

5-2007

Information Flow to Support Front End Planning

Ryan George

Clemson University, rgeorge@clemson.edu

Follow this and additional works at: https://tigerprints.clemson.edu/all_dissertations



Part of the [Civil Engineering Commons](#)

Recommended Citation

George, Ryan, "Information Flow to Support Front End Planning" (2007). *All Dissertations*. 67.

https://tigerprints.clemson.edu/all_dissertations/67

This Dissertation is brought to you for free and open access by the Dissertations at TigerPrints. It has been accepted for inclusion in All Dissertations by an authorized administrator of TigerPrints. For more information, please contact kokeefe@clemson.edu.

INFORMATION FLOW TO SUPPORT FRONT END PLANNING

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctorate of Philosophy
Civil Engineering

by
Ryan Thomas George
May 2007

Accepted by:
Dr. William Edward Back, Committee Chair
Dr. Lansford Bell
Dr. Jim Burati
Dr. William Bridges

ABSTRACT

Previous research has demonstrated the value of front end planning as it impacts project performance. This dissertation summarizes the findings of a research project which examined ways to improve information flow through the front end planning process. The front end planning process was carefully diagrammed as consisting of 33 distinct information flow activities, each with its own information flow entities and interactions. Fifty-one questionnaire survey forms were analyzed to obtain data for the 33 information flow activities that included activity duration, resources expended, and other supplemental insights such as the extent of information availability. The 51 projects were then grouped into successful and less successful categories based on several criteria to determine if the two groups had any significant differences in how they executed front end planning.

An analysis of the data concluded that successful projects often spent more time and utilized more resources on the front end planning process. An additional product of the research provided the information requirements for each activity. Information flow tables were also created for each activity. This dissertation provides general recommendations and insights for stimulating proactive actions during the front end planning process, each designed to improve the flow of information and increase the likelihood of project success.

DEDICATION

I would like to dedicate this work to my parents, Jamie and Alan George. Their continued love, support, and advice helped me more than words can describe. To my sister Jessica George, she was always there to listen and offer encouragement when I needed it. To my grandmother Dorothy Wilson, who would visit me often and give me much needed breaks. Lastly, to my friends Lance Netwon, Craig Buckthal, Rick Hoover, and Harold Price, they were always there to lift me up whenever I felt low. Thank you all, for this would not have been possible without you.

ACKNOWLEDGMENTS

I would like to thank Dr. Back, Dr. Bell, Dr. Bridges, and Dr. Burati for their assistance and guidance. For, without their mentoring, this research report would not have been possible. I would also like to thank the Construction Industry Institute and the members of Research Team 221 for all their help and support throughout this process.

TABLE OF CONTENTS

	Page
TITLE PAGE	i
ABSTRACT	iii
DEDICATION	v
ACKNOWLEDGEMENTS	vii
LIST OF TABLES	xiii
LIST OF FIGURES	xv
CHAPTER	
I. INTRODUCTION	1
Research Scope and Objectives	4
Research Team Members.....	5
II. METHODOLOGY	7
Literature Review – Phase I.....	8
Logic Diagram Development – Phase II.....	8
Survey Creation/Distribution – Phase III.....	11
Data Collection/Analysis – Phase IV.....	15
Statistical Findings – Phase V	21
Information Flow – Phase VI.....	23
Follow Up Surveys – Phase VII.....	24
Conclusions and Recommendations – Phase VIII.....	26
III. LITERATURE REVIEW	27
Front End Planning	27
Information	41
Impacts on the Construction Industry.....	48
Conclusion	49
IV. DATA ANALYSIS	51

Table of Contents (Continued)

	Page
Data Manipulation	51
Data Normalization.....	52
SAS (Statistical Analysis Software)	55
Box and Whisker Plots for Outliers.....	55
Data Analysis.....	57
Limitations of Data	65
 V. FINDINGS.....	 69
Introduction.....	69
Duration/Resource Analysis	70
Execution Difference Analysis	79
Duration/Resource and Execution Difference Analysis	
Findings Conclusion	96
Critical Activities in Front End Planning.....	99
Follow Up Survey I.....	107
Follow Up Survey II	111
 VI. LOGIC DIAGRAMS.....	 115
Introduction.....	115
Information Flow Activities Diagram.....	116
Micro Level Diagrams	125
Information Flow Tables.....	126
Information Flow Diagrams.....	130
Most Utilized Information Requirements	133
Conclusion	137
 VII. CONCLUSIONS & RECOMMENDATIONS	 139
Introduction.....	139
Research Objective One Conclusions.....	139
Research Objective Two Conclusions	145
Research Objective Three Conclusions	147
Benefits to the Construction Industry	150
Future Research	155
 APPENDICES	 157
A: Information Activities Diagram.....	159

Table of Contents (Continued)

	Page
B: Micro Level Diagrams	163
C: Survey Instrument	199
D: Information Flow Tables.....	219
E: Information Flow Diagrams	279
F: Normalized Data Values.....	281
G: Execution Differences Analysis Findings.....	333
H: Follow Up Survey I Comments	349
I: Follow Up Survey II.....	353
REFERENCES	379

LIST OF TABLES

Table	Page
1.1: Research Team Members.....	5
4.1: Normalized Data for Survey One	54
4.2: Illustration of Fisher’s Exact Test.....	63
5.1: Business Drivers as a Success Criterion	72
5.2: Project Objectives as a Success Criterion	74
5.3: Front End Planning as a Success Criterion	76
5.4: Information Availability as a Success Criterion	78
5.5: Abridged Fisher’s Exact Test Findings for Business Drivers and Four Questions.....	83
5.6: Frequency of Statistical Associations for Execution Difference Analysis.....	95
5.7: Complete Findings from Data Analysis when Front End Planning is the Success Criterion.....	97
6.1: Information Flow Activity List	118
6.2: Information Flow Activities and Description	121
6.3: Abridged Information Flow Table BP.8 – Raw Material Sourcing.....	128
6.4: Most Utilized Information Requirements.....	134
7.1: 33 Information Flow Activities for Front End Planning.....	141
7.2: Front End Planning Time & Resource for Successful Projects Projects (Perceived Effort).....	144

LIST OF FIGURES

Figure	Page
2.1: Research Methodology	7
2.2: Macro to Micro Logic Diagram (Moreau 1997)	10
2.3: Distribution of Projects by Total Installed Cost (TIC)	16
2.4: Project Sector Breakdown	17
2.5: Distribution of Construction Types	17
2.6: Distribution of Project Locations.....	18
3.1: Influence & Expenditure Curve for Project Life Cycle (Gibson et al, 1995)	30
3.2: IDEF Diagram of Front End Planning (CII, 1995).....	32
3.3: Pre-Project Planning Process (Gibson et al, 1995)	33
3.4: EPC Macro Model Logic Diagram (CII,1998).....	38
4.1: Box and Whisker Plot for BP.01 – Define Business Objectives	56
4.2: Data Analysis Questions.....	58
4.3: Abridged Two-Way Frequency Table	64
5.1: Frequency of Question One with Success Criterion.....	86
5.2: Frequency of Question Two with Success Criterion	88
5.3: Frequency of Question Three with Success Criterion	90
5.4: Frequency of Question Four with Success Criterion.....	91
6.1: Information Flow Diagram Example.....	131
6.2: Sample Information Flow Diagram	132

List of Figures (Continued)

	Page
7.1: Research Objective Two Findings.....	146

CHAPTER I

INTRODUCTION

The construction process is executed in a highly dynamic environment. While many factors contribute to a variable project delivery process, no one aspect is more difficult or challenging than the need to effectively manage information flow. Information exchange is critical during every phase of the construction process. Unfortunately, no methodology exists that effectively defines the information flow during front end planning. Major causes for this lack of knowledge result from the difficulty to accurately identify the information requirements in the front end planning process.

Existing literature has clearly established that an effective front end planning process contributes to enhanced project performance in all construction sectors. However, the planning process is highly dependent on the utilization of information that is generated and/or managed both internally and externally to the organization. Whether the information exists as data or formatted into a document, effective front end planning requires that specific information requirements be identified and fully satisfied in a timely fashion. The unavailability or inadequacy of necessary information within the front end planning process will likely diminish the likelihood of enhanced project performance.

Contributing to the difficulty of managing information flow within construction process is the fact that most project teams are diverse, consisting of individuals who have differing backgrounds, experiences, biases, perceptions, talents, and capabilities. These differences can lead to difficulties in the accurate exchange of information from one party to another. Each time information is exchanged, accessed, used, or modified, resources are consumed and time is expended. The quality of information and the manner in which information flows, with respect to its comprehensiveness, correctness, and completeness, can either enhance or hinder the successful execution of work. Therefore, it is important to identify when and what information is required within the planning process and how the generation or exchange of information can be improved within each individual phase of project delivery. It seems evident that a critical need exists to investigate information flow within the front end planning process.

Front end planning may also be referred to as Pre-Project Planning, Conceptual Planning, or Feasibility Analysis. There are numerous definitions for front end planning, but as defined for this research, and stated by the Construction Industry Institute (CII), front end planning is, “The process of developing sufficient strategic information with which owners can address risk and decide to commit resources to maximize the chance for a successful project” (CII, 1997). The specific activities included in this process are further explained in Chapter III. In summary it can be said that the front end planning process utilizes input from the project planning team to organize for the overall planning effort, provides selections from among project alternatives, provides for the development of a

project definition package, and provides a basis for the decision whether to proceed with a project's execution. Additionally, Cleland and Ireland (2002) state that front end planning "... includes all activities to develop a strategy for the commitment of resources to support the project objectives and goals." As identified above, front end planning is a critical stage in the project where the owner/project team has the greatest influence on the project.

Front end planning is primarily an owner driven process that begins with the business objectives of an organization, and is completed with the development of a project execution plan (PEP). The PEP is the "roadmap" the project team will follow throughout the remaining project phases to ensure the project meets the defined objectives. There are extensive amounts of information generated during the front end planning process. Information necessary for the efficient execution of front end planning needs to be timely, correct, comprehensive, and managed such that it can be accessed, shared, or modified as appropriate for the project.

Within the construction engineering industry, the front end planning process has been traditionally defined as having four primary phases (Gibson et al, 1995). These include:

- Organize for [Front End Planning]
- Select Project Alternatives
- Develop a Project Definition Package
- Make a Decision [to execute the project]

Practitioners would readily agree that information is continually exchanged between each of the front end planning phases. This information must be proactively managed from one process step to another, as the absence of correct or reliable information may result in the creation of assumptions or conclusions that ultimately prove invalid. Thus, the potential for enhanced project performance is diminished or significantly hindered. It can be inferred that if information flow is pre-determined prior to front end planning, then the planning process may be enhanced, potentially resulting in improved overall project performance.

Research Scope and Objectives

The front end planning process is both information intensive and information dependent. As a result, this dissertation identifies information flow to support the front end planning process. The objectives of this research is to:

1. Identify the information flow activities in front end planning and their interrelationships (logic), and determine if there are duration, resource, and additional execution differences between successful and less successful projects.
2. Identify the information requirements for the front end planning activities.
3. Suggest recommendations for improving information flow to support front end planning.

The methodology in which the research objectives were satisfied is discussed in more detail in Chapter II.

Research Team Members

This dissertation was assisted by a team of construction engineering practitioners representing member companies of the Construction Industry Institute (CII). These members were crucial to the successful completion of the research. The team also included three academic members from Clemson University. The entire research team consisted of twelve construction industry practitioners representing both contractor and owner organizations. The team is identified in Table 1.1.

Table 1.1 Research Team Members

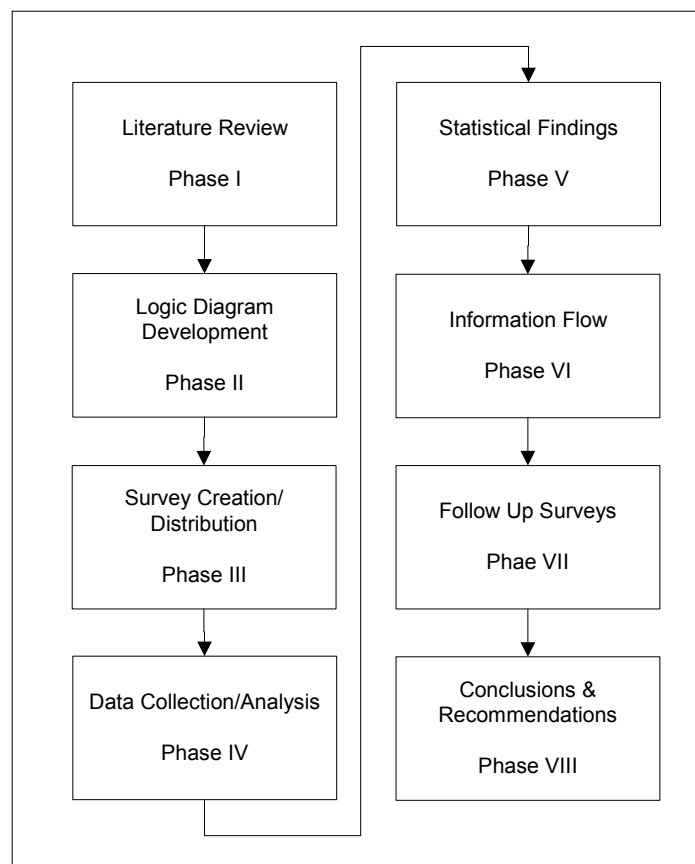
Name	Company	Organizational
Steve Harker	Akerkvaerner	Contractor
Andreas Kwetkus	Alstom	Contractor
Eric Ahlstrom	Amgen	Owner
Ron Bryant	Cargill	Owner
Nick Greims	CH2M Hill	Contractor
Edward Back	Clemson University	Academic
Lance Bell	Clemson University	Academic
Ryan George	Clemson University	Academic
Steve Todd	Fru-Con Construction	Contractor
Alex Moiseef	General Motors	Owner
Connie Barnes	International Paper	Owner
Norm Meadows	Shaw Group	Contractor
Pedro Colon	Smithsonian	Owner
Al Hester	Southern Company	Owner
Jay Pollard	US Steel	Owner

CHAPTER II

METHODOLOGY

The methodology for this research consisted of eight phases, and is represented as a flow chart in Figure 2.1. Each of the eight phases illustrated in the figure are further discussed in this chapter:

Figure 2.1 Research Methodology



Literature Review – Phase I

Phase I consisted of an extensive literature review on topics related to the research. The two primary topics of investigation involved information and front end planning. A query was performed in journal article databases to identify previous research performed on front end planning and information. All relevant journal articles were read, and relevant findings were incorporated into the literature review. The findings from the literature review are presented in Chapter III.

Logic Diagram Development – Phase II

To identify the information flow and information requirements within front end planning, it was first necessary to detail, or describe, the activities that comprise the flow of information. The first diagram is identified as the Information Flow Activities Diagram and is illustrated in Appendix A.

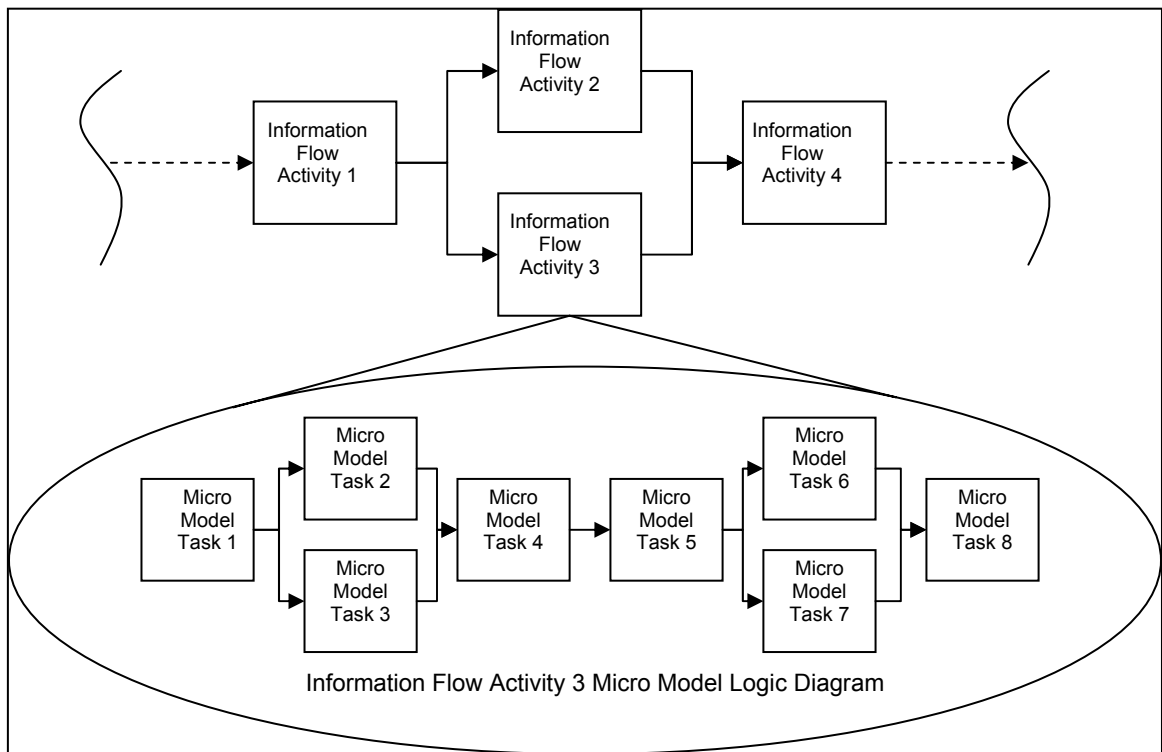
There were two levels of detail created for the information flow activities logic diagram. The first level of detail identifies the information flow activities within front end planning and was based upon the front end planning logic flow identified by CII research team 125 (CII, 1998). This CII diagram was used as a baseline by the research team. The model was changed and modified to show the current general logic of the information flow activities during a typical Engineering Procure Construct (EPC) construction process.

Many new activities were added, and the logic flow was changed to identify current information flow for an EPC project. Changes to this baseline model include:

- BP.11 (Risk Mitigation Analysis) is a new information flow activity added to the diagram,
- BP.12 (Refine Public Relations) is a new information flow activity added to the diagram,
- A repeat loop was added to the diagram to account for the different project alternatives that are present at the beginning of front end planning, and
- The location for CS.02, CS.03, PP.03, PP.06, PP.07, SD.01, and SD.02 were moved to different locations in the diagram.

The second level of detail identified the tasks necessary to execute a single information flow activity and are also in a logic flow diagram format. These diagrams are referred to as micro level diagrams and are illustrated in Appendix B. For this research, tasks are defined as the individual steps required to execute a single information flow activity. Figure 2.2 illustrates how the micro level diagrams relate to the information flow process diagram of 33 information flow activities. As identified by this figure, Activity 3 is complete when all the associated tasks are successfully executed.

Figure 2.2 Micro Logic Diagram Development (Moreau,1997)



The research team collaboratively developed all the diagrams within this research project. The research team was divided into sub teams. Each sub team was responsible for the creation of specific logic diagrams. When the sub teams completed all 33 micro level diagrams, the entire team reviewed each diagram and made corrections based upon the comments from the entire research team. The updated high level diagram presented in this dissertation is identified as the information flow activities diagram. This diagram consists of the 33 information flow activities necessary to adequately plan a typical EPC project.

In addition to the team review process, and as described later in this report, certain diagrams were selected for additional review and critique in the form of two Follow Up Surveys. A further description of these surveys appears

later in this chapter. Review comments were solicited from both owner and contractor personnel that did not participate in the original formulation of the diagrams.

The diagrams generated in this research are not based solely upon a specific facility type, location, or specific construction practices. These logic diagrams are intended to show the general logic flow to appropriately plan a typical project under the EPC process. The logic diagrams do not represent exactly any one company's front end planning process. They have been developed as generic models and individuals companies would need to modify the models to represent a company specific front end planning process.

Survey Creation/Distribution – Phase III

The creation of a survey to gather the required data needed to satisfy the research objectives was the next phase in the methodology. The purpose of the survey was to capture project specific characteristics, elapsed time, resources used, and additional project information regarding each of the 33 information flow activities.

The research team concluded that the survey should contain the following three sections: Project Profile, Front End Planning Characteristics, and Overall Project Assessment. After review of the literature and the research objectives, the development of the survey was initiated. The survey instrument underwent several revisions and was approved by a statistical advisor in the Experimental

Statistics Department at Clemson University. The survey instrument is presented in Appendix C.

The first section, the project profile page, collected general project information including the following:

- Company Name
- Contact Name
- Contact Email
- Contact Phone Number
- Project Name/Identifier
- Project Location
- Industry Sector
- Project Type
- Date of Project Completion
- Total Installed Costs

The information identified in this section of the survey was later used for descriptive statistics regarding the projects within the research data base.

The next section within the survey was designed to collect quantitative and qualitative data concerning each of the information flow activities. For this section, seven questions were asked against each of the 33 information flow activities. The first question was devised to collect the duration, or elapsed time (in days), of the particular information flow activity. The second and third questions quantify the resources expended, or effort, to complete the activity. The survey respondent would determine the total number of labor hours expended by

the owner organization (question two), and the labor hours expended by an external source (question three). External sources include contractors, vendors, suppliers, or other non company resources utilized by the company.

There were four questions that collected categorical data against each information flow activity. The survey respondent was asked to complete a performance rating ranging from Strongly Disagree to Strongly Agree with a Not Applicable option, as illustrated in Appendix C. To reduce confusion, a description of the activity was located below the title. The questions were as follows:

- This activity was successfully executed?
- This activity was unusually complex due to project requirements?
- This activity was executed efficiently?
- The information, documents, and data requirements were readily available for this activity?

The third and final section of the survey instrument was intended to ascertain information concerning specific criteria of the project. It collected data specifically related to the achievement of the business drivers, project objectives, and front end planning effectiveness and efficiency. These questions were as follows:

- The corporate business drivers were adequately defined?
- The corporate business drivers were adequately documented and communicated?
- The corporate business drivers were attained?
- The project objectives were satisfied?

- The [front end planning] process was effective and efficient?

For these specific questions, it was determined that a rating box would be used.

