PARTNERING IN CONSTRUCTION: Longitudinal Study of Pre-Contract Planning Model Demonstrates Reduction in Project Cost and Schedule Growth

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Abstract

Planning is known to enhance construction project performance in terms of cost, schedule, and quality. Yet, project teams oftentimes do not incorporate effective planning methodologies, typically citing a lack of time or capability to conduct detailed planning. This article proposes a brief yet rigorous project planning method, known as the pre-contract planning model, which is uniquely implemented between the owner and selected contractor project teams prior to contract award with the intent of increasing project team alignment and facilitating greater risk transfer from owner to contractor. Results from a multi-case longitudinal study documented the impact of the pre-contract planning model in terms of three success criteria: cost growth, schedule growth, and owner satisfaction, where cost and schedule growth were measured as percent increase of initial contract values. Projects that implemented the pre-contract planning model were compared with a control group that operated via a traditional project delivery process where the selected contractor directly proceeded to contract award without a formal planning process. Analysis revealed that the pre-contract planning model reduced cost and schedule growth by as much as 54% and 70% percent, respectively, indicating that pre-contract planning may be a viable planning mechanism to be implemented in the construction industry.

Research Details

INTRODUCTION

Effective planning has been linked to enhanced construction project performance, resulting in benefits such as cost- and time-savings, clearer project scope definition, and a reduction of change order frequency (Gibson, Wang, Cho, & Pappas, 2006; Haponova & Al-Jibouri, 2009; Yates & Eskander, 2002). Shapira Laufer, and Shenhar (1994) defined planning as “the process of deciding what to do and how to do it before action is required.” Yet oftentimes construction projects are not properly planned, with commonly cited reasons including a perceived lack of time or deficiencies in organizational expertise and drive to thoroughly perform preplanning tasks (Gibson et al., 2006; Rahmat & Shah Ali, 2010). Lack of effective planning process implementation is an important challenge because research has linked poor planning to delays, cost overruns, and owner dissatisfaction (Casinelli, 2005; HMSO, 1995; OGC, 2003; Wang & Gibson, 2010). The negative consequences of poor planning impact both contractors and owners alike (Ndekugri, Braimah, & Gameson, 2008).

In response to the limitations with project planning that exist in the construction industry, this article proposes a unique planning methodology for consideration called the pre-contract planning model. Whereas traditional procurement processes typically select a contractor and move directly into contract award (Santema, 2011; Sullivan, 2011), the pre-contract planning model is unique because it occurs with the selected contractor after the bidding process and prior to contract award. This unique timing enables all agreedto deliverables from the planning process to be included as a part of the final contract between the owner and contractor, which serves to facilitate greater risk transfer from owner to contractor. The key deliverable within the pre-contract planning model is an operational plan for the execution of the project that includes milestone schedule of operational activities and interactions, a technical plan of key delivery approaches that will be employed by the contractor, a risk management plan, and identification of owner action items. The operational plan provides high levels of clarification beyond the selected contractor's base proposal in the bidding phase, and their development prior to contract award results in higher levels of project team alignment once the construction phase commences.

This study contributes to the body of knowledge by presenting the process steps within the pre-contract planning model along with quantitative and qualitative data reflecting the model's corresponding impact on construction project performance. The study utilized an action research methodology to observe and measure construction project success criteria within a multi-project data set at a large government organization (LGO). A key contribution of this study was the quantitative and qualitative measurement of project success criteria to provide empirical results that document the ability of preplanning to improve construction project performance. Another research contribution was to analyze the impact that planning duration has on project success criteria, including cost and schedule growth. Results indicate that pre-contract planning may be a viable methodology that can be incorporated in the construction industry.

LITERATURE REVIEW

The literature review is divided into two sections. First, a review of traditional planning processes is organized according to the timing at which each planning process occurs within the construction project lifecycle. Second, key aspects of successful project planning practices are identified from the literature. These aspects helped inform and drive the action research method utilized to develop the pre-contract planning model.

Traditional Planning Processes

Traditional planning periods occur at different stages of the construction project lifecycle and include varying stakeholders, degrees of certainty, and objectives depending on their timing. The earliest stage of project planning occurs once the owner determines they have a need for a new project, at which point early contractor involvement may be engaged for initial front end planning processes (Gibson et al., 2006). Contractor planning activities also occur during the bidding process and oftentimes into pre-construction efforts (Seibold, 2005). Planning activities may also continue for the duration of the construction phase (Cohenca-Zall, Laufer, Shapira, & Howell, 1994). Each of these four traditional planning periods—front-end, prebid, preconstruction, and construction execution – are reviewed below according to their timing, objectives, stakeholder involvement, and planning activities.

Front End Planning

Front end planning is the initial planning process undertaken by the project owner, designer, and various consultants to assist with analysis of project feasibility and development of detailed project scope. Contractor input may also be solicited during front end planning efforts. Activities include all tasks between project initiation and the beginning of detailed design (Gibson et al., 2006). The Construction Industry Institute (CII) defines front end planning as the process of defining strategic objectives such that owners are able to address high-level project risk and determine resource allocation to maximize project success (Griffith and Gibson, 2001). The front end planning process typically includes budget formulation and initial scope definition from the owner organization's perspective.

