PERFORMANCE CHALLENGES OF MEGA PROJECTS

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Large (mega) capital projects are experiencing cost overruns and schedule delays that are negatively affecting return on investment. Energy and industrial construction projects face unique challenges in project execution due to geography, climate, labour market characteristics, investment and other factors, both internal and external to the industry. Nonetheless, there is an urgent need for industry to address these challenges in order to improve the long-term success and sustainability of industry. A survey of industry leaders regarding their perception of where industry is at, areas for improvement and challenges they are facing. We asked them their opinion on what practices are good or bad, what needs to be improved and what lessons they may have learned regarding industry planning and execution processes, practices and procedures for large capital projects. The paper will present the findings from this industry survey. We also conducted a literature search of published material of industry practices on large capital projects. We analyzed the published material and survey responses to determine the current industry project performance (where are we at today?), factors that affect performance (what are we doing today?) and how can we improve performance (what can we do tomorrow?). We then present our recommendations. We encourage executives to expand their oversight of projects.

Keywords: oversight, improvement, benchmarking, drivers, cost, schedule

1 INTRODUCTION

1.1 Background

Large (mega) capital projects in Alberta are experiencing cost overruns and schedule delays that are negatively affecting return on investment. Mega projects are defined as those exceeding $1 Billion total installed cost. As owners demand these projects be completed faster to maximize profit, to meet imposed deadlines and to get products delivered to market sooner, engineering and construction industry professionals continue to search for techniques that will provide them the opportunity to meet cost and schedule targets. Energy and industrial construction projects in Alberta face unique challenges in project execution due to geography, climate, labour market characteristics, investment and other factors, both internal and external to the industry. Nonetheless, there is an urgent need for industry to address these challenges in order to improve the long-term success and sustainability of our industry. The way to address these challenges is to determine key drivers, allocate responsibilities and intentionally align activities across the industry to improve performance.

1.2 Research Method

We conducted an online survey with selected industry leaders regarding their perception of where industry is at, areas for improvement and challenges they are facing. We asked them their opinion on what practices are good or bad, what needs to be improved and what lessons they may have learned regarding industry planning and execution

processes, practices and procedures for large capital projects. We present the findings from this industry survey. We conducted a literature search of published material of industry practices on large capital projects. Many researchers and professional organizations have examined where industry is now, what practices they are following, what challenges they are facing and where they should be going. We categorize and share their findings. We analyzed the published material and survey responses to determine the current industry project performance (where are we at today?), factors that affect performance (what are we doing today?) and how can we improve performance (what can we do tomorrow?).

2 HOW MEGA PROJECTS ARE DELIVERED

2.1 Project Phases

As a project progresses from inception to completion, project professionals continually seek a management framework that incorporates the best practices available to balance the business, technical and social issues that become part of any project (Hartman, 2000). One approach that the professionals use is the division of a project into a number of manageable pieces or segments, called phases, for improved management control and better decision making. Although the number of phases in a project life cycle typically can vary from four to ten, all organizations have a similar objective of managing these projects as efficiently and effectively as possible (Phillips et al, 1999). Each phase represents a group of activities that form a module in the process of developing and executing a project. A decision point or gate is located at the end of each phase to allow the organization to decide if the project should proceed to the next phase, if changes should be made before proceeding to the next phase or if the project should be terminated at that point. The progression of phases is known as the project life cycle.

2.2 Fast Tracking

Although most projects are delivered by this framework of phases, the delivery is not always orderly and sequential. Project professionals are under pressure from several decision makers within their organization to complete projects as quickly as possible for a number of reasons. Decision makers are in four areas, namely, commercial, financial, technical and execution. For example, for commercial reasons, an organization must complete a facility that will allow them to meet a delivery contract with a fixed timeline. For financial reasons, a fast completion would secure a timely revenue stream. On the other hand, complex technical and execution requirements often dictate a slower schedule. Project professionals attempt to balance these project priorities by fast tracking, a technique where many actions are done at the same time. An ideal project delivery would have engineering design completed prior to procurement of material and equipment followed by construction of the facility. In an attempt to shorten the schedule, project professionals perform activities simultaneously resulting in procurement and construction beginning before the engineering design is complete. Fast tracking introduces many challenges for the project professionals.