The survey respondent would have to check a box that best answered the aforementioned questions. The possible answers were Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, and Not Applicable. The survey respondent would check the box associated with the answer.

Three of these questions were used to separate the data into two samples, and were identified as the ‘success criteria’ during the statistical analysis. These questions were:

- The corporate business drivers were attained?
- The project objectives were satisfied?
- The [front end planning] process was effective and efficient?

The success criteria allowed the survey data to be divided into successful and less successful samples. All answers to the success criteria of strongly disagree, disagree, and neutral were identified as less successful projects. Similarly, all surveys for which the success criteria were answered agree and strongly agree were identified as successful projects.

Also, the survey asked questions concerning specific construction execution practices. The survey respondent was required to check either a ‘Yes’ box or a ‘No’ box indicating the answer to these questions. The questions are identified below:

- Was this project executed utilizing a partnering strategy?
- Does this project encompass relatively new process technologies?

- Was this project impacted by a high degree of government regulation?
- Was the [front end planning] process satisfactory?
- Was this project executed in an unusually dynamic risk environment?

Data Collection/Analysis – Phase IV

Beginning in November of 2005, the surveys and accompanying cover letters were distributed among the research team requesting that they forward the surveys to the project managers for completion. Each cover letter identified the purpose of the survey (to gather data pertinent to the use of information during front end planning), assured the respondents of confidentiality, and indicated that the information gathered from their survey would be used to develop a methodology to support the research objectives.

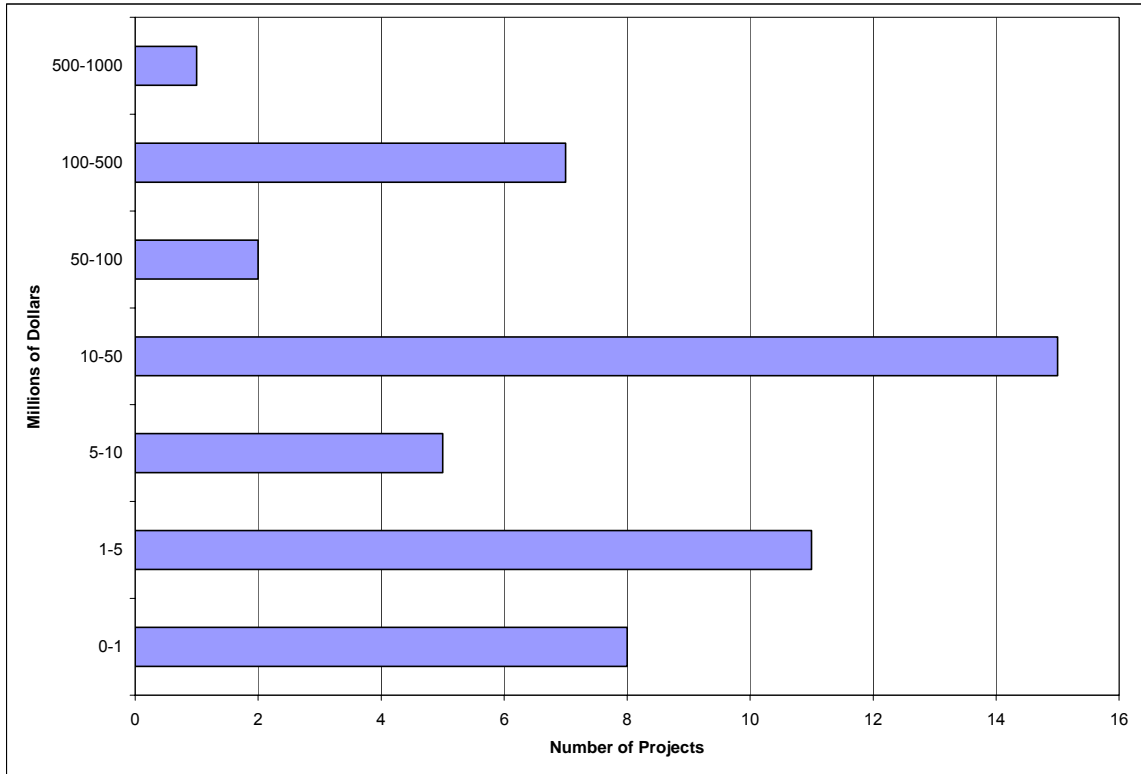
Data Collection

Since front end planning is primarily an owner driven activity, the majority of the survey respondents needed to be from owner companies. A few surveys were received from non-owner companies, but the data in these surveys were generally incomplete and were not used in the statistical analysis.

Fifty-one respondents from across the world completed the survey. In some instances, the same company provided several surveys from differing projects. The surveys contained information from projects exceeding \$2.9 billion in total installed costs (TIC). The distribution for the project TIC is depicted in Figure 2.3 As illustrated, the largest number of projects is in the \$10-50 million

dollar range. One project did not identify its TIC and is not included in this distribution.

Figure 2.3 Distribution of Projects by Total Installed Cost (TIC)



The market sectors represented within the database are from commercial and industrial type projects. However, 72% of the surveys were from industrial/manufacturing projects. The distribution of the project sectors is described in Figure 2.4. Additionally, the types of construction were divided between new construction projects and maintenance/renovation/retrofit type projects. There was a small percent of projects that were a combination of the previous two groups. This is more clearly illustrated in Figure 2.5. Additionally,

the surveys represented projects from locations worldwide. Figure 2.6 identifies the breakdown of domestic versus international projects.

Figure 2.4 Project Sector Breakdown

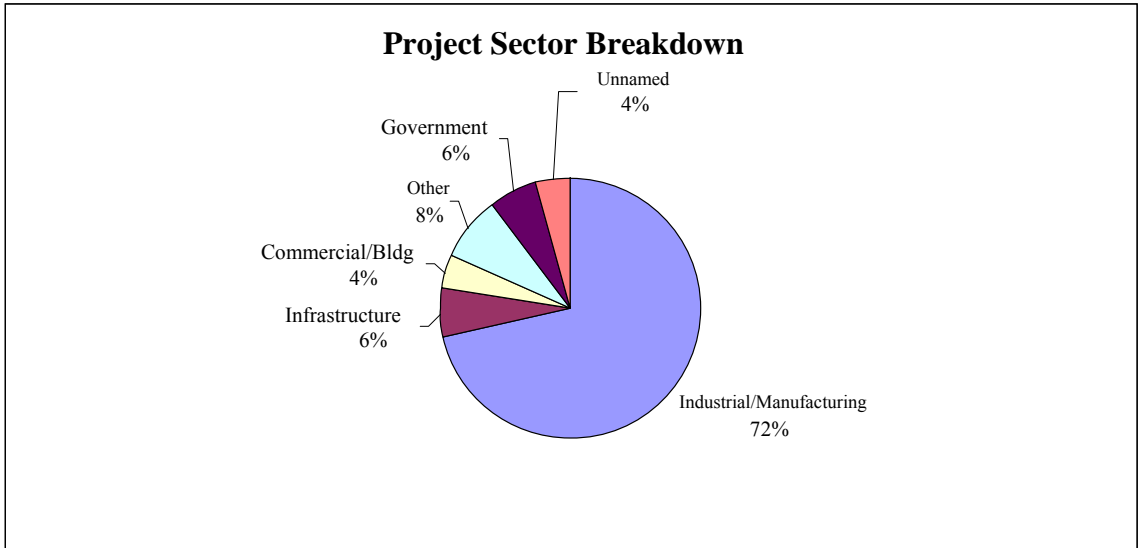


Figure 2.5 Distribution of Construction Types

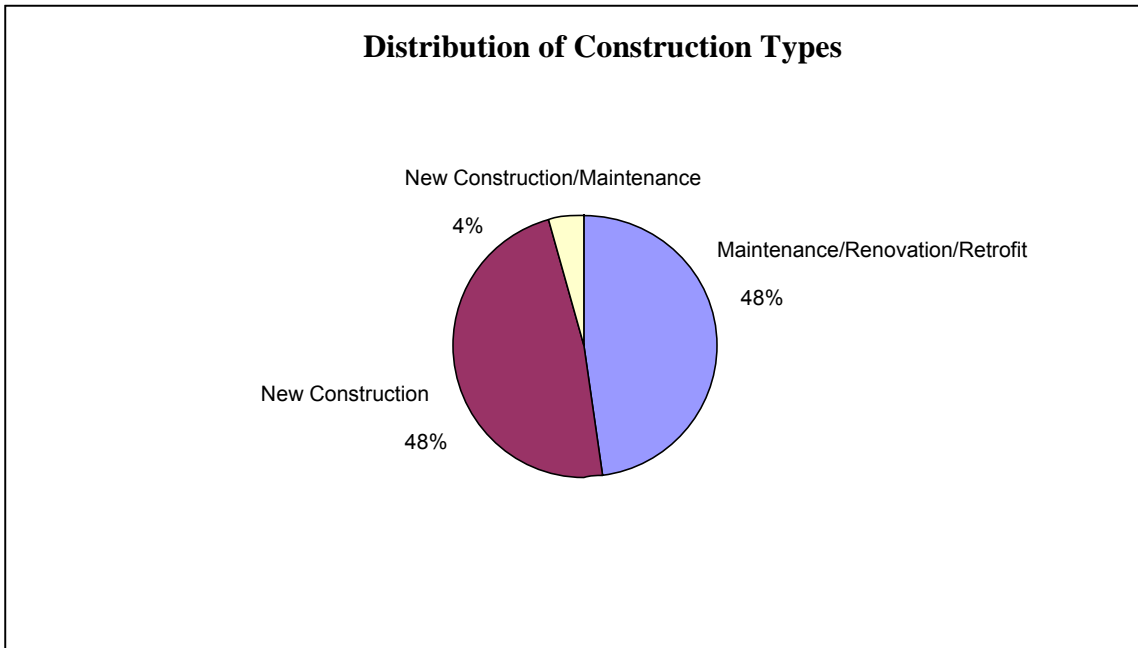
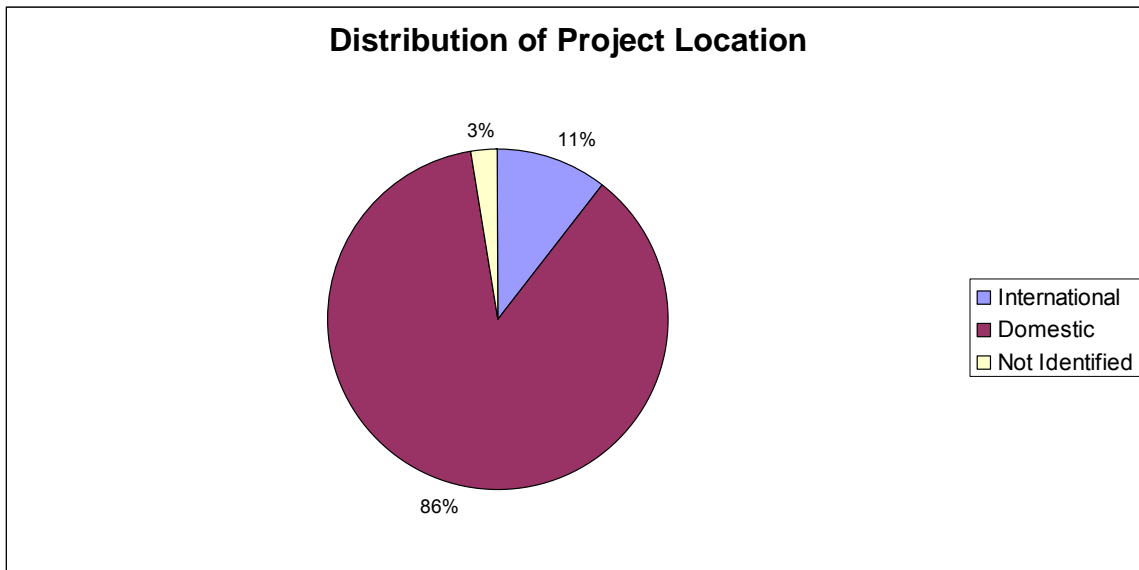


Figure 2.6 Distribution of Project Locations



The information received from the surveys was placed into a spreadsheet for data analysis. Once all the surveys were entered, the data was analyzed statistically to satisfy the research objectives. The data analysis is further summarized in Chapter IV.

Data Analysis

The methodology for the data analysis portion of the research was divided into two categories.

Duration/Resources Analysis

This analysis was designed to determine if statistical differences could be identified in the duration, utilization of internal resources, and utilization of external resources between projects that met specific success criteria than those

that did not. This statistical comparison was performed at the information flow activity level. The purpose of this analysis was to identify if the mean activity values for the successful projects were significantly different from the mean activity values for the less successful projects; thereby identify if successful projects spent more time or resources on the execution of front end planning.

To identify the two samples, the success criterion that identified successful and less successful needed to be clearly identified. It was decided that three criterion would be utilized as the success criterion from the survey. Each success criteria was analyzed independently of the other two within this category analysis. The success criteria were as follows:

- The front end planning process was effective and efficient
- The corporate business drivers were attained
- The project objectives were satisfied

In addition, it was decided to identify whether or not information availability impacts the duration and resource utilization within the information flow activities. As a result, a fourth success criterion was used for this analysis. The question is:

- The information, documents, and data requirements were readily available for this activity?

To perform this analysis, the data had to first be normalized (process discussed in data analysis chapter) to allow projects of differing sizes and TIC to be statistically analyzed.

The surveys were divided into two samples; one for 'Yes' responses and one for 'No'. Each time a new criterion was chosen, the previous sort was saved and the

data were sorted again independent of the previous success criterion's sort. Once the surveys were sorted, there were six values calculated for each activity. They were as follows ('Yes' means success criterion satisfied; 'No' means success criterion not satisfied):

- Duration for 'Yes' Sample for each activity
- Duration for 'No' Sample for each activity
- Owner Effort for 'Yes' Sample for each activity
- Owner Effort for 'Yes' Sample for each activity
- External Effort for 'Yes' Sample for each activity
- External Effort for 'Yes' Sample for each activity

A Folded F-Test was performed to identify if the two sample variances were equal. Depending upon the outcome of this analysis, either a Pooled or a Satterthwaite t-Test was performed to determine if the two sample means were statistically different from one another for each information flow activity. The level of significance for all the analysis was set at 0.05. The process was repeated for the other four success criteria. A summary of this analysis is presented in Chapter IV.

Execution Difference Analysis

This analysis was established to identify the association of each success criterion (see Duration/Resource Analysis section for identification of success criteria) with four key questions asked on the survey. For this research, an

association suggests that the answer to the success criterion will indicate the answer to the specific question. These key questions are as follows:

- This activity was successfully executed?
- This activity was unusually complex due to project requirements?
- This activity was executed efficiently?
- The information, documents, and data requirements were readily available for this activity?

A two-way frequency table was used to categorize the four questions for each of the 33 information flow activities. The table was devised to analyze how the respondent answered the question, versus whether the specific success criteria were met. The total values for the four possible answers were placed into the table, and the Fisher's Exact Test was performed to determine if there was an association between how each question was answered for the information flow activity versus the success criterion.

Each of the four questions was compared with the three success criteria independently (information availability was not identified as a success criterion for the analysis due to it being one of the four questions asked for each activity). The process was repeated for each success criteria to identify the associations with the four questions. A summary of the analysis is presented in Chapter IV.

Statistical Findings – Phase V

The first step in the findings was to determine the acceptable level of significance for the data findings. It was determined that using an alpha of 0.05 would be acceptable. This value was chosen to minimize the possibility of having

a Type I Error (see Findings chapter for further explanation). Thus, a confidence level of 95% could be associated with any statistical findings associated with the each category of the data analysis.

The null hypothesis for duration/resource data analysis was that there were no differences in the duration and internal/external resource expenditure mean values between successful projects and less successful projects. Type I Error would be to determine that there were statistical differences between the mean values for the two samples when there were none. It was important that activities not be identified as statistically different when they actually were not. Therefore, using an alpha of 0.05 would minimize the probability of making a Type I Error to one error out of twenty statistical findings.

The objective of the Execution Difference Analysis was to identify if any associations existed between the four survey questions asked for each activity and the three success criteria. The null hypothesis was that there were no statistical associations between the specific question and the specific success criterion for the activities. It was determined that minimize the possibility of a Type I Error was important to prevent false assumptions being made to duration and resource expenditure for successful and less successful projects. As a result, alpha was again chosen to be 0.05. Using 0.05 versus a larger value for Type I error provides a smaller chance of making a Type I Error (rejecting the null hypothesis when the null is true). This value was used to keep the possibility of identifying associations that did not exist to a relatively low number.

Due to the large number of statistical calculations performed in the research, experimental wide error was a concern. For the Duration/Resource Analysis, there is a possibility that a few of the findings could have resulted from this error. Additionally, some of the findings for the Execution Difference Analysis could have been due to a Type I Error. A further explanation is identified in Chapter IV.

Information Flow – Phase VI

To ensure the information requirements for each of the information flow activities were identified, the research team decided that information flow diagrams would be beneficial. The creation of these diagrams consisted of two parts. Part I consisted of identifying the information requirements and placing them into a table format. The research team was again divided into sub teams to identify the information requirements for each micro level task for the micro diagrams they were assigned. When each of the sub teams completed their specific assignments, the entire research team reviewed them for accuracy. This review process took place multiple times over the course of the research project. These information requirements were placed into tables and were identified as the information flow tables.

The entire research team reviewed each of the 33 information flow tables extensively. Information flow consists of all the information generated or utilized within a task. When all the activity information flow tables were agreed upon by the entire team, part II was initiated. Part II was the creation of the information

flow diagrams. All the information requirements identified was converted to graphical form as information flow diagrams. Chapter VI provides a more detailed explanation of the information flow diagrams.

Follow Up Surveys – Phase VII

Phase VII of the research methodology consisted of two Follow Up Surveys. The first Follow Up Survey was designed to capture more information on why specific findings from the research were found to be critical. Additionally, the second Follow Up Survey was performed to ask industry practitioners to review the micro diagrams and information flow tables for specific activities to determine their accuracy. The following sections provide more detail on these two surveys.

Follow Up Survey I

Follow Up Survey I was conducted to obtain further information regarding specific activities for the front end planning process. This survey asked industry practitioners questions concerning the activities indicated by the research as having a particular important impact on front end planning's effectiveness and execution. The information identified from this survey provides additional data that helps understand the specific findings, and provides further information that may assist planners in executing the activities in a more efficient manner. These questions were as follows:

- List the most critical information/data tasks for this activity.

- List the missing information encountered when executing this activity.
- Which tasks require the most focus with respect to allocation of resources?
- What are the potential causes for possibly executing the activity inefficiently?

The results from the survey were used in conjunction with the findings from the data analysis. These results were used to identify recommendations to improve the flow of information through the front end planning process and are located in Chapter V. The Follow Up Survey comments are included in Appendix H.

Follow Up Survey II

Follow Up Survey II was distributed to industry practitioners to review the micro level diagrams and the information flow tables for specific activities identified to be critical. The survey included a cover letter which identified the purpose of the survey (to review if the information flow tables and diagrams adequately identify the logic flow and information requirements) for specific activities in front end planning. The survey respondent was asked to review each of the micro level diagrams and information flow tables for these specific activities, and to provide responses/comments to the following three questions:

- Are the tasks on the diagrams comprehensive of the steps needed to execute this activity?
- Does the table correctly depict the flow of information through this activity?
- Does the information listing (documents and data) adequately identify the information needed to execute this activity?

In addition, space was included on the survey for comments from the survey respondent. A copy of this survey is included in Appendix I.

Conclusions & Recommendations – Phase VIII

The final phase of the methodology consists of the conclusions and recommendations section of the dissertation and is located in Chapter VII. The specific objectives are revisited and the findings from the research that satisfy each objective are identified. Lastly, potential future research is identified and discussed.

CHAPTER III

LITERATURE REVIEW

One of the objectives of this research was to identify the activities that comprise front end planning and to identify the information requirements for these activities. To achieve this objective, it was first necessary to define “front end planning” and “information” along with other important related terms. This chapter provides a literature review of definitions and descriptions of topics related to information, information management, information technology, information sharing, knowledge management, and front end planning.

While there is considerable research literature on the subject of front end planning for construction engineering, there is little evidence that there have been any focused studies on the relationship between information flow and front end planning. The purpose of this chapter is to review literature related to these topics.

Front End Planning

The term front end planning has many aliases and perhaps different industry meanings. The purpose of this section is not to provide a complete summary of all front end planning research. However, it is important to generally define front end planning and to explain the overall process. Such terms as

Feasibility Analysis, Conceptual Engineering, and Pre-Project Planning are common industry terms used to describe this phase of construction.