Pre-Bid Planning

Pre-bid Planning is a contractor planning activity that takes place prior to bid submission (Kara, 2010). While formulating their proposal, the contractor will review the scope and construction documents released by the owner to assess the project, estimate their proposed cost and schedule duration, and identify initial project execution information and resource allocation (Laufer, Shapira, Cohenca-Zall, & Howell, 1993). Research by Thomas and Ellis Jr. (2007) showed that effective contractor planning during the pre-bid phase results in higher productivity, lower cost, and shorter schedules. However, this planning during this phase includes little active owner involvement. Instead, each bidding contractor develops their proposal plan based on the owner's specifications, construction documents, or request for proposal.

Pre-Construction Planning

Pre-construction Planning typically begins when a single contractor is awarded the contract and may continue into early phases of the construction process. Pre-construction planning may involve contractor support in three phases of the project: (1) the planning or pre-design phase, (2) the design phase, and (3) the tendering and award phase (Al- Reshaid, Kartam, Tewari, and Al-Bader, 2005). Once a contract has been signed, the pre-construction planning stage is traditionally completed at no more than one month before mobilization and no more than two additional months beyond mobilization (Laufer et al., 1993). Pre-construction deliverables traditionally include a detailed front-end schedule, baseline milestone schedule, risk management process, project operations plan, and a clear scope (Casinelli, 2005; Hassanein, 2005).

Construction Execution Planning

Planning may occur during the construction phase, which consists of all activities beyond mobilization and completion of preconstruction planning. This phase of planning also encompasses risk management and can be focused on a single deliverable or the coordination and overlap of multiple tasks within the construction phase. Al-Reshaid and colleagues (2005) noted that traditional construction project delivery techniques generally only emphasize solving construction problems during the construction phase rather than planning them ahead of time

Driving Principles for the Pre-Contract Planning Model

The literature was also reviewed to identify key aspects of successful planning processes, which informed the action research development of the pre-contract planning model. Among the vast existing literature regarding project planning, four driving principles were identified to support the development of the pre-contract planning model: the pre-contract timing of planning activities, mitigation of uncontrolled risks, project team alignment, and risk transfer.

Timing of Pre-Contract Planning Activities

The literature suggests that a fundamental source of project risk stems from the inherent difficulty in anticipating future eventualities at the time of contract award, which renders traditional contract documents somewhat incomplete in terms of assigning contractor and owner responsibility for managing potential project risks (Witt & Liias, 2011). Research has shown that careful transfer and coordination of project risk helps clarify the contract and promote a common understanding between owner and contractor (Gao & Handley-Schachler, 2004). The pre-contract timing of the proposed planning model is therefore critical because it sets aside a formal period of time for the contractor and owner to explore potential risk eventualities within the project's constraints prior to signing the contract.

Mitigation of Uncontrolled Risks

The literature frequently observes the importance of identifying and analyzing risks associated with construction projects (Rahman & Kumaraswamy, 2004; Zou, Zhang, & Wang, 2007). In a study that analyzed construction projects where significant schedule reductions were achieved, Hastak, Gokhale, Goyani, Hong, and Safi (2008) found that risk identification and minimization was critical in eliminating interruptions that would have otherwise interrupted the construction process. While traditional risk management processes often focus on technical risks involved in the project (Sullivan, 2011), Santema (2011) also recommends that a supply chain mentality be applied to risk management such that the focus is instead placed on identifying and planning for risks that the contractor's project team does not directly control. In this approach, the contractor not only assumes responsibility for delivering the technical requirements of the project but also leverages their expertise to better coordinate their interactions with the owner or third party project participants and address other factors that are beyond the contractor's control.

Project Team Alignment

One key benefit of maintaining a risk management focus on uncontrolled risks is increased project team alignment, which is defined by the Construction Industry Institute as "the condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives" (CII, 1997). The reason alignment is important is that the construction industry is typically viewed as an adversarial environment because the construction team is comprised of multiple stakeholders who have differing priorities, expectations, and goals (Bresnen & Marshall, 2000; Brooker & Lavers, 1997). Research has correlated heightened project performance with planning processes that consider the roles and responsibilities of various project stakeholders (Bresnan,

1990; Griffith & Gibson, 2001). Another study recommended that proper definition of scope responsibilities between project stakeholders was correlated with reductions in cost and schedule growth (Wang & Gibson, 2010).

Risk Transfer

Risk transfer from owner to contractor is described in the literature as an important method to provide incentive for contractors to deliver projects efficiently (Witt & Liias, 2011). Traditional risk transfer methods frequently involve owner inspection and management of contractor activities to ensure adherence to contract specifications (Sullivan, 2011), yet tightly monitoring contractor operations in this manner has been shown to increase the risk of opportunism and decrease cooperation (Korczynski, 1996; Ruuska, Artto, Aaltonen, & Lehtonen, 2009). The pre-contract planning model adjusts the owner-contractor relationship by asking the contractor to provide project execution and risk management plans prior to the contract award, which places greater responsibility and accountability on the contractor. Due to the pre-contract timing of this model, the contractor essentially defines their contractual responsibilities through the risk management plan wherein risks that are not under its control are identified along with corresponding plans to minimize the potential risk impacts. By directly including project-specific risk management plans as a part of the contract, the contractor understands they are at risk for any deviation the project's original planned schedule and budget (Sullivan & Michael, 2008).

