.000%
20	B	CDOT	Formal	7.020%	11.230%	0.000%

*Note: Traditional refers either DBB, DBB A+B or DBB with ATCs, Alternative refers DB or CMGC

Hypothesis and Significance Test

Levene's (1960) test was computed to verify the assumption of equality of variances samples when performing ordinary comparison t-tests and has been considered in the results presented in this paper. In essence, nine comparisons were made; the first was based on the complete sample of performance metrics regarding the partnering intensity, procurement method, and maturity level. The next hypotheses were evaluated using a statistical significance level of 0.05 (e.g. $\alpha = 0.05$)

Hypothesis 1. As partnering intensity increases, the outcome in terms of cost growth, time growth and claim cost also increase.

Hypothesis 2. Partnering has increases ACM project outcome in terms of cost growth, time growth and claims cost.

Hypothesis 3. As agency organizational partnering maturity increases, the outcomes in terms of cost growth, time growth and claim cost for partnered projects also increase.

Discussion

Partnering's Impact on Cost Growth

One-way Analysis of Variance (ANOVA) was performed which test whether the mean values of cost growth were equal for:

Partnering Intensity

H_o: Means of cost growth are the same for each partnering Intensity

Delivery Method

H_o: Means of cost growth are the same for Traditional (T) and Alternatives (A) Delivery methods

Higher and Lower maturity category

H_o: Means of cost growth are the same for higher score of partnering maturity (Category A) and lower score of partnering maturity (Category D)

The descriptive statistics of the data is shown in Table 4-6. Figure 4-4 (a) (b) and (c) illustrates the boxplot between the cost growth and the categories: intensity, PDM, and maturity. A significant difference between different levels of partnering intensity using Tukey's Method pairwise comparisons will be identified by an individual error rate of 0.05 or less. The output summary is shown in Table 4-7.

Table 4-6. Descriptive statistics of case studies for cost growth parameter.

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Formal	12	0.033725	0.070621	0.02039	-0.0111	0.07860
Informal	5	0.000260	0.106053	0.04743	-0.1314	0.13194
Semi-formal	3	0.024033	0.042345	0.02445	-0.0812	0.12922

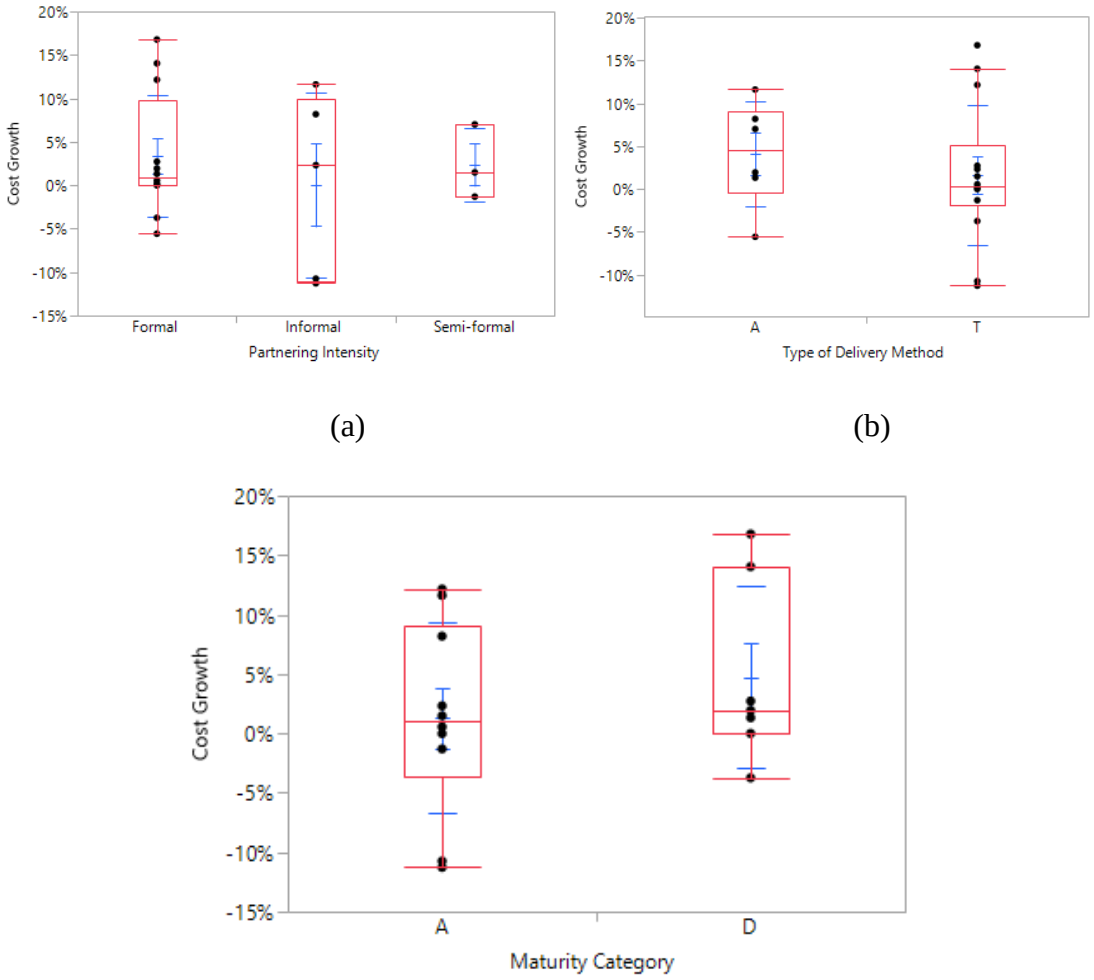

Figure 4-4. (a) Boxplot comparing cost growth and partnering intensity, (b) Boxplot comparing cost growth and project delivery method, (c) Boxplot comparing higher and lower category of partnering maturity.

Table 4-7. Comparisons for all pairs using Tukey-Kramer HSD – Cost growth and partnering intensity

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
Formal	Informal	0.0334650	0.0415202	-0.073049	0.1399791	0.7045
Semi-formal	Informal	0.0237733	0.0569652	-0.122363	0.1699095	0.9090
Formal	Semi-formal	0.0096917	0.0503506	-0.119476	0.1388590	0.9798

From the above analysis, the results imply that the average cost growth found in different partnering intensities are not significantly different at 0.05 of significance. Regarding the cost

growth and the type of project delivery method, the ANOVA test failed to reject the null hypothesis that the means of cost growth of these two groups are different with the p-value p = 0.5224. This result suggests that there is not a statistical difference on cost growth for traditional and alternative partnered projects. The same conclusion was obtained with the ANOVA test considering the maturity category (p=0.388). The category of maturity is not statistically significant in the cost growth of a partnered project.

Partnering's Impact on Time Growth

At the first, normality test was conducted to examine whether the normality assumption holds for the data set. Also, the Shapiro-Wilk test indicates to that time growth values are not normally distributed because the p-value is less than (0.01) as it is shown in Figure 4-5. Besides, the histogram plot denotes to the same conclusion. Parametric ANOVA analysis cannot be applied in this case.

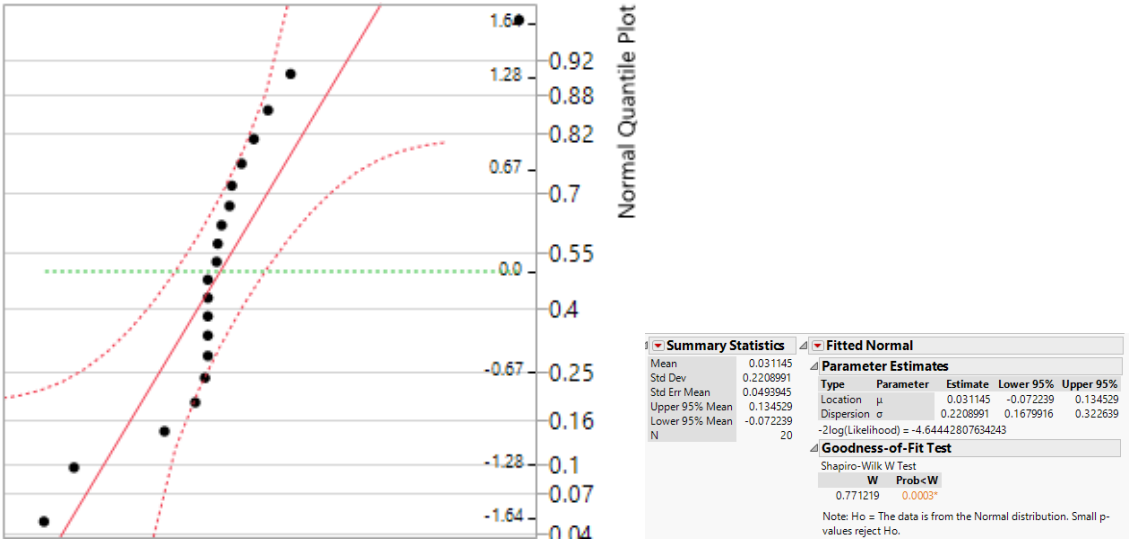

Figure 4-5. Probability plot of time growth

The proposed analysis is performed based on a nonparametric test (Kruskal-Wallis test).

Partnering Intensity

H_o: Means of time growth are the same for each level of partnering intensity

Delivery Method

H_o: Means of time growth are the same for traditional (T) and alternative (A) delivery methods

Higher and Lower maturity category

H_o: Means of time growth are the same for higher score of partnering maturity (Category A) and lower score of partnering maturity (Category D)

Where the Kruskal -Wallis H statistic was significant, the Mann-Whitney U test was used as a post hoc test to distinguish between the groups, with the Bonferroni correction being used to counteract the problem of multiple comparisons among sub-groups inflating the Type I error (Miller, 1991; Cohen, 1988).