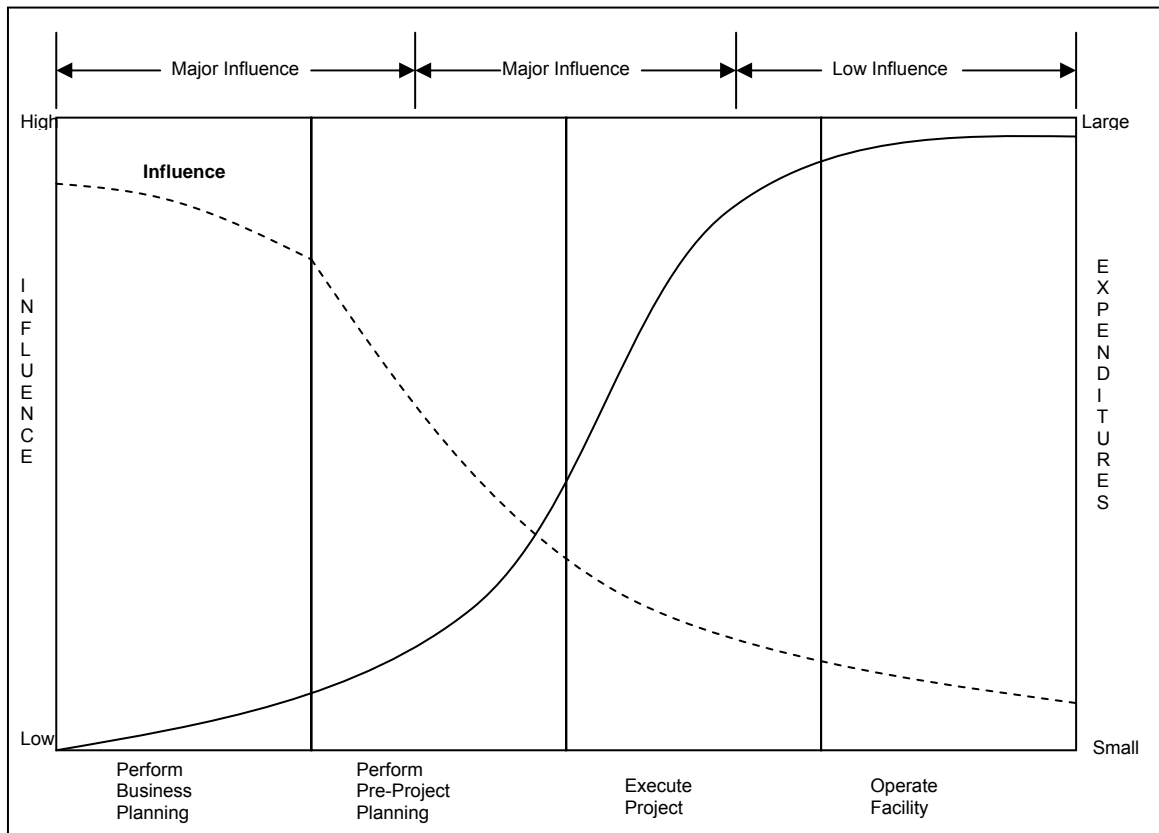
CII identifies that front end planning is comprised of gathering sufficient information and is an important step in the construction process. Cleland and Ireland (2002) expand upon this by stating that front end planning is the process of thinking through and making explicit the objectives, goals, and strategies necessary to bring the project through its life cycle to a successful termination when the project's product, service, or process takes its rightful place in the execution of project owner strategies.

Despite the different definitions of front end planning, most authors agree that front end planning is a key element to overall project success (Gibson et al, 1995, Webster, 2004, Smith, 2000, and Hartman & Ashrafi, 2003). Cleland and Ireland (2002) identify that decisions made early in the project process will, "...set the direction and force with which the project moves forward as well as the boundaries within which the work of the project team is carried out." Previous research has demonstrated that effective front end planning increases the likelihood of improved overall project performance (Gibson et al, 1995 and Gibson et al, 2006).

Front end planning allows the project team to have greater influence over the project. Many potential problems are identified proactively before they can greatly affect cost and schedule. Also, successful planning identifies which areas within the project need greater definition prior to execution. As the project enters the execution phase, the team has less influence to make low cost changes over

the project (more costly to implement changes on the project). Figure 3.1 (Gibson et al, 1995) illustrates this influence at the early stages of a project. The figure intends to show that as a project progresses through the various stages in its life-cycle, the opportunity to favorably influence a project diminishes with time. What could have been a proactive approach is now reactive, and more costly. Hamilton and Gibson (1996) identify that the construction industry recognizes that more effort in project planning results in more successful projects, and that research has shown this to be true. However, no research was found that specifically focused on the information flow through front end planning. This research will identify the information flow, and as a result, will further assist companies in making front end planning more effective and efficient. For this dissertation, information flow is defined as the information requirements and their logical flow through the front end planning process.

Figure 3.1 Influence & Expenditure Curve for Project Life Cycle (Gibson et al, 1995)



CII has identified front end planning as one of their best practices

(www.construction-institute.org). CII defines a best practices as, “... a process or method that, when executed effectively, leads to enhanced project performance.

CII Best Practices have been proven through extensive industry use and/or validation.” As a result, CII has indicated that successful execution of front end planning will enhance the likelihood for improved project performance.

Front end planning is a unique process that differs from organization to organization based upon their specific core capabilities. For the purpose of this literature review, front end planning will be described using the CII model.

Pre-Project Planning Defined

The Construction Industry Institute chartered a research project in 1991 to identify the means and methods to define a project and prepare a cost estimate for approval. A research team was assembled under the guidance of Dr. Edward Gibson. Using the U.S. Air Force's Structured Analysis and Design Technique (Gibson et al, 1995) as a baseline, the map of pre-project planning was defined.

This study identified the definition for pre-project planning as identified previously by this literature review. Additionally, the research team developed a process map for pre-project planning. The process is divided into four main categories: (1) organize for pre-project planning; (2) select project alternative(s); (3) develop a project definition package; and (4) decide whether to proceed (Gibson et al, 1995).

In addition, each main category is broken down into further steps. Each step under a category being a critical piece in the category. In 1993, the ICAMM DEFinition language (IDEF) diagram of front end planning was created. IDEF was a result of the research conducted by Ed Gibson on the US Air Force's Integrated Computer-Aided Manufacturing (ICAM) process. This diagram identifies the major steps needed to perform the planning process and is illustrated in Figure 3.2. This diagram eventually evolved from the IDEF diagram to the pre-project planning silos identified in Figure 3.3 (Gibson et al, 1995).

Figure 3.2 IDEF Diagram of Front End Planning (CII, 1995)

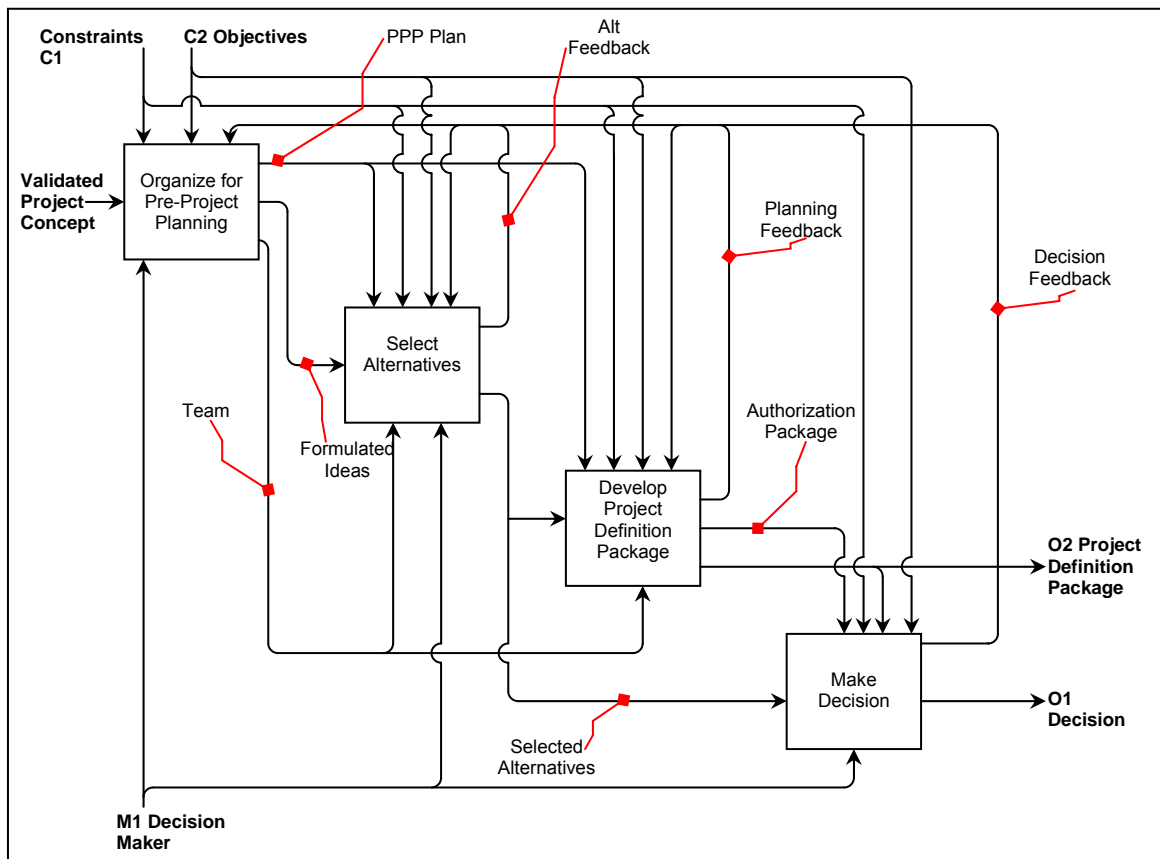
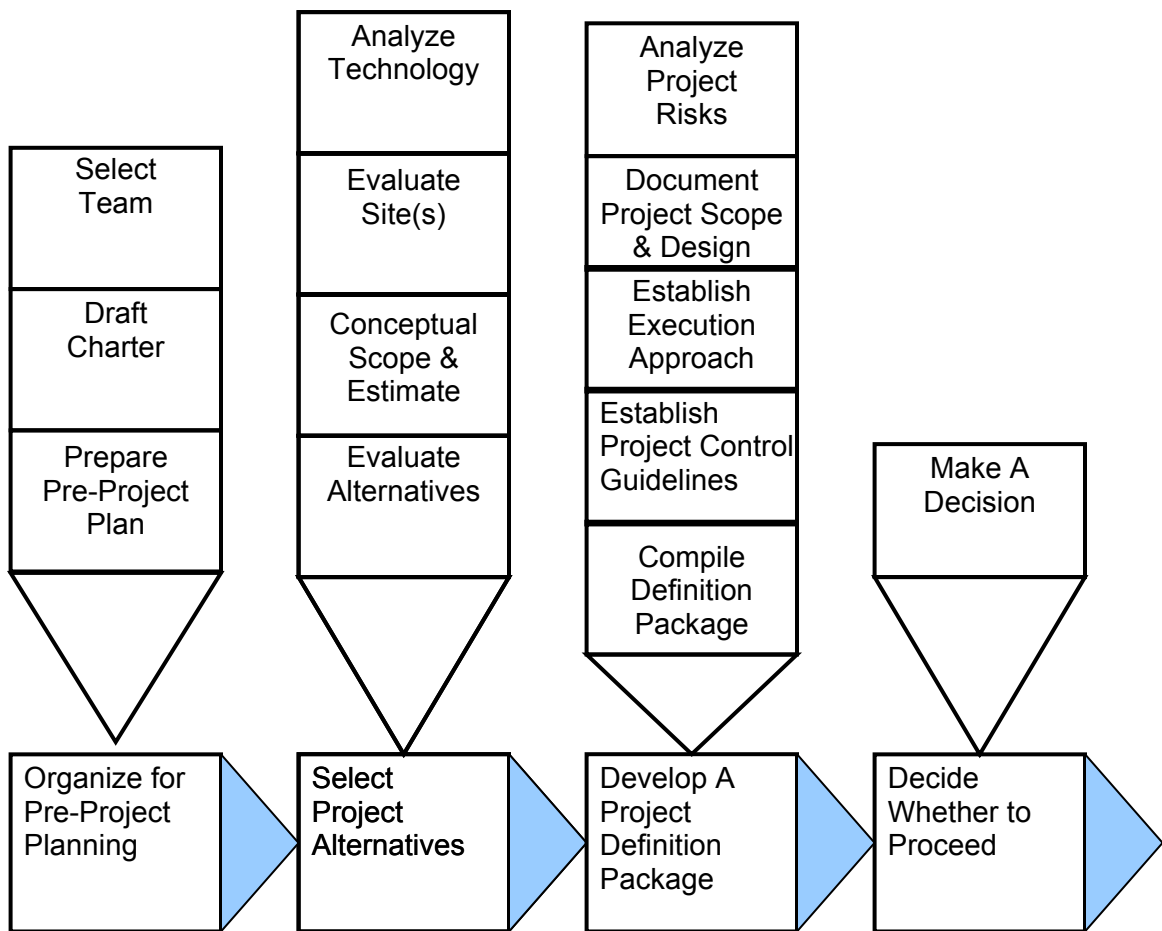


Figure 3.3 Pre-Project Planning Process (Gibson et al, 1995).



Gibson found that, “It is an owner’s responsibility that [front end planning] be performed adequately; however, many preproject-planning functions are performed by engineering consultants” (Gibson et al, 1995). This finding identifies that front end planning is primarily an owner driven function. However, there are consultants that are available to perform planning with the help of the owner company.

In addition, Hamilton and Gibson (1996) used a survey, interviews, and case studies and identified that, “through formal preproject-planning effort, risk is

reduced, cost performance can increase by as much as 20%, and schedule performance by as much as 40%”.”

CII published two manuals identifying the results from the research (CII, 1994) (CII,1995). These reference manuals identified the impact of successful front end planning on overall project performance and identified the major steps to plan a project.

Project Definition Rating Index (PDRI)

In 1994, CII chartered another research team to extend upon the previous research to provide owners and contractors with a means to better achieve business, operational, and project objectives for industrial type projects (Project Definition Rating Index (PDRI)-Industrial) (CII, 1996). Like the previous research project, a research team was assembled, and two research objectives were established: (1) quantify pre-project planning efforts; and (2) analyze the impact of the alignment of the project participants on a common set of project goals (Gibson et al, 2006).

When the research was concluded, the Project Definition Rating Index (PDRI) for industrial type projects was produced. PDRI is a weighted matrix with 70 different scope definition elements grouped into 15 categories and further categorized into three sections (Gibson et al, 2006). The objective of PDRI is to allow a planning team to quantify the completeness of the project’s scope definition during pre-project planning. The weighting matrix has a maximum score of 1,000 points. A lower score identifies that the project has a more

thorough scope definition. PDRI does not identify the specific information requirements for front end planning. Rather, it “audits” or evaluates the front end planning process for completeness and correctness of the project’s scope definition.

A benchmarking phase was instituted to validate how well PDRI measured scope definition. Previous project’s performance were measured against PDRI data and it was identified with statistical significance that a lower PDRI score identified that the scoping for a project was better defined than a project with a higher score.

Dumont, Gibson, and Fish (1997) found that PDRI, “... allows a project team to quantify the completeness of a project’s scope definition. The maximum score is 1,000 points, and a lower score represents a more complete scope definition.”

The PDRI matrix manual was published by CII in 1997. The title of the manual was, “Pre-Project Planning Tools: PDRI & Alignment’ (CII, 1997). This manual identified all the 70 different elements and provided a narrative on how to use the matrix. In addition, the manual identified that a lower PDRI score indicate that the project had more thorough scope definition.

PDRI Evolution

The initial PDRI matrix measured the scope definition completeness of industrial projects. In 1997 CII chartered another research team to create a PDRI

matrix for building projects. The objectives of this research team mirrored that of the previous team, and the methodology was similar.

Upon completion of the research, the Project Definition Rating Index for Building Projects (PDRI-Buildings) was developed. The format of the matrix was similar to the industrial PDRI matrix, but within a few differences existed. The PDRI-Buildings consists of 64 scope definition elements grouped into 11 categories and further summarized into three sections (Gibson et al, 2006). Additionally, the weighting for this matrix was different than the weighting of the PDRI-Industrial.

PDRI-Business was used on completed projects to validate the new PDRI matrix. Data were collected from projects and a PDRI score was completed. Statistical analysis was performed to identify a correlation between the PDRI score and project performance. Statistical analysis found a difference between projects that had a lower PDRI-Business score and those projects with a higher score. In addition, these findings indicated that a lower PDRI-Business score indicates a more thorough scope definition and an increased chance of improve project performance.

Griffith et al (1999) identified the PDRI matrix and found that PDRI contributes significantly to the construction industry by providing a checklist that identifies if the project's scope is well defined. In addition, "Analysis results revealed a significant difference between projects with a lower PDRI score (better preproject planning efforts) and projects with higher PDRI scores in terms of cost, schedule, and change order performance" (Gibson et al, 2006).

Pre-Project Planning Logic Diagram

Front end planning was later redefined in research work performed by CII. This research (CII, 1998) was designed to quantify the impacts of information management on Engineering Procure Construct (EPC) construction projects. However, the significant contribution to pre-project planning is that the research identified 30 activities that are required to adequately plan a typical EPC project. Additionally, these activities were placed into a diagram to identify the logic flow of the pre-project planning process. This logic diagram is depicted in Figure 3.4 (CII, 1998).

Back and Moreau (2000 & 2001) found that the construction process (pre-project planning, material management, design, construction, etc.) consists of a series of activities. Additionally, they identified that substantial cost and schedule reductions may result from improving the internal information exchange with the construction process.

Figure 3.4 EPC Macro Model Logic Diagram (CII, 1998)

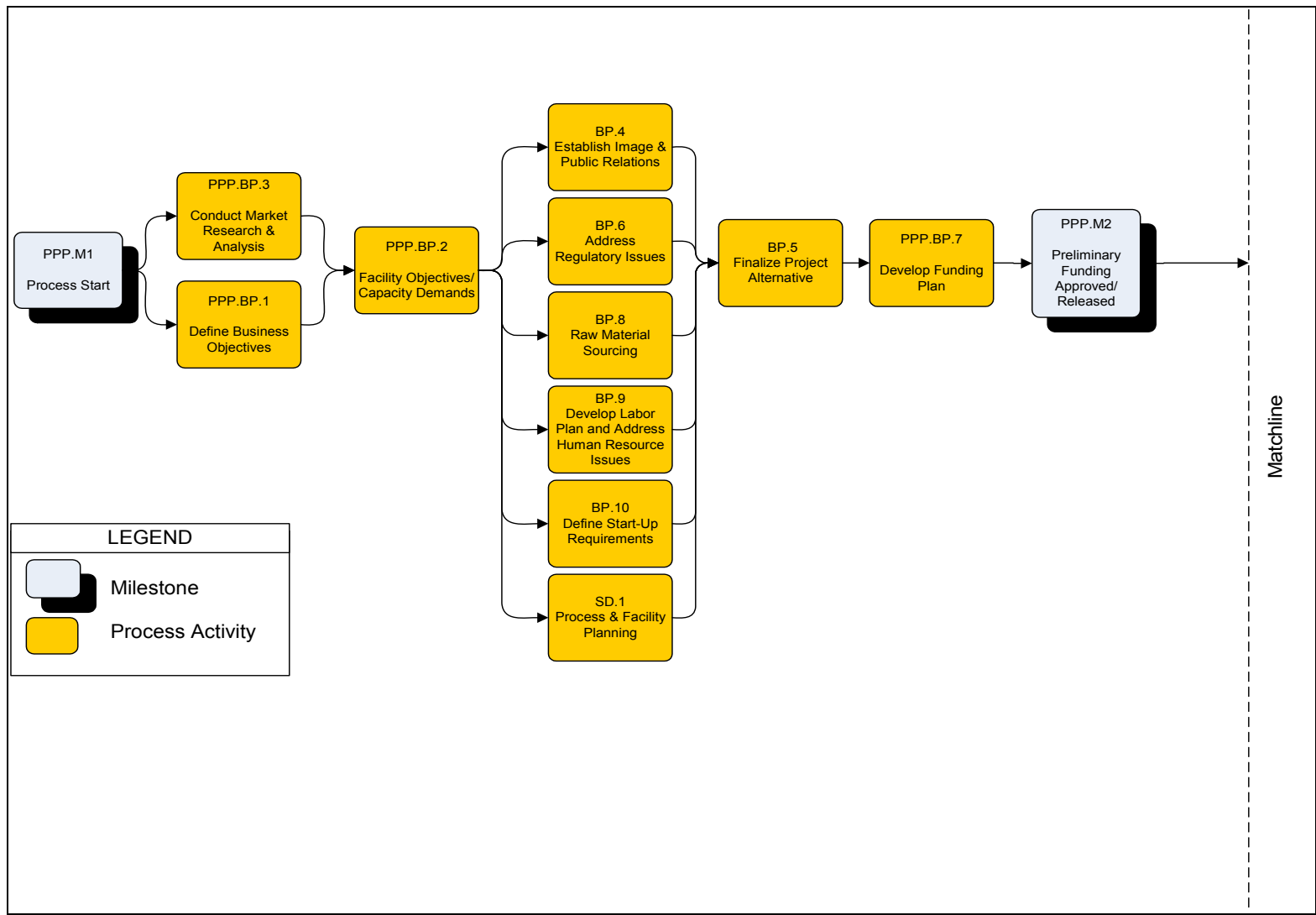


Figure 3.4 EPC Macro Model Logic Diagram (CII, 1998) “Continued”