METHODOLOGY

The methodology is divided into three sections. First, the process steps within the pre-contract planning model are presented in detail, focusing on the sequence of specific actions taken by the contractor and owner as well as their roles and responsibilities within each process step. Second, the applicability of the pre-contract planning model within various delivery methods is discussed. Finally, the research methodology of the multi-case longitudinal study is described, where the pre-contract planning model was applied on multiple similar construction projects at a large government organization and compared with projects that did not utilize a pre-contract planning model between the owner and contractor. The method of data collection used in the longitudinal study to measure project performance is also discussed in this section.

Pre-Contract Planning Model

The pre-contract planning model is a multi-step process that occurs between the owner and selected contractor prior to contract award. There are six distinct steps with the pre-contract planning model, beginning with training to educate the selected contractor team of the expectations, process steps, and deliverables. The selected contractor team then participates in a kickoff meeting to initiate the planning process and the planning and coordinating period transpires according to the specific needs of the particular project at hand. The results of the pre-contract planning model are documented in a deliverable format and reviewed at a summary meeting with all key project stakeholders. Only once all parties agree to the project plan is the contract signed. The steps within the pre-contract planning model are described in greater detail below.

Step 1: Pre-Contract Planning Model Training.
When implementing the pre-contract planning model, the owner organization must provide appropriate training on the expectations, process steps, and deliverables to the selected contractor as well as their own project personnel, such that all stakeholders in the project must understand their roles and responsibilities. The selected contractor team is trained that their role is to act as the leading party in the planning process, and they are responsible to develop operational and risk management plans as well as compile a list of information and supporting action items they will request from the owner. The owner's procurement officer is responsible for acting as the point of contact to coordinate pre-contract planning activities and meetings. The owner's project management group is responsible for reviewing the contractor's technical competence, ensuring the owner's concerns are addressed, and providing any technical information, resources, or decisions requested by the contractor to accommodate their operational and risk planning.

Step 2: Kickoff Meeting.
The contractor leads a kickoff meeting to present an overview of their project operational plan, including an outline the project milestone schedule and key operational interaction points between the owner and contractor, a risk management plan that identifies mitigation approaches for major risks, and clear delineation of owner actions items that are requested during the project during the project, and propose a schedule of activities that must be coordinated during the pre-contract planning period. Although the contractor is still responsible for technical risks, they are encouraged to focus on uncontrolled risks during the kickoff meeting and identify what information must be coordinated with the owner or other third party stakeholders. In this manner, the contractor-lead kickoff meeting begins the risk transfer process by holding the contractor accountable to provide operational and risk management plans up front prior to the contract award. Any major concerns of the owner's stakeholders are also brought forward and addressed during the kickoff meeting. As an outcome of this meeting, both the owner and contractor should be agree to and be comfortable with the major action items in the operational plan such as the key risks and associated mitigation approaches in addition to a schedule of what specific action items need to be planned and coordinated for the remainder of the pre-contract planning period.

Step 3: Plan & Coordinate Deliverables.
The bulk of the pre-contract planning model consists of a brief yet rigorous period of planning and coordinating the operational plan for the project, which includes a project milestone schedule of operational details, key technical approaches the contractor's team will use, a risk management plan, and agreed to owner action items for the duration of the project. The duration of this step is variable depending upon project size and complexity. The project milestone schedule is coordinated and agreed to by all stakeholders. The schedule within the operational plan is focused on interaction points between the owner and contractor to ensure that owner interventions during the project are limited to value-adding activities. The operational plan also includes a clear delineation of the project scope such that the responsibilities of the owner and contractor are understood by all stakeholders and expectations are aligned regarding how project activities will unfold during the construction phase. The risk management plan is formally documented to identify, prioritize, and mitigate key project risks. Each identified risk is accompanied by a written description of the risk, how it may impact the project, and a step-by-step plan of action to prevent the risk from occurring. Since all stakeholders are aware that uncontrollable risks may still occur even if the contractor does everything in their power to prevent them, the contractor is also

asked to describe their plan of action to minimize the impact of any uncontrollable risks that do in fact occur. The contractor also documents the potential impact to project cost, schedule, and quality that may result from uncontrollable risks. Owner action items during the construction phase are also identified, agreed to, and clearly documented.

Step 4: Insert Deliverables into Contract.
Once all deliverables from the planning and coordinating step are completed, they are inserted as an addendum or appendix to the owner organization's standard construction contract documents. In this manner, the contractor has provided greater definition of their contractual responsibilities than in traditional processes due to the inclusion of a project operational plan with the milestone schedule, risk management plan, and agreed-to owner action items. Including these deliverables in the contract facilitates greater risk transfer from owner to contractor.

Step 5: Summary Meeting. This meeting serves as a final and formal check that all parties agree to the project's operational plan, including the milestone schedule, technical approach, risk management plan, owner action items, and any other required deliverables prior to signing the contract. This meeting is not a question and answer session; rather, all planning activities must already be completed such that the Summary Meeting serves as a final review of the agreed to plan. If there are any areas of confusion or disagreement between representatives from either the owner or contractor project teams, planning and coordinating activities must be resumed to clarify the issue prior to reinserting to the contract.

Step 6: Contract Signed.
Once all parties agree to the pre-contract planning deliverables reviewed in the Summary Meeting, the risk transfer process is completed by signing the contract award. The awarded cost and schedule are clearly identified and all stakeholders are aligned with the understanding that construction performance will be tracked against the awarded cost, schedule, and operational and risk management plans.