The descriptive statistics of the data regarding time growth is shown in Table 4-8. Figure 4-6 (a) (b) and (c) illustrates the boxplot between the cost growth and the categories: intensity, PDM, and maturity.

Table 4-8. Descriptive statistics of case studies for time growth parameter.

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Formal	12	0.09404	0.223915	0.06464	-0.0482	0.23631
Informal	5	-0.14482	0.202540	0.09058	-0.3963	0.10667
Semi-formal	3	0.07283	0.044824	0.02588	-0.0385	0.18418

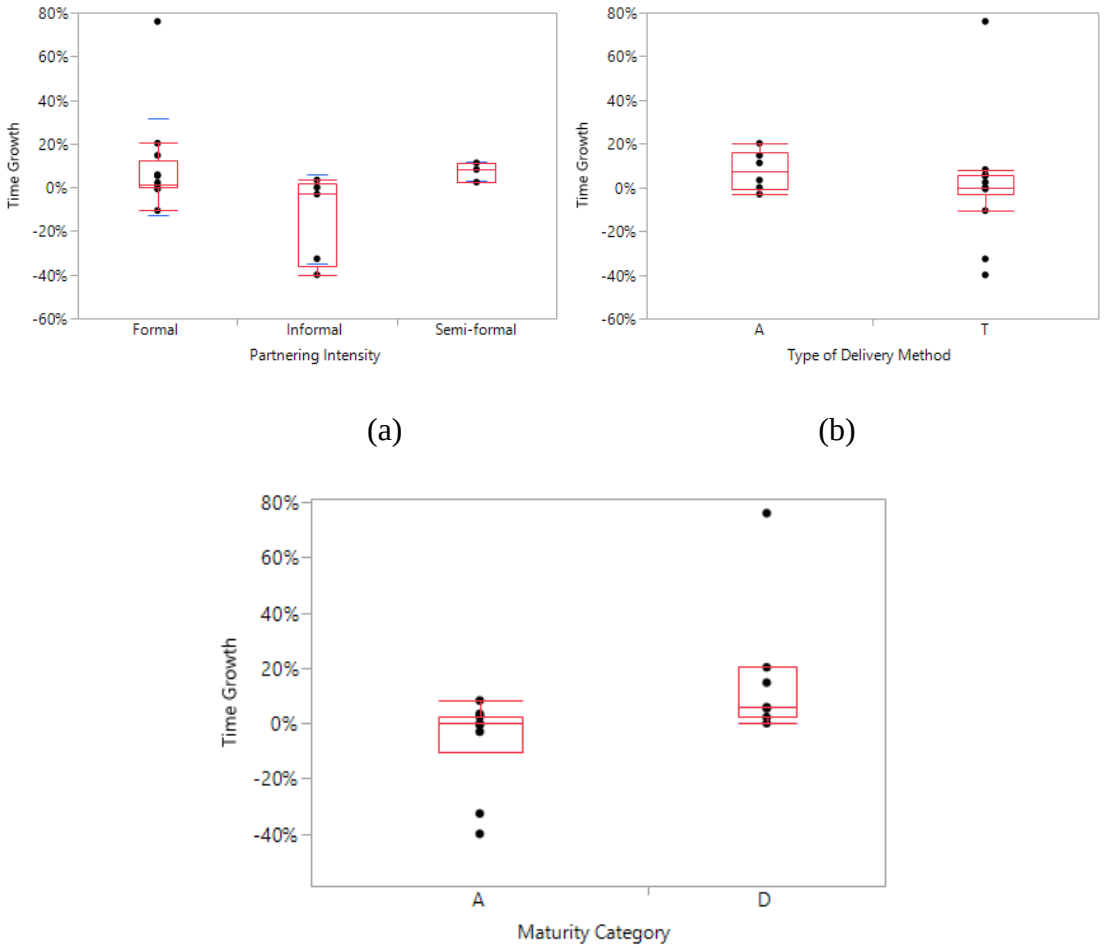

Figure 4-6. (a) Boxplot comparing time growth and partnering intensity, (b) Boxplot comparing time growth and project delivery method, (c) Boxplot comparing higher and lower category of partnering maturity

One outlier was excluded from the analysis corresponding to Louisiana DOT project in which partnering was introduced six months after the project began as a means to mitigate increasing time growth. The significant difference from partnering intensity can be detected using Wilcoxon Method nonparametric comparisons with individual error rate (0.05). The output summary is shown in Table 4-9.

Table 4-9. Nonparametric comparisons for each pair using Wilcoxon method.

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Lower CL	Upper CL
Semi-formal	Informal	3.20000	1.788854	1.78885	0.0736	.	.
Semi-formal	Formal	2.70833	2.860861	0.94668	0.3438	-0.647500	0.1300000
Informal	Formal	-4.95833	2.654791	-1.86769	0.0618	-0.458300	0.0070000

From the above analysis, the results imply that there is enough evidence that suggests that the means of the time growth among the different partnering intensity are not significantly different at 0.05 of significance.

Regarding the time growth and the type of project delivery method, the ANOVA test failed to reject the null hypothesis that the means of cost growth of these two groups are different with the χ^2=1.7681. This result suggests that there is not statistical difference on time growth for traditional and alternative partnered projects. However, the ANOVA test considering the maturity category (p=0.0123) and the time growth shows a statistical significance in the analysis. The category of maturity is statistically significant in the time growth of a partnered project.

Partnering's Impact on Claims

None of the case study projects recorded any costs of claims, defined as disputes that resulted in litigation. While some may wish to infer that partnering eliminated claims for projects regardless the partnering intensity, the type of procurement method and the maturity category, no such causal relationship can be established. An earlier analysis conducted on this research project compared the 10-year claims histories of two state DOTs that employ some level of partnering on all projects, Ohio and Utah, with that found in Montana and Vermont DOTs, which ceased partnering after deciding that its benefits did not justify the resources necessary to formally partner each project (Pinto and Gransberg 2017). That analysis found that while the states that

use formal partnering had a marginally lower claims cost, the difference was not statistically significant between the four agencies. That analysis also conducted a content analysis of the four DOTs' construction policy and procedure documents and concluded all four states had institutionalized partnering and that Montana and Vermont's level of partnering maturity was sufficient to achieve a claims history that was comparable to the states that continued to employ formal partnering. Both the results shown in the above tables and those reached in the earlier paper validate an early the research study performed by Gransberg et al. (1998) that concluded that implementing partnering facilitates the resolution of disputes and claims.

Limitations

In the case study, the partnering intensity was not significant for the three performance metrics studied: time, cost and claims outcomes. However, there are some intangible aspects associated with partnering that might affect the project performance. Therefore, additional investigation is needed to identify measures related organizational partnering maturity in transportation agencies. Because of the small size of the samples used in this study, further research is necessary to generalize the case study's findings.

Conclusion

There are benefits of partnering practices that were identified in those agencies who have a formal partnering program. All of them agree that the implementation of partnering facilitates better teamwork and communication regardless of the project delivery method. Partnering also furnishes a means to achieve a clear understanding of roles and responsibilities, as well as an effective issue resolution process. Furthermore, the research identified that employing partnering on both ACM and traditional projects result in a perceived improvement of performance outcomes. The research explored the spectrum of partnering intensity: formal aspects included

the use of agreements, contracts and incentives, contractor selection procedures and formal teambuilding and facilitation; informal aspects included the styles of organization and management adopted and project team dynamics.

Two main conclusions are drawn from the statistical analysis. First, there is no statistical evidence that suggests that the higher partnering intensity results in better outcomes on both traditional and ACM projects. Second, the analysis did find that the degree of partnering maturity is significantly correlated to improved project time growth.

The implication of the above findings is to suggest that agencies need to maintain a formal partnering program changes from a formalized strategy to improve project performance to a tool for training newly hired DOT employees and contractors new to the DOT regarding the agency's preferred method of doing business in a non-adversarial environment.

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CHAPTER 5. PARTNERING MATURITY ASSESSMENT TOOL AT PROGRAM LEVEL FOR TRANSPORTATION AGENCIES

A paper submitted to Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, published by American Society of Civil Engineers (ASCE).

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Abstract

Partnering has been used a means to enhance collaboration between transportation agencies and contractors with the ultimate aim to reduce claims and post-construction litigation since the mid-1990's. The literature reports that it is largely successful at the project-level; however, no formal study has measured the change in organizational behavior that results from adopting the fundamental principles of partnering as daily business practices to deliver projects using alternative contracting methods. The purpose of this paper is to fill that gap in the body of knowledge and propose an approach to measuring partnering program performance using maturity modeling. The study identified current partnering strategies found in the literature and a content analysis of 50 solicitation documents from 34 states transportation agencies in the United States. The partnering maturity model follows organizational capability maturity principles, defines five maturity levels and guides agencies to self-assess the current maturity in its program. This paper presents the maturity model and the results of the models' assessment by a

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transportation agency with longstanding experience delivering projects using design-build, construction manager-at-risk, and public private partnerships. This paper contributes to the existing partnering body of knowledge by furnishing an objective methodology to identify potential areas of improvement for partnering projects delivered using alternative methods.

Keywords: Organizational maturity, partnering, design-build, public private partnerships, construction manager-at-risk.

