Front End Planning In

The Modern Construction Industry

By

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ABSTRACT

Front end planning (FEP) is an essential and valuable process that helps identify risks early in the capital project planning phases. With effective FEP, risks can potentially be mitigated through development of detailed scope definition and subsequent efficient project resource use. The thesis describes the FEP process that has been developed over the past twenty years by the Construction Industry Institute (CII). Specifically, it details the FEP tools developed for early project planning and the data gathered to analyze the tools used within the CII community. Data from a March 2011 survey are given showing the tools commonly used, how those tools are used and the common barriers faced that prohibit successful FEP implementation. The findings from in-depth interviews are also shared in the thesis. The interviews were used to gather detail responses from organizations on the implementation of their FEP processes. In total, out of the 116 CII organizations, 59 completed the survey and over 75 percent of the respondents used at least one CII tool in their front end planning processes. Of the 59 survey respondents, 12 organizations participated in the in-depth interviews. The thesis concludes that CII organizations continue to find value in CII FEP tools due to the increase tool usage. Also the thesis concludes that organizations must have strong management commitment, smart succession planning and a standardized planning process to increase the likelihood of successful FEP strategies.
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CHAPTER 1: INTRODUCTION

Since the early 1990s, the construction research consortium, the Construction Industry Institute (CII), has looked at many aspects of Front End Planning (FEP). The term Front End Planning is referred to by other names such as pre-project planning or front end loading. In 1994, the CII publication, “Beginning a Project the Right Way” stated that a well-planned project can: (CII 1994)

- reduce total project design and construction costs by as much as 20 percent (versus authorization estimate).
- reduce total project design and construction schedule by as much as 39 percent (versus authorization estimate).
- improve project predictability in terms of cost, schedule, and operating performance.
- increase the chance of the project meeting environmental and social goals.

Past FEP research has helped construction industry organizations identify risks associated with projects. The research has led to the development of various tools that are used by numerous organizations (domestically and internationally). These tools have helped organizations develop the rudiments of a strong front end planning process.
The FEP tools that are pertinent to this thesis are the following:

1. Project Definition Rating Index (PDRI) (Industrial, Building & Infrastructure)
2. Front End Planning Toolkit
3. Alignment Thermometer
4. Shutdown/Turnaround Alignment Review (STAR)

The above tools have been shown to help construction organizations in the various stages of front end planning but most importantly in the project scope definition stage. When used, the tools help to develop a clear scope definition, proper team alignment and project risk identification. A result of the construction planning research has been the increase of industry efficiency in addressing critical front end planning issues.

1.1. Research Objective

In 2004, Research Team 213 surveyed CII members regarding the use of front end planning tools (Gibson, Ray, and Lyons 2006). The 2004 survey gave details about what tools members were using and how they were using the tools. The survey also gave insight as to reasons why organizations were using the tools and the specific benefits. Since 2004 no other survey has been created to collect data on how much the tools are used within the CII community. Also, since the 2004 survey, new tools have been created to help in the project-planning phase.

At the beginning of 2011, CII supported the second phase of Research Team 268 (RT 268), which includes this author. The first phase of RT 268 was responsible for the development of the PDRI for Industrial tool in 2010 (CII
The first objective of this research, the second phase of RT268, was to succinctly summarize the last twenty plus years of CII front end planning research through a thorough literary review. The second objective was to gather additional data about the CII FEP tool usage and compare the data to those in 2004. Finally, the last objective was to conduct interviews after the FEP short survey. The structured interviews were used to gain more detailed knowledge of an organization’s implementation process; specifically how the tools are implemented into the overall FEP strategy for CII members and the challenges face during the process. The research goals summarized:

1. Summarize twenty years of front end planning research through thorough literary review.
2. Gather more data on the usage of front end planning tools and compare to previous research results.
3. Conduct in depth interviews regarding organization planning implementation strategies.

The purpose of this research is to assess the value of front end planning through measurement of CII FEP tools within the CII community. The author believes that organizations find continued value in front end planning if the FEP organizations utilize the provided planning tools.

1.2. Research Team

For this research endeavor a research team was assembled. Research Team 268 consisted of 18 members including the author. Representatives from various CII member organizations that participated on the research team
included contractors and owners from different industry sectors. The purpose of having different member organizations was to include various approaches to the research process. RT 268 included five (5) members from public owner organizations, two (2) members from private owner organizations, eight (8) from contractor organizations, two (2) from an academic organization and one (1) from an industry consulting organization. The team members and corresponding organization are given in Appendix A.

![RT 268 Breakdown](Figure 1: RT 268 Breakdown)

RT 268 was a unique team in the fact that many of the research members carried over from the previous research effort that developed and assessed the benefits of the PDRI Infrastructure tool (CII 2011b). Among the 20 members, 10 carried over from the previous research effort. Other new members were involved in previous CII FEP research over the past 20 years (see Appendix A).

1.2.1. Team Purpose

The team objective was to conclude (for now) the 20 years of front end planning research within the CII community. For RT 268 there were three
distinct deliverables at the conclusion of the research process. The deliverables were:

1. Produce a front end planning overview guidance document
2. Update the FEP Toolkit
3. Produce a research summary report

1.3. Structure of Thesis

This thesis is organized into six chapters. It also includes appendices that provide information on the FEP short survey and interview instruments, as well as a detailed list of RT 268 and CII member organizations.

Chapter 1 includes an introduction to the research topic, research objectives, and the research team. Chapter 2 provides an explanation of the front end planning process and a literary review of the FEP research to date. The research hypothesis is also included in Chapter 2. The thesis research methodology for this study is addressed in Chapter 3. It gives an overview of how the detailed research steps were conducted. Chapter 4 details the survey data; it analyzes the 2011 short survey results and compares them to the 2004 survey results. In Chapter 5 the in-depth structured interviews are described. The chapter details the answers given to the questions asked in the interviews. Finally, Chapter 6 is a conclusion of the findings of the research and the author’s recommendations.
CHAPTER 2: BACKGROUND

Since 1991, CII FEP research has helped in defining clear project scopes and aligning successful project teams. Through the front end planning research numerous tools have been created. Currently, the most used tool is the PDRI although the other tools are used extensively. In 2004 data were gathered on the use of the available tools. However, since the 2004 survey, no FEP tool usage data have been gathered.

2.1. Construction Industry Institute

From the early 1980s, CII has been a driving force for process improvement in the construction industry. CII is a research consortium of 126 organizations and is based at the University of Texas at Austin. Its mission is to “improve the cost effectiveness of the capital facility delivery process and the competitiveness of its member organizations” (Irons and Gibson 2006).

CII has supported many research initiatives, which in turn has improved the efficiency of the construction industry. For example, CII has led research in the following areas (CII 2011a):

- Alignment
- Benchmarking
- Change Management
- Constructability
- Dispute Prevention & Resolution
- Front End Planning
• Lessons Learned
• Materials Management
• Partnering
• Risk Assessment
• Quality Management
• Team Building
• Zero Accident Techniques

2.1.1. Front End Planning

CII has identified front end planning as a critical element in the construction industry. Front end planning is described as a process of developing strategic information to identify risks and decide the resources needed to mitigate those risks (CII 2006b). The purpose behind the FEP process is to create an environment very early in the project lifecycle to effectively analyze potential projects risks. The desired result is to have a project that an organization can successfully manage.

Figure 2 provides a graphical depiction of the front end planning process in relation to the project lifecycle (CII 2006b; CII 1999). In an effective FEP process, the three phases (feasibility, concept and detailed scope) of a project are performed in order. The consecutive order of the phases is important because each phase provides important risk mitigation information before the next phase. Each of the phases is evaluated or “gate checked” before moving to the next phase as shown by the diamonds in the diagram (0, 1, 2, and 3).
An organization assesses the project resource requirements and project business objectives in the feasibility phase. In the concept phase, project team alignment and basic design documents are investigated. For example, crucial decisions regarding project location, technology, and contract strategy are tackled. This analysis should produce a plan to define the project scope. An organization must have an exhaustive plan in the detailed scope phase. To properly execute a project within the allotted budget and schedule, an organization’s plan should include a scope definition of critical issues.

2.2. Literature Review

Since the goal of the research was to gather data regarding the front end planning process and tools that organizations employ, it was necessary to summarize literature on the use of the FEP tools within the CII community. The literature review looks at the FEP research over the last 20 years.

2.2.1. Pre-Project Planning Research

The beginning of systematic front end planning research can found in the early 1990s, where the CII Pre-Project Planning Task Force took on the task of researching the process of front end planning. In its research efforts, the pre-
project planning team used the Integration Definition for Function Modeling (IDEF0), Structured Analysis and Design Technique methodology to outline the FEP process (Gibson, Kaczmarowski and Lore 1995). In the end the team concluded four major goals of front end planning: 1) organize for pre-project planning 2) select project alternative(s), 3) develop a project definition package and 4) decide whether to proceed with project. The research team also identified several important principles for successful front end planning. The principles were planning standardization, owner-driven process, well defined goals, full understanding of requirements and goals, detailed design to ensure predictability of costs and schedule and a corporate process that reinforces planning goals (CII 1994; CII 2006b). The Pre-Project Planning Handbook was published as a result of this project (CII 1995).

2.2.2. Project Definition Rating Index Industrial

The front end planning research continued with The CII Front End Planning Research Team (RT 113), which was formed to create “effective, simple and easy-to-use scope definition and alignment tools” (CII 1996). In 1994, the research team delivered the Project Definition Rating Index (PDRI) tool for industrial projects. The tool was created as a method to measure the level of scope definition. It allows project teams to evaluate the completeness of the project scope through a comprehensive scope definition element checklist. Checklist elements are based on task completeness, resulting in a score that can be related to the associated risk at the particular point in the front end planning process. The maximum score of the PDRI tool is 1000 points; the lower the score, the
more defined the project scope. From the analysis of 40 projects, RT 113 found that projects with scores lower than 200 were more successful (CII 1996).

2.2.3. Project Team Alignment

Another deliverable from RT 113 was the book, *Alignment During Pre-Project Planning* (CII 1997a). Alignment is an important aspect of project planning and is defined 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 1997a).

The research produced four key categories that must be addressed to ensure project alignment:

1. Culture
2. Execution Processes
3. Information
4. Project Planning Tools

2.2.4. Project Definition Rating Index Building

The FEP research continued in 1997, when CII supported Research Team 155 (RT 155) in a study to create a tool to be used on building and institutional construction projects that was similar to the PDRI for Industrial. RT 155 created and tested the PDRI for Buildings on sample projects (Cho, Furman and Gibson 1999). The analysis of the sampled projects showed a significant difference in project control variables such as cost and schedule between projects with low PDRI scores (detailed scope) and projects with higher scores (CII 1999; CII,
2.2.5. PDRI and Project Risk Management

In 2002, Wang explored the correlation between project performance and the PDRI score. In the analysis, information was gathered on 140 capital projects approximately $5 billion in construction costs. A connection between enhanced project performances and well-defined scope was established through this research (Wang 2002).

2.2.6. Federal Facilities Council Study

In 2003, the Federal Facilities Council Standing Committee on Organizational Performance and Management sponsored Technical Report #146. The report was titled “Starting Smart: Key Practices for Developing Scopes of Work for Facility Projects”. The report was issued to help public organizations better define project scopes for federal facilities. It acknowledged that a detailed front end planning process was essential to a detailed project scope. The research acknowledged essential practices for effective scope development related to scope definition. The report also gave an array of delivery systems and contract methods as derived from CII work (Federal Facilities Council 2003).