Applicability within Various Delivery Methods

The pre-contract planning model can be overlaid onto multiple delivery methods, including design-bid-build, design-build, and construction manager at risk. This is because the fundamental elements of the pre-contract planning model can be applied prior to contract agreement between the owner and any service provider, whether a contractor, architectural firm, or engineering company. In design-build, the pre-contract planning model occurs with the design-build team to address key risks in the delivery of both the design deliverables and the construction phase. Construction manager at risk arrangements, conversely, typically incorporate separate pre-contract planning sessions for each the design team and construction manager, who are contracted to the owner via distinct agreements. Each group is asked to plan, coordinate, and provide risk management of their independent scopes of work; however, each may be asked to address how their group will coordinate and interact with the other team for the duration of the design and construction phases. In design-bid-build, the pre-contract planning model can be utilized separately to plan the design and construction agreements.

In a low-bid environment, a the pre-contract timing is less effective because the selection of the lowest cost bidder is assured; however, the owner organization is still encouraged to employ the planning and

risk management aspects of the model with the low-bidder for multiple reasons. First, this form of planning further solidifies the expectations of how the business relationship between owner and service provider will be conducted for the duration of the project. Second, a formalized discussion of risks early in project execution provides the owner team with greater insight into the capability of the individuals on the service provider's project team, which then enables the owner to more effectively plan the internal management resources they will need to allocate to the project. The projects presented within this research study were all delivered via design-bid-build methodology and the pre-contract planning model was implemented between the owner's project team and the selected contractor on each project. The authors have separately applied the pre-contract planning model with success in all three delivery methods as well as low-bid environments, and note that the decision of whether to apply the pre-contract planning model within a given delivery method is ultimately at the owner organization's discretion.

Longitudinal Study of Model Application

Research testing of the pre-contract planning model was conducted at a large government organization (LGO) in the United States that will remain anonymous. The authors formed a two-year action research partnership with the LGO to assist their personnel with training and implementation of the pre-contract planning model. The longitudinal action research study began with in depth training of the LGO's procurement and project management personnel regarding successful implementation the pre-contract planning model on individual construction contracts. This training occurred over multiple sessions in various formats, including lecture-based presentations, question and answer sessions, conference calls, and case study training to share lessons learned from previous project implementations. Additional resources were provided for the LGO's personnel to review independently, including a textbook manual with process detail and step-by-step guidelines as well as an online training website with video-based training modules.

Twenty-one construction projects were selected as part of the longitudinal action research study based upon their availability and scope similarity. A contribution of this research was the similarity of the projects within the data sample, which were selected from the same geographical region, isolated bidding pool of contractors, defined group of owner project managers, and over the same two year period. The work scopes of the projects were all renovation projects as a part of the large government organization's small construction program, including roof and window replacements, meeting room renovations, and other building upgrades. The projects also had extremely similar sizes, scopes, contract values, and schedule durations. These variables were thus controlled for to the greatest extent possible within an industry setting, which provided the opportunity to analyze the projects according to the experimental variable of pre-contract planning model application and duration.

The data sample was divided into two groups: (1) a control group of construction projects that was delivered according to the LGO's traditional methods without a pre-contract planning period, and (2) an experimental group that included a formal planning period according to the procedures of the pre-contract planning model. The traditional planning process at the LGO consisted of price-based selection for construction services, where the selected contractor was immediately brought forward to contract award. There was no standard or formalized project planning process that occurred prior to or post contract award. Projects within the experimental group, conversely, implemented the pre-contract

planning model in order to analyze the resultant impact to project success criteria. The average performance of the experimental group was then compared with the control group. The impact of pre-contract planning duration was also analyzed by separating the experimental group into two sub groups: an Abbreviated Planning Duration subset where planning occurred for one week and an Extended Planning Duration subset where planning lasted approximately three weeks. These subgroups enabled the authors to examine the impact of pre-contract planning duration on project performance. Figure 1 depicts a flow chart of the research inquiry.

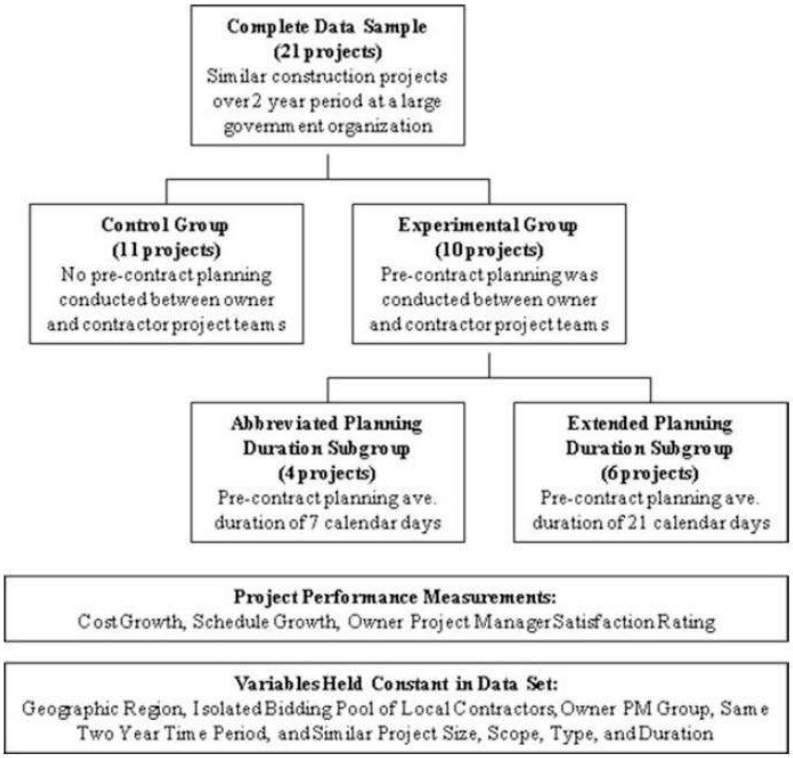

Figure 1. Flow chart of research inquiry.