3 WHERE ARE WE AT TODAY?

Large (mega) capital projects in Alberta are experiencing cost overruns and schedule delays. The quality of these projects and the safety performance are good. However, some projects are experiencing operational challenges that make it difficult for these project to attain the returns expected for such massive investment of time and capital.

4 WHAT ARE WE DOING TODAY?

When we asked the survey group about what made them unhappy with their project outcome and what concerned them or caused them to be stressed, we received a long list of responses.

- Project Cost
    - 44% felt that cost overrun would be 10-30% of budget
    - 11% felt cost overrun would be 30-50%
    - 23% felt that costs would overrun by 70-100%
- Engineering Design Completed before Sanction
    - Varied from 15% to as high as 80%
    - No clear indication of a preferred amount
- Project Team Performance
    - Poor team performance was caused by:
        - 43% cited misalignment between management and the project team
        - 29% identified lack of communication
        - 25% faulted personnel turnover
- Project Team Competence
    - Many respondents indicated that the competence level in all project teams (Owner, Engineering, Construction and Fabrication) had decreased and they believed that there were no more ‘A’ teams available

5 WHAT CAN WE DO TOMORROW?

5.1 Project Delivery Model

Robert Porter Lynch and Dr. George Jergeas (Lynch & Jergeas, 2014) identified three competing models for project delivery, namely, adversarial, transactional and collaborative. The Adversarial Project Delivery Model positions firms to (1) apply win-lose gaming techniques, (2) to challenge each other and (3) to exhibit adversarial attitudes. The Transactional Project Delivery Model is about bargaining, trading and participating in a price driven exchange. The Collaborative Project Delivery Model aims at working together, sharing ideas, aligning interest, fairly apportioning risk, and developing fast innovation. It is best used in complex, long-term projects where the stakes are high and ambiguity or uncertainty exists. Lynch and Jergeas analyzed 90

Canadian mega projects to determine the success rate of these three Project Delivery Models. They found that the success rate (defined as the % chance that the projects would be delivered on time, on budget and on target) for each Project Delivery Model was: Adversarial <10%, Transactional 20-30% and Collaborative 80-100%.

5.2 Engineering Design

In a recent study of 23 projects by the Construction Industry Institute and the University of Calgary (COAA, 2014), the optimum value for construction cost growth could be found at approximately 85% engineering design completed before construction start as shown in Figure 1.