Introduction

Partnering is a construction management tool which seeks to develop a high level of commitment between the parties of a contract to shared goals. Fellows (1997) argues that partnering embraces the continuous improvement philosophy embodied in total quality management (TQM). Different models for its application have been developed in procurement management as well as building construction projects. (Chadwick and Rajagopal, 1995; Harback et.al, 1994). Saunders (1997) provides a model for partnering which includes six key elements. Those elements are (1) open communication, both formally and informally, (2) co-operative attitudes, (3) trust among the parties, (4) a win/win approach to mitigation and negotiation, and (5) open sharing of information and (6) multi-level involvement. From those models, the potential benefits of partnering are widely known and quantifiable at the project level. (Ellram and Edis 1996, Murdough et al. 2007, Cacamis and El Asmar 2014, Black et al. 2000, Basham et al. 1994).

The mechanics of partnering have evolved since it was first introduced to the highway construction industry in the early 1990's. Early implementers advocated holding formal partnering workshops led by paid external facilitators and publicized the benefits accrued by investing the time and resources to assemble better working relationships among state personnel and construction contractors before beginning the arduous, complex process of construction the

highway project. The practice of formally partnering projects delivered by traditional design-bid-build (DBB) is well documented as being effective at reducing disputes that lead to both time and cost growth (CII 1991; Gransberg et al. 1999; Nyström 2008; Weston and Gibson 1993).

The result was a movement by AASHTO members to experiment with the approach, which met varying degrees of success across the nation (Gransberg and Scheepbouwer 2015). An example of this new approach within partnering spectrum is the recent AASHTO survey that reveals "Some of the perceptions found for choosing to not use formal partnering are: lack of familiarity with the process, limited resources to commit to a formal partnering program, and the difficulty in measuring tangible results." (Pinto-Nunez and Gransberg 2016). Surveys conducted by the AASHTO Subcommittee on Construction in 2012 and 2015 found that some states that had tried partnering had stopped, citing an inability to make a compelling business case for expending the time and resources involved in conducting formal partnering workshops. Some of the reasons cited are as follows:

- Repetitive workshops involving the same DOT and contractor personnel.
- Longstanding business relationships that predate the advent of partnering that showed little, if any, improvement due to the workshop experience.
- No discernable improvement in project claims experience.
- Difficulty is justifying taking the time and expense to formally partner routine types of projects such as overlays, etc.
- Perceptions by DOT personnel that construction contractors may abuse the workshop developed charter and by construction contractors that the state employees would not live up to promises made in the charter.

A successful partnering program should respond not only to the continual change in organizational and project processes but also as the business conditions has become critical to success, organizations must strive to create learning environments capable of rapidly adjusting to the changes they must face (Sparkling et al. 2016).

The literature describing the characteristics of highly competitive organizations can be summarized into the following key success factors shown in Table 5-1.

Table 5-1. Key references about maturation features on highly competitive organizations

Key success factors	References
Apply process improvement	Lockamy and McCormack 2004; Becker et.al 2009; Lu et. al 2010
Communication as the organization's mission	Lu et. al 2010
Improve information sharing tools	Becker et.al 2009
Institute employee involvement programs,	Pheng and Teo 2004; Bessant and Francis 1999
Establish formal complaint-resolution procedures	Bresnen and Marshall 2000
Institute incentive programs	Becker et.al 2009
Emphasize workforce training and formal mentoring programs	Lockamy and McCormack 2004
Formalize performance management and feedback processes	Lockamy and McCormack 2004; Becker et.al 2009
Perform job analysis and design	Lockamy and McCormack 2004
Support job rotation	Fong and Choi 2009
Establish team-based work designs	Lu et. al 2010
Align business and human resource strategies	Becker et.al 2009

DOTs that have implemented partnering at the program level have moved toward strategic program management by institutionalizing their processes in documents that include

partnering field guides, standard and special partnering provisions, and partnering process manuals (Murdough et al. 2007). However, most, if not all, partnering program documents are written presuming DBB delivery and a low bid award procurement (Ernzen et al. 2000). ACMs were originally implemented to increase the collaboration between all parties to a contract (Larson 1995), which is also the goal of traditional partnering. Therefore, it is logical that alternative project delivery methods will require alternative partnering practices that are in line with the new distribution of risk found in each specific ACM. Thus, there exists a need for a framework upon which to implement best partnering practices for ACM projects that also addresses a given agency's ACM partnering experience. Organizational capability maturity theory provides the basis for such a framework (Clegg et al.2002) because it seeks to measure the depth to which given business practices, such as partnering, have been institutionalized in the organization's policies, standard operating procedures, and business processes. This paper addresses the gap in the partnering body of knowledge by proposing a maturity model that measures the inclusion of effective partnering strategies identified in previous research in highway constructions programs as an alternative approach to provide continuous improvement within the organization.

Background

Partnering Maturity Modeling

Since there are many definitions for partnering, for purposes of this paper it is adopted the definition provided by Construction Industry Institute (CII) which states that partnering is *"a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational*

boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services" (CII, 1987). Despite of the differences found with the definition, what it is an agreement is the identification and validation of the pillars that need to be addressed in a partnering environment of the CII pillars of partnering (Bresnen and Marshall 1998) are as follows:

- commitment,
- trust,
- respect,
- communication, and
- fairness

They can be synopsized as factors leading to the consideration of all parties' goals at every level throughout project execution (CII 1991; Cowan et.al 2012). Individual relationships are based on trust, devotion to common goals, and a deeply understanding of each other's individual expectations and values (CII 1991). Organizational relationships are not only broader in nature but tend to be a function of past experience expressed in standard operating procedures and business processes that have been specifically developed to not only provide continuity and consistency of operations but also to protect the organization from being abused by other organizations with which it must do business (Rezvani 2008, Holt et al. 2000).

The term "organizational maturity" is not related to the relative age or experience of the project delivery team and its supporting organizations. The process strives to measure the depth to which a specific business practice like partnering has been institutionalized by inclusion in organizational policy, procedure, and process documentation. The fundamental litmus test for organizational maturity is whether or not a newly hired individual can refer to documented

practices in their job or if they must rely on the "institutional knowledge" of experienced members to maintain continuity of business practices. Therefore, in the case of partnering, the fact that the agency has a formal project partnering manual indicates a higher level of maturity than one that merely has a policy letter requiring partnering.

Organizational Maturity Theory

Organizational maturity is defined by the Capability Maturity Model Institute (2013) as follows: "The extent to which an organization has explicitly and consistently deployed processes that are documented, managed, measured, controlled, and continually improved." The operating term in the above quote is "processes." Capability maturity modeling is a method to assess organizational maturity. It assists the agency in identifying its ability to adopt and implement new business processes and acts as a yardstick for making project-level partnering intensity decisions that best fit the agency's capability to actually execute a given procedure or process. The definition given above defines "successful" project management processes as ones that are documented, managed, measured, controlled, and improved. Therefore, the maturity model assesses to what level a given process is institutionalized within a given organization.

The level of organizational partnering maturity increases when it moves from project-level partnering to establishing permanent features like standing dispute escalation ladders that apply to all projects regardless whether some form of partnering is being applied. Maturity Modeling is anchored in organizational behavior theory. Meyer and Rowan (1977) express the essential concept as follows:

"Institutionalized products, services, techniques, policies, and programs function as powerful myths, and many organizations adopt them ceremonially. But conformity to institutionalized rules often conflicts sharply with efficiency criteria and, conversely, to coordinate and control activity in order to promote efficiency undermines an organization's

ceremonial conformity and sacrifices its support and legitimacy… building gaps between their formal structures and actual work activities [italics added].”

Applying Organizational Maturity Modeling

Meyer and Rowan’s quote provides a context in which formal partnering workshops represent the ‘institutionalized program’ that has been ‘ceremonially adopted’ and the idea that regularly performing the ‘ceremony’ enhances project performance, reducing or eliminating claims is potentially the ‘powerful myth.’ The research conducted by Pinto and Gransberg (2016) studied the claims history in two DOTs that claimed to partner every project and two that had stopped formally partnering projects when they were unable to identify quantifiable benefits that justified the investment in time and resources. The results of this study show no statistically significant difference in the 5-year claims history of the two sets of DOTs. Opponents of partnering would be quick to seize upon this result as proof that partnering does not work. However, further analysis showed that the two DOTs that had ceased investing in formal partnering had institutionalized the principles and values of partnering to a point where partnering had become a routine business practice. Concerning the above quotation, they had reached a point where the ceremony embodied by the formal partnering workshop was no longer necessary or valuable.

Changing an organization, in this particular case, a transportation agency, from a reactive learning philosophy to a proactive learning culture requires the significant expenditure of time and resources. However, achieving solutions that reflect a focus on worker knowledge requires the organization as a whole and the employees as individuals to focus on the continuously obtaining and disseminating organizational maturity knowledge. This desire for learning and its application to change processes and behaviors lies at the heart of the mature organization and forms the foundation for the strategies pushing a organizational culture that embraces partnering.

Institutionalized Partnering

Transportation agencies that aim to thrive over the long-term must make continual improvements in program performance parameters. This mindset leads to a need to focus on the highest level of maturity. Specifically, the agencies that are constantly evolving and adapting to meet the challenges of the complex business environment found in construction are the organizations that will succeed (Chinowsky et al. 2007). A program level partnering maturity model is focused on success by continuously evolving organizational practices through the application of new knowledge and the continuous realignment of business practices based on a culture that captures and internalizes lesson learned on their projects. Organizational maturity is an indicator of the level of flexibility that the organization has to be able to adapt and apply in new business practices to achieve its strategic goals (Fahrenkrog 2003).

Research Objectives

The research discussed in this paper has two objectives:

1. To propose a model that allows an agency to characterize its organizational partnering maturity before embarking on a formal partnering program for projects delivered using ACMs.
2. To use the model to recommend paths of knowledge maturity and management inside the transportation agency as operational and strategic paths, respectively.