In accordance with traditional research methodologies for measuring construction project performance, three success criteria were documented as a part of this study: adherence to budget cost, scheduled duration, and owner satisfaction requirements (Westerberg, 2010; Swan & Khalfan, 2007). Cost and schedule growth was tracked via a modification of Wang and Gibson's (2010) methodology, which defined cost and schedule growth as the percent growth in actual project cost and duration compared with the original estimated values at the start of construction document development. For the purposes of this study, cost growth was defined as the percent dollar difference between the actual total project cost—including all accrued change orders—and the original contract award cost, which was the specific dollar value agreed to by the owner and contractor when entering into the original construction contract agreement. Schedule growth was similarly defined as the percent difference between the actual execution schedule duration (including all delays or acceleration impacts) and the original planned project duration at the time of contract award. In this manner the total cost and schedule growth rates measure the total project cost and schedule growth as a percentage of the initial contract values. The third and success criterion was a measure of owner satisfaction, wherein project managers from the LGO rated their

satisfaction with the performance of the selected contractor for each individual contract. The lead project manager in charge of each project provided the satisfaction ratings because they were deemed to have the greatest in-depth knowledge of contractor's performance throughout the duration of construction execution. Owner project manager satisfaction ratings were collected on a 1 to 10 Likert-type scale, where 1 = completely dissatisfied with the contractor's performance on the project and 10 = extremely satisfied with the contractor's performance.

During the longitudinal study, the authors participated as direct observers on each of the 21 construction projects included within the data sample. The authors compiled observations based upon direct participation in reviews of contractor bid documents, inspection in planning sessions, observations of weekly project management meetings, and involvement in project debriefing sessions. This direct examination enabled the authors to tabulate their observations throughout the entire construction phase, specifically regarding advantages and disadvantages observed in the implementation of the pre-contract planning model as compared with more traditional project planning techniques. Within these avenues, the authors specifically looked for differences in project dynamics, including owner and contractor reactions to the pre-contract planning model, general actions towards risk management, and planning deliverables completed by the project teams. The resultant findings were not necessarily evaluated according to specific qualitative criteria but instead were representative of general trends and actions the authors observed, which are intended to provide further background regarding how implementation of the pre-contract planning model affects project team dynamics.

DATA CHARACTERISTICS

The data set was analyzed on two levels. First, the impact of the pre-contract planning model on cost and schedule growth was compared with traditional processes that were operated according to contract award methodologies that did not incorporate a formal planning period. Next, the experimental group of projects that did have a pre-project planning period were divided into two subsets: one group had a short pre-project planning duration (one week) and the other group had a longer duration (three weeks). These subsets were analyzed to identify whether the duration of pre-project planning would have a noticeable impact on project success criteria.

Pre-Contract Planning Compared with Traditional Processes

The full data set was composed of 21 construction projects. The projects had similar budget costs and scopes, consisting of building renovations such as roof replacements, building envelop and exterior improvements, or remodeling of interior meeting rooms and office spaces. In order to maintain consistency throughout the dataset, all projects occurred within a single geographic region of the United States and were managed by the same group of owner project managers. The data set was divided into control and experimental test groups (summarized in Table 1). The control group consisted of eleven projects that were awarded according to the LGO's traditional process, which did not include a formal planning period between the contractor and owner. Instead, the selected contractor was directly awarded the contract and moved into contract award to begin the delivery of construction services, as is representative of most traditional project delivery methods (Gransberg, Koch, and Molenaar 2006). The

remaining ten projects were randomly selected to make up the experimental group that would implement the pre-contract planning model. These projects had an average pre-contract planning duration of 16.2 calendar days. The awarded project values ranged from $107 thousand to $5.2 million, with an average award value of $1.2 million. The control and experimental groups had similar values for award costs on average: $1.3 million for the control group and just under $1 million for the experimental group. Awarded project durations were also similar between the two groups, with an average duration of 166 days for projects in the control group and 137 days for experimental group projects.