2.2.7. Front End Planning Survey

To analyze the use of the Project Definition Rating Index (PDRI) tools, Research Team 213 surveyed member organizations in 2004 regarding the use of the PDRI tools (Industrial and Building) (Gibson, Ray and Lyons 2006). At the time, the main FEP tool available for CII organizations was the PDRI;
organizations had been using both PDRI types (the Industrial version had been published for eight years and the Building version for five years) but there was limited data detailing the use of the tools. The 2004 survey was the first attempt to collect data on the implementation of CII FEP tools.

The survey focused on determining the following (Gibson, Ray and Lyons 2006):

1. Number of CII members using the planning tool
2. Whether planning tools were incorporated within the organization’s FEP process?
3. Project type and size description on which members used the tools.

The study concluded that 61.7 percent of CII organizations used the PDRI to improve their planning efforts. Most of the organizations stated that the tool was improving their planning effectiveness. Of the organizations surveyed 61.7 percent were using the PDRI for Industrial Projects. In regards to the PDRI for Building Projects, 44.7 percent of the population used the tool. The majority of the organizations surveyed (81.4 percent), used the PDRI as a checklist in the early project planning stages (CII 2006a).

Some of the research findings of the different PDRI tool uses were unexpected. For example, several members reported that the PDRI was used to analyze bidding opportunities. Another surprise was the number of CII members that modified the PDRI to better fit their needs. Most importantly, whether it was CII tool or non-CII tool, the majority of organizations confirmed their
commitment to using a front end planning tool in the planning process (CII 2006a).

2.2.8. Analysis of FEP Results Using CII’s Benchmarking and Metrics Database

Using project data from its benchmarking and metrics database, CII published a report that analyzed front end planning practices. Published in 2006, the report offered research on FEP aspects including the cost of front end planning related to total project costs and the effect of good front end planning on performance metrics. The metrics such as cost growth, change orders, and schedule growth were analyzed in relation to PDRI scores, Pre-Project Index, percent design complete and the Alignment Index. Researchers measured the PDRI usage of the CII member population. Approximately 61 percent used the PDRI to aid in their front end planning processes (CII 2006a).

The front end planning cost related to total cost analysis was evaluated based on 395 owner projects and 212 contractor projects from various sectors such as infrastructure, building, and industrial. For projects greater or equal to $5 million, the mean front end planning cost for owners was 3.4 percent of total cost and 4.3 percent for contractors. The study concluded that contractors spend more than owners as a percentage of total cost for all small projects in all sectors. In the infrastructure sector, owners spend the most as a percentage of total cost on large projects (greater than $5 million) (CII 2006a).

Comparison of PDRI scores of industrial and building projects to performance metrics was also performed. There were 237 projects
with PDRI scores greater than 200 upon completion of the detailed design phase. Of these 237 projects, 186 performed poorer (on average) than the mean of the samples with PDRI scores under 200 (projects with better scope definition). For industrial projects, the researchers confirmed that the statistical difference in cost growth factor and schedule performance was significant. When the PDRI was used, there was a statistical difference in the performance metrics for building projects (CII 2006a).

The analysis on the percent design complete found that the project sub-sample of 27 industrial and 21 building projects that were above the median percent design complete, outperformed the sample below the median percent design complete on average for cost and schedule performance. For this sample the median percent design complete was 20 percent. If the percent design complete was greater than 20 percent, the project cost would decrease by 5.6 percent versus a project estimate at the end of front end planning process. At authorization for design and construction the cut off value was 20 percent design complete (CII 2006a).

To examine if the CII Pre-project planning index score has an effect on performance metrics, the researchers analyzed 676 projects, 609 industrial and 67 building projects. The total project cost of this sample was greater than $36 billion. The index score has a rating from 0 to 10. If a project definition had a score of 10, it is well-defined. For industrial projects, the research concluded that the differences in cost, schedule, and change order performance were statistically significant (CII 2006a).
To compare the Alignment Index scores with the performance metrics, data subsamples from 70 projects were analyzed. The Alignment Index is based on the Alignment Thermometer, which was created in previous research works (CII 1997a). The thermometer tool includes 10 questions that has a score range between 0 and 10. The team is perceived as better aligned if the score is higher. In this sample, the mean alignment score was 6.5. On average, for projects at the end of detailed design, sample projects which had an alignment score greater than the median outperformed projects with scores below the median in all three performance metrics; costs, schedule and change order performance (CII 2006a).

2.2.9. Front End Planning Toolkit

In 2006, CII’s Research Team 213 developed the Front End Planning Toolkit. The purpose of the tool was to be a “one stop shop” for the vast amount of CII FEP knowledge and the available front end planning tools. At the time, the tools available included: the Pre-Project Planning Handbook; Project Definition Rating Index, Industrial Projects; Alignment During Pre-Project Planning; and Project Definition Rating Index, Building Projects (CII 1995; CII 1996; CII 1997a; CII 1999).

In 2009, CII Research Team 242 updated the tools within the Front End Planning toolkit to clarify methods for using the four available tools. The 2nd edition of the Alignment During Pre-Project Planning – A Key to Success (CII 2005) was revised based on materials from a CII study funded by the National Institute for Standards and Technology and the collective knowledge from RT 242 (Howard, Gibson, Whittington and Cui 2009).
The 2nd editions of the Project Definition Rating Index, Industrial Projects and Project Definition Rating Index, Building Projects (CII 2006e; CII 2006d) were also based on the materials from the CII study funded by the National Institute for Standards and Technology and input from the research team. The updates to the PDRI tools resulted in significant updates. Mainly, the updates eliminated the “yes/no” options from some element definitions, discussed owner and contractor tool usage, and referenced sustainability and security issues (Howard, Gibson, Whittington, & Qingbin, 2009).

The FEP Toolkit is strongly linked to the Pre-Project Planning Handbook (published in 1995), which was archived by the research team. The purpose of Toolkit was to support the use of front end planning knowledge and increase consistency in planning to ultimately improve the effectiveness of capital projects. The Toolkit was developed in the HTML language and can be modified to an organization’s online website (CII 2006c).

2.2.10. Front End Planning for Renovation/Revamp Projects

In 2009, CII supported Research Team 242 to explore the unique front end planning topics associated with a subset of renovation and revamp (R&R) projects known as shutdown/turnaround/ouage (STO) projects. The team evaluated 25 case studies totaling over $1.4 billion and performed statistical analysis on project data from the CII Benchmarking and Metrics database. RT 242 also collected data from four workshops that focused on front end planning for STO projects (CII 2009).

The research showed that the CII owner’s mean total project volume
was $4.6 billion with $1.5 billion of it R&R projects. For CII contractors, the mean total project revenue was $5.2 billion with $1.5 billion of it R&R projects (CII 2009).

From its research on R&R projects, RT 242 found the following planning activities crucial for success:

1. Identify and engage key stakeholders
2. Ensure alignment and conduct teambuilding
3. Follow a defined front end planning process
4. Define critical scope issues and project drivers
5. Define existing conditions
6. Choose contract strategy for project constraints

One major deliverable from this research effort was the creation of the STAR (Shutdown Turnaround Alignment Review) tool (CII 2009). As a result of the research and analysis, RT 242 created a tool to give insight, management guidance and effective communication between teams working together (CII 2009).

2.2.11. Project Definition Rating Index Infrastructure

In 2010, CII’s Research Team 268 (RT 268, Phase I) developed the third installment of the PDRI tool, called the Project Definition Rating Index-Infrastructure Projects (CII 2010). After creating the tool, RT 268 tested the tool on completed projects within three years of the research. Through the research a significant difference was found regarding average schedule, cost and change order performance (Bingham et al. 2011).
2.3. Problem Statement and Hypotheses

The literature review for this thesis looks at prior FEP research and it gives an overview of all available CII planning tools. The goal of this investigation is to gather data regarding the front end planning process and what tools organizations employee, it was necessary to find literature that was available on the use of all front end planning tools within the CII community. The aforementioned tools are pertinent to the front end planning strategy within the construction industry and therefore data should be collected on their use and effectiveness.

2.3.1 Problem Statement

The lack of data since the 2004 survey on the use and effectiveness of FEP tools has led the author to gather current data on all available CII FEP tools.

2.3.2 Hypothesis

Organizations continue to value FEP tools; therefore, there is an increase in usage of front end planning tools within the CII community since the last FEP survey was conducted. More organizations in 2011 are using the planning tools compared to 2004.

2.4. Summary

Research conducted by CII reveals a strong connection between effective front end planning and improved project success measured by project cost, schedule and change order growth. Previous research indicates that well performed planning can reduce costs by as much as 20 percent, decrease project
variability and increase the chance of projects successfully meeting goals. The research indicates a direct correlation between the level of front end planning effort and project success (CII 1994).

The literature review shows that from the early 1990s, CII member organizations have incorporated the FEP process into their project cycles. Many organizations have also adopted the numerous front end planning tools within their processes. Although much is understood about the positive effects of front end planning, little is known about the current use of the tools and the implementation results. Since the 2004 survey, there has been little research on the actual use of CII front end planning tools.
CHAPTER 3: RESEARCH METHODOLOGY

Chapter 3 will examine the methodology used in gathering information for both the qualitative and quantitative analyses conducted in this research effort. A detailed methodology diagram will also be given.

3.1. Overall Research Methodology

Figure 3 outlines the research methodology for this thesis. The author first completed a literature review of the front end planning research relevant to the thesis. After the literature review, the author drafted document instrument for the short front end planning survey and the structure interviews. Once the author drafted the instruments, the documents were piloted. Shortly after, the survey document was distributed to CII members and the interview document was utilized, after which gather were collected and a report was written.
3.2. Front End Planning Short Survey

The front end planning survey was a follow up to the CII survey in 2004, which was the first attempt to collect data on the implementation of CII FEP tools. This survey was used to answer the question: “what tools are CII members using?” At the time, the survey only questioned members on two FEP tools: PDRI Industrial and PDRI Building. In 2004, the Industrial version had been published for eight years and the Building version for five years but there was limited data detailing the use of the tools.

One of the goals of this research endeavor was to collect additional data on the use of front end planning tools in the CII community. The goal was to
compare data from 2004 to the new data in 2011 and therefore the survey instruments were similar. In addition, data was to be gathered not only on the two tools from 2004 but also on the following new tools:

- PDRI Infrastructure
- Front End Planning Toolkit
- Alignment Thermometer
- Shutdown Turnaround Alignment Review (STAR)

At the time of the 2011 survey, there were 116 CII member organizations (Appendix B). The population for the short survey was the CII member population of member organizations at that time. By design, no attempts were made to involve organizations outside of CII and therefore the sample population does not represent the entire construction industry. However, CII member organizations are some the most successful and most recognized organizations in the industry.

3.2.1. Survey Instrument Creation

The front end planning short survey instrument (Appendix C) was created in February and March of 2011 through a collaborative effort between the author and RT 268. The author first drafted the new survey instrument based on the 2004 survey document.

The author included questions addressing the additional four tools and added a question on the common barriers to effective front end planning. There was also space provided at the end of the survey for additional comments.
Afterwards, the survey was reviewed and edited by RT 268. Subsequently, the survey was piloted by four RT 268 team members and slight changes were made based on that input. Final changes were made before the surveys were distributed to CII members at the March 2011 Board of Advisors meeting. The typical attendee at the Board of Advisors meeting is a senior level executive. This individual is responsible for managing an organization’s overall capital projects mission and is knowledgeable of the organization’s front end planning process.

The front end planning survey was available in three different formats, a hard copy, a portable digital format (PDF) version, and an online version. The hope was to make the experience very convenient in order to gather as much data as possible. The goal of the front end planning survey was to receive 70 organization responses. At the time on the survey on spring 2011, there were 116 CII organizations.