Methodology

The literature established that the main problem in the implementation and measurement of partnering environments and outcomes at the program level is not related to technical issues but rather to people and organizational issues. Given the potential benefits of moving agencies to an institutionalized partnering, the researchers focused on current best partnering practices within public agencies. These perspectives were obtained through a methodology that emphasized both

the analysis of existing partnering documentation and the development of new knowledge based on research findings. The research had four steps: (1) literature review and content analysis; (2) data analysis, (3) model development, and (4) model validation. Additionally, the research team developed a spreadsheet assessment tool to assist in the value judgment and implementation of partnering at the program level. Figure 5-1 illustrates the structure of the partnering maturity model (PMM) and research methods.

The first step of the research methodology is the literature and content analysis. It sought to determine the level of use of a number of key concepts. These include the following:

- The use of partnering on most projects as a matter of routine,
- Evaluation of partnering process both within and external to the agency,
- Alignment of agency business objectives with those of the other parties to the contract,
- Identification of common partnering tools.

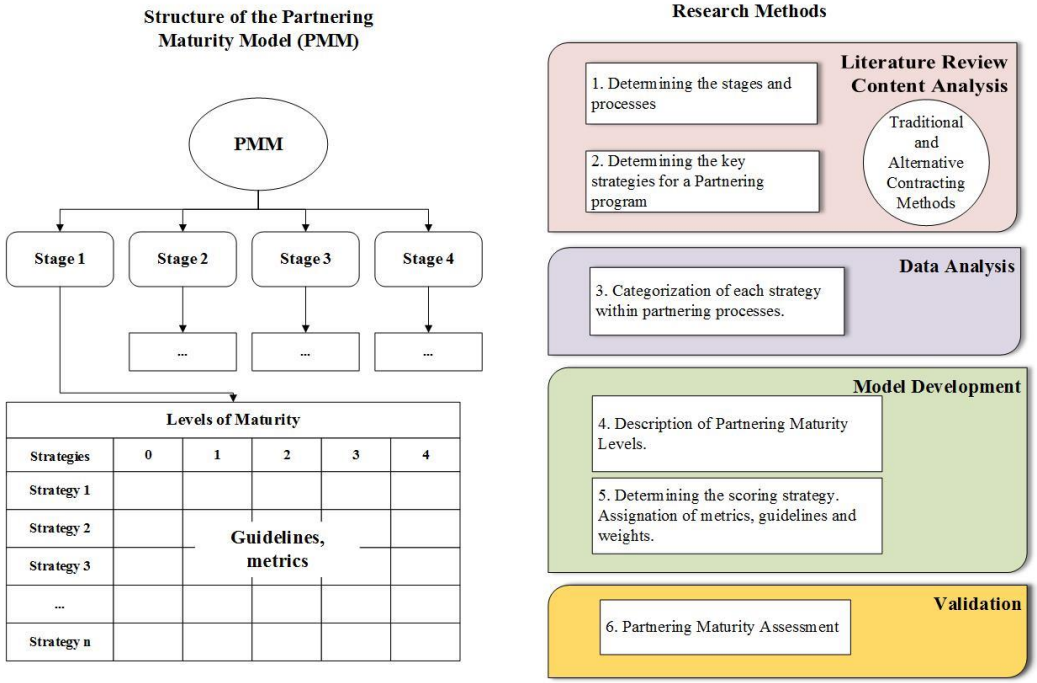

Figure 5-1. Structure of the partnering maturity model (PMM) and research methodology

As a result of this step, partnering strategies were identified as key components of a successful partnering program which are discussed in the following section. Once the strategies have been identified, they were categorized into the partnering process including traditional and alternative delivery methods. The data analysis includes the description, weighting criteria, and maturity scoring for each strategy. The final step in the research methodology is the validation of the maturity model with a DOT with a long-standing partnering program. The Florida DOT whose personnel have used partnering on projects delivered by both traditional and alternative delivery methods over the last 15 years was selected and agreed to participate. The validation involved 11 members of the same DOT ranking each strategy for a specific project delivery method partnering program. After each expert had ranked, the results were discussed to reach an agreement about the score for each strategy assessed for the agency. The results were shown graphically indicating the main areas of improvement that the agency can attain.

The proposed methodology integrates the principal variables that determine those areas which agency partnering program management could be improved or whether are gaps in the agency policy that need to be filled, including key processes and degree of maturity. The model includes organizational and cultural levels which characterize an agency, based on the analysis of the documentation they have developed to implement partnering at project level. This characterization allows the development of 14 strategies and five maturity levels. The same model reflects the information of diverse project delivery methods and enhances the identification of potential paths of partnering maturity, given that the achievement of some agencies can be replicated by others and following the experience exhibit in the literature review. The content analysis focused on prior research, specifically, work by Shane et.al (2012) and Gransberg et.al (2015) to determine how practitioners have introduced partnering practices into

the corporate culture. The results of this analysis provide the foundation for the maturity model and assessment tool presented in this paper.

Discussion

The content analysis was conducted at two levels: The description of partnering stages, processes, and strategies. The upper level includes an integration of traditional and alternative procurement methods activities that are related with partnering stages and processes. At the lowest level, the partnering strategies were found to be the most commonly business organizational practices and most frequently incorporate in business policies and documentations. These findings are described below along with their supporting statements.

Partnering Stages and Processes

The content analysis focused on finding details about how partnering is instilled into the project delivery process in DOT documents. The analysis was divided into three stages: partnering activities during pre-award, partnering activities during procurement, and partnering activities found in post-contract close-out. The pre-award partnering content analysis covered the initial partnering workshop as well as the development of the partnering charter. The contract execution stage partnering content analysis focused on the use of periodic follow-up partnering meetings throughout the construction duration. Post-construction partnering content analysis captured indications of evaluations and surveys of project participants to rate and evaluate the partnering experience and to determine lessons learned from partnering on the completed projects. The list of suggested activities developed during each partnering stages is illustrated on Figure 5-2.

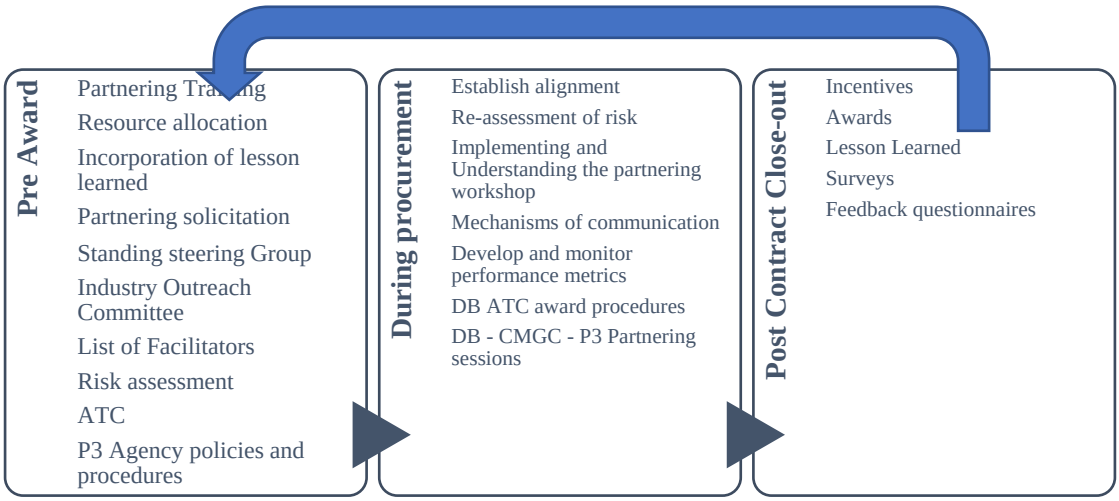

Figure 5-2. Activities associated to partnering stages including traditional and alternative delivery methods.

California, Colorado, and Ohio were found to have the richest sets of partnering documents, including partnering process information in multiple documents. Most of the other DOT documents covered only pre-construction and contract execution partnering. Post-construction partnering activities including project partnering evaluations were rarely mentioned. Table 5-2 summarizes the partnering documentation and process literature from DOT. This leads to the conclusion that those agencies that do not evaluate the project partnering experience do not routinely collect lessons learned and ideas for improving partnering on the next project. While not conclusive, this leads to the inference that even though many agencies are implementing project-level partnering, they are not institutionalizing it in their business policies and processes.

Table 5-2. Summary of partnering contract administration and partnering process literature from state DOTs

	Alaska	Arizona	California	Colorado	Connecticut	Florida	Indiana	Kansas	Kentucky	Maine	Maryland	Michigan	Minnesota	Missouri	Nebraska	Nevada	Ohio	Oregon	South Carolina	Texas	Utah	Virginia	Washington	West Virginia	Wisconsin	Wyoming
Pre-Award	d	a, b	a, b	a, c	c	a, c	b	d	b, c	b	a	c	a	b	b	a	a,b,c, d	b, c	d	b, c	a, b	a	a	d	a	b
During Procurement	d	a, b	a, b	a, c	c	a, c	b	d	b, c	b	a	c	a		b	a	a,b,c, d		d	b	a, b	a, c	a	d	a	b
Post-Constract Close-out		a	a, b	a, c			b				a	c	a			a	a,b,c, d				a		a		a	

a = Partnering Manual; b = Standard Specifications; c = Special Provisions; d = Construction Manual

As a result of this analysis, the research team decided to base further analysis on the following four partnering processes: Initiation, management work planning process, development process, and closure.

The partnering initiation process recognizes that a program should begin based on the project delivery method timeline indicates and the teams across of the organization are assigned and committed to doing so. It includes the definition of the partnering values, the implementation of a collaborative working environment, training program, leadership, and alignment between project objectives and business objectives.