Table 1. Traditional vs. pre-project planning data sets

Project Award Characteristics	Control Group	Experimental Group
Number of Projects	11	10
Average Pre-Contract Planning Duration (days)	0	16.2
Total Awarded Cost	$14,244,385	$9,994,887
Average Awarded Cost per Project	$1,294,944	$999,489
Total Awarded Schedule (days)	1,822	1,373
Average Awarded Schedule per Project (days)	166	137

Impact of Pre-Contract Planning Duration

A subset of the full data sample was also analyzed to better understand the relationship between pre-contract planning duration and the resulting impact on project success criteria. The ten projects in the experimental group were divided into two subgroups with distinct pre-contract planning durations. The first subgroup, which consisted of four projects, had a pre-contract planning duration of 7 calendar days and was referred to as the Abbreviated Planning Duration subset. The remaining six projects in the experimental group were implemented with a pre-contract planning duration of approximately 3 weeks and were referred to as the Extended Planning Duration subset. The characteristics of these subsets are summarized in Table 2

Table 2. Varied pre-contract planning duration data subsets

Project Award Characteristics	Abbreviated Planning Duration	Extended Planning Duration
Number of Projects	4	6
Average Pre-Contract Planning Duration (days)	7	22
Total Awarded Cost	$1,997,933	$7,996,954
Average Awarded Cost per Project	$499,483	$1,332,826
Total Awarded Schedule (days)	699	674
Average Awarded Schedule per Project (days)	175	112

RESULTS

The results of the study are described in two sections. First, the control and experimental groups were compared in order to understand the impact of pre-contract planning on project success criteria when compared with traditional processes. Second, further analysis of the experimental group demonstrated the impact of differing pre-contract planning durations on project performance.

Pre-Contract Planning vs. Traditional Processes

At the end of the two-year longitudinal study, the project success criteria were calculated for each of the 21 contracts. Results are summarized in Table 3. The control group were documented to have a total cost growth of $1.74 million (an average of $158 thousand per project), which represented a cost growth rate of 12.2%. The experimental group, which employed the pre-contract planning model, was observed to have a total cost growth of $619 thousand (an average $61 thousand per project) at a cost growth rate of 6.8%. These results showed the experimental group achieved decrease average cost growth per project of 60.9%. Measurements of schedule growth yielded similar results. The control group had a total growth in schedule duration of 1,627 days (148 days per project), which was equivalent to a schedule growth rate of 89.3%. The experimental group was impacted by a total schedule growth of 761 days (76 days per project) at a schedule growth rate of 49.2%. These results showed a 44% decrease in cost growth per project for projects that implemented the pre-contract planning model. The third success criterion of owner satisfaction showed an average rating of 9.4 out of 10 in the experimental group as rated by owner project managers. These ratings represented a 32.4% increase in owner project manager satisfaction when compared with the control group.

Table 3. Impact of traditional vs. pre-contract planning on project success criteria

Success Criteria	Control Group	Experimental Group	Percent Impact
Number of Projects	11	10	–
Average Pre-Contract Planning Duration (days)	0	16.2	–
Total Amount of Cost Growth	$1,740,115	$619,102	–64.4%
Average Cost Growth per Project	$158,192	$61,910	–60.9%
Total Schedule Growth (days)	1,627	761	–53.2%
Average Schedule Growth per Project (days)	148	76	–48.5%
Cost Growth Rate	12.2%	6.8%	–44.0%
Schedule Growth Rate	89.3%	49.2%	–44.9%
Average Owner PM Satisfaction Rating (1–10)	7.1	9.4	33.7%

Impact of Pre-Contract Planning Duration

Comparison of the control and experimental group results appear to indicate that pre-contract planning model holds the potential to greatly reduce cost and schedule growth on small and medium construction projects. Yet owner organizations that implement this method may cite schedule constraints as a reason to limit the amount of time their project teams devote to pre-contract planning activities. In an effort to quantify the importance of adequate pre-contract planning duration, further analysis was conducted by dividing the experimental group into two subsets for further analysis—projects with Abbreviated Planning and Extended Planning durations. Results are summarized in Table 4. The four projects in the Abbreviated Planning Duration subset were found to have a total cost and schedule growth rate of 8.8% and 83.4%, respectively. The six projects in the Extended Planning Duration subset were observed to have cost and schedule growth rates of 5.5% and 26.4%, respectively. These results demonstrated a 36.8% reduction in cost growth rate and a simultaneous reduction in schedule growth rate of 68.3%.

Table 4. Impact of pre-contract planning duration on project success criteria

Success Criteria	Abbreviated Planning Duration	Extended Planning Duration	Percent Impact
Number of Projects	4	6	—
Average Pre-Contract Planning Duration	7	22	—
Total Amount of Cost Growth	$175,332	$443,770	153.1%
Average Cost Growth per Project	$43,833	$73,962	68.7%
Total Schedule Growth (days)	583	178	−69.5%
Average Schedule Growth per Project (days)	146	30	−79.6%
Cost Growth Rate	8.8%	5.5%	−36.8%
Schedule Growth Rate	83.4%	26.4%	−68.3%
Average Owner PM Satisfaction Rating (1–10)	8.9	9.8	10.6%

DISCUSSION

The discussion is broken into three sections. The first section provides a high level discussion of documented the impact of the pre-contract planning model on construction projects for a large government organization. The second section addresses the advantages observed in projects that incorporated the pre-contract planning model. The final section examines potential limitations that were observed in projects that implemented the pre-contract planning model. The observed advantages and disadvantages are examined in terms of project characteristics such as project team dynamics, contractor and owner reactions, and planning process outputs as compared with more traditional project planning methods. These items are intended to provide further insight and discussion into general trends observed

by the authors in their role as direct observers of each of the 21 construction projects within the data sample.