With the different formats, the data collection strategy needed to be well planned. A Microsoft Excel® document was used to store the collected FEP data. The hard copy and digital surveys needed to be manually keyed into the survey database. For the online survey results, the data was copied into the Excel® database.

### 3.2.2. Survey Issued

CII member organizations were given three opportunities to complete the front end planning survey. The first opportunity was at the Board of Advisor meeting in March 2011 in New Jersey. A hard copy of the survey was provided to member organizations at the meeting. Seventeen surveys were
completed and returned at this meeting. Subsequently, member organizations that did not complete the survey at the meeting or were not present at the meeting were emailed a PDF survey copy. In total, 10 organizations emailed completed PDF surveys. The final option was an online survey. Thirty-two member organizations completed the survey online. Table 1 gives an overview of the different methods organizations submitted completed surveys to RT 268.

**Table 1: Survey Submittal**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Copy (Board of Advisor Meeting)</td>
<td>17</td>
</tr>
<tr>
<td>Digital (Emailed PDF)</td>
<td>10</td>
</tr>
<tr>
<td>Online (CII Survey Website)</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

Table 2 shows the monthly progress in collecting the 2011 front end planning surveys.

**Table 2: Survey Completion Month**

<table>
<thead>
<tr>
<th>Month Completed</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>17</td>
</tr>
<tr>
<td>April</td>
<td>0</td>
</tr>
<tr>
<td>May</td>
<td>21</td>
</tr>
<tr>
<td>June</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

3.2.3. **Analysis**

Upon the synthesis of these data, the results were analyzed by looking at both the quantitative and qualitative responses. The author evaluated the
descriptive statistics and used frequencies when assessing the use of the six different tools. A mean calculation was used in the examination of the years of use for the PDRI tools. Also, pattern matching was used to identify common themes in the qualitative answers in the survey. Results of the updated survey were compared to the 2004 survey results in order to assess the increase of FEP tools usage. The complete analysis of the 2011 FEP survey results can be found in Chapter 4. The chapter also analyzes the 2011 survey in relation to the 2004 survey.

3.3. In-Depth Interview

The in-depth interviews gave an opportunity for further analysis on the use of the front end planning tools, as well as implementation strategies. The short survey could only “scratch the surface” of the different front end planning strategies within the CII community. Since there are many large and complex organizations within the CII community, it would have been very difficult to initially ask for a 60 minute long interview instead of a short survey. The short survey gives insight and a snapshot into what organizations were doing; however, to gain implementation details, more in-depth research was needed. The in-depth interview was developed for the middle to upper manager. Typically this individual has a limited amount of time but an hour-long interview would not have been a burdensome commitment.

The purpose of the in-depth interview was to engage the organization in a conversation regarding their front end planning strategy. It was imperative to cover all the topics in the interview. However, since the interview was
qualitative in nature, it was important to allow the organization representatives to speak freely about the process.

Organizations that volunteered for a follow up interview through the FEP short survey in the spring of 2011 were contacted regarding the interview. A total of 19 organizations volunteered to share more information regarding their front end planning process.

These organizations were contacted by the author and in the end 12 organizations (15 individuals) or over 10 percent of the 116 CII members were interviewed. The interviews took place from mid September 2011 to February 2012. Table 3 details the organizations that participated in the in-depth interview process.

### Table 3: In-depth Interview Participants

<table>
<thead>
<tr>
<th>Organization</th>
<th>Type</th>
<th>Date</th>
<th>Type</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Contractor</td>
<td>September-11</td>
<td>Telephone</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>Owner</td>
<td>September-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>Owner</td>
<td>September-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>Owner</td>
<td>October-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Contractor</td>
<td>October-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>Contractor</td>
<td>October-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>G</td>
<td>Owner</td>
<td>November-11</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>Contractor</td>
<td>December-11</td>
<td>In-Person</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>Owner</td>
<td>January-12</td>
<td>In-Person</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>Owner</td>
<td>January-12</td>
<td>Telephone</td>
<td>2</td>
</tr>
<tr>
<td>K</td>
<td>Owner</td>
<td>January-12</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td>L</td>
<td>Contractor</td>
<td>February-12</td>
<td>Telephone</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

#### 3.3.1. Interview Instrument

After analyzing the responses to the short survey, the author identified potential topics for the structured interviews. The topics were FEP
process, FEP tools, succession planning, and alliance planning. In addition, the author thought it was crucial to ask about FEP process examples and planning aspects interviewees thought were most important.

A structured set of questions was drafted based on the issues the author felt were important to the study based on the responses from the short front end planning survey. The list was vetted by RT 268 and then edited. The interview instrument is provided in Appendix D. Once the document was completed, the final was piloted in the first interview. The author updated the instrument once again based on the initial interview then continued to use the final document for the remaining interviews.

3.3.2. Interview Process

Unlike the survey, the interviews were conducted over the telephone or in person. The author communicated with the organization as to interview time opportunities. Since the different contacts for the organizations were both domestic and international, there was no standard time slot for the interviews. The interviewees were from the countries; the United States, Canada and England. The most challenging aspect of the in-depth interview was time scheduling. Since the interviews were with upper management individuals, sometimes scheduling was difficult. Below is the email that was the author sent to the organizations:
Dear “Organization”

This past summer your organization completed a survey on the use of Front End Planning (FEP) tools in the CII community. From the completed survey, your organization indicated that it was willing to share success stories regarding implementation of FEP tools.

Our research team would like to know if you or someone in your organization would be willing to participate in a follow-up telephone interview? The purpose of the telephone interview is to ask detailed questions about use of FEP tools and also on what is required to implement a successful FEP process. The interview should last no more than one hour.

If you would like to participate in the follow-up interview, please let us know and we will contact you or your representative to schedule a time for the interview. Once scheduled, a reminder will be sent two days before the interview time with a list of topics that will be covered. Once again, we would like to thank you ahead of time for your participation. If there are questions please feel free to contact me.

Yours truly,

Roberta Bosfield
CII Graduate Research Assistant
Arizona State University

Figure 4: In-Depth Interview Email

3.3.3. Analysis

The analysis for data collected from the structured interviews was qualitative in nature. Once the case studies were completed, the data was transcribed and organized. Since case studies are sometime difficult to measure, pattern-matching was the principal mode of analysis of the in-depth interviews. Based on Yin’s explanation-building concept, the analysis details the common links or themes within the twelve interviews (Yin 1994).
The complete analysis of the in-depth interview results can be found in Chapter 5. The chapter covers the responses to the questions; common themes and recommendations based on interview responses.

3.4. Summary

In summary, all organization respondents of the short survey and in-depth interview were volunteers from the CII community. The data collection instruments were both reviewed and piloted by RT 268 after the author drafted the documents. Like many other research efforts, there are limitations with the data from this methodology. First, the organizations that completed the initial 2004 FEP survey were not the same organizations in the 2011 survey. Another limitation is the “convenience” sample. Since all organization respondents were volunteers, this sample population cannot represent the entire construction industry. Apart from the limitations, the collected data is still useful for its original intended purpose.
CHAPTER 4: FRONT END PLANNING SURVEY ANALYSIS

The survey results for both the 2011 and 2004 are reported, analyzed, and compared in this chapter.

4.1. Survey Respondents

At the time of the 2004 survey, there were 92 CII member organizations eligible for the front end planning survey. These included 47 owners (51.1 percent) and 45 contractors (48.9 percent) in the total population. Of the 92 organizations, 70 organizations responded, which was a response rate of 76.1 percent. Thirty-six owners (51.4 percent) and 34 contractors (48.6) responded to the survey. In the end, of the 70 respondents, 43 organizations (61.4 percent) used at least one CII front end planning tool in 2004.

Looking at the 2011 survey population, there were 116 CII member organizations (Appendix E). Of the 116 organizations, there were 56 owners (48.3 percent) and 60 contractors (51.7 percent). Fifty-nine organizations responded to the 2011 survey, a response rate of 50.9 percent. Of the 59 respondents, there were 32 owners (54.2 percent) and 27 contractors (45.8 percent). In the 2011 survey, of the 59 respondents, 46 organizations (78.0 percent) used at least one CII front end planning tool.

To compare, the respondent percentages of owners and contractors are similar between 2004 and 2011. There were no significant changes in the population make up of owners and contractors. However, in looking at the survey response rate, the 2011 rate was far lower than that in 2004. Even though there were more members in 2011, there were 11 less survey respondents. Yet,
in 2011, a greater percentage of respondents used at least one tool (78.0 percent) compared to the percentage (61.4 percent) in 2004. Table 4 gives population and response details of the two survey populations.

**Table 4: FEP Survey 2004 and 2011 Comparison**

<table>
<thead>
<tr>
<th>Year of Survey</th>
<th>2004</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>CII Total Organization Population</td>
<td>92</td>
<td>116</td>
</tr>
<tr>
<td>Survey Respondents</td>
<td>70</td>
<td>59</td>
</tr>
<tr>
<td>Percentage of CII Members</td>
<td>76.1%</td>
<td>50.9%</td>
</tr>
<tr>
<td>Owners</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>Contractors</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>Respondents # and % used at least one tool</td>
<td>43 or 61.4%</td>
<td>46 or 78.0%</td>
</tr>
<tr>
<td>Respondents Used None</td>
<td>27</td>
<td>15</td>
</tr>
</tbody>
</table>

In conclusion, there were more survey participants in 2004 compared to 2011 but the tool usage was slightly higher among the 2011 respondents. One issue that also should be addressed is the organization overlap between both surveys. Of the 2011 survey respondents (59), 39 respondent organizations were part of the overall survey population in 2004. The remaining 20 respondent organizations did not complete the 2004 survey. Therefore, the survey respondents for 2004 and 2011 are not the same.

In summary, the two populations are comparable when looking at the owner and contractor metrics; however, care should be given when extrapolating since the specific respondent organizations for the 2004 and 2011 surveys are different.
4.2. FEP Survey Results

4.2.1. Overall Use of CII FEP Tools

In the 2011 survey, questions one though six, measured the overall usage of the FEP tools. Respondents had the answer options: “Yes”, “No”, or “Not Applicable”. An organization could respond “Not Applicable” if the tool did not apply to its organization work process. The questions asked the respondent whether their organization uses the PDRI for Industrial Projects, PDRI for Building Projects, PDRI for Infrastructure Projects, Alignment Thermometer, Front End Planning Toolkit and the Shutdown/Turnaround Alignment Review (STAR) tools, respectfully. In the 2004 survey, the overall usage was only measured for the PDRI for Industrial Projects and PDRI for Building Projects tools.