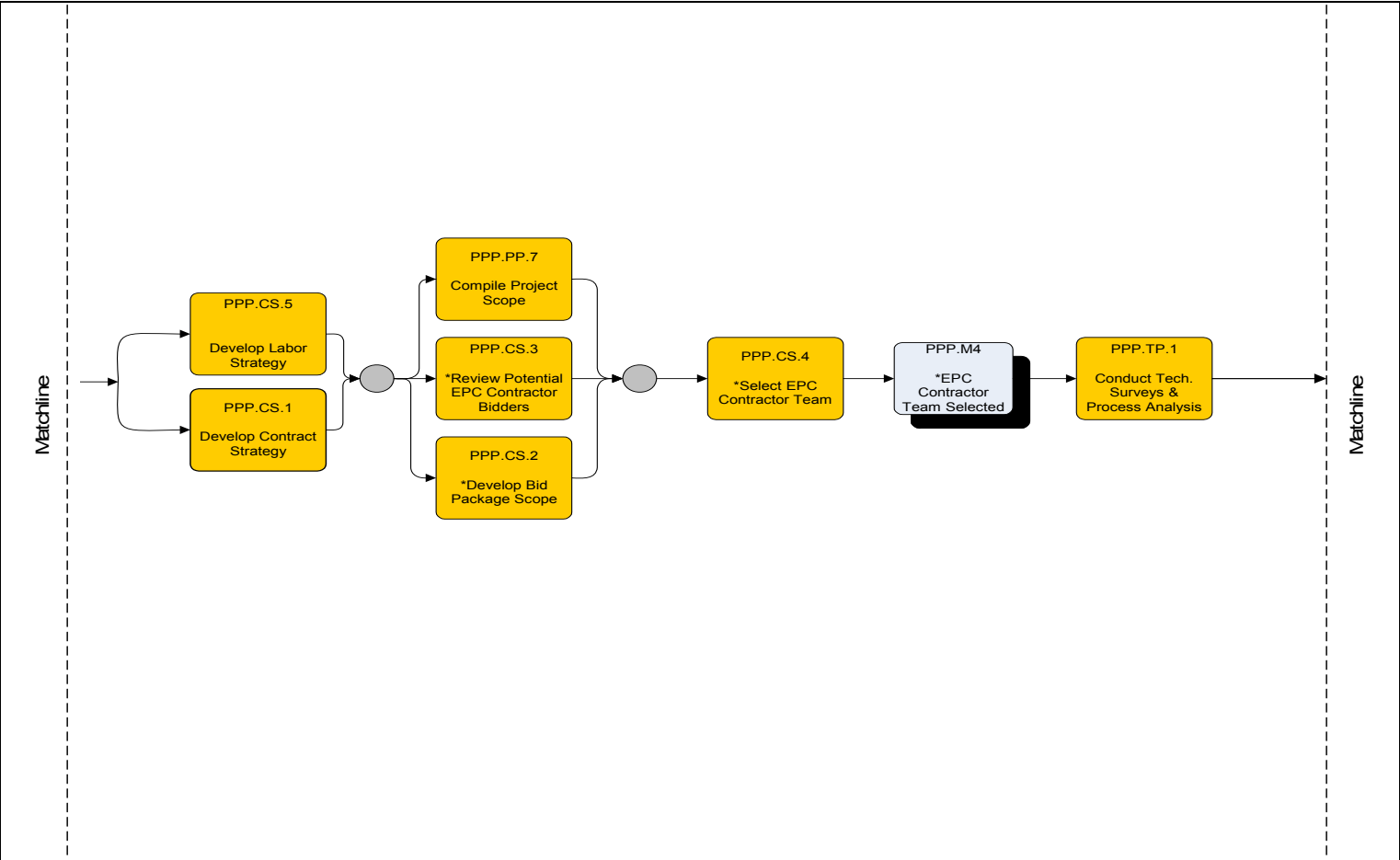
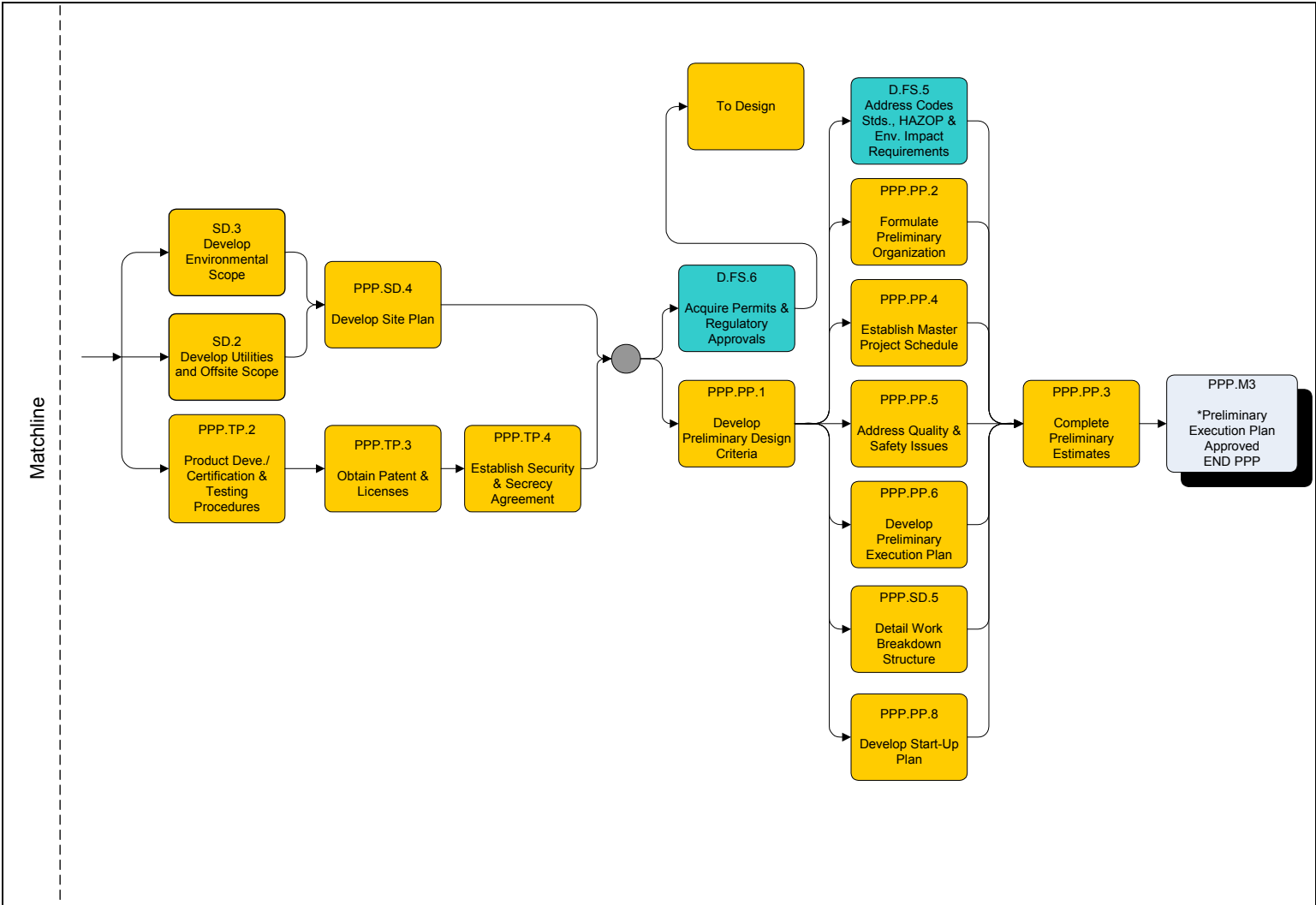


Figure 3.4 EPC Macro Model Logic Diagram (CII, 1999) “Continued”



Front End Planning

A benchmarking study was performed by Gibson et al (2006) and found that, “A workshops was held to modify the PDRI-Buildings to reflect the organizations’ specific terminology.” Data were collected from 45 projects and the findings indicated that projects with more scope definition saw better project performance in terms of cost, schedule, and change orders (Wang, 2002). These findings validated previous research and identified that better front end planning results in increased project performance. However, no further research has been conducted upon this topic.

As identified previously in this literature review, previous research conducted found that front end planning process is a crucial process that leads to improved project performance. However, research has only identified the importance of front end planning and the major steps involved in the process. Currently, no research exists that identify the specific information requirements, or the flow of information, within the process. Similarly, the detailed steps for front end planning have not been identified.

Information

Information is defined as, “The communication or reception of knowledge or intelligence” (Webster.com). It may be given verbally, exchanged through email, written in documents, stored in filing cabinets, or electronically in computer databases. Moreau (1997) in her research report identified that

information is, "... all data and document resources of a firm which may be composed of discrete forms of text, image, audio, or numeric."

Further investigation reveals a plethora of topics related to information, but these topics do not relate to the flow of information through front end planning. As a result, much of the literature was not used for this dissertation. However, there were information subjects that were particularly relevant to this research. These topics include information management, document management, information technology, and information sharing. The following sections of this literature review provide an overview of these topics and an understanding of these topics assists in the comprehension of this research topic.

Information Management

Information Management is not a new concept. Some would define information management as, "The handling of information acquired by one or many disparate sources in a way that optimizes access by all who have a share in that information or a right to that information" (www.answers.com). In the construction process, information is processed in numerous ways, and it is not fully effective without a means of control. When information is not properly managed, it can be lost, misplaced, or misused. The construction industry is continuously seeking ways to improve construction, thus there is a need to continuously improve techniques of information management.

Bjork (2003) references work by Egan (1998) in a research report stating, "... many believe that more efficient information management is a primary

mechanism for the construction industry to increase its productivity.” Currently, there are Information Management Systems (IM) in place to enhance the construction process. Egan further states that the construction industry can benefit from implementing a IM System on projects. This results from a localized location for all the information that flows through construction.

Back and Moreau (2001) state that information management is, “The use of all agency personnel, processes, policies, and technologies that define and comprise the information infrastructure in order to coordinate the use on information from the time it is created until it is no longer useful and eliminated.” Krings and Hantikainen (1996) identify that an effective information management system allows users to compile, access, and analyze critical information in an efficient manner. In other words, information management is a system to control the information resources of the company/enterprise.

Often, engineers spend countless hours locating, deciphering, and using information. Every time information is used, company resources are consumed and time is expended (Back, Moreau, and Toon, 1996). Furthermore, when information is used, accessed, or manipulated; this information may result in new information. Without an effective information management system, information has the potential to be lost or misused. Therefore, it is imperative that information is managed in a manner to allow quick dissemination by the users. Furthermore, Gelle and Karhu (2003) state that businesses are receiving too much information that is scattered, unreliable, and obsolete. They also cite work by Marien (1999) that this oversupply of useless information results in a decreased value of the

information. It is the function of an information management system to identify, store, and disseminate accurate information.

The constantly changing construction industry has brought many changes to the ways in which firms handle their information management strategies. In the past, many individuals in a business were located in a centralized area. “Hard Copies” of information could be stored in a filing cabinet that could be readily accessed by the company. Today however, the construction industry has grown into a world-wide industry. Many construction firms have multiple offices located in numerous countries around the world. As a result, the method in which information is managed has also changed. Information is now stored in computers, on networks, expert systems, and on the World Wide Web. Each of these means of storage can be accessed from a remote site, allowing more rapid information processing.

With rise of the use of computers in the construction and engineering industry, information is more accessible than before. Information Management is a system that permits the users to store information in a centralized location. Furthermore, the system allows users to easily access the correct information when it is needed. In a study by Sulankivi (2004), which qualitatively identifies the impacts of an effective information management system in design firms, it was shown that the greatest impact of the system on designers was an easier distribution and publication of documents, easier to record information, and information was easier to retrieve.

The benefits of information management possess great potential for the front end planning process. As identified earlier, information management provides methodologies for allowing information to be centralized and available to many different individuals. This may reduce the duration of front end planning by making information more readily available when needed. The following sections identify areas on information management that may be applicable for information flow during front end planning.

Document Management

Information systems operate on the basic principle of managing information in a central location commonly known as document management. Two decades ago, document management consisted primarily of hard copies stored in the company's storage room placed in archives for future use. On a project level, one individual was often responsible for controlling all document storage requirements. During this time, Front end planning requirements were very nominal. Information was stored on site, or in the home office. Additionally, team members were located in a centralized location, and information was easily accessible.

The construction industry has evolved. As such, information management requirements have changed as well. Project team members are no longer centralized and information can no longer be stored in hard copies in one location. As a result, document management has changed into electronic document management. "Electronic document management (EDM) technology

has the potential to enhance the information management in construction projects considerably, without radical changes to current practice” (Turk 2003). Turk further states in his 2003 paper that, “EDM systems focus on facilitating the management of documents pertinent to particular enterprises, projects, and work groups in computer networks.” In front end planning, EDM allows team members to access and manipulate information on the project across all organizational boundaries.

EDM is known by many names. The most common include Document Management Systems, Project Bank, Information Management Systems, and Project Extranet or Project Web. The implementation of an information management system in Front end planning involves most, if not all, of the items previously identified in this chapter. Front end planning is an information intensive process. Gaonkar and Viswanadham (2001) state, “The universal reach of the internet has made possible the ubiquitous, uninterrupted and opportune flow of information enabling new business models and great efficiencies in existing processes.” The use of the computer and software has allowed information to be stored, accessed, and manipulated by parties from across the globe. The primary system of information management in Front end planning is the use of Information Management Systems. Currently, many companies have created software that provides an Information Management platform tailored to the construction industry. These software packages are primarily used for the engineering and construction phases. However, the storage, access, and manipulation of data capabilities allow them to be used in Front end planning.

Document management uses software, hardware, data, and knowledge to efficiently control, store, and perform project related information tasks. When effective document management strategies are utilized, documents are located in a centralized location that is accessible to all front end planning party members

Information Technology

With advances in computers and electronic data interchange, information technology is often misunderstood as information management. However, information technology is only a tool to manage information as it is not a complete system. Moreau in her thesis (1997) states that, “A technology is a scientifically developed tool used to simplify or enhance specific task within the business cycle.” She further states that information technology may be hardware, software, and systems that process the information. Lai and Mahapatra (1997) provide a different definition of information technology as, “Technologies dedicated to information storage, processing, and communication.” They further state, “[Information Technology] focuses on the hardware, software, telecommunications, and office equipment that transforms raw data to useful information, adding new value in the process.” Zipf (2000) states that information technology, “... [makes] it possible for ‘timely’ information to be provided to project managers so they can manage effectively.”

In the past, information technology in construction was used primarily for data processing and data storage (Breuer et al, 1994). Recently, the construction industry has made radical changes in the methods in which information

technology is used. Pena-Mora, Vadhavkar, Parkins, and Webber (1999) identify that the architectural/engineering/construction (A/E/C) industry has grown exponentially over the past several years and the IT usage has grown with it. They further state that the use of information technology has improved operations of business by increasing both service quality and productivity.

Advanced technologies can be located in all of the civil engineering's traditional sectors (Smith et al, 2001). The use of these new technologies allow an increase in the productivity of tasks and to process, store, and disseminate information faster. Once this information is passed on (information sharing), information technology devices provide decision making capabilities, instant data transfer, data analysis, and many other capabilities that streamline the engineering process. Information technology allows information to be instantly transferred and analyzed. These tributes are beneficial during front end planning. Throughout the planning process information technology allows information to be stored, processed, manipulated, and accessed in a more efficient manner than before.

Impact on the Construction Industry

As identified within this literature review, front end planning has been found through extensive research to contribute to enhanced project performance. Additionally, the process of front end planning has evolved from its initial conception in the early 90's, and is currently under refinement today. It has also been identified that previous research has been conducted on the topics of front

end planning and information, but not on the two topics combined. In each case, specific quotes were used to identify that each are crucial to successful execution of a construction project.

Front end planning has been statistically verified to impact achievement of project success. Similarly, research has stated that information has a large impact on the construction industry and that the front end planning process is highly information dependant. However, currently no research has been conducted to identify the impacts of information, or to identify the specific tasks necessary to execute front end planning process. Therefore, it is the purpose of this research report to identify the specific tasks necessary execute a typically planned project and the flow of information through front end planning process. Lastly, this research report will seek to make recommendations to improve the flow of information through the process.

Conclusion

One goal of the literature review was to distinguish between the terms of information technology and information management. This research did not seek to identify potential improvements and/or problems associated with the introduction of new information technologies. Rather, the study of information identified it is constantly manipulated, exchanged, and utilized. In addition, information management topics were reviewed and identified that there are many different ways in which information can be managed.

The analysis of front end planning examined current research performed on front end planning. This review identified that front end planning plays an important role in achieving an improved level of project performance. Additional review of relevant topics identified that no research exists that identifies the flow of information within front end planning. By this, it is meant that no literature existed that specifically describes the information requirements or the precedence relationship between information dependent project planning activities. This research report contributes to the construction industry by addressing this need.

CHAPTER IV

DATA ANALYSIS

Data Manipulation

The purpose of the survey was to obtain data from both successful and less successful projects depending upon the success criteria previously identified. Successful projects were identified as projects that met specific success criteria and those that were labeled less successful did not meet the criteria. It was decided that answers that were both ‘Strongly Agree’ and ‘Agree’ would be grouped into one sample and be labeled as successful. While the ‘Strongly Disagree’, ‘Disagree’, and ‘Neutral’ would be grouped into a second sample and be identified as less successful. This was done for all questions/questions in which these types answers were used (see Appendix C for a copy of the survey instrument).

A neutral response was grouped with the less successful answers. The justification for this decision was that the survey respondent did not identify the answer as successful; apparently leaving room for project performance improvement. As a result, all strongly disagree, disagree, and neutral responses indicated that the project could be interpreted as leaving room for improvement. An answer of less successful does not mean project failure, but implies that the project was not a complete success.

The justification for this methodology resulted from low data in the five categories. As a result, it was determined that grouping the data would better serve the data analysis. However, by doing so, specific findings may be lost. Such findings may be the inability to perform correlation analyses on the data. An example may include a correlation to the level of duration and resource expenditure to the answer to a specific success criterion (duration and resource expenditure increase/decrease with the answer to the success criterion).

Data Normalization

The pool of projects contained in the database represents projects from throughout the world. Additionally, these projects all vary in cost, and duration for front end planning. As a result, it is difficult to compare the amount of elapsed time spent on planning a \$100,000 project to a \$100,000,000 project. Thus, the data were normalized to allow projects of differing sizes to be compared, and the normalization process was completed for duration and resource utilization for all 33 information flow activities. Next, the individual value for a particular activity was divided by the total time. This provided the percentage of total perceived effort. For example, if the total elapsed time for front end planning from one survey equals 100 days, and one activity has a single duration of five days; then the normalized value is $5/100$ or 5% perceived effort. This process was repeated for the internal and external resource values (identified as internal and external labor hours on the survey).

The methodology identified above assumes similar accuracy when providing the duration and resource expenditure data. In other words, data relevant to larger projects has the similar level of accuracy on data collected on smaller projects. This assumption is based on current project controls practices where companies are managing the time spent on specific activities, and the total resources utilized to execute the activity. However, the 33 information flow activities will not match the current practices of the organization, and will result in a small level of subjectivity in the data.

Table 4.1 illustrates an example of this process. The first column identifies the survey number. Each survey was assigned a particular number for referencing purpose. The second column denoted the specific activity. The following three columns identified the survey values, and the last row is the sum of all the values. This value identifies the total duration and owner and external resources used for the project. The final three columns identify the specific normalized value. The specific normalized value was determined by dividing the specific activity value by the total. Complete lists of all normalized data values are presented in Appendix F.

It was found that data were not collected against all of the activities on a few of the surveys. This confirms that front end planning is a project specific process, and often a project may not perform a specific activity. For example, in Table 4.1, BP.09, BP.12, and TP.04 do not have any values. This indicates that for this project, these three information flow activities were not executed.

Table 4.1 Normalized Data for Survey One

SURVEY RESPONSE DATA					NORMALIZED DATA (%)		
Survey	Activity	Duration (Days)	Labor Hours		Duration	Labor Hours	
			Owner	External		Owner	External
1	BP.01	30	280	160	2.60%	6.79%	3.59%
1	BP.02	5	80	40	0.43%	1.94%	0.90%
1	BP.03	25	240	160	2.17%	5.82%	3.59%
1	BP.04	5	24	0	0.43%	0.58%	0.00%
1	BP.05	30	160	40	2.60%	3.88%	0.90%
1	BP.06	30	240	460	2.60%	5.82%	10.33%
1	BP.07	30	240	0	2.60%	5.82%	0.00%
1	BP.08	15	120	200	1.30%	2.91%	4.49%
1	BP.09	0	0	0	0.00%	0.00%	0.00%
1	BP.10	3	32	56	0.26%	0.78%	1.26%
1	BP.11	5	84	32	0.43%	2.04%	0.72%
1	BP.12	0	0	0	0.00%	0.00%	0.00%
1	CS.01	30	70	60	2.60%	1.70%	1.35%
1	CS.02	60	76	80	5.20%	1.84%	1.80%
1	CS.03	15	16	96	1.30%	0.39%	2.16%
1	CS.04	15	50	80	1.30%	1.21%	1.80%
1	PP.01	90	160	200	7.81%	3.88%	4.49%
1	PP.02	15	40	120	1.30%	0.97%	2.69%
1	PP.03	60	80	220	5.20%	1.94%	4.94%
1	PP.04	5	30	80	0.43%	0.73%	1.80%
1	PP.05	5	48	84	0.43%	1.16%	1.89%
1	PP.06	15	80	160	1.30%	1.94%	3.59%
1	PP.07	60	84	184	5.20%	2.04%	4.13%
1	PP.08	60	200	160	5.20%	4.85%	3.59%
1	SD.01	60	16	120	5.20%	0.39%	2.69%
1	SD.02	30	16	120	2.60%	0.39%	2.69%
1	SD.03	45	100	160	3.90%	2.43%	3.59%
1	SD.04	15	60	160	1.30%	1.46%	3.59%
1	SD.05	5	16	48	0.43%	0.39%	1.08%
1	TP.01	150	880	374	13.01%	21.35%	8.40%
1	TP.02	150	240	400	13.01%	5.82%	8.98%
1	TP.03	90	360	400	7.81%	8.73%	8.98%
1	TP.04	0	0	0	0.00%	0.00%	0.00%
TOTAL		1153	4122	4454	1.00	1.00	1.00

SAS (Statistical Analysis Software)

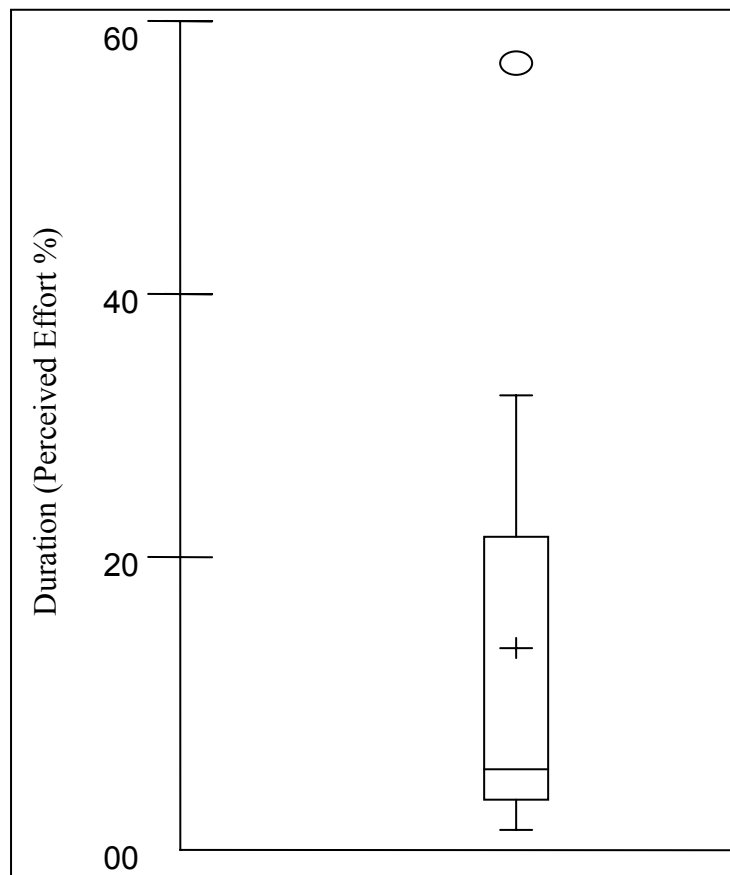
The statistical software used to analyze the survey data was SAS. This software package allowed the data to be imported from an Excel file in order to perform all the necessary statistical analysis. There were three main types of analysis performed for this research project. The first was used to identify any outliers within the data. This was performed by creating box and whisker plots of the data values and any data values located outside the outer limits was removed from the data pool. The second analysis included standard t-Test to determine if the sample means were significantly different between the successful and less successful projects. To properly complete this test, a Folded F-Test was first performed to determine if variances were equal. Depending upon the results of this analysis determined the type of t-test performed on the two samples. The third analysis was a Fisher's Exact Test for two-way frequency table analysis. This analysis determined the measure of association between the answers from two different Yes/No questions.