The partnering work planning process involves a list of activities that need to be embraced for the success of the partnering program. It includes the workshops, the development, and implementation of the risk management and communication plan, the issue resolution process, the performance metrics and the resource utilization and accountability.

The partnering development process leads to the development and maintenance of a workable scheme to accomplish the business needs for the project.

The partnering closure process ensures formalizing acceptance of the projects and brings it to an orderly end. It includes the lessons learned documentation and the development and implantation of the improvement process.

It is important to state that this is not a linear process and some activities can overlap each other. The four processes are associated with the key partnering strategies followed explained in this paper.

Partnering Strategies

The overall definition of partnering program maturity can be described by 14 strategies as follows:

Partnering Values - Refer what the agency wants to develop as a foundation for the "way that they do business." Those partnering principles refer relative worth, utility, the importance that is intrinsically desirable in the organization (CII, 1991).

Collaborative working environment - It is the intentional use of good communication skills; the commitment by all members to resolve issues thoroughly, quickly, and fairly (Bresnen and Marshall, 2002)

Partnering Training Program - It is designed to improve partnering skills refer to the partnering values or principles among the agency personnel as well as the main parties of a project if it is needed.

Alignment - Agreement and set-up of goals, business vision, objectives.is the process to link organizational goals with the project's goals. Requires a common understanding of purposes and goals of the organization, and consistency between every objective and plan right down to the incentive offers (CII, 2013).

Leadership - It is a process by which a person influences others to accomplish an objective and directs the organization in a way that makes it more cohesive and coherent. It is a process whereby an individual influences a group of individuals to achieve a common goal (Mintzberg, 1980).

Workshops - Refers to the meeting(s) at which a group of people engages in intensive discussion and activity on a particular project. This process could include a third-party to facilitate it. This third party can be internal or external to the agency. The third party is not bound by law to maintain confidentiality but may be required to do so by terms of a contracting agreement with the parties. The events and proceedings are not necessarily protected from legal discovery (AASHTO Partnering Guidebook, 2005).

Risk Management Plan – Refers the development and implementation of documentation that prepares to foresee risks, estimate impacts, and define responses to issues. It contains a risk assessment matrix (Kwak and Ibbs, 2002).

Communication Plan – Refers the development and implementation of a set of procedures that aim providing team parties with information about the project(s). The plan formally defines who should be given specific information, when that information should be delivered and what communication channels will be used to deliver the information (PMI, 2013).

Issue Resolution Process - A process that consists of identifying and resolving issues, action planning, and follow-up agreements (AASHTO Partnering Guidebook, 2005).

Performance Metrics – development and control of performance metric that includes but it is not limited to measures an organization's behavior, activities, and project's performance (Willis and Rankin, 2011).

Resource utilization and accountability – refers to the responsibility of employees to complete the tasks with an efficient use of resources, which they are assigned, to perform the duties required by their job, and to be present for their proper shifts in order to fulfill or further the goals of the organization. It is also a management process that ensures employees answer to their superior for their actions and that supervisors behave responsibly as well (PMI, 2013).

Documentation management and control - Includes an outline that explains the management procedure of documents, virtual or physical, during the project life cycle. It is a road map to track, add, archive, and remove the documents from the system (PMI, 2013).

Follow-up process – development and implementation of a monitoring system to get feedback on the main objectives of the agency such as schedule, requirements, effectiveness, etc. (ISO 9001).

Improvement Process – development and implementation of an ongoing effort to identify, analyze, improve and optimize the quality of the agency's projects (ISO 9001).

Data Analysis

Strategies Categorization

After the identification of the key strategies, they were grouped according to their relevance in the partnering process. Figure 5-3 illustrates the stages of partnering with each stage's associated strategies, and Table 5-3 totals the number of strategies associated with each partnering stage.

Figure 5-3. Partnering strategies associated with partnering processes

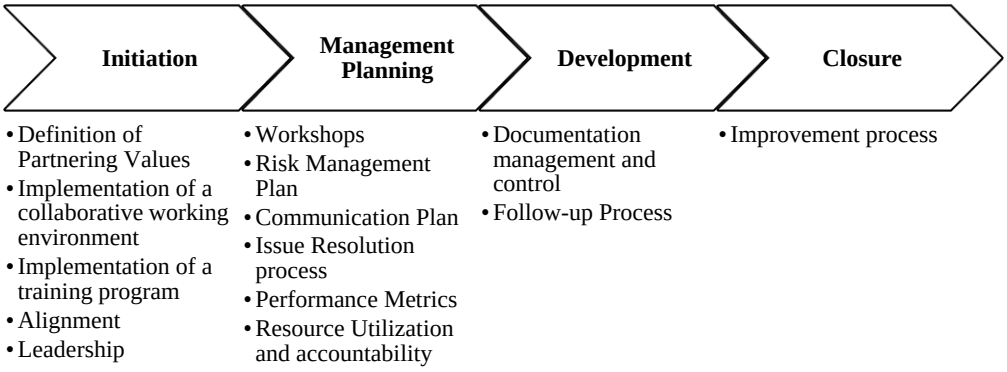

Table 5-3. Total number of partnering strategies by process

	Stage Totals			
	Initiation	Management Planning	Development	Closure
Total Strategies per process	**5**	**6**	**2**	**1**

As a result of the content analysis, 14 strategies were identified. The Table 4 displays the presence of those characteristics within partnering documentation in 34 transportation agencies grouped into two categories: Partnering Program and No partnering program. The shaded numbers in Table 5-4 indicate the higher number of strategies per agency. From this analysis is noticeable that agencies who do not have a formal partnering program have 11 and 10 out of 14 strategies incorporated in their business philosophy. Another remarkable finding is the Issue

Resolution process is included on 32 out of 50 evaluated documents which indicates that it is an important element within the business strategic goals.

For the purpose of this paper, organizational partnering maturity is a measure of the number of partnering strategies that has been institutionalized based on being contained into documentation, agency's policies and business objectives. Overall maturity is a function of the number of strategies that are found in the DOT documentations, the higher number of strategies found the more mature the agency is. Figures 5-4 and 5-5 illustrate the findings of Table 5-4, categorizing states by type of program and by the level of maturity. The states that are not shown with a dot or colored indicate that they were data not available neither evaluated for this study.

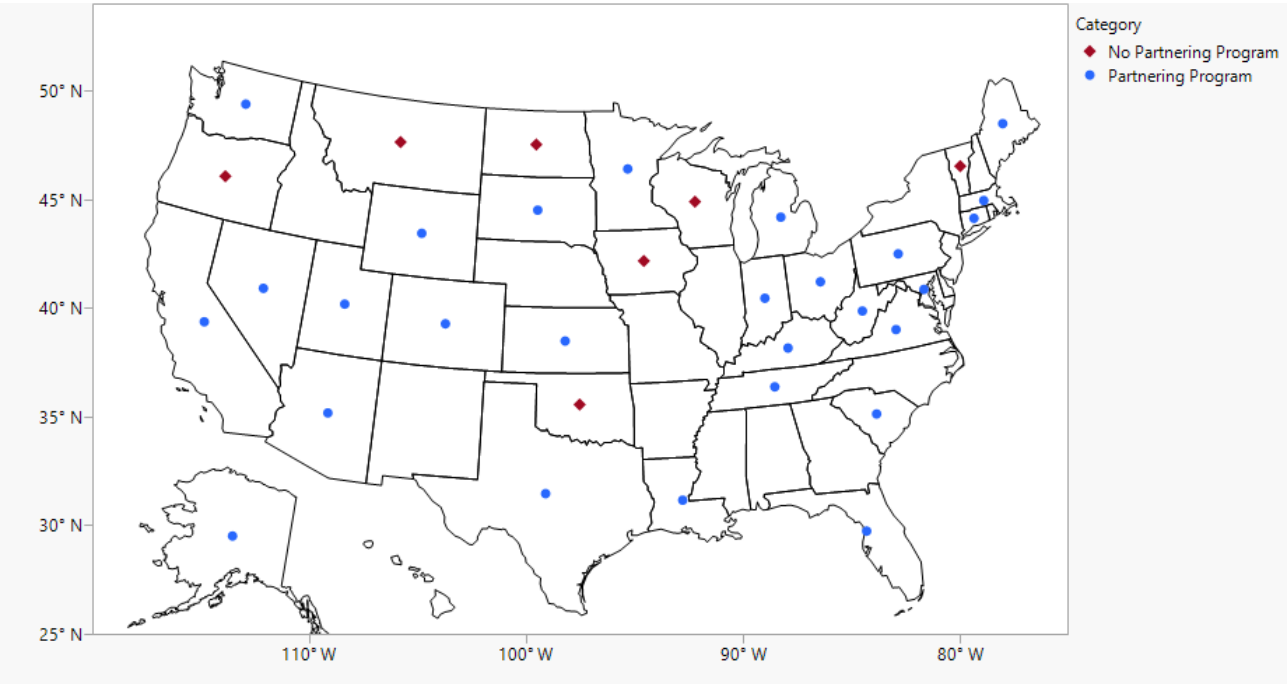

Figure 5-4. States identified by category: Partnering program and No-Partnering program.