In Table 5, the tool usage results for questions one through six in the 2011 survey are given. For the PDRI for Industrial Projects tool, when applicable, there were 41 out of 53 organizations that used the tool or 77.4 percent. Eighteen out of 37 respondents or 48.6 percent used the PDRI for Building Projects tool when applicable. For the relatively new PDRI for Infrastructure Projects tool (which was published in 2010), 12 out of 36 respondents or 33.3 percent used the tool when applicable. Fifty-three respondents indicated the Alignment Thermometer was applicable to their organization and 16 or 30.2 percent used the tool. For the Front End Planning tool, 53 respondents also indicated the tool was applicable and 24 organizations or 45.3 percent used the tool. When applicable, 7 of 50 organizations or 14.0 percent used the STAR tool.
Table 5: Survey FEP Tool Usage (N=59), 2011

<table>
<thead>
<tr>
<th>FEP Tool Type</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Total</th>
<th>% Using when applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDRI for Industrial Projects</td>
<td>41</td>
<td>12</td>
<td>6</td>
<td>59</td>
<td>77.4%</td>
</tr>
<tr>
<td>PDRI for Building Projects</td>
<td>18</td>
<td>19</td>
<td>22</td>
<td>59</td>
<td>48.6%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>59</td>
<td>31</td>
<td>28</td>
<td>118</td>
<td>65.6%</td>
</tr>
<tr>
<td>PDRI for Infrastructure Projects</td>
<td>12</td>
<td>24</td>
<td>23</td>
<td>59</td>
<td>33.3%</td>
</tr>
<tr>
<td>Alignment Thermometer</td>
<td>16</td>
<td>37</td>
<td>6</td>
<td>59</td>
<td>30.2%</td>
</tr>
<tr>
<td>Front End Planning Toolkit</td>
<td>24</td>
<td>29</td>
<td>6</td>
<td>59</td>
<td>45.3%</td>
</tr>
<tr>
<td>Shutdown/Turnaround Alignment Review (STAR)</td>
<td>7</td>
<td>43</td>
<td>9</td>
<td>59</td>
<td>14.0%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>59</td>
<td>133</td>
<td>44</td>
<td>236</td>
<td>30.7%</td>
</tr>
</tbody>
</table>

Of the 59 total respondents in 2011, 44 organizations used at least one PDRI tool within the FEP process. Figure 5 shows that 21 respondents or 47.7 percent only used the PDRI Industrial tool, and three or 6.8 percent only used the PDRI Buildings tool within the planning process. There were no respondents that only used the PDRI Infrastructure tool. There were eight respondents or 18.2 percent that used both the PDRI Industrial and Buildings tools. Five respondents or 11.4 percent used both the PDRI Industrial and Infrastructure tools within the FEP process. There were no respondents that used both the PDRI Buildings and Infrastructure tools. Finally, there were seven or 15.9 percent respondents that used all three tools within the FEP process.
Table 6 shows the overall usage results for the PDRI for Industrial Projects and PDRI for Building Projects from 2004. Recall that these two tools were the only tools measure evaluated in 2004. The PDRI for Industrial Project was used by 37 respondents or 61.7 percent when applicable. When applicable, 21 respondents or 44.7 percent used PDRI for Building Projects.

Table 6: Survey FEP Tool Usage (N=70), 2004

<table>
<thead>
<tr>
<th>FEP Tool Type</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Total</th>
<th>% Using when applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDRI for Industrial Projects</td>
<td>37</td>
<td>23</td>
<td>10</td>
<td>70</td>
<td>61.7%</td>
</tr>
<tr>
<td>PDRI for Building Projects</td>
<td>21</td>
<td>26</td>
<td>23</td>
<td>70</td>
<td>44.7%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>58</td>
<td>49</td>
<td>33</td>
<td>140</td>
<td>54.2%</td>
</tr>
</tbody>
</table>

When comparing the PDRI for Industrial Projects tool use between 2004 and 2011, the number of organizations using the tool increased. Also, the usage rate of 2011 was higher than that of 2004. At a high level, it can be said that the usage of the PDRI for Industrial Projects has increased. When comparing the PDRI for Building Projects, there were three less organizations using the tool than
in 2011 but the usage rate is slightly higher. Of the newly measured tools, The FEP Toolkit had the greatest usage rate. It was followed by the PDRI Infrastructure, the Alignment Thermometer and the STAR tools, respectively.

Another way of looking at the overall tool usage is to segregate the data by the owner and contractor breakout. Table 7 describes use of tools for owners and contractors in the 2011 survey. Similar to Table 5, there are two subtotals. The first subtotal corresponds to the PDRI Industrial and Building tools, which were surveyed in 2004. The second subtotal is that for the remaining four tools (PDRI for Infrastructure Projects, Alignment Thermometer, Front End Planning Toolkit and STAR).

Of the 20 contractor respondents for the PDRI Industrial and Building tools, 66.7 percent used the tools when applicable and owners used the tools 64.8 percent of the time when applicable in the planning process. Regarding the PDRI for Infrastructure Projects, Alignment Thermometer, Front End Planning Toolkit and STAR tools, when applicable contractors used the tools 36.6 percent of the time and owners used the tools 26.4 percent when applicable.

**Table 7: FEP Survey Usage by Organization Type (N=46), 2011**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Total</th>
<th>% Using when applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor (N=20)</td>
<td>24</td>
<td>12</td>
<td>18</td>
<td>54</td>
<td>66.7%</td>
</tr>
<tr>
<td>Owner (N=26)</td>
<td>35</td>
<td>19</td>
<td>10</td>
<td>64</td>
<td>64.8%</td>
</tr>
<tr>
<td><strong>Subtotal (PDRI Industrial and Building)</strong></td>
<td><strong>59</strong></td>
<td><strong>31</strong></td>
<td><strong>28</strong></td>
<td><strong>118</strong></td>
<td><strong>65.6%</strong></td>
</tr>
<tr>
<td>Contractor (N=20)</td>
<td>30</td>
<td>52</td>
<td>26</td>
<td>108</td>
<td>36.6%</td>
</tr>
<tr>
<td>Owner (N=26)</td>
<td>29</td>
<td>81</td>
<td>18</td>
<td>128</td>
<td>26.4%</td>
</tr>
<tr>
<td><strong>Subtotal (Other Tools)</strong></td>
<td><strong>59</strong></td>
<td><strong>133</strong></td>
<td><strong>44</strong></td>
<td><strong>236</strong></td>
<td><strong>30.7%</strong></td>
</tr>
</tbody>
</table>
Like the previous table, Table 8 shows the tool usage by contractor and owner in the 2004 survey results. When applicable 58.1 percent of the contractor organizations used a version of the PDRI Industrial and Building tools compared to 69.4 percent of the owner organizations.

**Table 8: FEP Survey Usage by Organization Type (N=43), 2004**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Total</th>
<th>% Using when applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor (N=18)</td>
<td>18</td>
<td>13</td>
<td>3</td>
<td>34</td>
<td>58.1%</td>
</tr>
<tr>
<td>Owner (N=25)</td>
<td>25</td>
<td>11</td>
<td>0</td>
<td>36</td>
<td>69.4%</td>
</tr>
</tbody>
</table>

Compared to 2004 results, contractors in 2011 are using the PDRI Industrial and Building tools more often when applicable and owners are using the tools slightly less than that of 2004. It could be possible that owners have placed more of the front end planning responsibility on the contractors as part of the contract agreement. The contractor and owner usage of the PDRI for Infrastructure Projects, Alignment Thermometer, Front End Planning Toolkit and STAR tools are significantly less than that of the 2011 usage rates of the PDRI Industrial and Building tools.

At a high level, there are some changes; however, it must be noted that the respondent organizations are not the same for both surveys.

**4.2.2. Reasons Why FEP Tools are Not Used**

To address the “No” and “Not Applicable” answers to the tool usages questions, the seventh question in the 2011 survey is an open question asking the organization why it was not using any of the front end planning tools. Figure
Figure 6 depicts the common reasons why organizations were not using the front end planning tools.

Of the 59 organization respondents, 43 organizations had responded to the question. Fourteen of the 43 respondents or 33 percent mentioned that their organizations were not familiar with the tools. Thirteen of the 43 organizations or 30 percent commented on the use of other front end planning tools. Some organizations use outside planning tools such as Independent Project Analysis (IPA) or have their own in house planning tools in use. Three of the 43 or seven percent respondents mentioned that their organizations will soon implement a tool and another three respondents (seven percent) indicated that the tools were difficult to use. Ten of the respondents, 23 percent, listed other reasons for not using the tools.

Figure 6: Reasons Why FEP Tool is Not Used (N= 43), 2011
Below are related comments from 2011 respondents why the tools were not used.

- We are new to CII this year and have not yet used any of the tools.  
  - Owner

- “We have not used the STAR tool because we are not familiar with its application. We are coming up to speed on the application and we will apply the tool as part of our project delivery”  
  - Owner

- “We use a proven methodology for front end planning that fits our business model. While we do not specifically use the named PDRI or FEP tools, our standard process includes the use of standard product schedule templates –from Tender to Contract Close.”  
  - Contractor

The following comments were made about the difficulty of tool usage.

- “We tried using PDRI for industrial projects years ago, but it was very hard to translate internal deliverables and nomenclature. Also many of the categories in the PDRI aren’t applicable for many of our projects as they simply respond to RFQ's from others. I do want to try to re-invigorate PDRI in the near future, however.”  
  - Owner

- “Star Tool is very complex.”  
  - Contractor

- “Well do small projects $1 million - $50 million and the PDRIIs are too complex. When we get time we're going to simplify the PDRI Industrial for our use.”  
  - Contractor

In 2004, Of the 24 organizations that responded to this question, 13 of the organizations or 54 percent were not using the CII PDRI tools mainly because the use of other tools (Figure 7). Respondents either used internal tools or external tools such as the IPA. Seven of the respondents or 29 percent were not familiar with the tools and four organizations or 17 percent have other reasons for not employing the PDRI tools.
To conclude, organizations do not employ some of the FEP tools because of their use of other non-CII front end planning tools. Also, compared to 2004, organizations in 2011 are still unfamiliar with some of the CII FEP tools. Some organizations have even indicated that the tools are complex and it is difficult to successfully implement into their organizations.

4.2.3. PDRI Incorporated into Planning Processes

To further understand how the PDRI tools are are in budgetary process of an organizations planning process, the eighth question of the 2011 front end planning survey focused on the incorporation of the PDRI tools in the planning process. The question specifically asked if the PDRI is part of the budgetary approval process for capital projects. Of the 59 total respondents, 55 answered the question. Of this total, 23 organizations or 41.8 percent answered, “Yes” to the question as shown in Table 9.
Below are selected responses from organizations on the question on the PDRI use in the budgetary process.

- “PDRI has been implemented for several years and is used extensively in the company as a Front End Planning tool, but not as a budgetary stage gate” - Owner

- “Usage is still on an individual project / project manager basis. We have not institutionalized these front end planning tools across [company name]. We are working towards that now (our standard process, procedures and tools).” - Contractor

- “Use it as an evaluator to pass our decision review board before capital approval” - Owner

Table 10 shows the results to PDRI incorporation in 2004. Of the 40 responses, 25 organizations or 62.5 percent had used the PDRI apart of their budgetary approval process. In addition below are comments why some organizations do not incorporate the PDRI as apart of the budget approval process (CII 2006a).

- “PDRI is used sporadically based on individuals experiences as well as client requirements / requests.” - Contractor

- At this time PDRI is a reference tool. It has not necessarily been integrated fully into our practices. We have other tools we use as well. – Contractor

- PDRI is bundled with PDRI assistance as a Value-Add service. Typically it is well received by those who have used it. – Contractor

Table 10: Incorporation of PDRI into Company Policy, 2004

<table>
<thead>
<tr>
<th>Incorporated</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
<th>% Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23</td>
<td>32</td>
<td>55</td>
<td>41.8%</td>
</tr>
</tbody>
</table>

40
A conclusion of the analysis and selected quotes is that the PDRI is not as extensively used to help with the budget decision today as in 2004. However, organizations still find value when using the PDRI tools in the front end planning process.

4.2.4. Usage Frequency and Project Size

To get a more detailed look at the PDRI tools in the FEP process, questions nine through eleven of the 2011 survey asked organizations how often are the PDRI tools used in the detailed scope phase of a construction projects. CII members were also asked to give a size estimate of those projects (Large, Medium or Small). The purpose of the question was to understand when organizations thought the PDRI added value to the planning process. The results from the 2011 survey are located in 11.