Box and Whisker Plots for Outliers

The purpose of this analysis was to remove any outliers from the data pool obtained from the surveys. An abridged box and whisker plot is depicted in Figure 4.1. This box and whisker plot identifies the external resources for activity BP.01. The box identifies the Inner Quartile Range for the data values. The line within the box illustrates the median value, and the '+' symbol represents the average value for the data. The lines extending from the box, or 'whiskers',

illustrate the extreme values within the data. Any values found outside these lines are considered outliers and a candidate data value to be excluded from the data set (the circle in Figure 4.1). For this table, there is only one data value that is an outlier requiring removal from the data set. This process was repeated for all 33 activities, and all outliers identified within these plots were removed from the statistical analysis.

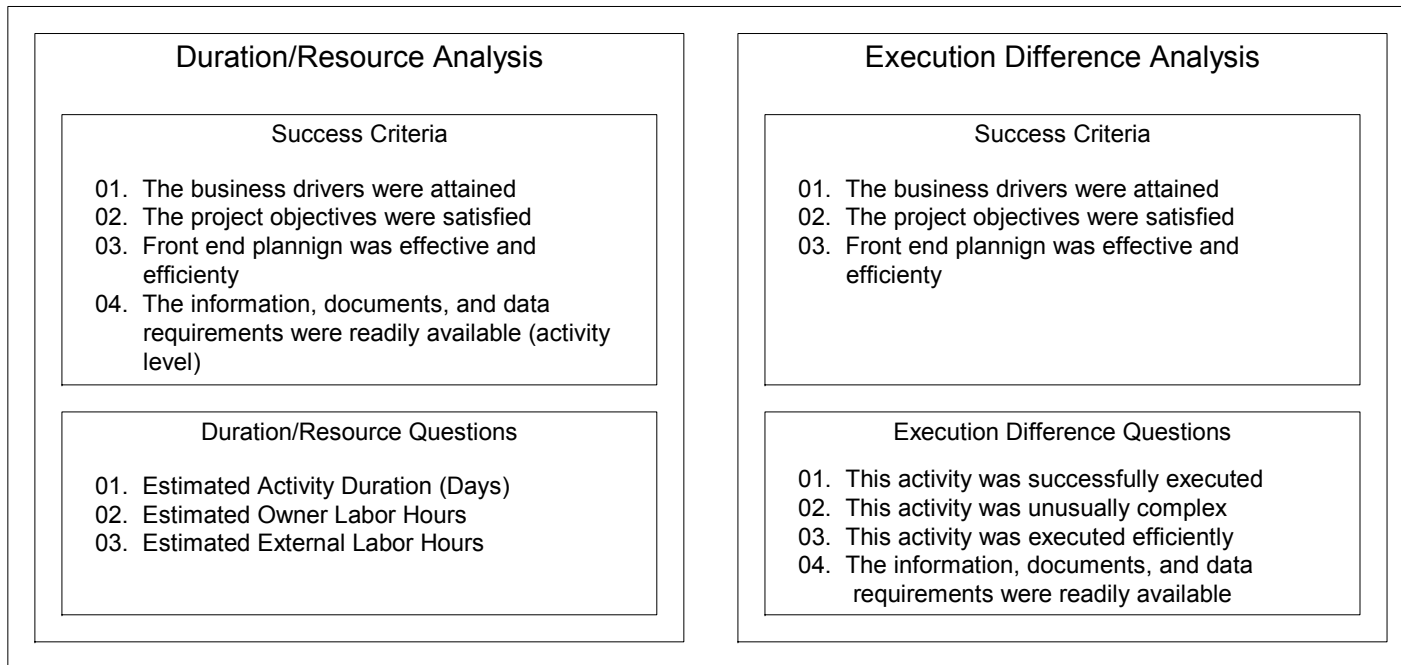
Figure 4.1 Box and Whisker Plot for BP.01 – Define Business Objectives



Data Analysis

The data analysis was divided into two categories. The t-Test and the Fisher's Exact Test discussed previously are the two types of statistical tests performed for this research. Duration/Resource Analysis comprised of the analysis of the normalized mean values taken from the survey. The Execution Difference Analysis utilized the two-way frequency tables to measure the level of association between specific questions asked for the information flow activities and the success criterion. Recall, an association suggests that an answer to a specific question will indicate the answer to another question. Figure 4.2 identifies the breakdown of the questions utilized for the two analyses.

Figure 4.2 Data Analysis Questions



Duration/Resource Analysis

The purpose for this analysis was to identify if there were any statistically significant differences between durations and resource expenditure of the activities for successful versus less successful projects. As identified earlier, there were three questions on the survey that asked specific questions that were used to separate the survey data into different samples. These questions were as follows:

- Corporate business drivers were attained?
- The project objectives were attained?
- The [front end planning] process was effective and efficient?

In addition to the three success criteria identified above, it was determined to identify if the availability of information impacted the durations and resource expenditure of the information flow activities. As a result, the question asking if all the information, documents, and data were readily available was used as a fourth success criterion. Also, three questions were asked for each information flow activity. These questions sought to capture the duration, internal resources utilized (labor hours), and external resources utilized (labor hours) and were used to identify if successful projects spent more/less time or utilized more/less resources than less successful projects.

The surveys were divided into two samples for each of the success criteria (recall the grouping of the survey answers changed the number of categories from five to two); one sample represents the projects where the success criterion was met, and the other represented projects that did not. Each success criteria was analyzed independently of the others. In other words, the projects were separated

for one success criterion and analyzed. Next, they were re-sorted for the next criterion. This process was used for each of the success criteria.

When the surveys were sorted, the means and standard deviations of the duration (elapsed time), owner labor hours (owner resources), and external labor hours (external resources) were calculated for each activity for each of the two samples. As a result, the activities had statistical values for the projects where the success criterion was met and values for projects where they were not. Folded F-Test was performed to determine if the two groups had equal variances. Depending on the result from this analysis, either the Pooled t-Test or the Satterthwaite t-Test method was used to determine if the means were significantly different. The Pooled method was used if the two variances were assumed equal, while the Satterthwaite method was utilized when the variances were not. A level of significance of 0.05 was used to determine which means were significantly different. This level of significance was used to identify a higher confidence in the findings and to ensure that a smaller likelihood of activities identifying a difference in mean values when they actually did not. The SAS program provided a P-Value (a measure of how much evidence exists against the null hypothesis) which was used to identify the activities with differing mean values. If the P-Value or the t-Test was less than alpha ($P\text{-Value} < 0.05$) then the means were considered significantly different.

By setting alpha to 0.05, there is a possibility that some of the findings may be the result from Type I Error. Due to the four success criteria asked for each of the 33 information flow activities, a total of 132 t-Tests were performed in

this analysis. As a result of the level of significance being set at 0.05, experimental wide error suggests there is possibility that seven of the findings from this analysis will result from Type I Error.

Execution Difference Analysis

The Execution Difference Analysis determined any association between the three success criteria and the four questions asked with each activity. An association indicates that the response to the success criteria question will suggest the answer to the question asked for each information flow activity. These questions were asked for each activity and were used to identify if any differences in execution strategies exist between successful and less successful projects.

The purpose of this analysis was to determine if successful projects answer the questions differently than the less successful. Since this analysis was categorical, it was determined that the outliers would not skew the data, and therefore were not removed from the analysis. To remind the reader, the four questions asked with each survey are as follows:

- This activity was successfully executed?
- This activity was unusually complex due to project requirements?
- This activity was executed efficiently?
- The information, documents, and data requirements were readily available for this activity?

The two-way frequency table identified how the survey respondent answered a particular question (placed into two groups of 'Yes' for successful and

‘No’ for less successful) versus whether the success criteria was met (again ‘Yes’ or ‘No’). Each survey answer was placed into one of four possible categories. A Fisher’s Exact Test was then used to determine if there is an association between the success criterion question and the specific question. Additionally, Fisher’s Exact Test uses the hypergeometric distribution rather than the chi-squared distribution (commonly used on two-way frequency tests with large amounts of data values) when computing the P-value.

For each of the 33 activities, four two-way frequency tables were created, resulting in a total of 132 frequency tables, with each table analyzed within the SAS software. The SAS software provided a P-Value for each of the tables. A P-Value is the probability of obtaining a result at least as extreme as that obtained (assuming the truth of the null hypothesis that the finding was the result of chance alone). This P-Value was then compared to the level of significance of 0.05. This value was selected to minimize the amount of error to an acceptable level and to improve the confidence level in the findings. Tables where the P-Value was less than 0.05 indicated an association between the two questions.

The analysis also presents the possibility for experimental wide error. Due to the analysis identifying the association between the three success criteria and the four questions asked for the 33 information flow activities, a total of 396 Fisher’s Exact Tests were performed in this analysis. As a result of the level of significance being set at 0.05, experimental wide error suggests there is possibility that twenty of the findings from this analysis will result from Type I Error.

Table 4.2 provides an illustration of the Fisher’s Exact Test Two-Way Frequency table. The row values indicate the number of answers to the success criteria, and the column values indicate the answers to the specific question. When the rows and columns are analyzed together, there are four potential answers. The first cell in the two-way frequency table is where projects did not meet the success criteria and the question answer is ‘No’. This is identified by the letter ‘X’. The second is where the success criteria were not met and the question was answered ‘Yes’, or ‘Y’. The third possible answer was where the success criteria were met and the question was answered ‘No’. This selection is depicted by the letter ‘V’. The last possible answer is where the success criteria were met, and the question was answered ‘Yes’. The letter ‘Z’ identifies this value. The totals on the right side of the table are the sum of the row values; while the totals on the bottom are the sum of the columns. The cell location where the two totals meet is the sum of the entire data used in the cell. An actual example is depicted in Figure 4.3.

Table 4.2 Illustration of the Fisher’s Exact Test

Success Criteria	Question		Total
	No	Yes	
No	X	Y	X + Y
Yes	V	Z	V + Z
Total	X + V	Y + Z	$\Sigma[(X + Y) + (V + Z)]$ or $\Sigma[(X + V) + (Y + Z)]$

Figure 4.3 Abridged Two-Way Frequency Table

Association of the Business Drivers with Statement 2 (Was the task unusually complex?)						
Activity	Name	P value	Question			
PP.03	Develop Contract Strategy	0.02	Success			
			Criteria	No	Yes	Total
			No	2	10	12
			Yes	19	13	32
			Total	21	23	44
PP.06	Select EPC Contractor Team	0.01	Question			
			Success			
			Criteria	No	Yes	Total
			No	1	10	11
			Yes	16	11	27
Total	17	21	38			

The row values indicate the number of answers to the business drivers. For PP.06, there were eleven projects that did not meet their business drivers and 27 that met the established objectives. The column values also indicate the answers to whether the task was unusually complex. Again for PP.06, there were 17 activities where the task was not considered complex and eleven that were. When the rows and columns are analyzed together, there are four potential possible answers. The first is where projects did not meet the business drivers and the task was not unusually complex; this is in row one column one. The second is where the business drivers were not met and the task was unusually complex; row one column two. The third possible answer was where the business drivers were met and the task was not unusually complex. This is identified in row two column one. The last possible answer is where the business drivers were met and the task was unusually complex; row two column two.

The objective of the analysis was to identify if successful projects answered the questions differently than less successful projects. If the analysis indicate an association, then inferences can be made to the execution strategies for front end planning between the two samples. This analysis yields particular benefits to the construction industry. For example, in Figure 4.3, the analysis indicates that successful projects found activities PP.03 and PP.06 not to be unusually complex. Additionally, less success projects found the two activities to be complex. This indicates that less successful projects found portions of the front end planning process to be complex, and as a result, may not have executed the process effectively.

Limitations of Data

The ultimate goal of data collection would allow statistical analysis to be performed on the data according to size, industry sector, type of construction, and success criteria. For example, analysis would have allowed projects to be categorized, then analyzed to determine if there are any significant findings between the groups. Additionally, a sufficient amount of data for each of these categories would provide a more accurate depiction of the sample. Unfortunately, this effort had to be foregone due to the lack of survey responses. Therefore, all the data had to be placed into one collective group. By doing so, the data analysis is limited upon the assumption that all construction is the same. This is not the case. Project size, the sector type, and the type of construction all make each

project distinct from the other. However, the analysis of data performed in this section grouped all categories together.

As a result of the limited data, the results of the analysis cannot be used as an industry benchmark. Significantly more data would be needed to make such a claim. Furthermore, the research findings may be more insightful if a higher number of less successful project data had been available for study. A larger data set would have provided more accurate statistical analysis for the research, and thus a more accurate depiction of the overall process.

The data collection process introduced a degree of subjectivity. Obviously, the survey respondents did not collect, nor record, time spent in front end planning when each task was executed. Similarly, front end planning for every company is different. The macro baseline created for this research project is to show the general sequence for project planning. The terms and definitions of the activities depicted within this research may not exactly match that of the company. As a result, the survey respondent had to answer the questions to the best of their knowledge and relate the diagrams as accurately as possible to their front end planning process

Another area for subjectivity concerns activity TP.04. When the survey was initially distributed, this activity was not included with the remaining activities. When the error was realized, an updated survey was distributed back to the survey respondent. Some surveys were already completed, and were not updated. However, even with the addition of the updated surveys, there were no surveys that provided any data on this activity. Upon discussing these results with

the research team, it was concluded that this may have resulted from the projects not performing this activity. Additionally, many survey respondents may have been reluctant to disclose information on projects where this activity was required. As a result, no data points were collected against this activity. This does not imply this activity is not important. However, based upon the project data, this activity is a project specific activity and only necessary depending on the project requirements.

Based upon the limited data collected for this research, industry generalizations about project planning by sector is restricted. However, inferences for the entire construction industry may be made based upon the data and analysis presented within this report.

CHAPTER V

FINDINGS

Introduction

As stated in the data analysis chapter, there were two categories of analysis performed for this research report. The Duration/Resource Analysis utilized the standard t-Test to determine if there were any differences between the mean values for the differing samples. The Execution Difference Analysis identified the level of statistical association between the four questions asked with each activity and the success criterion. The following sections identify the significant findings from these analyses.

An additional examination of the analyses sought to identify if any activities may impact the efficiency and effectiveness of front end planning. The results from this analysis identified six information flow activities that are critical for effective front end planning. The specific information flow activities and justification are identified in this chapter. In addition, the information requirements for these six critical information flow activities are identified.

Lastly, this chapter provides the comments from both Follow Up Surveys. Recall that Follow Up Survey I's objective was to identify additional information as to why the six critical activities were identified as being critical to effective and efficient front end planning. Furthermore, Follow Up Survey II's objective was to provide additional reviews of the micro level diagrams and the information flow

tables for the six critical activities. The results from these surveys are identified in this chapter.

Duration/Resource Analysis

Recall that respondents were surveyed to estimate the elapsed time, owner employee labor hours expended (internal resource usage), and external resource usage (non-owner employees working for or contracted to help with front end planning) for each of the 33 information flow activities. Similarly, the respondents were asked a series of questions regarding business drivers, project objectives, and front end planning efficiency and effectiveness. Similarly, a question regarding the availability of information was asked for each information flow activity. The SAS software program identified the P-Values associated with the t-Test described in Chapter IV.

The two sample mean values for the 33 information flow activities were analyzed for each of the success criteria for this analysis. The following tables (Tables 5.1 – 5.4) identify those activities that have a P-Value of 0.05 or less. This indicates different normalized mean values. Each table identifies the activity, mean value for the two samples, the sample sizes for the samples, and the P-Value. As a result of normalizing the data, all the values indicated in the tables are in normalized percentages (perceived effort of the activity). Recall from the previous chapter that the survey responses were manipulated from six categories to three categories. Additionally, the successful projects are identified by the ‘Yes’ samples and the less successful identified by the ‘No’ sample.

As shown in the tables below, there were 33 out of the 132 t-test findings that contained means with significant differences (some activities appear more than once). Additionally, of those 33 activities, 27 activities had mean durations higher in the ‘Yes’ category versus the ‘No’ category. These finding indicate that the majority of projects that met the specific success criteria spent more time and resources on these information exchange activities than projects that did not meet the objectives. This suggests that projects that met the specific success criteria took longer to complete each activity, and utilized more labor hours to complete the activities. Generally speaking, these data validate the presumption that more time spent on front end planning will increase the likelihood of improved project performance.

Table 5.1 identifies the information flow activities with different mean values when the success criterion is the “Business Drivers”. There were six activities that were identified in this table. Furthermore, of these six, five had mean durations higher in the ‘Yes’ category than in the ‘No’ category. The only activity that did not follow the trend of higher successful values was BP.09.

Table 5.1 Business Drivers as a Success Criterion

Duration	Activity Name	Sample	Sample	Mean	Mean	Difference	P-Value
		Size "No"	Size "Yes"	"No"	"Yes"	Yes-No	
BP.09	Develop Labor Plan and Address Human Resource Issues	10	24	4.42	2.31	-2.11	0.03
CS.01	Develop Contract Strategy	12	30	2.14	3.39	1.25	0.02
Owner	Activity Name	Sample	Sample	Mean	Mean	Difference	P-Value
		Size "No"	Size "Yes"	"No"	"Yes"	Yes-No	
CS.02	Develop Bid Package Scope	9	24	2.52	4.53	2.01	0.05
External	Activity Name	Sample	Sample	Mean	Mean	Difference	P-Value
		Size "No"	Size "Yes"	"No"	"Yes"	Yes-No	
PP.04	Establish Master Project Schedule	8	12	2.38	5.07	2.68	0.04
PP.05	Address Quality and Safety Issues	7	11	1.09	4.26	3.18	0.00
PP.08	Develop Startup Plan	7	8	1.02	3.77	2.75	0.05

Table 5.2 identified the least amount of significant findings in this analysis. Only three of the 33 information flow activities were identified as having means that were significantly different between the samples when “Project Objectives” was the success criterion. These were BP.02, BP.05, and BP.08. Of these three activities, only one activity, BP.08, had means in the ‘Yes’ sample exceed the values in the ‘No’ sample. Both BP.02 and BP.05 expended more owner resources on the less successful projects than the successful projects.

Table 5.2 Project Objectives as a Success Criterion

Duration	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.08	Raw Material Sourcing/Source Building Materials	2	20	1.30	2.49	1.20	0.00
Owner	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.02	Identify/Select Project Alternatives	9	30	5.81	3.38	-2.43	0.03
BP.05	Finalize Project Alternatives	6	23	4.56	2.54	-2.02	0.04
External	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
NONE							

Table 5.3 illustrates the findings when “Front End Planning was Effective and Efficient” was the success criterion. Front end planning had the most activities with differing mean values. A total of twelve findings are identified (BP.04 appearing in duration and owner resource expenditure and PP.06 appearing in all three areas). PP.06 is the most significant finding from the research. This activity contained a significant statistical value for each of the three categories. Thus, successful execution and information management in this activity may be critical to overall project success.

Further analysis of this table identifies that of the twelve activities identified indicated that ten activities had values higher in the ‘Yes’ sample. Thus, this trend indicates that more time and resources spent on front end planning may result in achieving this success criterion. In addition, only two activities had values higher in the ‘No’ sample. These activities are BP.02 for the duration analysis and TP.03 for external resources. These findings may have resulted from the small sizes for each sample.

Table 5.3 Front End Planning was Effective and Efficient as a Success Criterion

Duration	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.04	Establish Image & Public Relations	5	17	0.98	3.40	2.42	0.00
BP.09	Develop Labor Plan and Address Human Resource Issues	6	29	4.27	2.39	-1.88	0.03
PP.06	Develop Preliminary Execution Plan	9	25	2.04	3.69	1.65	0.05
Owner	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.04	Establish Image & Public Relations	5	18	0.08	3.50	3.41	0.03
BP.12	Refine Public Relations	2	9	0.19	1.27	1.08	0.02
PP.06	Develop Preliminary Execution Plan	9	25	1.67	3.53	1.87	0.04
SD.02	Develop Utilities and Offsite Scope	7	22	1.22	2.88	1.67	0.03
TP.03	Obtain License Agreements	2	4	7.97	1.76	-6.21	0.01
External	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.10	Define Start-Up Requirements	4	12	0.94	3.98	3.05	0.01
PP.05	Address Quality & Safety Issues	4	13	1.61	3.44	1.83	0.04
PP.06	Develop Preliminary Execution Plan	5	13	2.19	4.78	2.60	0.03
PP.07	Compile Project Scope	5	15	3.64	6.96	3.32	0.01

Table 5.4 identifies the findings when the success criterion was whether “Information was Readily Available” for the activity. There were seven significant findings identified in Table 6.4 that were found to have differing means. Additionally, all values in the ‘Yes’ sample were higher than the ‘No’ sample. These findings indicate that more time and resources were expended on these activities to insure that all information was readily available, or to gather and process the required information.