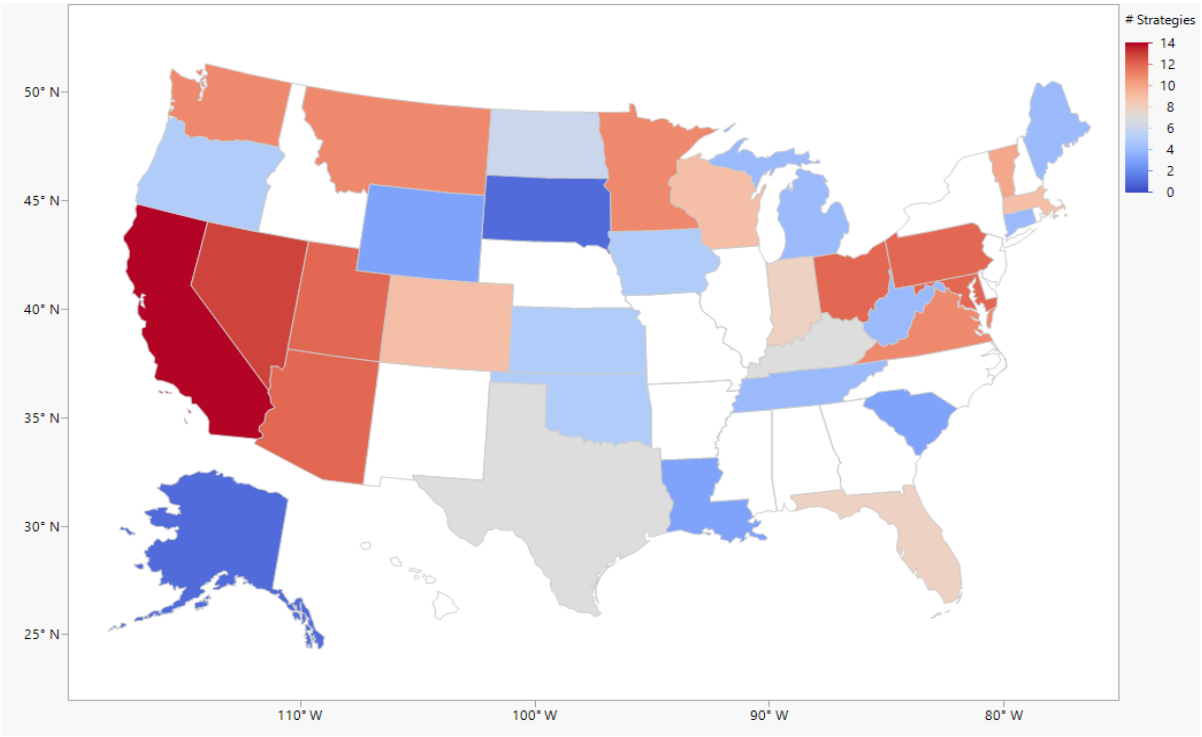

Figure 5-5. States identified by the number of strategies found in the content analysis.

Model Development

The model development involves two main components: the description of partnering maturity levels including the stratification of each strategy in each maturity level, and the weighting criteria and maturity scoring. The description of two components are described as follows.

Partnering Maturity Levels

The primary outcome of this research is a partnering maturity model for transportation agencies at the program level. The drivers motivating an agency to embrace a partnering organizational culture were previously discussed. Therefore, the components of the maturity model are called strategies and provide the foundation for an agency to move through a series of activities that result in increasing the maturity of the agency's partnering culture.

Table 5-4. Matrix of transportation agencies and key partnering strategies identified in the content analysis.

			Strategies														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	DOT	Type of Documentation*	Partnering Values	Collaborative working environment	Partnering Training Program	Alignment	Leadership	Workshops	Risk Management Plan	Communication Plan	**Issue Resolution Process**	Performance Metrics	Resource utilization and accountability	Documentation Management & Control	Follow-up process	Improvement Process	Total number of strategies per Agency
Partnering Program	California	PM - SS - SP - CM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**14**
	Nevada	PM	X	X	X		X	X	X	X	X	X	X	X	X	X	**13**
	Arizona	PM - SS - CM	X	X	X		X	X	X	X	X	X		X	X	X	12
	Maryland	PM	X	X	X		X	X	X	X	X	X		X	X	X	12
	Ohio	PM - SS - SP - CM	X		X		X	X	X	X	X	X	X	X	X	X	12
	Pennsylvania	SP	X		X		X	X	X	X	X	X	X	X	X	X	12
	Utah	PM	X	X	X		X	X	X	X	X	X		X	X	X	12
	Minnesota	PM	X	X			X	X	X	X	X	X		X	X	X	11
	Virginia	PM	X				X	X	X	X	X	X	X	X	X	X	11
	Washington State	PM	X		X		X	X	X	X	X	X		X	X	X	11
	Colorado	PM - SP	X	X				X	X	X	X	X		X	X		9
	Massachusetts	PM		X		X	X		X	X	X	X	X		X		9
	Florida	PM	X					X	X	X	X	X		X	X		8
	Indiana	PM - SS	X	X				X		X	X	X		X	X		8
	Texas	PM - CM		X			X		X		X	X		X	X		7
	Kentucky	SP	X	X			X		X		X			X		X	7
	Kansas	CM				X				X	X	X		X			5
	Maine	PM - SS - CM		X			X				X	X					4
	Michigan	SP		X			X				X	X					4
	Tennessee	SP		X			X				X	X					4
	West Virginia	CM				X				X	X	X					4
	Connecticut	SP				X				X	X	X					4
	Wyoming	SS				X					X	X					3
	Louisiana	CM				X					X	X					3
	South Carolina	CM		X							X	X					3
	Alaska	CM	X														1
	South Dakota	SP							X								1
No Partnering Program	Montana	SS	X	X		X	X		X	X	X	X	X		X	X	**11**
	Vermont	SS	X	X		X			X	X	X	X	X		X	X	**10**
	North Dakota	SS		X					X	X	X	X		X			6
	Oklahoma	SS				X			X		X	X	X				5
	Wisconsin	PM - SP	X				X	X	X	X	X	X		X	X		9
	Oregon	SS - SP - CM				X				X	X	X		X			5
	Iowa	SS				X				X	X	X		X			5
Total No. of citation for each strategy			18	18	8	12	18	14	21	23	**32**	31	9	20	18	13	

* Note: PM = Partnering Manual, SS = Standard Specifications, SP = Special Provisions, CM = Construction Manual

The proposed organizational maturity self-assessment tool detailed in subsequent sections of this document is not an "examination" where the agency is seeking to get the highest possible score, but rather a thoughtful reflection on the organization's strengths. The outcome is a pragmatic assessment of those areas where an agency can invest resources to improve the consistency of current construction project administration. Therefore, getting a low rating on a given factor does not indicate failure. It indicates that if that factor is important to the successful delivery of a construction project, the agency should invest time and resources to increase their maturity in that area. For example, if a DOT rated itself as "Defined" because it had a partnering manual, it could institute a periodic training program to raise its rating to "Managed."

The evolution of an institutionalized partnering program is defined in this research as a five-level approach with

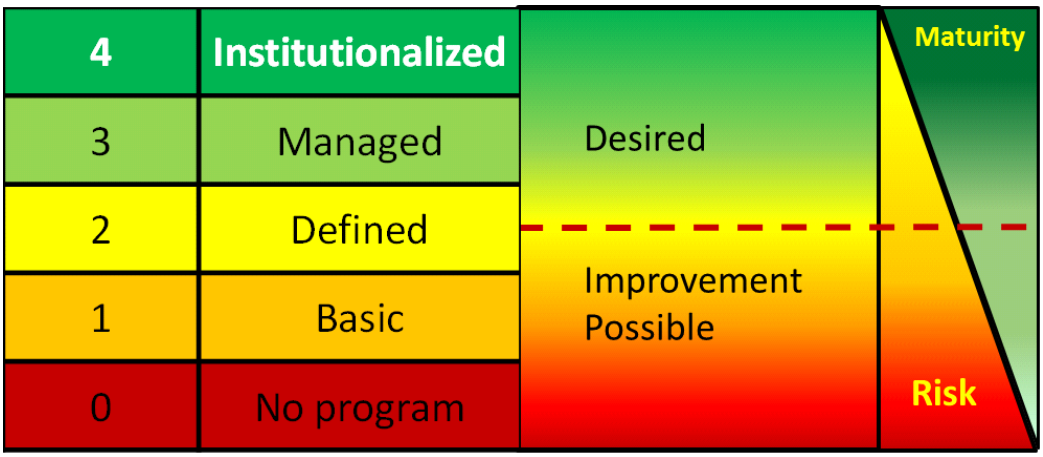

Figure 5-6. Heat map of partnering maturity levels.

Table 5-5 explains the definitions of the five levels of organizational maturity the maturity along with Figure 5-6 which displays a heat map method for interpreting the results of the partnering maturity self-assessment tool.

Table 5-5. Characteristics of maturity level in PMM

Level	Description
Level 0	**No partnering program** - No partnering principles, practices, and tools are applied or considered.
Level 1	**Basic.** There is no formal process, strategies or designated staff to lead partnering program. However, very limited partnering practices are used based on previous experiences. Minimal effort in reducing risks or risk taking for short term benefits. Ad-hoc strategies are applied by people with partnering skills, and the process is poorly controlled. No training opportunities are available.
Level 2	**Defined**. There are a written partnering policy and strategies outlined. There is a ritual process, including previous plans and designated staff (dedicated roles) to lead partnering program. The performance metrics and the control of the documentation depend on the project or the person who is leading the partnering program.
Level 3	**Managed.** Organization-wide standards and strategies are deployed and applied to multiple projects. The partnering process is fully established and managed using metrics, and it can be adapted to special projects. An organizational training process and an incentive program are also available.
Level 4	**Institutionalized (Culture Transformation).** The agency has and uses aligned, integrated, and structured partnering strategies, documentation, and a validated system of continuous improvement to achieve business goals. The focus is on continually improve metrics performance through change management (e.g. incremental and innovative changes). This program is a competitive asset of the agency.