Of the 40 respondents for the PDRI Industrial tool, 7 used the tool on all projects, 21 used the tools on some projects and 12 used the tools on few projects. In other words, 70 percent of the respondents used the PDRI Industrial tools on some or all of their projects of various project sizes.

Of respondents that used the PDRI Building tool, 12 of 17 used the tool on some of the projects or over 70 percent and the sizes of the projects were mostly medium and large projects. For the relatively new PDRI Infrastructure tool, 2 used the tool on all projects, 5 used the tool on some projects and 4 used the tool

<table>
<thead>
<tr>
<th>Incorporated</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
<th>% Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25</td>
<td>15</td>
<td>40</td>
<td>62.5%</td>
</tr>
</tbody>
</table>

...
on selected projects. However, the respondents mainly used the tool on large projects.

Table 11: PDRI Usage Frequency and Size, 2011

<table>
<thead>
<tr>
<th>Usage on Projects</th>
<th>Size of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large (&gt;20M)</td>
</tr>
<tr>
<td>All</td>
<td>28</td>
</tr>
<tr>
<td>Some</td>
<td>21</td>
</tr>
<tr>
<td>Few or Select</td>
<td>12</td>
</tr>
<tr>
<td>PDRI for Industrial Projects (N=40)</td>
<td></td>
</tr>
<tr>
<td>PDRI for Building Projects (N=17)</td>
<td></td>
</tr>
<tr>
<td>PDRI for Infrastructure Projects (N=11)</td>
<td></td>
</tr>
</tbody>
</table>

In Table 12, the results for the 2004 PDRI usage frequency and project size are given. Of the respondents that used the PDRI Industrial tool, 9 used the tool on all projects, 20 used the tool on some projects and 8 used the tool selectively. The respondents used the tools more so on medium and large projects. For the PDRI Building tool, there was almost an equal amount of organizations that used the tool on all, some and few projects. These organizations also evenly used the tools on all project size types.

Table 12: PDRI Usage Frequency and Size, 2004

<table>
<thead>
<tr>
<th>Usage on Projects</th>
<th>Size of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large (&gt;20 million)</td>
</tr>
<tr>
<td>All</td>
<td>30</td>
</tr>
<tr>
<td>Some</td>
<td>20</td>
</tr>
<tr>
<td>Few or Select</td>
<td>8</td>
</tr>
<tr>
<td>PDRI for Industrial Projects (N=37)</td>
<td></td>
</tr>
<tr>
<td>PDRI for Building Projects (N=21)</td>
<td></td>
</tr>
</tbody>
</table>

When looking at the data from 2011 and 2004 on the PDRI project use and size, today organizations continue to use the PDRI Industrial tool on some or all projects mainly on large and medium size projects. In regards for the PDRI Building tool, fewer organizations are using the tools selectively. These
organizations find value to the PDRI Building tool and are using the tool more often.

4.2.5. Years Usage

Another way to measure value of the front end planning tools is through a measurement of years of use. Shown in Table 13 are the average years of use from the 2011 survey of organizational use for the PDRI Industrial and Building tools are 5.0 and 4.7 respectfully. The PDRI for Infrastructure projects was released in late 2010 therefore the average years in use was not asked in the survey.

Table 13: PDRI Years in Use, 2011

<table>
<thead>
<tr>
<th></th>
<th># of Years (Avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDRI for Industrial Projects</td>
<td>5.0</td>
</tr>
<tr>
<td>PDRI for Building Projects</td>
<td>4.7</td>
</tr>
<tr>
<td>PDRI for Infrastructure Projects</td>
<td>NA</td>
</tr>
</tbody>
</table>

Figures 8 and 9 show the distribution of year usage for the PDRI Industrial and Building tools. The two figures are shown to describe the range of use among respondents in order to better understand the 2011 average years in Table 14. Figure 8 details the 38 respondents that comprise the 5.0 year average for the PDRI Industrial tool. Of the 38 respondents, 28 (73.7 percent) have used the tool for five or less years. Ten (26.3 percent) of the 38 respondents use the tool for more than five years.
Recall that the average year of use for the PDRI Building tool was 4.7 years. According to Figure 9, of the 16 respondents, 12 (75 percent) of the organization have used the tool for five years of less. Three (18.8 percent) of the respondents have used the tool for either seven or eight years. There is one respondent that used the tool for fifteen years.

According to Table 14, in 2004 the average use of for the PDRI
Industrial and Building tools are 4.3 and 2.7 respectfully.

**Table 14: PDRI Years in Use, 2004**

<table>
<thead>
<tr>
<th></th>
<th># of Years (Avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDRI for Industrial Projects</td>
<td>4.3</td>
</tr>
<tr>
<td>PDRI for Building Projects</td>
<td>2.7</td>
</tr>
</tbody>
</table>

A comparison of 2011 and 2004 result indicates that the average years of use is higher for the PDRI Industrial and Building tools. The Industrial tool is slightly higher by 0.7 years and the Building is much higher by 2.0 years. With a difference of seven years between the surveys, if organizations had continued to find value in the PDRI tools since 2004, one would expect the average years to be higher. To conclude there are two possible reasons for the small increase of average years. The first reason, which has been previously noted, being that different organizations have responded to both surveys. The second being the ebb and flow of the use of the tools within an organization. The author believes this is mostly due to a change in leadership in an organization. The third reason could be because of poor historical record-keeping.

**4.2.6. Effect of Tool Use**

Respondent organizations that used the PDRI tools were also asked if the use of the tools has had a positive effect, negative effect, or no effect on their planning process effectiveness. If organizations have a positive effect, it could give an indication of the value that the FEP tool provides. Of the 44 organizations that used at least one PDRI the tool, 41 organizations responded to this specific
question. Of the 41 respondents, there were 37 organizations or 90.2 percent that found the PDRI tools positive, one organization or 2.4 percent found that the PDRI tools had little or no effect, and there were three organizations or 7.3 percent that found one of the PDRI tools had a positive effect while another PDRI tool had little or no effect.

Specifically regarding the PDRI Industrial tool, of the 40 respondents, 39 found that the tool had a positive effect. For the PDRI Building tool, 15 of the 17 respondents found the tool to have a positive effect. The overwhelming positive trend continued with the PDRI Infrastructure tool. Ten of the 11 found the tool to have a positive effect. Table 15 gives the details for the 2011 responses.

### Table 15: PDRI Effect, 2011

<table>
<thead>
<tr>
<th>Effect</th>
<th>Positive</th>
<th>Negative</th>
<th>Little or None</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDRI for Industrial Projects</td>
<td>39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PDRI for Building Projects</td>
<td>15</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>PDRI for Infrastructure Projects</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

When looking at the 2004 PDRI effects, organizations found the tools to have an overall positive effect. For the PDRI Industrial tool, 34 of the 37 respondents found the tool had a positive effect in the planning stages. Of the 16 respondents, 14 found the PDRI Building tool had a positive effect. The results are shown in Table 16.

### Table 16: PDRI Effect, 2004
In conclusion, in 2011 organizations continued to find that the PDRI tools had an overwhelming positive effect in the front end planning process. Even though there were a few organizations that recognized little or no effect in their planning process, overall the experience is still very positive.

4.2.7. Top PDRI Uses

Question 12 in the 2011 survey asked organizations for their top uses of the PDRI tools. Respondents were give nine choices and of the nine, Table 17 lists the top five. Organizations use the PDRI as a checklist as the top response. Also, many of the organizations use the tool as a “gate” check and in conjunction with other front end planning tools. Organizations tend the use the PDRI with help of a facilitator outside the project team. This is very helpful for keeping planning team objectives. Finally, organizations tend to use the PDRI to measure the performance of their FEP processes.

Table 17: PDRI Top Uses (N=48), 2011

<table>
<thead>
<tr>
<th>Top 5 PDRI Uses</th>
<th>Response Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. As a checklist in early project development</td>
<td>31</td>
</tr>
<tr>
<td>2. As a “gate” check before moving to the next project phase</td>
<td>30</td>
</tr>
<tr>
<td>3. In conjunction with other front end planning measurement methods (i.e., IPA, internal measures, etc.)</td>
<td>29</td>
</tr>
<tr>
<td>4. With the help of a facilitator who is outside the project team</td>
<td>27</td>
</tr>
<tr>
<td>5. As a means of measuring or benchmarking front end planning process performance</td>
<td>25</td>
</tr>
</tbody>
</table>

In 2004, most organizations also used the PDRI tools as a checklist in
the early development stage. Also most of the respondents used the PDRI as a “gate” checklist, in conjunction with other FEP methods and as a means of benchmarking the planning process performance. According to Table 18, 2004 respondents also found the PDRI valuable when it was used as an audit tool.

**Table 18: PDRI Top Uses (N=40), 2004**

<table>
<thead>
<tr>
<th>Top 5 PDRI Uses</th>
<th>Response Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. As a checklist in early project development</td>
<td>35</td>
</tr>
<tr>
<td>2. As a “gate” check before moving to the next project phase</td>
<td>31</td>
</tr>
<tr>
<td>3. In conjunction with other front end planning measurement methods (i.e., IPA, internal measures, etc.)</td>
<td>31</td>
</tr>
<tr>
<td>4. As a means of measuring or benchmarking front end planning process performance</td>
<td>30</td>
</tr>
<tr>
<td>5. As an audit tool</td>
<td>18</td>
</tr>
</tbody>
</table>

A conclusion of the analysis, organizations continue to value the PDRI when it used as a checklist in the early development stages and as a “gate check”. Currently, organizations still continue to find the PDRI tool valuable when it used with other planning methods and it measures the FEP process performance. However, organizations are using the tool more as an audit tool today than in 2004.

**4.2.8. Common Barriers**

In the final question in the 2011 FEP survey, organizations were asked to identify common barriers that prevented effective use of CII FEP tools. Table 19 lists the lack of knowledge of the available CII FEP tools as the most common barrier among organizations. The second most common barrier was the use of other existing planning methods already embedded in the organizations, with 18
responses. Even though this is a barrier to use of CII FEP tools, it is great to see that organizations are still planning no matter what tool is being used. (There is still a planning process within these organizations; however, the success of those processes is unknown.) The lack of resources (time, money, etc.) is the third most common barrier that hinders CII tool usage. The fourth barrier is the lack of trained facilitators. Without the right personnel to help facilitate, organizations will usually have difficulty successfully using the tools. The lack of facilitators can hinder the use of CII tools but that barrier can easily be overcome if organizations commit to training. The last barrier is lack of management commitment. It is extremely difficult for any organization to take on new tasks and goals without the support of top management. Without the “buy-in” of leadership a front end planning process can never win.

Table 19: Top Barriers (N=45), 2011

<table>
<thead>
<tr>
<th>Top Barriers</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge or understanding, not familiar</td>
<td>20</td>
</tr>
<tr>
<td>2. Other existing processes or alternate methods for planning</td>
<td>18</td>
</tr>
<tr>
<td>3. Resources, including time or money</td>
<td>15</td>
</tr>
<tr>
<td>4. Lack of trained facilitators</td>
<td>14</td>
</tr>
<tr>
<td>5. Lack of management commitment</td>
<td>13</td>
</tr>
</tbody>
</table>

4.3. Summary

In conclusion, the purpose of the 2011 front-end planning survey was to gather more data on the use of FEP tools within the CII community. Fifty-nine organizations responded to the survey. Of the 59 organizations, 46 organizations use at least one CII FEP tool. In comparing the results of the 2011 survey to the 2004 survey, the PDRI tools are still the most widely used tools within the CII
community. Many organizations use the PDRI tool on at least some of their projects ranging in size from small to large and indicate that there is an overwhelming positive effect of tool use on their projects.
CHAPTER 5: STRUCTURED IN-DEPTH INTERVIEWS

The purpose for the in-depth interviews was to further investigate the FEP process, FEP tools and look for key implementation issues. As previously described, of 59 organizations that completed the short front end planning survey, 12 organizations volunteered to thoroughly describe their planning processes through an interview. These organizations gave great insight into what a typical owner or contractor organization experiences during the front end planning process. The typical interviewee was a manager or director of a construction, engineering or facilities division within the respective organization. The interviewees had on average twenty-plus years of industry experience and held an extremely influential position within the organization.