Table 5.4 Information Availability as a Success Criterion

Duration	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
PP.06	Develop Preliminary Execution Plan	20	19	2.46	3.87	1.42	0.03
Owner	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
BP.09	Develop Labor Plan & Human Resource Issues	14	28	2.05	3.57	1.52	0.03
PP.06	Develop Preliminary Execution Plan	18	20	2.07	4.06	1.99	0.01
PP.07	Compile Project Scope	16	29	3.37	8.18	4.80	0.00
External	Activity Name	Sample Size "No"	Sample Size "Yes"	Mean "No"	Mean "Yes"	Difference Yes-No	P-Value
PP.05	Address Quality and Safety Issues	7	13	1.49	3.40	1.90	0.03
PP.07	Compile Project Scope	10	14	3.93	7.10	3.17	0.02
SD.01	Process & Facility Planning	7	7	1.91	7.58	5.67	0.03

When all five tables are analyzed together, two common trends are identified. The first finding implies that the sample sizes for the ‘Yes’ sample exceeds the sizes of the ‘No’ sample. This may result from bias on behalf of the survey respondent. In other words, the survey respondent may have been reluctant to identify that the project was not a success. As a result, the majority of the data values are in the ‘Yes’ sample. The other finding is that there is a small amount of data values in the external resources expended for both ‘Yes’ and ‘No’ samples. This may have resulted from two possibilities. First implies that since front end planning is primarily an owner driven activity, then there would be minimal external resource input. Another factor is that the survey respondent may have misunderstood the meaning of the term ‘external’, and did not assign data values to that section. Additional interpretations and comments on the findings are presented in Chapter VIII.

Execution Difference Analysis

Recall the four questions asked for each of the 33 information exchange activities:

1. Was the task successfully executed?
2. Was the task unusually complex?
3. Was the task executed efficiently?
4. The information, documents, and data requirements were readily available for this activity?

The potential answers to these questions were assigned the following ranks: 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, 6 – Not Applicable. However, when the data was first analyzed, there was insufficient numbers in ranks 1 and 2. As a result, it was determined that a new ranking system would replace the one previously mentioned. This new ranking is as follows: 1 – Strongly Disagree, Disagree, and Neutral, 2 – Agree and Strongly Agree, and 3 – Not Applicable. The values in category one do not imply the project failed. Rather, since the surveyor did not answer agree or strongly agree, then this indicates room for improvement. Thus, these were grouped into less successful.

The survey respondents were asked a series of questions regarding the success criteria. These objectives were assigned the following mark: 1 – Objective Met, 2 – Objective Not Met. Based upon this information, the research was able to statistically identify whether an association between the success criteria and the four questions for each activity existed. As previously identified, a Two-Way Frequency test was performed to identify this association. A confidence level of 95% ($\alpha = 0.05$) was used. Any P-Values of 0.05 or less was identified to show an association. This value was used to reduce the possibility of having a Type I Error. It was determined that it was more important not to identify associations between the success criterion and the questions when there were actually none.

The findings from this analysis is presented in Appendix G. An example is included in Table 6.6 - Abridged Fisher's Exact Test Findings for Business

Drivers and Four Questions. Analysis of the tables identified an association between certain activities with specific questions for the success criteria. An analysis was performed for each of the success criteria previously mentioned herein this research report. For statement one (Was the activity successfully executed?), all the activities that indicated an association, regardless of the success criterion analyzed, found the successful projects answering the same to the question. Similarly, all less successful projects mostly answered the same to the same questions. As a result, when the success criteria was achieved, this activity was successfully executed.

Question two (Was the activity unusually complex?) indicated similar results. All findings indicated that more data values existed in the table field where the success criterion was met and the task was not usually complex. Thus, these activities, when the success criterion was met, were not complex. This may indicate that the complexity of these activities may have an impact upon achieving specific objectives.

The third question (Was the task executed efficiently?) and statement four (Was all the information, documents, and data requirements were readily available for this activity?) had findings similar to that of statement one. All findings indicated reveal that the majority of the data values are represented where the success criterion was met and the question was answered 'Yes'. For statement three, this indicates that these activities were executed efficiently when the specific objective was met. Similarly, statement four revealed that the

activities had all the information needed when executed when the objective was met.

Table 5.5 Abridged Fisher's Exact Test Findings for Business Drivers and Four Questions

Business Objectives			
Q1 - Was the task successfully executed?			
Activity	Name	P value	Question
BP.11	Risk Mitigation Analysis	0.05	Success
			Criteria No Yes Total
			No 4 8 12
			Yes 2 28 30
			Total 6 36 42
Q2 - Was the task unusually complex?			
Activity	Name	P value	Question
PP.03	Complete Preliminary Estimates	0.02	Success
			Criteria No Yes Total
			No 2 10 12
			Yes 19 13 32
			Total 21 23 44
PP.06	Develop Preliminary Execution Plan	0.01	Question
			Success
			Criteria No Yes Total
			No 1 10 11
			Yes 16 11 27
			Total 17 21 38
PP.07	Compile Project Scope	0.04	Question
			Success
			Criteria No Yes Total
			No 2 9 11
			Yes 18 14 32
			Total 20 23 43

Table 5.5 Abridged Fisher's Exact Test Findings for Business Drivers and Four Questions "Continued"

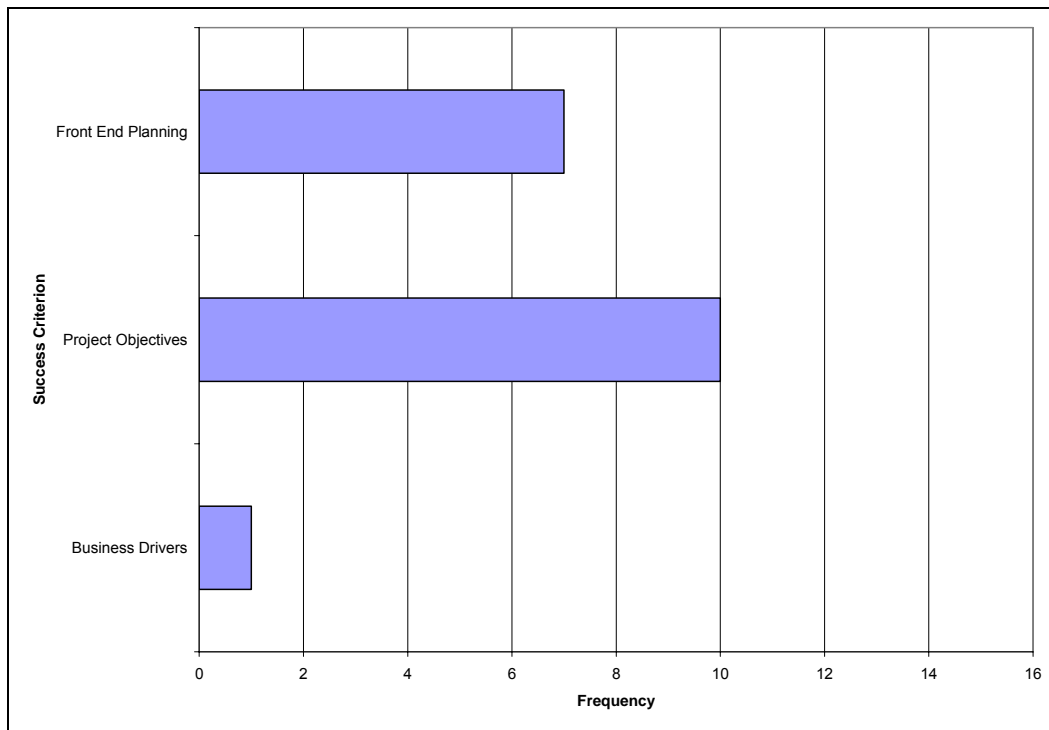
Business Drivers			
Q3 - Was the task executed efficiently?			
Activity	Name	P value	Question
PP.02	Formulate Preliminary Organization	0.02	Success
			Criteria No Yes Total
			No 4 5 9
			Yes 2 27 29
			Total 6 32 38
PP.08	Develop Startup Plan	0.03	Question
			Success
			Criteria No Yes Total
			No 8 4 12
			Yes 8 21 29
			Total 16 25 41
Q4 - Was information readily available?			
Activity	Name	P value	Question
PP.01	Develop Preliminary Design Criteria, Including PFDs & P&IDs	0.04	Success
			Criteria No Yes Total
			No 8 4 12
			Yes 8 20 28
			Total 16 24 40
PP.07	Compile Project Scope	0.03	Question
			Success
			Criteria No Yes Total
			No 7 4 11
			Yes 8 24 32
			Total 15 28 43

These findings indicate that successful projects executed certain activities differently than less successful projects. For example, when front end planning effectiveness is used as the success criterion, 21% of the activities for successful projects indicated an association that they were successfully executed. In addition, 45% of the activities with an association were executed efficiently, and 12% had all the information requirements available when the success criterion was met. The findings above indicate an execution difference from successful and less successful projects. When the other success criteria are used the results are similar. The following sections identify the specific findings from each of the four success criteria.

Question One: Was the Task Successfully Executed

The findings identified in the analysis of question one with the different success criteria are identified in Figure 5.1. The frequency identifies the number of activities that indicated an association with question one and the success criterion. As shown in the figure, front end planning identified seven activities with an association, project objectives had the most with ten, and business drivers only had a single activity that indicated an association.

Figure 5.1 Frequency of Question One with Different Success Criterion



Further analysis of the findings indicated that many information flow activities with an association with one success criterion indicated an association for more than one success criterion. Six activities identified through statistical analysis were found to have an association with the question and two of the success criterion. These information flow activities are as follows:

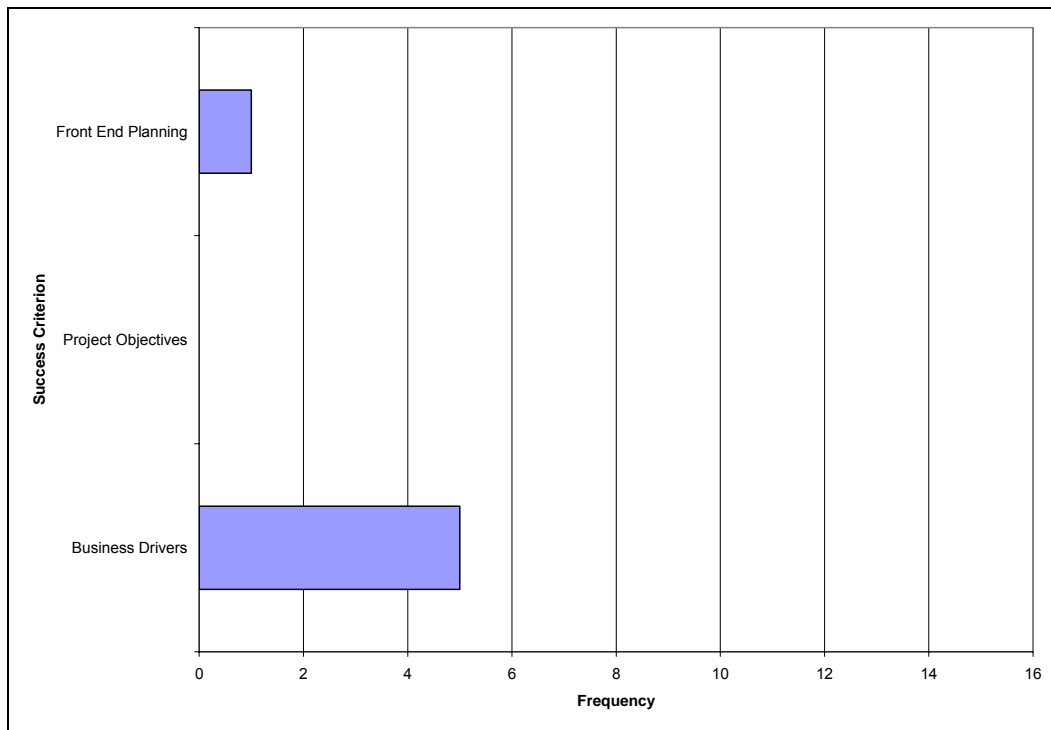
- PP.03 – Complete Preliminary Estimates
- PP.04 – Establish Master Project Schedule
- PP.06 – Develop Preliminary Execution Plan
- PP.07 – Compile Project Scope
- SD.01 – Process and Facility Planning
- SD.05 – Detail Work Breakdown Structure

The findings for this question found that nearly all activities that identified an association indicated that successful projects answered the same. The activities indicating an association with the question indicated that nearly all successful projects answered 'Yes' to these questions. Similarly, nearly all the projects that failed to attain the success criterion answered the same for the question. Based upon these findings from the data, projects that attained the success criterion executed front end planning differently than those that did not.

Question Two: Was the Task Unusually Complex

When question two was analyzed, it was identified that few statistical associations existed between the success criterion and the question. Figure 5.2 illustrates the number of activities with an association with the success criterion and question two. Business drivers had the most activities with five, front end planning had one activity, and no activities were identified when project objectives was the success criterion.

Figure 5.2 Frequency of Question Two with Success Criterion



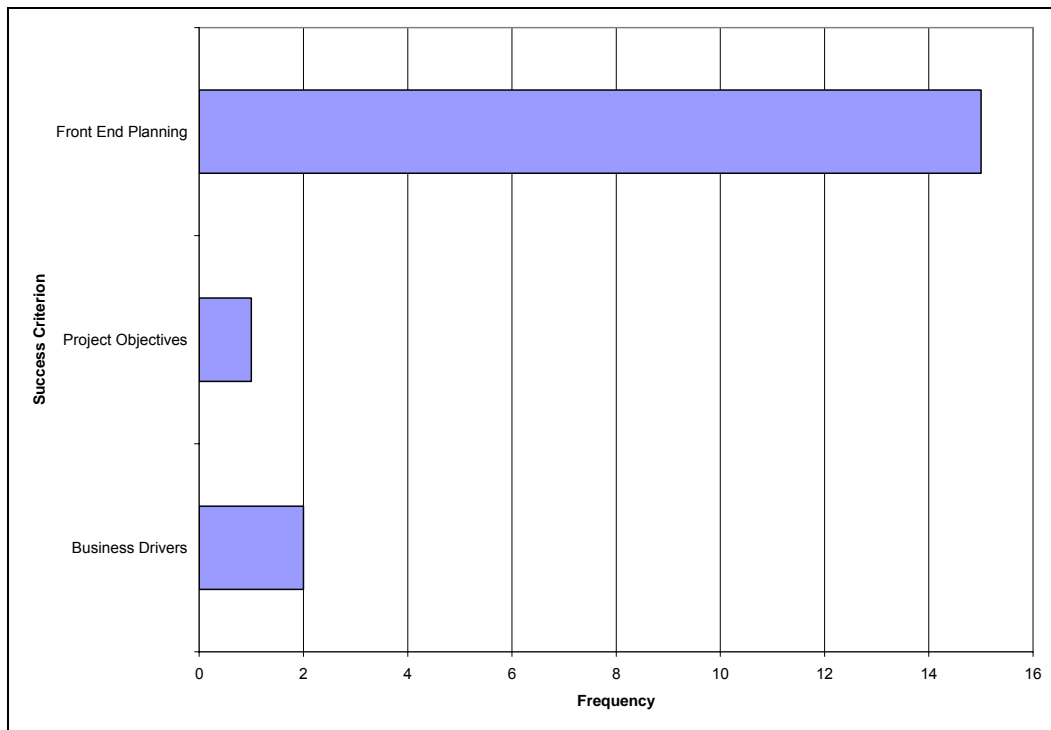
The findings for this question found that nearly all activities that identified an association indicated that successful projects answered the same for the questions. Activities indicating an association found that the successful projects answered 'No' to this question; indicating that the activities were not complex. Similarly, nearly all the projects that did not meet the success criterion answered the same for the question; indicating that the activity was complex. Based upon these findings, projects that met the project objectives executed front end planning differently than projects that did not.

Question Three: Was the Task Executed Efficiently?

The findings identified in the analysis of the question three with the different success criteria is identified in Figure 5.3. The frequencies in the figure identify the number of information flow activities that have an association with question three. Fifteen activities were identified when front end planning was the success criterion. This indicates that 45% of the information flow activities indicated an association when front end planning is the success criterion. Business drivers and project objectives only identified two activities, project objectives had only one activity, and only two activities were identified when business drivers was the success criterion.

Further analysis of the findings indicated that many activities with an association with one success criterion indicated an association for more than one success criterion.

Figure 5.3 Frequency of Question Three with Success Criterion

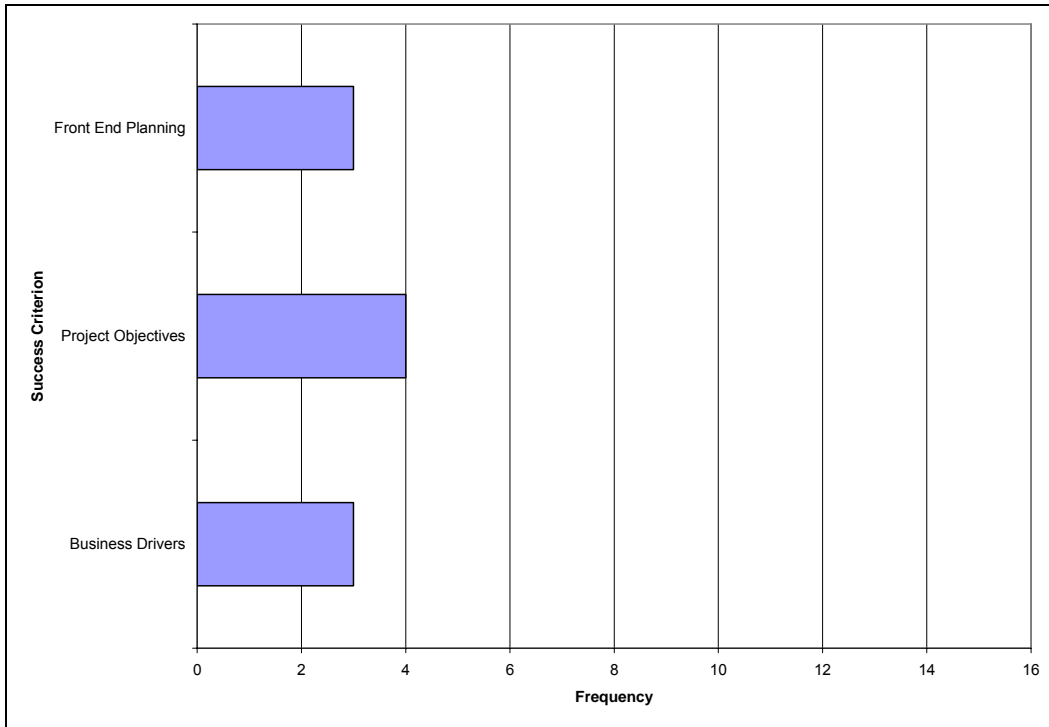


The findings for this question found that nearly all activities that identified an association indicated that successful projects answered the same for all the question. The activities indicating an association with the question indicated that nearly all successful projects answered ‘Yes’ to these questions. Similarly, nearly all the projects that did not attain the success criterion answered the same for the questions. Based upon these findings from the data, projects that attained the success criterion executed these specific activities more efficiently than less successful projects.

Question Four: Was all the Information, Documents, and Data Requirements were Readily Available for this Activity?

Figure 5.4 identifies the number of information flow activities that indicated an association with question four. Project objectives had four activities while front end planning and business drivers both had three activities each.

Figure 5.4 Frequency of Question Three with Success Criterion



Additional analysis of the activities indicating an association with question four identified that only three activities had an association with more than one success criteria. BP.04 and PP.07 had an association with two of the success criteria. These two were project objectives and front end planning for BP.04 and business drivers and project objectives for PP.07.

The findings indicated that nearly all projects that identified an association indicated that successful projects answered the same for the question. The activities indicating an association indicated that nearly all successful projects answered 'Yes' to the question. Similarly, nearly all the non-successful projects answered nearly the same for the question. Based upon these findings from the data, projects that were successful executed front end planning differently by having all the required information available when needed.

Additional Findings

An additional analysis was performed on the findings identified by the Execution Difference Analysis. It was identified that there were 12 potential chances that an activity could be found to have an association (three for question one, three for question two, three for question three, and three for question four). As a result, each information flow activity that indicated an association was further analyzed to determine the total number of times it was identified.

Further analysis revealed that there were information flow activities that reappeared in the findings. This analysis was performed by reviewing the findings for the Execution Difference Analysis and determining which activities were found to be identified as statistically significant more often. As stated, there were a total of twelve times a particular activity could indicate an association (three success criteria asked against the four questions). These information flow activities are as follows:

- SD.01 – Process and Facility Planning appears in 42% of the findings

- PP.06 – Develop Preliminary Execution Plan appears in 42% of the findings
- PP.07 – Compile Project Scope appears in 50% of the findings
- PP.03 – Complete Preliminary Estimates appears in 33% of the findings
- SD.05 – Detail Work Breakdown Structure appears in 25% of the findings

Execution Difference Analysis Conclusions

Table 5.6 provides an overview of the significant findings from the Execution Difference Analysis. The findings in this table illustrate that the number of statistical associations differs depending upon the success criterion. This indicates a difference in the execution of front end planning between the four success criteria.

The “X” on the right side of the table identify the statistical association with the success criterion and the specific question. Business drivers provided the least amount of associations with eleven. Project objectives identified fifteen associations. However, front end planning had the largest number of statistical associations with 26. Since front end planning is designed to fulfill the business and project objectives, this may be the source of the high number of associations. Front end planning was identified by the research team as the success criterion to pursue for any significant conclusions and recommendations identified by this research report. This resulted from previous research indicating that if front end planning is executed efficiently and efficiently, then the remaining objectives will have a higher probability of being satisfied.

When analyzing each of the findings from the Execution difference analysis, it was found that the majority of the survey responses for the four questions were almost identical for successful projects. It was found that successful projects, for the majority, found each information flow activity to be successfully executed, not unusually complex, executed efficiently, and all the information requirements available. Similarly, all the less-successful projects, for the majority, indicated survey responses opposite to the successful projects. This indicates that a key difference in execution strategies exists between successful and less successful projects.