Impact of Pre-Contract Planning on Cost and Schedule Growth

The results of the longitudinal case study at the LGO indicate that the pre-contract planning model has the potential to impact project performance in a positive manner as measured in terms of cost and schedule deviations. Table 5 summarizes the cost and schedule growth rates observed for each of the four project groups that were analyzed within the full data set. The control group of projects that did not implement pre-contract planning was used as the baseline for comparison with the project groups that did incorporate the pre-contract planning model. The experimental group consisted of all projects that implemented the pre-contract planning model and was documented to have a 44% and 44.9 % reduction in cost and schedule growth rate, respectively, when compared with the control group. The two subgroups within the experimental group were separated based upon their duration of pre-contract planning. The Abbreviated Planning Duration subset, which had a pre-contract planning duration of seven calendar days, had reduced cost and schedule growth rates by 28.2% and 6.6%, respectively. The highest performing data subset was the Extended Planning Duration subset, which had an average pre-contract planning duration of 22 calendar days. The Extended Planning Duration subset had a reduction in cost and schedule growth rates by 54.6% and 70.4% when compared with the control group

Table 5. Summary of pre-contract planning impact on cost and schedule growth

Project Group	Days of Pre-Contract Planning	Cost Growth Rate	Percent Impact vs. Control Group	Schedule Growth Rate	Percent Impact vs. Control Group
Control Group	0	12.2%	–	89.3%	–
Experimental Group	16.2	6.8%	– 44.0%	49.2%	– 44.9%
Abbreviated Planning Duration Subset	7	8.8%	– 28.2%	83.4%	– 6.6%
Extended Planning Duration Subset	22	5.5%	– 54.6%	26.4%	– 70.4%

Observed Advantages of Pre-Contract Planning

Several key advantages were observed on projects that implemented the pre-contract planning model as compared to traditional projects that move directly into contract award upon contractor selection. These advantages were observed via the authors' direct participation on the projects from an action research perspective during the more than two years duration of the longitudinal case study. The observed advantages of the pre-contract planning model included increased scope definition prior to contract award, greater alignment of expertise amongst the project team, heightened project team accountability

for tracking and managing project success criteria, streamlined project team interactions, and increased contractor due diligence for planning activities.

Scope Definition

By incorporating a planning period prior to the final contract award, the contractor and owner both develop a more clear understanding of what will be delivered and what items are out of scope. This occurs due to the pre-contract planning model's emphasis on providing an operational plan for construction execution activities including the development of detailed risk management plans. The pre-contract planning activities resulted in an alignment of expectations between the contractor and owner, which is critical to project performance because the owner has a clear understanding of what they will receive and the contractor specifically defines what items are included and excluded from their scope of work.

Alignment of Expertise

By incorporating a planning period prior to the final contract award, the contractor and owner both develop a more clear understanding of what will be delivered and what items are out of scope. This occurs due to the pre-contract planning model's emphasis on providing an operational plan for construction execution activities including the development of detailed risk management plans. The pre-contract planning activities resulted in an alignment of expectations between the contractor and owner, which is critical to project performance because the owner has a clear understanding of what they will receive and the contractor specifically defines what items are included and excluded from their scope of work. be needed from the owner in order to be successful. The contractor is then asked to present an operational plan, identify risks to the plan, and propose solution strategies to minimize these risks from negatively impacting the project. By enabling the contractor to lead the planning meetings and lay out their operational plan, a sense of team empowerment is promoted where the contractor is encouraged to present solutions to the owner throughout the project lifecycle, which provides greater alignment of contractor expertise. This is a role reversal from traditional processes with traditionally see the contractor becoming more reactive to owner directives (Sullivan, 2011).

Heightened Sense of Accountability

The pre-contract planning model can be easily coupled with a performance reporting system for the duration of the construction phase. This is because the contractor clearly defines their operational and risk management plans, which are then included in the contract. Deviations from these plans can be documented on a regular basis (for example, as a part of weekly project meetings). Any deviations can be quantified based upon their impact to project success criteria of cost and schedule growth.

Streamlined Project Team Interactions

Keys points of interaction between the owner and contractor for the duration of the project are defined and confirmed during the pre-contract planning period. Specific individuals within each organization are assigned as points of contact to streamline the flow of information during communications. This is coupled with the contractor's operational plan, which clearly lays out key interaction points that will occur

throughout the project duration, such as when key decisions, inputs, reviews, or support are needed from the owner. This coordination provides clear expectations of project activities that must be conducted by the owner. These expectations are agreed to by the designated owner representatives during pre-contract planning, and they are held accountable to interface with the rest of the owner organization to ensure appropriate resources are allocated in the agreed-upon fashion.

Increased Due Diligence

Holding planning activities prior to the contract award promotes greater contractor due diligence in developing an operational plan and coordinating this plan with owner representatives. Since the contractor is driving towards signing the contract, which is only awarded once the project execution plan is in place, this process inherently provides greater motivation to conduct a formal and thorough planning process. The Summary Meeting also serves as one final check that all parties agree to the project execution plan, which minimizes gaps in expectations between the owner and contractor prior to signing the contract.

Observed Limitations of Pre-Contract Planning

Although the pre-contract planning model may have the potential to improve project success criteria by reducing cost and schedule growth, limitations of the model were also observed. Limitations presented themselves in terms of required behavioral adjustments that are difficult for the project team to enact during implementation. For example, the project team may exhibit a tendency to rush to contract award at the expense of pre-contract planning quality or a hesitance with truly enabling a contractor-lead process. Other limitations are more process-oriented, such as the lack of contractor compensation during pre-contract planning and the need for the owner organization to provide training resources to contractors who may be unfamiliar with the processes, expectations, and requirements of the pre-contract planning model. Each of these limitations are discussed below.