Each of the partnering strategies explained in the previous section was analyzed into the five levels of maturity, to determine the scoring strategy and guidelines that describe them. All this information will become the output of the spreadsheet assessment tool. The description of the strategies through the different levels of maturity is shown as Appendix of this paper.

Weighting criteria and Maturity scoring

After establishing the set of stages, weights must be assigned to reflect on their relative importance. Available weighting methods can be classified into two categories: equal weights method and rank-order weighting method. The equal weights method does not require the decision makers' preferences. Based on statistical analysis from previous AASHTO surveys (Gransberg, et. al 2015), in which there is no statistically difference between the relevance in the partnering stages to achieve successful partnering outcomes, the researchers assigned the same weight to each stage. However, the assessment tool can be programmed to fit weights according to the business objectives of the agency.

The score for the different levels of maturity was assigned on a scale from 0 to 4 points. The highest level of maturity (Institutionalized) is associated with the highest level of scoring (4).

Validation

Partnering Maturity Assessment

The purpose of validation is to ensure that each phase of the chosen research methodology rigorously adheres to the highest standards of quality. This level of quality in planning, executing, and evaluating research is measured as validity (Lucko and Rojas 2010).

Observations made throughout a vetting workshop with partnering experts from Florida DOT (FDOT) noted that the participants were very engaged and receptive to the concepts presented. All participants reported a greater understanding of partnering strategies and level of maturity. A focus group was held the day to apply the spreadsheet assessment tool. To summarize the major findings of this vetting were:

- The maturity model reflects the essence of partnering regarding key activities and tools.
- The participants were able to discuss the status quo of partnering with the organization
- The maturity model provides reference to identify areas of potential improvements within the program.

The assessment only developed for the Design-bid-build program. The overall results of the assessment are shown in Figure 5-7.

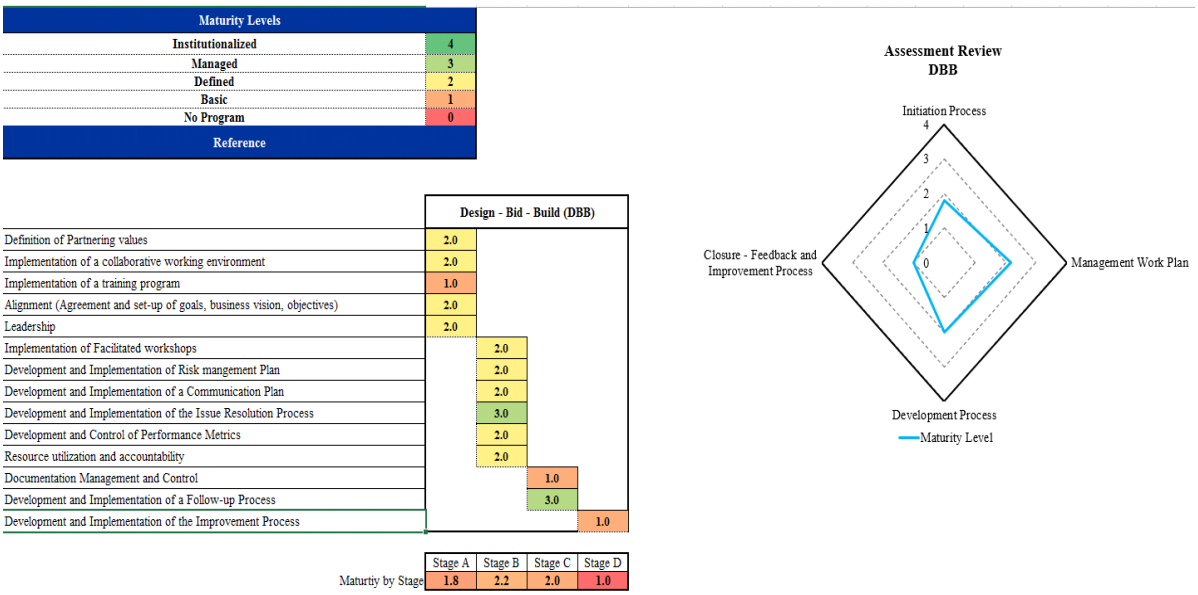

Figure 5-7. Partnering maturity assessment for FDOT – DBB Program

Limitations

This study focuses specifically on applying partnering strategies to highway construction projects within transportation agencies in the US. Since the results are based on data collected from only DOTs, international generalizations should be made cautiously. This paper also adopts an overall processes and key partnering strategies for both traditional and alternative procurement methods. The validation process only included one agency.

Conclusion

Partnering is an approach to manage highway construction projects that enforces communication, mutual goals and reduces confrontation and conflict. The primary outcome of this research is a maturity tool for transportation agencies who have experiences partnered projects with traditional and alternative contracting methods. Agencies who have integrated a higher number of partnering strategies discussed in this paper, shows the higher scores in the maturity model. These strategies provide the principal foundations for an organization to adopt partnering organizational culture. This partnering maturity model concept requires the state

highway agencies to focus on a long-term outlook for improvement. The development of ritual learning process requires effort, cooperation and understanding at all representative agency's departments and in all 14 strategies developed. The organizations can realize the value of having a dispute resolution process in a partnering program based on the maturity level that they have. Therefore, they can objectively evaluate where they currently stand in the partnering readiness process and strategically define and invest in business strategies in a successful manner.

Acknowledgements

The authors express their appreciation to the National Cooperative Highway Research Program (NCHRP), Transportation Research Board, under the National Academy of Sciences for sponsoring this research. The authors also thank the NCHRP Project 19-10 Panel for their comments and direction during the research process. Additionally, the writers thank the state transportation agency personnel who supported this research through their time and effort, without their valuable contributions this research would not have been possible.

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CHAPTER 6. **CONCLUSIONS, CONTRIBUTIONS, AND RECOMMENDATIONS**

Partnering is an approach to manage highway construction projects that enforces communication, mutual goals and reduces confrontation and conflict. The primary outcome of this dissertation is a maturity tool for transportation agencies who have experiences partnered projects with traditional and alternative contracting methods. Agencies who have integrated a higher number of partnering strategies discussed in Chapter 5, shows the higher scores in the maturity model. These strategies provide the principal foundations for an organization to adopt a partnering organizational culture.

This comprehensive partnering concept requires the state highway agencies to focus on long-term improvement. The development of ritual learning process requires effort, cooperation and understanding at all representative agency's departments and in all 14 strategies proposed and developed. The organizations can realize the value of having a dispute resolution process in a partnering program based on the maturity level that they have. Therefore, they can objectively evaluate where they currently stand in the partnering readiness process and strategically define and invest in business strategies in a successful manner.

Contributions to Theory

This dissertation provides a comprehensive analysis of partnering practices to date at the project level for highway construction projects, where the practice has been utilized for more than a decade on average. It synthesizes the findings of partnering organizational changes applied in construction management, and also presents a comparison of partnering practices regarding project procurement methods. This study will extend the findings of previous partnering research from the state transportation sector.

This research effort contributes to the body of knowledge on institutionalizing the principles of partnering and paradoxical theories in the construction industry (Koppenjan et al. 2011; Szentes and Eriksson 2015), by reflecting on how the benefits and advantages of partnering are consistent with the implementation of partnering principles.

This study adds to the body of knowledge on management maturity modeling as applied to the highway construction industry (Carr 2005, 1983; Drew and Skitmore 1997; Ngai et al. 2002, Gransberg, et.al. 2015). It is the first study to empirically develop a partnering organizational maturity model.

Contributions to Practice

Findings from this dissertation offer several practical implications for DOTs at project level personnel regarding partnering practices. Chapter 4 also provides insight on the differing intensities of partnering found in the field and how to structure the partnered project selection process. Chapter 6 aims to provide owners an understanding of the implications of using partnering with respect to project delivery method. It also clarifies the reasons that owners can benefit by selecting a partnering approach for a given project, and leveraging the process to increase levels of integration and cohesion with their contractors.

The results and conclusions obtained from this study will provide DOTs with the means to:

1. Develop decision making procedures to select projects to be managed under partnering techniques based on their key performance indicators and values of partnering that the agency wants to embrace;
2. Improve current partnering procedures including intensity approach and the maturity model; and,

3. Develop a framework procedure for DOTs to measure the outcomes in their partnering practices regarding the type of project delivery method.

Limitations

This study is subject to several limitations that provide opportunities for future work. First, this study applies only to the U.S. state transportation sector and limits the generalizability of the findings. However, this study will still prove useful to those outside the DOTs, including in federal sector as partnering is also used widely at building construction sector, and appears to be growing at the air transportation sector. Comparisons between this work and that of Gransberg et al. (1998) will help draw comparisons between state agencies at project level. The case study in Chapter 3 provides a level of generalizability by examining cases at the local level.. These factors offer reason to believe that the findings will be generalizable beyond the agency level. Regardless, future studies should be focused on capturing the use of partnering at the program level and on compare U.S. partnering practices with those in Europe and Latin America.

Second, this study is heavily reliant on the quality of data available from DOTs sources, particularly for Chapter 4 and Chapter 5. To compensate, the research conducted numerous checks on the data, such as consulting with the database managers, comparing common fields across two different databases, and cross-checking in some cases with partnering and contract documents. The data is validated on a smaller subset of projects. Regardless, these measures will likely not resolve all errors. Some amount of error related to data entry or missing values will likely remain.