Table 5.6 Frequency of Statistical Associations for Execution Difference Analysis

Activity	Description	Business Drivers				Project Objectives				Front End Planning			
		Association				Association				Association			
		Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
BP.01	Define Business Objectives							X				X	
BP.02	Identify/Select Project Alternatives											X	
BP.03	Conduct Market Research and Analysis											X	
BP.04	Establish Image and Public Relations								X				X
BP.05	Finalize Project Alternative												
BP.06	Address Regulatory Issues					X				X			
BP.07	Develop Funding Plan					X						X	
BP.08	Raw Material Sourcing/Source Building Materials											X	
BP.09	Develop Labor Plan and Address Human Resource Issues												
BP.10	Define Start-Up Requirements												
BP.11	Risk Mitigation Analysis	X										X	X
BP.12	Refine Public Relations												
CS.01	Develop Contract Strategy												
CS.02	Develop Bid Package Scope												
CS.03	Review Potential EPC Contractor Bidders												
CS.04	Select EPC Contractor Team												
PP.01	Develop Preliminary Design Criteria, Including PFDs and P&IDs				X								
PP.02	Formulate Preliminary Organization			X		X						X	
PP.03	Complete Preliminary Estimates		X			X				X		X	
PP.04	Establish Master Project Schedule					X				X		X	
PP.05	Address Quality and Safety Issues					X							X
PP.06	Develop Preliminary Execution Plan		X			X			X	X		X	
PP.07	Compile Project Scope		X		X	X			X	X		X	
PP.08	Develop Startup Plan			X									
SD.01	Process and Facility Planning		X			X				X		X	X
SD.02	Develop Utilities and Offsite Scope											X	
SD.03	Develop Environmental Scope								X				
SD.04	Develop Site Plan												
SD.05	Detail Work Breakdown Structure		X			X							
TP.01	Conduct Technical Surveys and Process Analysis				X						X	X	
TP.02	Product Development/Identify Certification and Testing Procedures											X	
TP.03	Obtain License Agreements												
TP.04	Establish Security and Secrecy Agreement												

Duration/Resource and Execution Difference Analysis Finding's Conclusion

The complete findings from both analysis are provided in Table 5.7 when front end planning was the success criteria. This table provides all the values for both tests, and is designed to provide a high level review of the two data analysis findings. This table identifies the mean normalized values for the duration, internal resources, and external resources for both samples for all 33 activities. In addition, the table identifies whether the mean values were significantly different from one another. The last four columns identify whether an association existed between the four question and the activity. An 'X' indicates an that the response to the specific question indicates the response to the success criteria question.

The table also identifies those activities that were found to be statistically different between successful and less successful projects. Additionally, the information flow activities that indicated an association with the success criteria regarding front end planning effectiveness and efficiency are also identified in the table. The planning team can determine if these activities are applicable to their specific project, and ensure that care be utilized during the execution of these activities.

Table 5.7 Complete Findings from Data Analysis when Front End Planning is the Success Criterion

		Front End Planning as Success Criteria									Association			
Activity	Description	Duration			Internal Resources			External Resources			Q1	Q2	Q3	Q4
		Mean Less Successful	Mean Successful	Significantly Different	Mean Less Successful	Mean Successful	Significantly Different	Mean Less Successful	Mean Successful	Significantly Different				
BP.01	Define Business Objectives	6.30	4.42	NO	5.09	5.38	NO	6.97	14.23	NO			X	
BP.02	Identify/Select Project Alternatives	5.95	4.25	NO	5.62	3.63	NO	4.84	6.89	NO			X	
BP.03	Conduct Market Research and Analysis	3.54	2.86	NO	4.26	2.77	NO	4.61	3.78	NO			X	
BP.04	Establish Image and Public Relations	0.98	3.40	YES	0.84	3.50	YES	0.00	3.39	NO				X
BP.05	Finalize Project Alternative	2.83	2.27	NO	3.08	2.96	NO	7.20	3.88	NO				
BP.06	Address Regulatory Issues	4.19	2.77	NO	4.05	2.75	NO	3.83	6.02	NO	X			
BP.07	Develop Funding Plan	5.61	5.44	NO	5.35	4.64	NO	14.63	8.35	NO			X	
BP.08	Raw Material Sourcing/Source Building Materials	2.08	2.47	NO	1.74	2.47	NO	2.98	3.67	NO			X	
BP.09	Develop Labor Plan and Address Human Resource Issues	4.27	2.39	YES	3.88	2.85	NO	2.66	1.82	NO				
BP.10	Define Start-Up Requirements	2.29	3.11	NO	2.08	2.93	NO	0.94	3.99	YES				
BP.11	Risk Mitigation Analysis	1.83	2.20	NO	2.11	2.09	NO	2.09	1.28	NO			X	X
BP.12	Refine Public Relations	1.08	1.35	NO	0.19	1.27	YES	0.00	1.41	NO				
CS.01	Develop Contract Strategy	2.50	3.19	NO	2.76	3.19	NO	1.29	1.00	NO				
CS.02	Develop Bid Package Scope	3.36	2.84	NO	4.11	3.55	NO	5.38	3.86	NO				
CS.03	Review Potential EPC Contractor Bidders	1.42	1.80	NO	1.53	2.07	NO	1.74	1.96	NO				
CS.04	Select EPC Contractor Team	1.52	1.29	NO	2.39	1.34	NO	2.03	1.36	NO				
PP.01	Develop Preliminary Design Criteria, Including PFDs and P&IDs	6.03	6.09	NO	6.22	6.14	NO	10.36	11.15	NO				
PP.02	Formulate Preliminary Organization	1.17	1.40	NO	1.15	1.46	NO	3.30	2.03	NO			X	
PP.03	Complete Preliminary Estimates	4.36	6.20	NO	4.37	7.09	NO	7.28	9.51	NO	X		X	
PP.04	Establish Master Project Schedule	3.40	3.69	NO	3.15	3.01	NO	3.23	4.25	NO	X		X	
PP.05	Address Quality and Safety Issues	2.06	3.02	NO	1.38	2.05	NO	1.61	3.44	YES				X
PP.06	Develop Preliminary Execution Plan	2.04	3.69	YES	1.67	3.53	YES	2.19	4.78	YES	X		X	
PP.07	Compile Project Scope	6.07	4.72	NO	6.03	6.76	NO	3.64	6.96	YES	X		X	
PP.08	Develop Startup Plan	2.04	1.83	NO	1.99	1.79	NO	1.77	2.82	NO				
SD.01	Process and Facility Planning	5.28	3.93	NO	2.84	3.47	NO	3.23	5.41	NO	X		X	X
SD.02	Develop Utilities and Offsite Scope	2.31	2.92	NO	1.22	2.88	YES	3.10	6.36	NO			X	
SD.03	Develop Environmental Scope	2.52	2.53	NO	1.84	2.67	NO	1.90	2.04	NO				
SD.04	Develop Site Plan	4.68	4.39	NO	2.81	4.00	NO	7.56	5.79	NO				
SD.05	Detail Work Breakdown Structure	2.27	2.45	NO	1.68	2.36	NO	4.34	3.01	NO				
TP.01	Conduct Technical Surveys and Process Analysis	2.98	3.98	NO	2.89	4.38	NO	6.30	5.34	NO		X	X	
TP.02	Product Development/Identify Certification and Testing Procedures	3.11	2.47	NO	1.23	2.16	NO	4.61	4.27	NO			X	
TP.03	Obtain License Agreements	5.63	2.13	NO	7.97	1.76	YES	4.52	2.71	NO				
TP.04	Establish Security and Secrecy Agreement	0.00	0.00	NO	0.00	0.00	NO	0.00	0.00	NO				

Out of the potential 99 information flow activities (33 activity mean values for the three categories duration, internal resource expenditure, & external resource expenditure), 12% of the activities were significantly different when comparing findings between successful and less successful projects. Of these significant findings, 83% of the mean normalized values were larger on successful projects versus the less successful. These values indicate that successful projects generally spent more time and resources on front end planning than less successful or neutral projects.

The findings identified in the Execution Difference Analysis indicated that successful projects answered differently than less successful projects. The majority of the successful projects indicated that the activities were executed efficiently, were successfully executed, were not complex, and had all the information requirements available. Similarly, the less successful projects identified the opposite; certain activities were not efficient, not executed successfully, were unusually complex, and did not have all of the required information.

Based upon these findings, it can be said that projects in this data set that met specific success criterion executed front end planning differently than those that did not. From the data analysis findings, successful projects generally:

- Spent more time on front end planning.
- Spent more internal resources on front end planning.
- Spent more external resources on front end planning.
- Executed the activities more efficiently.

- Executed the activities more successfully.
- Had activities that were not unusually complex.
- Had all the information requirements available when needed.

These findings are significant for the industry and confirm long held beliefs or suspicions. The findings above indicate that the projects used for the data analysis that met specific success criteria executed front end planning differently than those identified as less successful. However, they do not indicate that if the front end planning activities are executed in accordance with the above questions then the project will achieve the success criterion. Rather, they indicate a trend in the data that more successful projects had differing execution strategies than projects that were less successful. These differences include longer duration, more resources utilized, the information flow activities were successfully executed, executed efficiently, and had the necessary information requirements during front end planning.

Critical Activities in Front End Planning

Based upon the success criteria, the information flow activities were reviewed to identify if any were more critical than others to effective and efficient front end planning. For selection of these activities, a methodology was utilized and ultimately a consensus was reached by the research team. The following list identifies the selection criteria for these activities:

- The question regarding front end planning effectiveness and efficiency was used as the primary success criterion. This was chosen based upon previous research indicating that effective front end planning will improve the likelihood of improved project performance.

- The findings from the Duration/Resource Analysis, Execution Difference Analysis, and the answers to the four questions asked for each information flow activity were reviewed to identify any significant findings.
- Activities with a major difference in the mean values and/or having a small P-Value for the Execution Difference Analysis were identified and labeled as significant.
- The selected activities were presented to the CII research team to obtain a consensus that these activities are significant to effective and efficient front end planning.
- Six activities were ultimately selected as being critically important to effective and efficient front end planning.

The activities are listed in alpha-numeric order. The order they appear does not signify a hierarchal importance during the front end planning process. These activities were selected by consensus and are provided as recommendations only.

Each project planning team should review each of the 33 information flow diagram activities to determine which activities are critical to their specific project. The following sections identify the six critical information flow activities and presents reasons for their particular importance

BP.02 – Identify/Select Project Alternatives

BP.02 had a strong level of association (P-Value was 0.0003) with the question regarding the efficient execution of this activity (question three). In fact, this P-Value was one of the strongest identified in Execution Difference Analysis. This strongly indicates that when this activity is executed efficiently then there is an increased chance for project success.

Additional analysis of the four questions revealed the following in regards to the execution of the information flow activity:

- S01 – 75% of the projects successfully executed this activity
- S02 – 41% of the projects identified that this activity was unusually complex
- S03 – 33% of the projects stated that this activity was not executed efficiently
- S04 – 43% of the projects did not have all the information readily available

These findings indicate that almost one-half of the projects surveyed in this research report indicated this task was complex and not all the information was readily available. Additionally, BP.02 was not executed efficiently for one-third of the projects surveyed.

The large impact of this activity upon front end planning may result from its ability to steer the planning team in the wrong direction, or to cause the, “Wrong project to be constructed successfully.” Simply, if the wrong alternatives are identified, then all the effort succeeding this activity will be for naught. Therefore, it is important for this activity to be executed properly with all the information required.

BP.04 – Establish Image & Public Relations

BP.04 offers little information that is critical to the physical execution of the project. However, companies are realizing that having a positive public image is just as important as building a successful project. As a result, companies are

placing more labor hours and resources needed to adequately plan for a positive public relations plan.

BP.04 contains mean values that are significantly different for the duration and internal resources analysis. Successful projects spent more time than less successful projects; less successful projects devoted only 0.98% of their total duration to the this activity while successful projects devoted 3.40% of their total duration. In addition, successful projects utilized more internal resources than less successful; 3.50% for successful projects versus 0.08% for less successful projects.

There are no real significant findings in the analysis of the four questions in regards to percent 'Yes' versus percent 'No'. However, the Fisher's Exact Test (measure of association) identified that BP.04 was more successful when this activity had all the information readily available. As a result, it is important that this activity have all the necessary information and be executed adequately.

BP.10 Define Start-Up Requirements

With respect to successfully executing the front end planning process, successful projects devoted more external resources to the execution of this activity; 3.44% of the total duration for successful and 0.94% for the total duration for less successful. Inadequate planning for this activity may result in delays or unsatisfactory performance. The analysis of the four questions asked for each information flow activity identified interesting findings. These are as follows:

- S01 – 21% of the time the activity was not successfully executed
- S02 – 54% of the time the activity was unusually complex
- S03 – 31% of the time the activity was not executed efficiently
- S04 – 35% of the activities did not have all the information readily available

As identified earlier, successful projects devoted more time on this activity by a factor of four. Additionally, more than one-half of the projects identified this activity as being complex. This may result from successful planning teams identifying the importance of this activity. The large difference in duration between successful projects and less successful projects indicates that planning teams spend the necessary time on this activity to increase the possibility for increased project performance. Additionally, this activity may impact project success if the start-up requirements are not identified prior to actual start-up, then many problems may arise that result in a less successful projects.

PP.05 Address Quality and Safety Issues

Successful projects devoted more external resources to this activity with respect the successfully executing the front end planning process. Successful projects utilized 3.98% of the external resources for this activity while less successful projects only utilized 1.61%. From the Execution Difference Analysis, information was more likely to be available for the more successful projects. This indicates that this activity may be critical to front end planning. As a result, front end planners need to pay more attention to the execution of this activity.

Analysis of the four questions identified the following:

- S01 – 12% of the time the activity was not successfully executed
- S02 – 35% of the time the activity was unusually complex
- S03 – 24% of the time the activity was not executed efficiently
- S04 – 27% of the activities did not have all the information readily available

The impacts of this activity upon front end planning may result from the negative influence on the project that results from poor quality and safety.

Additionally, poor safety may result in increased indirect costs and negative publicity upon the project and the organizations involved in its construction.

Therefore, project planning teams need to spend time and resources to ensure that they properly plan for quality and safety issues.

PP.06 – Develop Preliminary Execution Plan

PP.06, no matter which way one examines the criteria, always contains a significant statistical value. For the duration analysis, successful projects spent 3.69% of the total duration while less successful projects only had a duration of 2.04% of the total. For internal resource utilization, successful projects utilized 3.53% and less successful only utilized 1.67%. Lastly, successful projects utilized more external resources (4.78%) than less successful projects (2.19%). Thus, it can be inferred that successful execution and information management with respect to this activity is critical to overall project success. Additional analysis of the four questions also revealed that PP.06 contained a large number

of statistical associations in the execution difference analysis. Further analysis of the four questions found the following:

- S01 – 20% of the time the activity is not successfully executed
- S02 – 45% of the time the activity is unusually complex
- S03 – 37% of the time the activity is not executed efficiently
- S04 – 39% of the time the activity does not have all the information requirements available

These values indicate that this activity is unusually complex half the time, not executed efficiently 1/3 of the time, and does not have all the information requirements available when need. Additionally, when the projects are not successful, this activity is executed in less time and has fewer resources advocated to its completion.

From the data mentioned above, it is not surprising that PP.06 is a significant activity during front end planning. This activity is extremely important for its completion results in the creation of the Project Execution Plan (PEP), and is the final step in front end planning. The PEP is the plan by which the project will be executed, and if this plan is not created properly, the potential for project success is less. As a result, this activity needs to have resources allotted to its completion and it needs to be executed efficiently.

SD.02 Develop Utilities and Offsite Scope

With respect to successfully executing the front end planning process, successful projects devoted more owner resources (2.88%) to the execution of this activity than less successful projects (1.22%). Additionally, the findings from the

Execution Difference Analysis identified that successful projects executed this activity more efficiently than the less successful projects. This indicates that SD.02 may impact overall project success during front end planning. As a result, front end planners need to effectively execute this activity when planning projects to improve the likelihood of adequately planning projects.

The analysis of the four questions identified the following:

- S01 – 10% of the activities were not successfully executed
- S02 – 25% of the activities were unusually complex
- S03 – 24% of the activities were not executed efficiently
- S04 – 29% of the activities did not have all the information readily available

The impacts of this activity upon front end planning may result from poor construction and operability of the project. If the utilities scope is not properly planned, then there exists the potential to run into situations where the project may not receive the required utilities to successfully operate. As a result, the project will not function to its capacity and result in a less successful project. When project planning teams spend the time and resources to execute this information flow activity, then the required information needed to identify the required utilities and their origin for the project are identified. Poor planning may lead to assumptions that ultimately may prove false and result in a less successful project.

Follow-Up Survey I

A Follow Up Survey was conducted to obtain further information regarding the critical activities. Of the six critical activities identified, the comments identified data pertinent to five. No comments were documented for BP.02. The significant findings from the Follow Up Survey are presented in a table in Appendix H – Follow Up Survey One Comments. The purpose of the table is not to identify all the information needed to execute the activity successfully. Rather, this table identifies key comments from industry practitioners as to potential reasons why these activities were found to be time critical, information intensive, or otherwise process constraining. This table identifies information that is often overlooked when planning projects, and potential bottlenecks that may result in front end planning.

In general, the survey responses indicated that the following factors most impact the activities and it is recommended that care be paid to the information required for these entities: scope definition, risk identification and mitigation, resource allocation for task execution, clear definition of roles and responsibilities, and effective communication mechanisms. It appears that communications between the planning team and external entities such as the public key stakeholders and equipment suppliers are especially critical. These and other information flow issues may be more adequately addressed through a careful selection of persons participating in, or better represented within, the front end planning team.

The following sections identify key comments from Follow Up Survey one. Recall, there is no information for BP.02.

BP.04 – Establish Image and Public Relations

From the Follow Up Survey, it was identified that community involvement was the critical information needed to execute this activity. Often, this information can be obtained from surveys and community meetings. Additionally, the Follow Up Survey identified that the information most often found to be missing for this activity is who the key stakeholders are, what the public relations budget is, and what the public relations plan is.

The Follow Up Survey also identified that during this activity, more focus should be utilized on identifying the public relations area and alignment of the public relations plan with corporate and project goals. The reasons identified for potential causes for these tasks's inefficiency are not involving the stakeholders in the project, having a poor public relations plan, failure to understand the culture where the project will be located, and only focusing on positive impacts from the projects.

BP.10 – Define Start-Up Requirements

The critical information to execute BP.10 is the specific start-up objectives of the project, the start-up plan, and input from the operating and maintenance personnel who will operate the project when completed. Similarly, the

information most often missing during the execution of this activity is key data from the vendors and stakeholders and an insufficient start-up plan.

For BP.10, the Follow Up Survey identified that there were tasks that require more focus. These tasks are the identification of the start-up objectives, acquiring operations and maintenance input, and review of the start-up plan. Additionally, the survey identified that insufficient attention early in the project, a poor start-up plan, lack of resources, and no key stakeholder input are potential causes for this activity to be executed inefficient.

PP.05 – Address Quality and Safety Issues

The critical information for this activity are the identification of the safety goals, the safety/quality plan, and input from the workers. Additionally, the Follow Up Survey identified that the information most often not available during this activity are the local safety requirements, the client's safety requirements, and the conditions of the site.

The tasks that were identified that require more focus during execution are the identification of the safety goals, the development of the safety/quality plan, review of local requirements and conditions, and gathering worker input. In addition, potential causes for inefficiency results from poor resource allocation, the safety/quality expectations not clearly defined, lack of time for thorough site investigations, and lack of knowledge of the corporate policy on safety/quality.

PP.06 – Develop Preliminary Execution Plan

The preliminary execution plan is the final information flow activity in front end planning. As a result, all the information generated in the process is accumulated in the plan. However, the Follow Up Survey identified that there is still critical information in the plan. The survey identified that the areas of execution risk are important since they define potential issues up front and a mitigation plan to resolve those issues. Additionally, it was identified that incomplete scope definition, vendor data, and a clear definition of roles and responsibilities are often missing from the preliminary execution plan.

The survey identified that there were tasks that require more focus. These tasks include the identification of execution risk, creation of risk mitigation alternatives, and the execution of the project execution plan. Similarly, the survey identified that potential causes for inefficiency were unrealistic schedules, poor scope definition, lack of resources, and a poor risk mitigation plan.

SD.02 – Develop Utilities and Offsite Scope

The development of preliminary utilities and offsite scope is often overlooked during front end planning. However, the Follow Up Survey identified that this information flow activity is very important. Critical information from this activity is the process/equipment utilities requirements. Additionally, the information most often missing during execution are the right of way requirements, stakeholder involvement, and estimates of the requirements.

There was only one task identified that required more focus. This task was the determination of the process/equipment requirements. However, the survey identified many potential causes for execution inefficiency. These are poor communication of the user's requirements, lack of a conceptual design, and having poor vendor data.

Follow Up Survey II

The objective of the second Follow Up Survey was to have additional industry practitioners review the micro level logic diagrams and the information flow tables for the six critical activities identified previously. The survey respondents were asked to review each of the documents, and answer 'Yes' or 'No' to the questions. Recall the questions asked on the survey:

- Are the tasks on the diagrams comprehensive of the steps needed to execute this activity?
- Does the table correctly depict the flow of information through this activity?
- Does the information listing (documents and data) adequately identify the information needed to execute this activity?

A total of ten Follow Up Surveys were received from the industry. Each of the answers regarding the information flow activities was analyzed to determine that validity of the diagrams and tables. The following identifies the results from Follow Up Survey two:

- BP.02 – Identify/Select Project Alternatives
 - 100% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 80% state the table correctly depicts the flow of information.

- 80% state the information listing adequately identifies the information requirements
- BP.04 – Establish Image and Public Relations
 - 90% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 90% state the table correctly depicts the flow of information.
 - 90% state the information listing adequately identifies the information requirements
- BP.10 – Define Start-Up Requirements
 - 80% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 80% state the table correctly depicts the flow of information.
 - 70% state the information listing adequately identifies the information requirements
- PP.05 – Address Quality and Safety Issues
 - 100% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 90% state the table correctly depicts the flow of information.
 - 70% state the information listing adequately identifies the information requirements
- PP.06 – Develop Preliminary Execution Plan
 - 90% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 100% state the table correctly depicts the flow of information.
 - 80% state the information listing adequately identifies the information requirements
- SD.02 – Develop Utilities and Offsite Scope
 - 60% state the diagrams are comprehensive of the steps needed to execute this activity.
 - 80% state the table correctly depicts the flow of information.
 - 80% state the information listing adequately identifies the information requirements

The results of the Follow Up Survey two indicate that the diagrams and the tables adequately depict the tasks and information requirements necessary to execute front end planning. Only the critical activities were used for this survey because they were identified as being critically important to effective execution of

front end planning, and many recommendations were made from these information activities.