Hesitance with Role Reversal

The pre-contract planning model places responsibility on the contractor's project team to act as the expert party and lead the process of laying out the construction operational plan, identifying project risks, determining optimal risk mitigation strategies, and communicating potential risk impacts to the owner. Yet contractors may be initially hesitant to bring project risks to the owner's attention prior to signing the contract. The authors observed this behavior to be a by-product of the contractor's motivation to maintain a "good" relationship with the owner and not provide any "bad news" early in the project.

Tendency to Rush

Since the contract is not officially awarded until after pre-contract planning process is completed, members from both the contractor and owner organizations may attempt to rush the process in order to finalize and secure the contract award. Rushing the pre-contract planning process may result in shortcuts, loose ends, and non-specific risk mitigation strategies and operational plans. Proper owner facilitation and

enforcement of the pre-contract planning structure is required in order to minimize the negative impacts of this limitation.

Lack of Compensation

Contractors may initially be reluctant to engage in planning activities prior to signing a contract without being compensated. Therefore, it is critical that owner organizations provide a pre-proposal information session with the release of their Request for Proposal in order to communicate the intent and benefits behind the pre-contract planning process with potential bidders. The owner should communicate that the pre-contract planning model is structured for the contractor's benefit, as well as the owner's, because it is a contractor-lead process that enables the contractor's project team to lay out their operational plan, identify and minimize risks, and coordinate all this information with the owner's project team prior to mobilizing. The owner organization must also be sensitive to the aspect of compensation on a project-to-project basis. For example, some form of stipend may be appropriate for more complex projects that may require an extensive planning process. The authors note that feedback has been extremely positive from participating contractors, who have stated that although pre-contract planning may appear to be more work up front, it is highly beneficial. This is because the pre-contract planning model minimizes problems from materializing during the construction phase, which enables to get on and off the job in a more efficient manner (Sullivan, Kashiwagi, & Chong, 2009).

Training Requirements

Training is required to ensure that members of both the owner and contractor project team are familiar and comfortable with the expectations, processes, and deliverables within the pre-contract planning model. Even if the owner has implemented the process multiple times in the past, it should not be forgotten that the contractor group may be participating in pre-contract planning for the first time and thus needs training support in order to be successful in running a new process. The owner must allocate adequate time and resources to ensure all parties must be properly trained in the process, their roles, the expectations, and the overall purpose of pre-contract planning efforts.

CONCLUSION

The objectives of this article were threefold. First, the article proposed a unique planning process for construction projects, called the pre-contract planning model. This model is unique due to the timing of the planning process, which occurs with the between the owner and selected contractor as a final procurement step prior to contract award. Second, the study demonstrated the impact of project planning on both quantitative and qualitative project success criteria compared. Third, the impact of varied planning duration on project success criteria was analyzed.

An action research methodology was utilized to implement the pre-contract planning model on a multi-project data set at a large government organization. The projects were divided into a control group that was conducted via a price-based contract award without any formal planning, which was representative of traditional industry practices. An experimental group of projects implemented the pre-contract

planning model for a total duration of one to three weeks. Project success criteria were measured for each project to document their cost and schedule growth as well as owner satisfaction ratings of contractor performance. The pre-contract planning model was found to reduce cost growth rates by 44% and schedule growth rates by 44.9% compared with traditional processes. Analysis also revealed that extended pre-contract planning durations reduced cost and schedule growth rates by as much as 54.9% and 70.4% as compared with traditional processes.

A contribution of this research study was that the pre-contract planning model appears to be a viable consideration as a brief, yet effective, construction planning process that has the potential to reduce cost and schedule growth. Observations of project team dynamics indicated that the pre-contract timing of the planning activities facilitated increased project team alignment as well as greater risk transfer from owner to contractor. Analysis provided quantitative and qualitative empirical data of real construction projects showing the beneficial impact of preplanning processes may have on key success criteria for construction projects.

Another contribution was the specific construction project data sample that was analyzed, which controlled for project timing, size, geographic location, budget value, schedule duration, available contractor pool, and owner project management personnel. Obtaining detailed cost and schedule data for construction projects of such similarity is often difficult to accomplish, particularly when the main objective was to select a data sample where as many variables as possible were held constant in order to enable an “apples to apples” comparison of project performance resulting from varying planning approaches and durations. For this reason, one limitation of this study was the number of projects that qualified for inclusion in the data set, which caused the authors to be wary of employing detailed inferential statistical analysis of the results. Nonetheless, the 21 projects included in the study enabled an apples to apples comparison of real-time construction projects, which is oftentimes a rare opportunity in the field of construction industry research. Future research is recommended to incorporate results of medium- and large-scale construction projects, which would build upon the data set presented in this article, which consisted of smaller construction projects with an average value of $1.2 million.

Future research is also recommended to include continued testing in multiple owner organizations across various regions to understand whether these variables impact the adoption of the pre-contract planning model. Another consideration for future study is to track the source of each change order as well as its associated cost and schedule duration impacts in order to better understand the cause of impacts, which may shed additional light on their relationship to planning (or a lack thereof) on the project. The quality of pre-contract planning conducted by the project teams on each individual project may also be a subject of future investigation.

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