The 12 organizations were a mix of owners and contractors from various industry sectors. Some of the group sectors included oil and gas, energy, natural gas, infrastructure and others. The annual revenue and employee count for the group is widely distributed. Compared to the CII population of 116, the sample size of 12 organizations is relatively small (less than 10 percent). However, the author feels that the lessons learned in these interviews can still be utilized in construction organizations across the industry. Table 20 and 21 describes the CII organizations interviewed.

<table>
<thead>
<tr>
<th>Table 20: Interview Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td></td>
</tr>
</tbody>
</table>
Table 21: Year Range of CII Tool Usage (N=12)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Organization Type</th>
<th>Revenue</th>
<th>Project Type</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Contractor</td>
<td>$9.2B</td>
<td>Oil &amp; Gas, Manufacturing, Mining</td>
<td>47,000</td>
</tr>
<tr>
<td>B</td>
<td>Owner</td>
<td>$9.1B</td>
<td>Energy, Natural Gas</td>
<td>4,400</td>
</tr>
<tr>
<td>C</td>
<td>Owner</td>
<td>$5.4B</td>
<td>Nuclear</td>
<td>12,800</td>
</tr>
<tr>
<td>D</td>
<td>Owner</td>
<td>$297B</td>
<td>Oil &amp; Gas</td>
<td>80,000</td>
</tr>
<tr>
<td>E</td>
<td>Contractor</td>
<td>$6.3B</td>
<td>Energy, Infrastructure, Nuclear,</td>
<td>23,500</td>
</tr>
<tr>
<td>F</td>
<td>Contractor</td>
<td>NA</td>
<td>Infrastructure, Energy, Manufacturing</td>
<td>NA</td>
</tr>
<tr>
<td>G</td>
<td>Owner</td>
<td>$189B</td>
<td>Oil &amp; Gas</td>
<td>29,800</td>
</tr>
<tr>
<td>H</td>
<td>Contractor</td>
<td>NA</td>
<td>Oil &amp; Gas</td>
<td>NA</td>
</tr>
<tr>
<td>I</td>
<td>Public Owner</td>
<td>$273M</td>
<td>Infrastructure and Building</td>
<td>NA</td>
</tr>
<tr>
<td>J</td>
<td>Public Owner</td>
<td>$3.4B</td>
<td>Infrastructure and Building</td>
<td>NA</td>
</tr>
<tr>
<td>K</td>
<td>Public Owner</td>
<td>NA</td>
<td>Infrastructure and Building</td>
<td>NA</td>
</tr>
<tr>
<td>L</td>
<td>Contractor</td>
<td>NA</td>
<td>Infrastructure and Building</td>
<td>NA</td>
</tr>
</tbody>
</table>

The document used in the interviews (see Appendix D) was created to help foster conversation as well as seek answers and collect data. Organizations were probed on specific topics and given follow-up questions. Once again, the main interview topics addressed were the FEP process, FEP tools, succession planning and alliances. Organizations were also asked to describe specific examples and any important aspects they thought were crucial to the success of the FEP process. Questions were structured in order to investigate reasons behind the behavior of organizations.

5.1. Interview Answers

The following sections describe each of the main thematic areas investigated in the interviews.

5.1.1. Organization FEP Process
In the first topic of the interview, organizations were asked to generally describe their front end planning processes for a project. Specifically, what are the different stages CII planning practices come into effect (feasibility, concept, design, etc.); who is responsible for tracking the planning process; and what requirements are necessary to successfully advance projects. Organizations were also asked to describe their history with CII, FEP practices and FEP tools. Below are findings the author gathered from the responses:

- Eleven of the 12 organizations interviewed have had a long-standing relationship with the Construction Industry Institute. One owner company recently became a member of the CII community and recently started to use the PDRI tools. This owner organization is so convinced of the benefits of CII practices and tools that it heavily uses the PDRI tool to assess its projects.

- All of the organizations already had a front end planning process in place and all had integrated at least one CII FEP tool within the process. The most popular tool was the PDRI.

- The process in which a CII tool was used mainly depended on the organization type. Public owners tend to implement mid to late design phase. Private owners plan in the conceptualization phase. Contractors usually plan once awarded the work.

- Organizational planning responsibility varied. Six organizations (5 owners and 1 contractor) have a group solely responsible for the planning integration within the entire organization. The remaining
organizations (2 owners and 4 contractors) place the planning responsibility on the individual department groups.

- Most importantly, all of the organizations have a formal planning process for projects. Depending on the size of the project some of the front end planning tools were mandatory and at other times optional.

- Half of the interviewees mentioned that a successful FEP process is hard to implement an effective FEP process without organizational “buy-in”. Commitment from the organization’s leadership to project team members is vital to effective FEP.

- Nine of the 12 organizations mentioned that people’s unwillingness to plan was the most common barrier to an effective planning process within the organization. Interviewees said that people’s tendency to start a project without identifying the risks at the beginning of the project was a great barrier. Even organizations with a gated process and mandatory tool implementation said people’s unwillingness to plan in the beginning of the project is a barrier. However, because of the embedded mandatory policies this problem is reduced.

Below are specific quotes from interviewees regarding their FEP processes.

- “We’re definitely winning work because of our successful front end planning process.” (Organization E).

- “The front end planning process helps us build with the end in mind.” (Organization E).

- “The front end planning process helps us answer the questions, is the process correct; are we using the right tools; and do we have the right people?” (Organization L).
From the answers, it seems that the respondents value of front end planning process and their relationship with the CII community. The organizations also find value in the CII FEP tools because the tools are heavily used in the planning process. Even though the planning process structures vary among the organizations, there are still strong formal processes in place. The organizations interviewed were evenly distributed between an organizational and departmental approach. According to the interviewees, since the organizational approach is centralized, the planning process is more efficient. There is less redundancy since the same process and tools are used for the entire organizations. However, it was mentioned that caution must be taken to limit bureaucracy in the centralized approach. Even though the responsibility of project planning also varies there are checks and balances within the organizations. Within the front end planning process, organizations found the most common barrier was the unwillingness of people to plan. However, even with the barriers, some of the benefits, as stated from the organization quotes, are additional work, clear project vision and accurate use of project resources.

5.1.2. Organization FEP Tools

The second topic in the interview went more in-depth into the CII and non-CII tools organizations used in their processes. The line of questioning was intended to collect information about the specific uses of the tools. Below are highlights of the responses.

• Seven of the organizations have the PDRI tools embedded within the formal FEP processes (5 Owners and 2 Contractors). Many
organizations used the PDRI tools as a checklist prior to and during the project planning phases.

- In the FEP process, all of the organizations had the project manager or engineer involved when using the tools in the planning stages of a project. All organizations recognized that it was essential to have the project manager/engineer involved in planning. After a project was reviewed, the project FEP analysis was passed along to the upper manager for approval.

- Eight of 12 organizations that required the PDRI in its planning process required projects to have certain scores before moving along to the next planning stage. This is also known as a gated process and is mainly employed by owner organizations.

- The lack of CII tools experience was the most mentioned barrier by the interviewees for this specific topic. Organizations that make CII tools optional mainly experienced this barrier because standardized training is not in place.

The following are quotes by interviewees related to this topic.

- “The PDRI is not about the score, it’s about the process of scope definition” (Organization J)

- “The tools are a great way to manage the young talent in our organization” (Organization C)

- “Even though the tool process is informal, it is invaluable.” (Organization F)

For the organizations interviewed, FEP tools are not only used because of the requirements in place. The front end planning tools are used to provide a
proven way to assess projects through detailed scope definition. Also, the tools provide a method to manage or train talent within an organization. If an organization can provide proper training on the tools, the process can be invaluable.

5.1.3. Succession Planning

During the interviews the topic of succession planning revealed the biggest vulnerability for organizations from the author’s perspective. Succession planning is a focus on ensuring continuity of planning over a long period of time, despite turnover of personnel. The answers to the questions give an indication of the organization’s strength in the front end planning process. Some companies recognize that even though they currently have strong practices in place, a small change in personnel could dramatically change the success of their FEP process. Below is an overview of the common responses to succession planning topic in the interview.

- Five interviewees have a vital person in their organization who is the mainly responsible for the success of the FEP process. Interviewees recognize that individual champions can be a liability since all the knowledge resides with one person.

- Two organizations detailed how leadership changes affect the direction of a FEP process. Some times with a change in organizational leadership, new planning initiatives are introduced. These two organizations mentioned that in the past, their organizations had moved away from CII tools within the FEP process and new non-CII planning tools were
used mainly due to a change in leadership.

• Seven organizations have the process deeply embedded within their cultures and therefore if key personnel leave, the FEP strategy would continue. Having the FEP process deeply embedded within an organization did not ensure a problem free implementation process. The deeply embedded process only guaranteed minimal changes if someone were to leave the organization.

• All of the organizations admitted that the front end planning training always needs improvement to ensure the process strength. Without the proper training an organization’s potential successes are sometimes limited.

Two owner organizations made the following statements regarding succession planning:

• “There used to be just one champion but now the process is engrained within the department.” (Organization B)

• “More facilitators are needed in house to ensure the strength of the process. This year our goal is to have more training.” (Organization J)

In order for an organization to continue its effective planning process after the exit of key personal, its FEP process must become culturally embedded. When the success of a FEP process is heavily dependent on a few key individuals, an organization must strengthen its planning process by involving others.

For example, one organization has a planning process group or steering committee to provide extensive support and training on the organization’s
planning process and tools. This steering committee “owns” the process, and because it is made up of senior personnel continuity is maintained and project teams are compelled to follow the process.

5.1.4. Organization Alliances

Front end planning during a project alliance is extremely crucial to a successful project. For this research purpose, the specific partner relationships in an alliance are owner/contractor and contractor/contractor. Organizations mentioned that the strength of the relationship and their partner’s front end planning process many times determine the success of a project. The following are responses to the topic of alliances.

- All organizations stressed the importance of effective communication during FEP within an alliance.
- Six of the 12 organizations (5 contractors and 1 owner) admitted to planning “in the closet” without the knowledge of the project partner.
- One contractor organization (Organization H) always completes its own planning strategy and process no matter the agreement or participation of the client. This organization willingly admitted to completing a PDRI assessment many times without the knowledge of the project partner. This organization wanted to mitigate risks it thought its partners had overlooked.
- One contractor (Organization E) talked about a partner relationship with another CII member that is fully engaged in the front end
planning process. This company mentioned that working with another
CII member makes it easy to communicate because both organizations
understand the importance of proper scope definition and successful
team alignment. This interviewee said that, “being a CII member in a
alliance is a competitive advantage”.

Below is another specific organization quote related to alliances.

- “Trust is absolutely necessary when planning in a alliance.”
  (Organization F)

In regards to alliances in the FEP process, effective communication is
essential. Also, even in an alliance, an organization must still perform its own due
diligence. From the interview responses, organizations must not only perform
front end planning with their partners, they also perform a project assessment on
their own to ensure all project aspects are addressed.