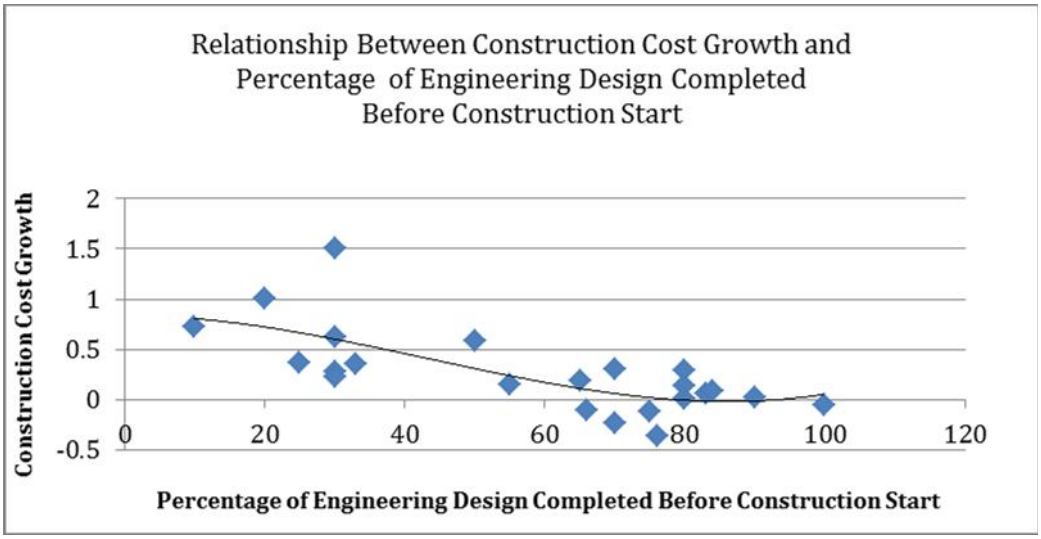

Figure 1: % Design Completed before start Construction versus Construction Cost Growth

5.3 Recommended Actions to Improve Project Performance

The industry survey group, researchers and professionals organizations have identified a number of actions that they recommend be taken to improve project performance. These recommended actions included the following:

- Develop a clear scope definition and restrict changes
- Complete front-end planning including the Project Execution Plan (PEP)
- Align all project teams to follow the Project Execution Plan (PEP) and remove those who are not aligned
- Select an appropriate project delivery system
- Prepare realistic cost and schedule estimates
- Provide sufficient time to complete the engineering design

5.4 Expand Executive Oversight and Leadership

Two researchers, Dr. George Jergeas (Jergeas, 2014) and Mr. Dick Westney (Westney, 2013) tell us that Executives are responsible for oversight and must ask the right questions at the right time throughout all phases of a capital project. The list of questions that the executives may ask/probe the Project Director included:

- How are delays during the early front-end phases of a project reflected in the final completion date?
- What is the project team's approach regarding planning and scheduling the project under unpredictable conditions?

5.5 Employ Leading Indicators as Early Warnings

Researchers and professional organizations recommended that industry employ leading indicators as early warnings of impending problems.

5.5.1 *Early Warnings During Project Planning*

- Changes to scope during FEED
- Delays in engineering
- Contingencies used quickly
- Late permits
- Late decision making

5.5.2 *Early Warnings During Project Implementation*

- Changes in approved construction and engineering plans
- Material delays
- Multiple change orders
- Changes to long lead items after orders placed
- Delays without schedule changes

5.6 Manage Risks, Contingencies and Allowances

Dr. George Jergeas (Rolstadas et al, 2011) addressed risk management in projects. Decisions based on limited information cannot always be right the first time. A structured and thorough risk management process is needed. Conventional risk management has created a climate of risk aversion. Risks should be categorized as operational, strategic or contextual with contingencies or allowances allocated for each risk category. Each category or risks should be assigned to the team that is best suited and capable to effectively manage those risks.

6 CONCLUSION

The energy industry in Alberta is at a crossroad. Mega projects are being cancelled or suspended for further review. Outsourcing is happening more and more each day. Investors are threatening to go elsewhere. Industry must become more efficient in delivering their mega projects. Industry Leaders need to change what they are doing. Industry Leaders, practitioners and researchers know the problems, know the solutions and know the barriers yet industry is still reporting the same problems and the same poor performance. Now is the time to identify the best solutions that can be implemented as quickly as possible.

Industry can implement solutions quickly and effectively if it operates in a trust based, collaborative environment led by Owners. Organizations must establish collaborative relationships to share, promote and reinforce lessons learned and best practices. Project teams must be aligned and integrated. Key stakeholders need to develop an aligned and focused mindset of common goals and objectives. Plans must be developed to achieve these goals and objectives by establishing working relationships that are mutually committed to success as endorsed by senior Executives. The future of Alberta is at stake. Industry can either lead the way to improve project performance with a bold new approach or they can maintain the status quo and ultimately see investors go elsewhere and engineering and fabrication business continue to be outsourced.

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