CHAPTER 7. **GENERAL REFERENCES**

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APPENDIX A: INSTITUTIONAL REVIEW BOARD EXEMPTION DOCUMENT

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 9/9/2015

To: Dr. Douglas Gransberg
394 Town Engineering

From: Office for Responsible Research

Title: NCHRP Project 19-10 AASHTO Partnering Handbook, Second Edition

IRB ID: 15-471

Study Review Date: 9/8/2015

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B: PARTNERING MATURITY RUBRICS AND DESCRIPTION

Maturity Model Categories

Code	Categories	Strategies	Weight
A	Initiation Process	Partnering Values	0.25
		Implementation of a collaborative working environment	
		Implementation of a training program	
		Alignment	
		Leadership	
B	Management Work Planning Process	Implementation of Facilitated workshops	0.25
		Development and Implementation of Risk management Plan	
		Development and Implementation of a Communication Plan	
		Development and Implementation of the Issue Resolution Process	
		Development and Control of Performance Metrics	
		Resource utilization and accountability	
C	Development Process	Documentation Management and Control	0.25
		Development and Implementation of a Follow-up Process	
D	Closure & Improvement Process	Development and Implementation of the Improvement Process	0.25

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
A	S.01	Partnering values	Refer what the agency wants to develop as a foundation for the "way that they do business." Those partnering principles refer relative worth, utility, the importance that is intrinsically desirable in the organization.	Total lack of awareness. Not considered	Some knowledge about partnering values but it is set up based on previous experiences or people with past experiences	Partnering values are defined by the agency but only apply to specific projects. (project-oriented)	Partnering values are defined and documented by the agency for any project, but it is not entirely integrated into the agency	Partnering values are aligned, integrated within the agency policies (Add value)
A	S.02	Implementation of a collaborative working environment	It is the intentional use of good communication skills; the commitment by all members to resolve issues thoroughly, quickly, and fairly.	Not considered	The agency applies subjective judgments. It is poor, and it is based on ad-hoc basis	The collaboration procedures are defined, but it is just applied in some type of projects. That decision is not a process well-documented	A routine process based on a documented procedure	The agency has a standard, documented process and a system for developing collaborative environment not only for projects but also for the agency departments.

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
A	S.03	Impleme ntation of a training program	It is designed to improve partnering skills refer to the partnering values or principles among the agency personnel as well as the main parties of a project if it is needed.	Not considered	Some training is provided.	The training program is documented. The staff is aware and competent in the training program. However, the results of the training are just for project's purposes, not agency business objectives	Collective knowledge. Effectiveness of training is observed, analyzed, and communicated to the agency	The teams in the agency propagate new knowledge regarding partnering through the continuous improvement
A	S.04	Alignme nt (Agreem ent and set-up of goals, business vision, objective s)	Agreement and set-up of goals, business vision, objectives.is the process to link organizational goals with the project's goals. Requires a common understanding of purposes and goals of the organization, and consistency between every objective and plan right down to the incentive offers.	Not established	Defined but unplanned. The objectives and targets exist, but no action plan available to reach them.	Business objectives, targets, and goals are documented. Action plans are reviewed. The projects' action plan is developed but is not integrated with business objectives.	Integrated; analyzed. Business objectives, targets, and goals are the result of statistical analysis and benchmarking. The action plan is integrated	Fully achieved; validated. Some advanced models are used to predict targets and business targets.

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
A	S.05	Leadership	It is a process by which a person influences others to accomplish an objective and directs the organization in a way that makes it more cohesive and coherent. It is a process whereby an individual influences a group of individuals to achieve a common goal.	Not considered	No formal process to implement a program in terms of leadership. Subjective judgments about leadership in the partnering program are applied.	The agency has a standard and documented process equivalent to address this strategy. However, it is not fully implemented, or it is just focused on project goals purposes.	The agency has a well-known documented process to address leadership in the program. It includes succession plans for critical leadership roles. It is applied not only for projects but also within the agency departments.	In addition to the previous level. There is strategic leadership that is included in the agency's policy. There is a system for capturing feedback/lessons learned by collecting information after every project is completed in order to improve the process continuously
B	S.06	Implementation of Facilitated workshops	Refers to the meeting(s) at which a group of people engages in intensive discussion and activity on a particular project/topic/objective. This process could include a third-party to facilitate it. This third party can be internal or external to the agency. The third party is not bound by law to maintain	Not considered	Kick off meetings are held at the beginning of projects with/without the facilitator. Subjective judgments and ad-hoc basis	Written standards, procedures and methodologies to determine a type of facilitated workshops for every type of project. It is not fully implemented in the agency.	Written standards, procedures and methodologies to determine the type of facilitated workshops for every type of project. It is fully implemented in the agency.	The agency has a systematic process to determine the type of a facilitated workshop, and it is recommended for every type of project. The people in the organization are well-trained in facilitated skills and methods. It includes a

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
			confidentiality but may be required to do so by terms of a contracting agreement with the parties. The events and proceedings are not necessarily protected from legal discovery.					feedbacks/lesson learned system for continuous process improvement.
B	S.07	Development and Implementation of Risk management Plan	It is a document that a project manager prepares to foresee risks, estimate impacts, and define responses to issues. It contains a risk assessment matrix.	Not considered	The risks are addressed just for complex projects based on ad-hoc basis and subjective judgements. There is no written standard or procedure	Written procedures and standards exist to address the risk management plan. It is not fully implemented in the agency. Varies from project to project.	Risk Management plan is established, implemented, executed and controlled	Risk analysis processes are well-documented, known and implemented. Improvement recommendations are collected and integrated into the agency's policy
B	S.08	Development and Implementation of a Communication Plan	It is a set of procedure that aims to provide team parties with information about the project(s). The program formally defines who should	Not considered or exist	No documented procedures. The communication plan is informal	Written procedures and standards exist to address the communication plan. It is not fully implemented in the agency. Varies	Communication plan is established, implemented, executed and controlled. There is active participation of	Communication plan is established, implemented, executed and controlled as part of the

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
			be given specific information, when that information should be delivered and what communication channels will be used to deliver the information.			from project to project.	the agency personnel to improve the process	institutional policy.
B	S.09	Development and Implementation of the Issue Resolution Process	A process that consists of identifying and resolving issues, action planning, and follow-up of those agreements.	Not considered	No documented procedures. The agency designates project leaders that may use their subjective judgments on an ad hoc basis	Written procedures and standards exist to address the issue resolution process. It is not fully implemented in the agency. Varies from project to project.	Written procedures and standards to address the issue resolution process are established and fully implemented in the agency throughout the program.	In addition to the previous item, there is an institutional policy and a system for the feedback/lessons learned by collecting information after the project is completed in order to improve the process continuously

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
B	S.10	Development and Control of Performance Metrics	A performance metric includes but it is limited to measures an organization's behavior, activities, and project's performance (e.g. cost, time, quality, safety, legal factors)	Do not define	Performance metrics are defined for specific projects on the ad-hoc basis. It does not have a strict control. Not documented	Written procedures and standards exist to define, measure and monitor the performance metrics of the program. It is not fully implemented in the agency. Varies from project to project.	Written procedures and standards to define, measure, control the performance metrics are established and fully implemented in the agency throughout the program. It includes a procedure to communicate those results	In addition to the previous item, there is an institutional policy and a system for the feedback/lessons learned by collecting information after the project is completed in order to continuously improve the process
B	S.11	Resource utilization and accountability	It is the responsibility of employees to complete the tasks with an efficient use of resources, which they are assigned, to perform the duties required by their job, and to be present for their proper shifts in order to fulfill or further the goals of the organization. It is also a management process that ensures employees answer to	Not considered or exist	Partially exists. Ad-hoc basis. There is no documented process for accountability	Written procedures and standards exist to control the resources of the program. It is not fully implemented in the agency. The liability varies from project to project.	Written procedures and standards to resource management and accountability are established and fully implemented in the agency throughout the program.	The agency provides organizational project management with an appropriate workforce with the right level of competence for each project-related role in the program. Full commitment forms the upper

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
			their superior for their actions and that supervisors behave responsibly as well.					management to project teams.
C	S.12	Documentation Management and Control	Includes an outline that explains the management procedure of documents, virtual or physical, during the project life cycle. It is a road map to track, add, archive, and remove the documents from the system.	Documentation and records do not exist	Documentation management process partially exists, but the agency does not have a control system to record the information. Ad-hoc basis	The documentation management and control process are documented. It has well-explained procedures to every type of project	The documentation management and oversight process is available and integrated to the agency. It is a complex system, integrally managed.	The documentation management and control process are improved by reducing its complexity to manage it. It can be adapted according to the defined variables of the program
C	S.13	Development and Implementation of a Follow-up Process	Monitoring to get feedback on the primary objectives of the agency such as schedule, requirements, effectiveness, etc.	Not considered	Follow-up processes are defined for specific projects on the ad-hoc basis. It does not have a strict control. Not completely documented	Written procedures and standards exist to identify and implement the follow-up process. It is not fully carried out in the agency. It is applied during the projects.	Written procedures and standard to define and implement the follow-up process are established and fully carried out in the agency throughout the program. It includes a process to communicate those results	In addition to the previous item, there is an institutional policy and a system for the feedback/lessons learned by collecting information after the project is completed in order to improve the process continuously

Strategies definition and Level Explanation								
				Level 0	**Level I**	**Level II**	**Level III**	**Level IV**
Cat.	**Code**	**Strategy**	**Definition**	**0**	**1**	**2**	**3**	**4**
D	S.14	Development and Implementation of the Improvement Process	It is an ongoing effort to identify, analyze, improve and optimize the quality of the agency's projects.	Not considered	Process partially exists. The agency may use their subjective judgments on an ad hoc basis	Written policies, standards, procedures may exist. Or, the agency may hire a subject matter expert to implement new strategies in the program. The implementation varies from project to project	A routine process exists. There is a system for the feedback/lessons learned by collecting information after the project is completed in order to improve the process continuously. (e.g. incentives, awards)	In addition to the previous item, there is an institutional policy integrated to the strategic objectives of the agency.