5.1.5. FEP Success Example

In the structured interview process, the author asked the interviewees if
they could provide an example that showed that the respective FEP processes are
effective. During the 12 interviews, all of the interviewees indicated that at one
time or another the FEP process and tools helped its organization select better
projects and assemble successful teams. Below is a specific example from the
interviewee of an owner organization (Organization G) that demonstrates the
value of an effective FEP process and the PDRI tool.

According to the interviewee, Organization G was evaluating a potential
project and had recently completed a project assessment. Within its front end
planning process, which includes the PDRI-Industrial, the organization had found that it could not go ahead with the project because of the extremely high risks.

The interviewee said that another company had taken on the project that Organization G rejected. In the end, according to the manager at this owner organization, “the project was a disaster!” Most importantly, the manager said the following about the FEP process.

- “It’s okay when a project does not advance to the building stage. In fact you know that the process is working when the indicators tell you it’s not the best project for your company.”

To conclude, the organizations interviewed, found value in their respected FEP processes. All interviewees recognized that the FEP process has helped and continues to help their organizations select winning projects. One organization specifically said that the process is very valuable when potential projects are shelved due to high risks.

5.1.6. Beneficial FEP Aspects

To conclude the structured interview, the author asked interviewees if there were any final beneficial aspects they would like to share. Due to time constraints, not every interviewee responded to the question.

Some beneficial aspects shared ranged from the need of increased training to improved communication within the project team. One owner mentioned that the likelihood of project success is increase by having a thorough FEP process. A public owner mentioned that the PDRI holds team members in the project planning phase accountable. A contractor said that a strong process makes the team think about the project “step by step”. An owner in the oil and gas
industry mentioned that the FEP process is about getting the right team in place within the appropriate time.

Below are specific responses to the question.

- “The PDRI has been great for the organization.” (Organization K)
- “The FEP process makes sure that the project team succeeds.” (Organization G)

A conclusion of the analysis and selected quotes is that the benefits of a strong front end planning process are many. A strong FEP process helps to build aligned teams by better training, holds team members accountable and increases the likelihood of success.

5.2. Summary

In the end, the author interviewed 12 CII member organizations. The participating organizations shared their experiences on the front end planning process, the tools in the process; succession planning and planning within alliances. Using the pattern-matching technique, the author identified that a number of important aspects when implementing a FEP process. In the end, CII organizations find value in the FEP tools within their formalized planning processes.
CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusions

Over the last twenty years, CII research has shown the value of an effective front end planning process in the construction industry. The past research has not only provided guidance on the FEP process but has also produced tools that help better define project scope and build stronger teams. The problem statement at the beginning of this research is the lack of data of the use on CII front end planning tools and the implementation of the planning process.

The objectives of this research investigation were to summarize research on the CII front end planning process, gather more data on the usage of front end planning tools and conduct in-depth interviews regarding planning implementation strategies. The purpose of the objectives is to show that CII organizations continue to find value in the FEP tools by the increase usage of tools when comparing usage data of 2011 and 2004.

In the spring of 2011, the author sent a survey to the 116 CII members. Fifty-nine organizations responded (over 50 percent) to the 2011 front end planning survey. The 59 organizations included 32 owners and 27 contractors. Of the 59 organization respondents, 46 organizations used at least one CII planning tool or 78 percent of the respondent population. Compared to the 2004 results, there were 11 less respondents but one more organization that used at least one tool (the usage percentage had increase form 61 percent to 78 percent). From the data analysis, the organizations that use tools, reported that the effect of the tools were overall very positive. Organizations mainly used the tools on
selected projects. There were a few organizations that used the tools on all projects. The average usage years of the PDRI for Industrial tool was 5.0 years and 4.7 years for the PRDI for Building tool. Compared to the 2004 survey, the years of usage for the PRDI for Industrial tool was 0.7 years higher and 2.0 years higher for the PRDI for Building tool.

Based on the 2011 data gathered, the usage of front end planning tools is slightly higher than that in 2004. Although there are sample limitations, the author believes that there are probably many more organizations in the CII community that are effectively using front end planning tools within their processes. The percentage of use was found to be greater in 2011 compared to 2004. This usage increased supports the hypothesis that through increased tool usage, organizations continue to find value in the FEP tools.

The author also interviewed 12 CII organizations. The in-depth interviews were used to further research the questions posed in the short front end planning survey. The topics covered in the interviews were the organizations planning process, tool usage, succession planning and alliances. All of the organizations interviewed had structured planning processes in place. Of the 12 organizations, all mentioned using the PDRI tool. Organizations either used the tools as is or had customized the FEP tool to fit the organizational needs. Regarding the topic of succession planning, most of the organizations mentioned that more training on the planning process tools is always needed. About half of the organization admitted that having a single “FEP Champion” was a risky strategy in terms of continuity.
This was particularly expressed in interviews with organizations that did not mandate the use of FEP tools in the planning process. Of the organizations interviewed all mentioned that effective communication is essential within the alliance process. The organizations also mentioned benefits of an effective front end planning process such as talent development, successful project teams and an increase probability of project success.

6.2. Recommendations

The research presented in this document supports the benefits of the front end planning process in the construction industry. The front end planning research over the last 20 years along with the findings of this current research effort are documented in this report. The purpose of the research was to gather information on the use of CII tools and the challenges faced during the process. This document presents research that can help construction organizations better implement their planning processes.

The author recommends more frequent data collection efforts on the use of front end planning tools. The seven-year span between the 2004 and 2011 was long. Future data analysis should separately examine organizations that completed previous surveys compared to those that have not. The author also recommends that CII create an informal learning and training opportunity for organizations not familiar with the tools to seek help from others. An informal community, perhaps the current FEP Community of Practice (COP), could be strengthen so that organizations could share experiences and advice on ways to integrate the front end planning tools.
REFERENCES


APPENDIX A

RESEARCH TEAM 268 MEMBERS
Phase I:  
Development of PDRI for Infrastructure  
(2008-2010)

Mahir Aydin  
Ontario Power Generation

Evan Bingham  
Arizona State University

Eskil E. Carlsson  
CSA Group

Paul Mickey Collins  
Pathfinder

Don Cooley  
CH2M HILL

Brian Foy  
Burns & McDonnell

Dennis W. Gardner  
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David R. Halicks  
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Tim Hoopengarner  
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Chad Kendrick  
Southern Company

Steve Laskowski  
Fluor Corporation

Robert Mitrocsak  
Architect of the Capitol

Jim Palmer  
Hill International

Richard Payne  
Jacobs

Scott Penrod  
Walbridge

Tim Podesta  
BP America, Inc.

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WorleyParsons
Phase II
Implementation Survey and Integration of Tools
(2011-2012)

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Don Cooley  CH2M HILL
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John R. Fish  Ford, Bacon & Davis, Inc. / S&B Engineers & Constructors, LLC
Brian Foy  Burns & McDonnell
G. Edward Gibson, Jr.  Arizona State University
David R. Halicks  Tennessee Valley Authority
Steve Laskowski  Fluor Corporation
Sandra MacGillivray  Coreworx Inc.
Robert Mitrocsak  Architect of the Capitol
Scott Penrod  Walbridge
Tim Podesta, Co-Chair  BP America, Inc.
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James B. Vicknair  WorleyParsons
Brian H. Werle  Jacobs
James Yuengert  Smithsonian Institution
APPENDIX B

CONSTRUCTION INDUSTRY INSTITUTE (CII) ORGANIZATIONS
2011 FEP Survey Sample Population

CII Owner Organizations (56)

Abbott*
Air Products and Chemicals, Inc.*
Ameren Corporation
American Transmission Company
LLC
Anheuser-Busch InBev*
Aramco Services Company*
Archer Daniels Midland Company
Architect of the Capitol
Barrick Gold Corporation
BP America, Inc.*
Bristol-Myers Squibb Company
Cameco Corporation
Cargill, Inc.*
Chevron*
CITGO Petroleum Corporation
ConocoPhillips*
DTE Energy
DuPont*
Eastman Chemical Company*
Ecopetrol S.A.
Eli Lilly and Company*
Eskom Holdings Limited
ExxonMobil Corporation
General Electric Company
GlaxoSmithKline
Hovensa, LLC
International Paper*
The Dow Chemical Company*
Irving Oil Limited
Kaiser Permanente
Kinross Gold Corporation
Koch Industries, Inc.
LyondellBasell
Marathon Oil Corporation
National Aeronautics & Space Administration
NOVA Chemicals Corporation
Occidental Petroleum Corporation
Ontario Power Generation*
Petroleo Brasileiro S/A – Petrobras*
Praxair, Inc.
SABIC - Saudi Basic Industries Corporation
Sasol Technology
Shell Global Solutions US Inc.*
Smithsonian Institution*
Southern Company
Statoil ASA
Teck Resources Limited
Tennessee Valley Authority*
The Procter & Gamble Company*
TransCanada Corporation
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/EL
U.S. Department of Energy*
U.S. Department of Health & Human Services*
U.S. Department of State*
U.S. General Services Administration

*Participated in 2004 Survey
CII Contractor Organizations (60)

Alstom Power Inc.*
AMEC, Inc.
Apex Engineering, Inc.
AZCO INC.
Baker Concrete Construction Inc.
Bateman Engineering N.V.
Bechtel Group, Inc.
Bentley Systems Inc.
BIS Frucon Industrial Services Inc.
Black & Veatch
Burns & McDonnell*
CB&I*
CCC Group, Inc.*
CDI Engineering Solutions*
CH2M HILL*
Coreworx Inc.
CSA Group*
Day & Zimmermann*
Dresser-Rand Company*
Emerson Process Management
eProject Management, LLC
Faithful+Gould
Flad & Associates
Flint Energy Services Ltd.
Fluor Corporation*
Foster Wheeler USA Corporation
Grinaker-LTA/E+PC
Gross Mechanical Contractors, Inc.
GS Engineering & Construction Corporation
Hargrove Engineers + Constructors
Hilti Corporation
Industrial Contractors, Inc.
Innovative Design Engineering Associates, Inc.
Jacobs
JMJ Associates LLP
JV Driver Projects Inc.
KBR
Kvaerner North American*
Construction, Inc.
Lauren Engineers & Constructors, Inc.
M. A. Mortenson Company

McDermott International, Inc.
Midwest Steel, Inc.
Mustang*
Oracle USA, Inc.
Parsons
Pathfinder LLC
Quality Execution, Inc.
S&B Engineers and Constructors, Ltd.*
Siemens Energy, Inc.
SNC-Lavalin Inc.
SOG - Óleo e Gás S/A - SETAL
Technip
The Shaw Group Inc.
URS Corporation
Victaulic Company
Walbridge*
Wanzek Construction, Inc.
WorleyParsons*
Zachry Holdings, Inc.*
Zurich

* Participated in 2004 Survey
APPENDIX C

FRONT END PLANNING SURVEY
**Front End Planning Survey, 2 10 12**

*We are collecting data in this short survey to include in a presentation at the CII Annual Conference in summer 2012; Our intent is to understand the extent of usage and implementation of Front End Planning tools, including the Project Definition Rating Index (PDRI) within the CII membership. Please take a few moments to answer the following questions and then e-mail or fax it back to Dr. Gibson. We will maintain strict confidentiality of your answers. Thank you for taking the time to fill this out.*

Company: __________________________ Name: ______________________

Title: __________________________ Phone: ______________________

Email: __________________________

**Does your company use:** *(mark all that apply)*  See details on attached page

1) PDRI for Industrial Projects  
   ___ Yes  ___ No  ___ Not Applicable

2) PDRI for Building Projects  
   ___ Yes  ___ No  ___ Not Applicable

3) PDRI for Infrastructure Projects  
   ___ Yes  ___ No  ___ Not Applicable

4) Alignment Thermometer  
   ___ Yes  ___ No  ___ Not Applicable

5) Front End Planning Toolkit  
   ___ Yes  ___ No  ___ Not Applicable

6) Shutdown/Turnaround Alignment Review (STAR)  
   ___ Yes  ___ No  ___ Not Applicable

*If you checked No or Not Applicable to questions 1) through 6), please answer only the following question and thank you for your time, otherwise, complete the applicable sections below.*

7) Comments about why you are NOT using any of these front end planning tools (e.g., haven’t heard about it, use another tool, doesn’t fit with our business model, etc.)

________________________________________________________________________

8) Has the PDRI been incorporated as part of your organizational (corporate) planning process for budgetary approvals of capital facilities?  
   _____ Yes  _____ No

Comments about its usage:

________________________________________________________________________

Please turn over ==>  

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9) PDRI for Industrial Projects (CII Implementation Resource 113-2)—if applicable

a. Usage on Projects:   ___ All   ___ Some   ___ Few or Select

b. Typical Size of Projects that PDRI is used on (pick all that apply):

   ___ (> $20 million) ___ ($5-20 million) ___ ($1-5 million) ___ (<$1 million)

c. Approximately how many years has your company been using the PDRI for Industrial Projects? _____

d. Effect of PDRI usage on front end planning effectiveness at your organizations?

   ___ Positive   ___ Negative   ___ None or Little

10) PDRI for Building Projects (CII Implementation Resource 155-2)—if applicable.

a. Usage on Projects:   ___ All   ___ Some   ___ Few or Select

b. Typical Size of Projects that PDRI is used on (pick all that apply):

   ___ (> $20 million) ___ ($5-20 million) ___ ($1-5 million) ___ (<$1 million)

c. Approximately how many years has your company been using the PDRI for Building Projects? _____ years

d. Effect of PDRI usage on front end planning effectiveness in your organization?

   ___ Positive   ___ Negative   ___ None or Little

11) PDRI for Infrastructure Projects (CII Implementation Resource 268-2)—if applicable.

a. Usage on Projects:   ___ All   ___ Some   ___ Few or Select

b. Typical Size of Projects that PDRI is used on (pick all that apply):

   ___ (> $20 million) ___ ($5-20 million) ___ ($1-5 million) ___ (<$1 million)

c. Effect of PDRI usage on front end planning effectiveness in your organization?

   ___ Positive   ___ Negative   ___ None or Little

Please turn over =>>
12) **Please check all that apply**—the PDRI is used:

- More than once on most projects
- As a checklist in early project development
- With the help of a facilitator who is outside the project team
- In a modified form for small or unusual projects
- In conjunction with other front end planning measurement methods (i.e., IPA, internal measures, etc.)
- As a means of measuring or benchmarking front end planning process performance
- As an audit tool
- As a “gate” check before moving to the next project phase
- To help capture lessons-learned

13) **Please check all that apply**—Barriers that prevent you from using CII front end planning tools:

- Resources, including time or money
- Knowledge or understanding, not familiar
- Lack of trained facilitators
- Other existing processes or alternate methods for planning
- Lack of management commitment
- Not convinced these tools are of value
- Bad experience in the past
- Not required by corporate policy or clients
- Tools are not applicable to our business model
- Tools are too cumbersome
- Other:

Additional Comments: (success stories, why you don’t like these tools, willing to share case studies, areas needed for improvement, additional tools needed, shared quotes and so forth)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
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____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Again, Thank you very much!

Please return to Edd Gibson at edd.gibson@asu.edu or Roberta Bosfield at rbosfiel@asu.edu
Or fax it to Edd Gibson at 480-965-1769.

If you need more information about any of these tools, please contact us.
APPENDIX D

IN DEPTH INTERVIEW INSTRUMENT
FEP Survey Interview/Case Study Questionnaire, RT268 9 2011

In-depth follow-up questions to the FEP survey given in March 2011. The questions are for companies who expressed interest in sharing success stories with Research Team 268.

Organization/Name: ____________________       Phone #: ____________________

Position Title: ____________________

Date & Time: ____________________

Interview Script:
1) Introduction (7.5 Minutes)
   a. Who we are and what we are doing
      i. Thanks for meeting with us today. Before we get started we want to give some more insight as to who we are in the CII community. Our team, RT268, is continuing Front End Planning (FEP) research within the CII community. There are 19 members on the team and Dr. Edd Gibson is the academic chair. Dr. Gibson has been on the front line of FEP research and is widely known for creating the PDRI trilogy.

   b. Let the CII member know that the interview is a follow-up to the FEP survey completed earlier this year.
      i. This past summer your organization completed the brief survey regarding your organization’s FEP process. Our research team is following up with a telephone interview regarding your organization’s responses. We will like to collect more detailed information on the specific tools used, strategies employed and common barriers faced in the FEP process. Also after the telephone interviews our research team will take a deeper look at 3-5 organizations for case studies. This would entail perhaps a site visit or a series of additional interviews with others.

   c. Interview Structure
      i. The interview we will cover the topics you received prior to this call. Our hope is to stay true to the list in order to complete the interview within the one-hour time frame.

   d. Interview is confidential
      i. Most importantly before we start the interview we want to read to you the confidentiality clause:
         1. Thank you for agreeing to participate with RT268 in this in depth interview regarding FEP within your organization. Your input will be a valuable piece of the process to complete our CII research goals. We promise that individual and organization names will not be included in the final research publication. Also, anything said in the interview will not be disclosed. Finally upon completion of research, we will share the results in our final publication.
         2. In order to continue with the interview, please indicated that you understand the clause and give permission to continue.

Company Name

Permission to Continue:    ☐ YES    ☐ NO

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2) **Topic: Organization FEP Process**

Now onto the first interview topic. The following questions will help us get an understanding of your organization’s history with CII FEP tools and your organization’s overall process.

a. Please describe your organization’s front end planning history with CII tools.
   i. When did you start?

b. Was there a front-end planning process in place when you arrived at your organization?
   i. Did you restart the process?

c. Can you walk through your organization’s front-end planning process?

d. How many people are involved in maintaining the planning process?

e. What levels are involved in your organization’s planning process? (executives, senior managers, etc.)

f. At what project stage(s) does your organization implement its plan?
   i. Different for owners and contractors

g. Will you be willing to share your FEP process? If not can you describe your process? *** (what are we expecting?)
   i. Is there gated planning process
   ii. Who is involved in tracking the gated phases?
   iii. What are the requirements to advancing in the process? (management review, signoff, etc.)

h. What specific barriers to using CII tools do you see in your organization?
   i. Can you give examples of the benefits of using CII tools with your organization?

3) **Topic: FEP Tools**

The next section of the interview will cover specific CII and non-CII tools your organization uses. We will also ask about the benefits to using the tools.

a. Please describe what CII tools your organization currently uses.

b. Does your organization use FEP tools besides CII FEP tools?
   i. What are they?

c. What other tools is most beneficial to your organization?

d. Please describe how the tools are used in your organization? (mandatory checklist, audit tool, etc.)

e. How have the tools added value to your organization? How do you measure this value? (Higher profits, more defined project scope, less change orders etc.)
   i. Do you have data for the tool use?
   ii. Do you have a matrix to track the value added?
   iii. How do you measure the effectiveness of the FEP tools?
   iv. How have you been able to maintain FEP tools in your organization structure?
   v. Do you see any threats that might eliminate tools within your organization?

f. How do others in your organization feel about the FEP tools?

4) **Topic: Succession Planning**

Continuing the topic of the last two questions, we would like to ask about the succession planning for your organization’s FEP process.

a. Is there one main front-end planning “champion” in your organization?
   i. Is there a leadership committee?

b. What would happen if this person/committee leaves your organization?
c. Does your organization have a succession strategy for front end planning to continue if this person leaves?

5) Topic: FEP Project Examples
   a. Can you give a specific project example of how front-end planning has helped your organization?
   b. How well do you think your organization would fare if it did not have a strong front-end planning strategy?

6) Alliances/Partnerships
   Sometimes it is difficult to adhere to your organization’s FEP process within a partnership. The next few questions address this predicament.
   a. Do you use FEP tools in a joint venture?
   b. How do you use the tools with organizations that do not have a FEP process? (Do you use it in the closet)

7) Most Important FEP Aspects
   The following question is the last of the interview.
   a. Looking at the FEP process, in your opinion what is the most important aspect to you and your organization?

8) Close Out/Thank You (7.5 Minutes)
   Thanks for participating the interview. We know it’s sometimes difficult to make time for activities such as these. We truly appreciated your organization’s participation not only in this interview but also in the brief survey earlier this year. Before we hang up, if needed, would your organization be willing to talk more in depth?
APPENDIX E

FRONT END PLANNING SURVEY ORGANIZATIONS
**Organizations That Completed 2011 FEP Survey**

**CII Owner Organizations (32)**

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Organization Name</th>
</tr>
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<tbody>
<tr>
<td>Air Products and Chemicals, Inc.</td>
<td>Petroleo Brasileiro S/A – Petrobras</td>
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<tr>
<td>Ameren Corporation</td>
<td>SABIC – Saudi Basic Industries</td>
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<tr>
<td>Anheuser-Busch InBev</td>
<td>Corporation</td>
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<tr>
<td>Aramco Services Company</td>
<td>Sasol Technology</td>
</tr>
<tr>
<td>Architect of the Capitol</td>
<td>Shell Global Solutions US Inc.</td>
</tr>
<tr>
<td>BP America, Inc.</td>
<td>Smithsonian Institution</td>
</tr>
<tr>
<td>Cargill, Inc.</td>
<td>Southern Company</td>
</tr>
<tr>
<td>Chevron</td>
<td>Statoil ASA</td>
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<tr>
<td>ConocoPhillips</td>
<td>Tennessee Valley Authority</td>
</tr>
<tr>
<td>DuPont</td>
<td>The Dow Chemical Company</td>
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<tr>
<td>Eastman Chemical Company</td>
<td>The Procter &amp; Gamble Company</td>
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<tr>
<td>Eli Lilly and Company</td>
<td>TransCanada Corporation</td>
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<tr>
<td>International Paper</td>
<td>U.S. Department of Energy</td>
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<tr>
<td>Irving Oil Limited</td>
<td>U.S. Department of Health &amp; Human Services</td>
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<tr>
<td>Kaiser Permanente</td>
<td>Services</td>
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<tr>
<td>LyondellBasell</td>
<td>U.S. Department of State</td>
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<td>Ontario Power Generation</td>
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### CII Contractor Organizations (27)

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<thead>
<tr>
<th>Contractor Organization</th>
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<tr>
<td>Alstom Power Inc.</td>
<td>Quality Execution, Inc.</td>
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<td>Bateman Engineering N.V.</td>
<td>S&amp;B Engineers and Constructors, Ltd.</td>
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<tr>
<td>Burns &amp; McDonnell</td>
<td>Siemens Energy, Inc.</td>
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<td>CB&amp;I</td>
<td>SNC-Lavalin Inc.</td>
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<td>CCC Group, Inc.</td>
<td>URS Corporation</td>
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<td>CDI Engineering Solutions</td>
<td>Walbridge</td>
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<tr>
<td>CH2M Hill</td>
<td>WorleyParsons</td>
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<td>Coreworx Inc.</td>
<td>Zachry Holdings, Inc.</td>
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<td>CSA Group</td>
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<td>Day &amp; Zimmermann</td>
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<td>Dresser-Rand Company</td>
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<td>Fluor Corporation</td>
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<td>Foster Wheeler USA Corporation</td>
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<td>Pathfinder LLC</td>
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