The lowest value was 60% for the question related to the micro level diagram for activity SD.02. However, many comments added by the survey respondent were very project specific. It was determined that these comments were applicable to a few projects and were not integrated into the micro level diagrams. This results from the objective of the diagrams to identify the tasks and information requirements for a general EPC project. It is recommended that each planning team modify the diagrams to account for their specific project. Thus, despite the lower value of survey responses indicating the diagrams are correct, the diagrams were not significantly modified.

CHAPTER VI

LOGIC DIAGRAMS

Introduction

An important objective of this research was to identify the information requirements for front end planning. The term requirements, for this research, is defined as the information needed and generated during the execution of front end planning. To accomplish this objective, it was determined that a logic diagram identifying the information flow activities would be necessary. The information flow activities diagram is a graphical representation of the activities that generate and utilize information within the front end planning process. In addition, the logic flow of the tasks necessary to execute an information flow activity was generated for each of the 33 activities. These diagrams are referred to as micro level diagrams.

In addition to the information flow activities diagram, a detailed diagram depicting the flow of information through front end planning was developed. The information flow diagram identifies the information requirements needed prior to and during execution of an information flow activity within the front end planning process. The diagram also identifies where the information is generated, utilized, or created once the specific activity is completed.

The information flow diagram can be considered a logical precedence of the flow of information within each information flow activity. The creation of the

information flow diagrams was done in two phases. Phase I was the identification of the information flow and information requirements for each of the micro level tasks. Recall that tasks are the steps that comprise the information flow activities within front end planning. Phase II was the creation of diagrams to identify the information flow within front end planning. These are aptly named the information flow diagrams. The following sections identify the logic diagrams generated by this research project.

Information Flow Activities Diagram

The literature review identified that previous research was conducted on the activities that comprise front end planning for a typical EPC project (CII, 1998) (Moreau, 1997). During this review period, new information flow activities were created, existing activities were customized, and the logic flow was modified to generate the information flow activities for front end planning. These changes included adding BP.11 and BP.12. Ultimately, the final product was the modified EPC front end planning information flow activities diagram. This diagram can be viewed in its entirety in Appendix.

There are two tiers of detail associated with the information flow activities diagram. Tier one identifies the five primary phases of the front end planning process. These phases, when executed effectively, account for the major items needed within the preliminary project execution plan, and are as follows:

- Business Plan
- Contract Strategy

- Project Execution Plan
- Facility Scope Plan
- Product Technical Plan

Each activity included on the information flow diagram is associated with an activity code. This code was modeled after the initial coding used by the CII (1997). For example, the Business Planning phase is coded 'BP' for tier one. All subsequent code elements are followed by periods. Each activity found in tier two under Business Planning phase has 'BP' as its first code element, then numbered. For example, Define Business Objectives is the first tier two activity under Business Planning. The code denoted for this activity is 'BP.01'. These codes are not intended to indicate the execution order of the phase two activities. Rather, these codes help to identify the activities. Table 6.1 identifies the 33 information flow activities and the phase in which the activities belong.

There are milestones depicted on the diagram to indicate the progressions through the planning process. As there is no information flow associated with these milestones, they are not identified as a step within front end planning. Tier two is an expansion of the primary phases and creates the list of all the information flow activities. In total, there are 33 information flow activities associated with the information flow activities diagram.

Table 6.1 Information Flow Activity List

BP Business Plan

- BP.01 Define Business Plan
- BP.02 Identify/Select Project Alternatives
- BP.03 Conduct Market Research and Analysis
- BP.04 Establish Image and Public Relations
- BP.05 Finalize Project Alternative
- BP.06 Address Regulatory Issues
- BP.07 Develop Funding Plan
- BP.08 Raw Material Sourcing/Source Building Materials
- BP.09 Develop Labor Plan and Address Human Resource Issues
- BP.10 Define Start-Up Requirements
- BP.11 Risk Mitigation Analysis
- BP.12 Refine Public Relations

CS Contracting Strategy

- CS.01 Develop Contract Strategy
- CS.02 Develop Bid Package
- CS.03 Review Potential EPC Contractor Bidders
- CS.04 Select EPC Contractor Team

PP Project Execution Plan

- PP.01 Develop Preliminary Design Criteria, Including PFD's and P&ID's
- PP.02 Formulate Preliminary Organization
- PP.03 Complete Preliminary Estimates
- PP.04 Establish Master Project Schedule
- PP.05 Address Quality and Safety Issues
- PP.06 Develop Preliminary Execution Plan
- PP.07 Compile Project Scope
- PP.08 Develop Start-Up Plan

SD Site Development Plan

- SD.01 Process and Facility Planning
- SD.02 Develop Utilities and Offsite Scope
- SD.03 Develop Environmental Scope
- SD.04 Develop Site Plan
- SD.05 Detail Work Breakdown Structure

TP Technical Plan

- TP.01 Conduct Technical Surveys and Process Analysis
- TP.02 Product Development/Identify Certification and Testing Procedures
- TP.03 Obtain License Agreements
- TP.04 Establish Security and Secrecy Agreement

Tier One Definitions

The Business Planning phase, or strategic planning, involves the goals and objectives of a business entity (Gibson et al. 1993). This phase provides a comprehensive structure to identify the business objectives of the company, and to ensure that the project(s) is in line with these objectives.

The Contracting Strategy activities are comprised of the steps needed to identify the contract strategy to execute the project if executed. This plan reviews the business and project objectives, identifies any partnerships the company is involved with, and selects an EPC contractor or creates a list of potential bidders for execution of the project.

The Project Execution Plan phase results in the creation of the project execution plan, or PEP. The PEP is a detailed plan identifying how the project will be executed once approved. The initial estimate, initial schedule, and safety plan are created under this phase. Additionally, the project scope and the start-up plan is compiled.

The Facility Scope Plan results in the identification of necessary components needed during the design phase (which initiates after front end planning). The scope of work for the facility and process are documented. Additionally, utility requirements are identified, the governmental environmental restrictions documented, and formation of the initial site plan is completed. Lastly, the work breakdown structure (WBS) is created.

The last Tier One category is identified as the Product Technical Plan. This category identifies the technical requirements of the project and includes the

identification of license agreements, testing procedures, and any security/secretcy requirements that may be needed for the project. This phase is executed more on industrial projects, but has applicability to other types of construction.

Milestones are used to measure the progress through the front end planning process. Even though they do not indicate a specific phase, they are critical. As a result, these events were coded in the order they appear on the diagram. The first code element is 'M', then followed by their order which they appear on the logic diagram (start to finish). For example, Process Start is the first milestone, and it is coded, 'M1'. The baseline model was utilized for the definitions of the milestones. Additionally, the team collectively determined the location for the milestones.

The descriptions of the activities that comprise front end planning are identified in Table 6.2. Some of the descriptions were taken from Moreau's research (2000). However, some of the definitions were generated by this dissertation. The new information flow activities were previously identified herein this research report.

Table 6.2 Information Flow Activities and Descriptions

Activity	Description
BP.01 – Define Business Objectives	Identification and prioritization of specific corporate business related objectives pertaining to the development of a capital project.
BP.02 – Identify/Select Project Alternatives	Identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies.
BP.03 – Conduct Market Research and Analysis	Those activities required to initially determine whether a new facility, or plant expansion, is needed and corporately beneficial, and should be approved for project initiation. Pre-existing corporate information useful to the decision making, such as historical cost data and project performance histories, are made available.
BP.04 – Establish Image and Public Relations	Activities initiated to establish a positive corporate image in a project locale to improve public relations and to demonstrate the benefits of a proposed project to a local community, municipality, or governing body. Potentially negative project impacts are identified and corporate strategies appropriate to mitigate such impacts are formulated.
BP.05 – Finalize Project Alternatives	Selection of a final project site from among alternatives. Site selection is predicated on physical suitability, availability, cost, environmental considerations, and other related business objectives defined by the owner.
BP.06 – Address Regulatory Issues	Activities initiated to address regulatory issues and reporting requirements necessary for a project's development. Regulatory agencies may be at the local, state, or federal level of government. Required actions to ensure project compliance during the construction phase and during plant operations are identified and undertaken by the appropriate party.
BP.07 – Develop Funding Plan	Financial appropriation plan and timetable, or the authorized allocation of funds for a specific project as currently envisioned.

Table 6.2 Information Flow Activities and Descriptions “Continued”

Activity	Description
BP.08 – Raw Material Sourcing/Source Building Materials	The process of determining qualified sources of raw materials to support plant operations. Modes of delivery, scheduled quantities, cost, storage requirements, and other such issues are considered.
BP.09 – Develop Labor Plan and Address Human Resource Issues	Includes personnel administration and definition of administrative procedures. May include requirements for project staffing for all project phases and plant operation. Source of labor and adequacy of supply are determined. Human resource issues are evaluated to establish project policy.
BP.10 – Define Start-Up Requirements	The process of early definition and planning of plant start-up requirements to ensure smooth transition from the construction phase to plant operations.
BP.11 – Risk Mitigation Analysis	The process of identifying risk elements, severity, and frequency. This process also includes determining risk mitigation techniques for the project.
BP.12 – Refine Public Relations	Finalize public relations plan based upon which project alternative was selected.
CS.01 – Develop Contract Strategy	Identification of the major components in the engineering, procurement, and construction concerning responsibilities, scope, and costs to achieve the best overall project objectives
CS.02 – Develop Bid Package Scope	Identification of the major components of equipment procurement and construction concerning scope and responsibilities.
CS.03 – Review Potential EPC Contractor Bidders	The process of screening contractors by the project owner, according to a given set of criteria, in order to determine their competence to perform the work if awarded the contract. Includes approved bidders list-List of a group of Suppliers or Subcontractors that have been approved to provide bids or quotations for materials or services for a particular single package.
CS.04 – Select EPC Contractor Team	Selection of one firm or a team of firms for the actual engineering, procurement, and construction process.

Table 6.2 Information Flow Activities and Descriptions “Continued”

Activity	Description
PP.01 – Develop Preliminary Design Criteria, Including PFD’s and P&ID’s	Activities which provide general design criteria and project objectives used as the basis for developing the project design concept(s). After this process is complete, the design progresses to the level where detail design calculations and construction documentation can be begun.
PP.02 – Formulate Preliminary Organization	Development of senior management assignments and project responsibilities for design and construction.
PP.03 – Complete Preliminary Estimates	Development of estimated cost and labor-hours to complete the work. Includes obtaining external pricing information for major equipment, materials, and services from potential consultants, suppliers, and others to prepare and estimate.
PP.04 – Establish Master Project Schedule	Development of a standard sequenced task logic network reflecting the major control activities and relationships between Engineering, Procurement, and Construction, and Start-up. A preliminary schedule; the results of applying known, contractual, or tentative dates to the sequence of work prior to resource scheduling.
PP.05 – Address Quality and Safety Issues	Development of quality and safety management systems; development of procedures for quality and safety improvement processes.
PP.06 – Develop Preliminary Execution Plan	The dependencies and constraints are identified from the task lists, standard logic diagram, and deliverables to produce a sequenced task list replicating a logic diagram. A key project management tool enabling the project manager to delineate, in as much detail as required, the plan for executing a project and by this means advise all concerned departments and individuals in the company of the requirements, responsibilities and assignments for carrying out the task.
PP.07 – Compile Project Scope	Consolidation of facility scope plan activities and feedback of technical, commercial, and project execution requirements from instruction and/or consultation with the client. Develop preliminary summary of project characteristics, contractual arrangements, and related project information.

Table 6.2 Information Flow Activities and Descriptions “Continued”

Activity	Description
PP.08 – Develop Start-Up Plan	Development of a facility start-up plan which defines required activities, sequence of execution, and assignment of responsibilities.
SD.01 – Process and Facility Planning	Determine the requirements for acquiring and maintaining the physical location, process equipment, and physical infrastructure of the project.
SD.02 – Develop Utilities and Offsite Scope	Determine the requirements for power, water, sewer, and other utilities and/or infrastructure, as well as other support facilities not part of the immediate location.
SD.03 – Develop Environmental Scope	Determine the extent of environmental work such as remediation, assessments, wetlands, and other considerations.
SD.04 – Develop Site Plan	Determine the location and physical layout of facilities, utilities, infrastructure and other support processes or structures.
SD.05 – Detail Work Breakdown Structure	Preparation of a list of tasks and deliverables that break the work scope into manageable work pieces, including time and cost aspects.
TP.01 – Conduct Technical Surveys and Process Analysis	Collection of initial technical information that may be in the form of drawings, engineering specifications, and other information formats that is used to define plant components and process requirements.
TP.02 – Product Development/Identify Certification and Testing Procedures	Early refinement and/or development of plant processes and manufacturing products. Identification of certification requirements and appropriate testing procedures to ensure corporate and regulatory policy compliance.
TP.03 – Obtain License Agreements	Activities to secure appropriate patents and licenses for processes and products associated with the project's development and life-cycle operation. Procedures focused on ensuring that proprietary products and processes are secure.
TP.04 – Establish Security and Secrecy Agreement	Creation of any security requirements needed for the project among project participants. Establishment of differing security levels for project when required.

Micro Level Diagrams

Each micro level diagram represents the tasks and logic needed to complete a single information flow activity. The coding system for the micro level diagrams is a continuation of the coding system utilized for the information flow activities diagram described above. In the information flow activities diagrams, the tasks were first identified by the phase (tier one), followed by a period and a number to identify the particular information flow activity (tier two). The micro level diagram tasks are identified by tier three. These activities are identified by a period and the task number following the tier two identification, which is identified as tier three. For example, the first micro level task in BP.01 (Business Planning) is identified by BP.01.01. Similarly, the second task is coded BP.01.02. This process was repeated for all micro level tasks.

It should be noted that the number sequence does not indicate the precedence order in which the tasks appear. Rather, they are used as task identifiers. Also, during the review process, some tasks were deleted from the diagrams. In certain cases, deletions were performed after the coding system was in place. Due to the stage in which the deletions occurred, the micro level diagram tasks were not recoded. As a result, some of the diagrams are missing sequence number codes. This does not indicate an error in the diagram. Rather, this indicates a location where the diagram was updated prior to finalizing the dissertation and associated documentation. The logic flow of each micro level diagram is presented in Appendix B.

The micro level diagrams are constructed with a precedence relationship between tasks, which is similar to that previously described for the information flow activities diagram. The tasks are depicted with a box. Within the box is the name of the task and the tier three code. Each diagram begins and ends with oval shaped tasks aptly named 'Previous Step' for the start of the diagram, and 'Next Step' for the conclusion of the diagram. Small circles within the logic indicate a link to another micro level diagram that exists within the logic prior to the completion of the micro level activity. Similarly, an activity where a document is created is identified separately from the rest with a box where the bottom line is curved. Finally, activities that involve a decision are illustrated by a triangle. The flow out of this activity is constrained by the answer to the question identified within the decision box.

Information Flow Tables

It was determined that the information required for front end planning would best be identified in tabular form. To complete this phase, a detailed spreadsheet of the information requirements was completed for each information flow activity (see Appendix D).

Every task was individually evaluated and the information requirements were investigated and linked to the task in which it originated. Each document used, document produced, data used, and data produced was specifically identified for each task. Similarly, if a document used data, or the data originated from another micro level task, that task was identified and its origin documented.

When completed, the table outlined all the information used in addition to its original micro level task. Additionally, the information generated by the task for later usage is documented. A sample of one information flow table is included in Table 6.3.

The first column in the table identifies the specific task number the information entity affects. Column two provides the reference to the task where the information is generated. The specific task is identified, or if the information source is outside of front end planning, then it is identified by 'EXT'. The next four columns identify the document used, document produced, data used, and data produced for each task.

Table 6.3 Abridged Information Flow Table BP.8 – Raw Material Sourcing

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.8.1	BP.5.9			Decision	
BP.8.1	BP.7.5	Funding Plan			
BP.8.1			Feed Stock Requirements		
BP.8.2	BP.8.1	Feed Stock Requirements			
BP.8.2	EXT			Supply Chain Alternatives	
BP.8.2			Sourcing Document		
BP.8.3	BP.8.2	Sourcing Document			
BP.8.3			Modified Sourcing Document		
BP.8.4	BP.8.3	Modified Sourcing Document			
BP.8.4					Feed Stock Compliance
BP.8.5	BP.8.3	Modified Sourcing Document			
BP.8.5					Logistics Issues
BP.8.6	BP.8.3	Modified Sourcing Document			
BP.8.6					Supplier Performance
BP.8.7	BP.8.3	Modified Sourcing Document			
BP.8.7					Cost Ranges
BP.8.8	BP.8.4			Feed Stock Compliance	
BP.8.8	BP.8.5			Logistics Issues	
BP.8.8	BP.8.6			Supplier Performance	
BP.8.8	BP.8.7	Raw Material Estimate			
BP.8.8			Modified Sourcing Document		
BP.8.9	BP.8.8	Modified Sourcing Document			
BP.8.9			Final Sourcing Document		

The 33 information flow activities were sub divided among the team into sub teams. The methodology to complete the tables was executed in a similar fashion as with the creation of the micro diagram tasks. When each sub team completed their tables, the entire research team reviewed and validated the tables to ensure the information requirements and task links to ensure its accuracy. After the tables were approved, the next step was to create the information flow diagrams. In addition, the diagrams were again re-evaluated by the entire team. As a result, the diagrams had two separate comprehensive reviews within the research team.

The purpose of the information flow tables was to identify the precedence flow of information within project planning and to identify which information items were used most often through front end planning. When all the individual micro level diagram information tables were completed, a master file was created containing all the information contained on the individual diagrams. A sort was performed to group all the specific information used and their location of use. This sort was performed to identify if any information entities were utilized more often through the front end planning process.

The value added from this sort was to identify to project planning teams which information entities are highly utilized. Currently, no research exists that identifies which pieces of information are high utilized within front end planning. This sort intends to fill this gap by determining if any information entities are highly utilized.

Benefit of the Information Flow Tables

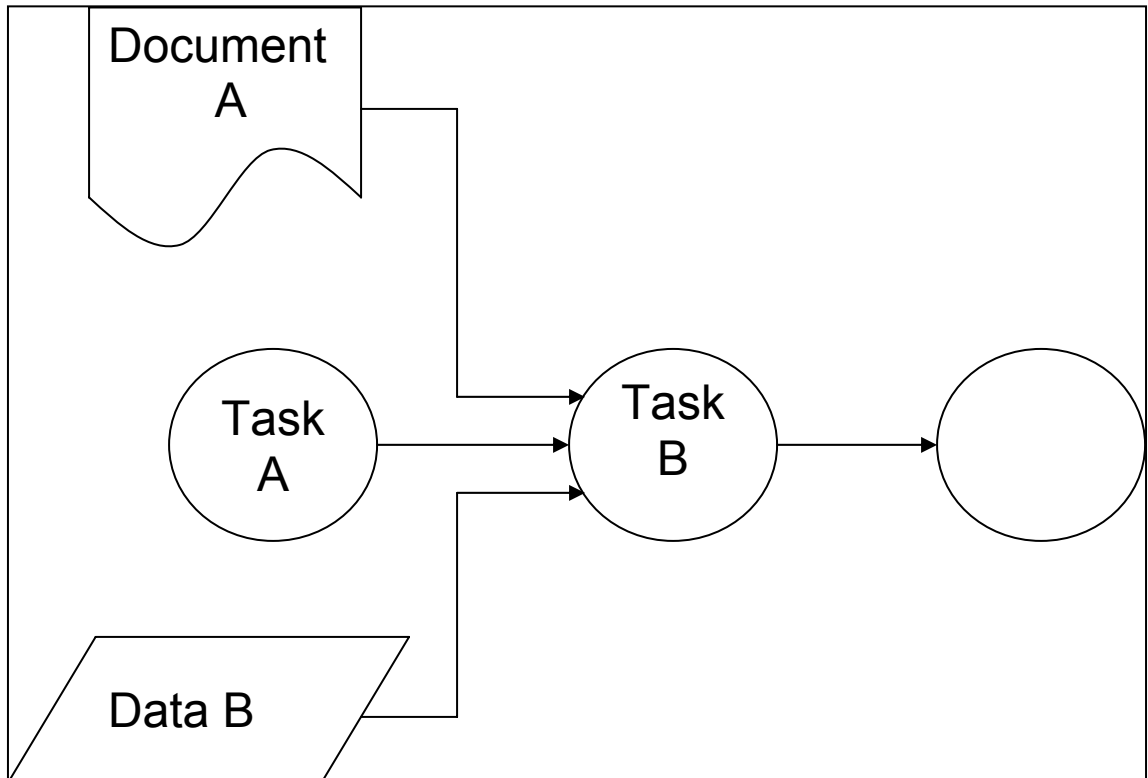
When the information flow tables are used in conjunction with the micro level diagrams, all the requirements to complete a specific activity are identified. The information flow tables provide a detailed listing of all the information requirements for front end planning. Specifically, the information is linked to the task where it originated. As a result, the planning process can be executed in a more efficient manner since all the tasks and information requirements are identified prior to executing front end planning. Currently, no research identifies the information requirements for front end planning. The tables identified above address this need.

Information Flow Diagrams

The information flow diagrams depict a graphical representation of the micro diagrams and the information flow tables. These diagrams provide a logical sequence of the information flow, and identify where they are used within the micro level diagrams tasks. The logical flow of the diagram follows the same logic of a successor/predecessor type diagram. In these diagrams the information requirements acts like a predecessor task. Additionally, a task will not execute until all the predecessor tasks have been executed. Figure 6.1 identifies how the flow diagrams are read. All the tasks are identified by circles, data are identified by parallelograms, and squares with curved bottom lines represent documents. In this example, Task B cannot execute until Task A has been executed, Document

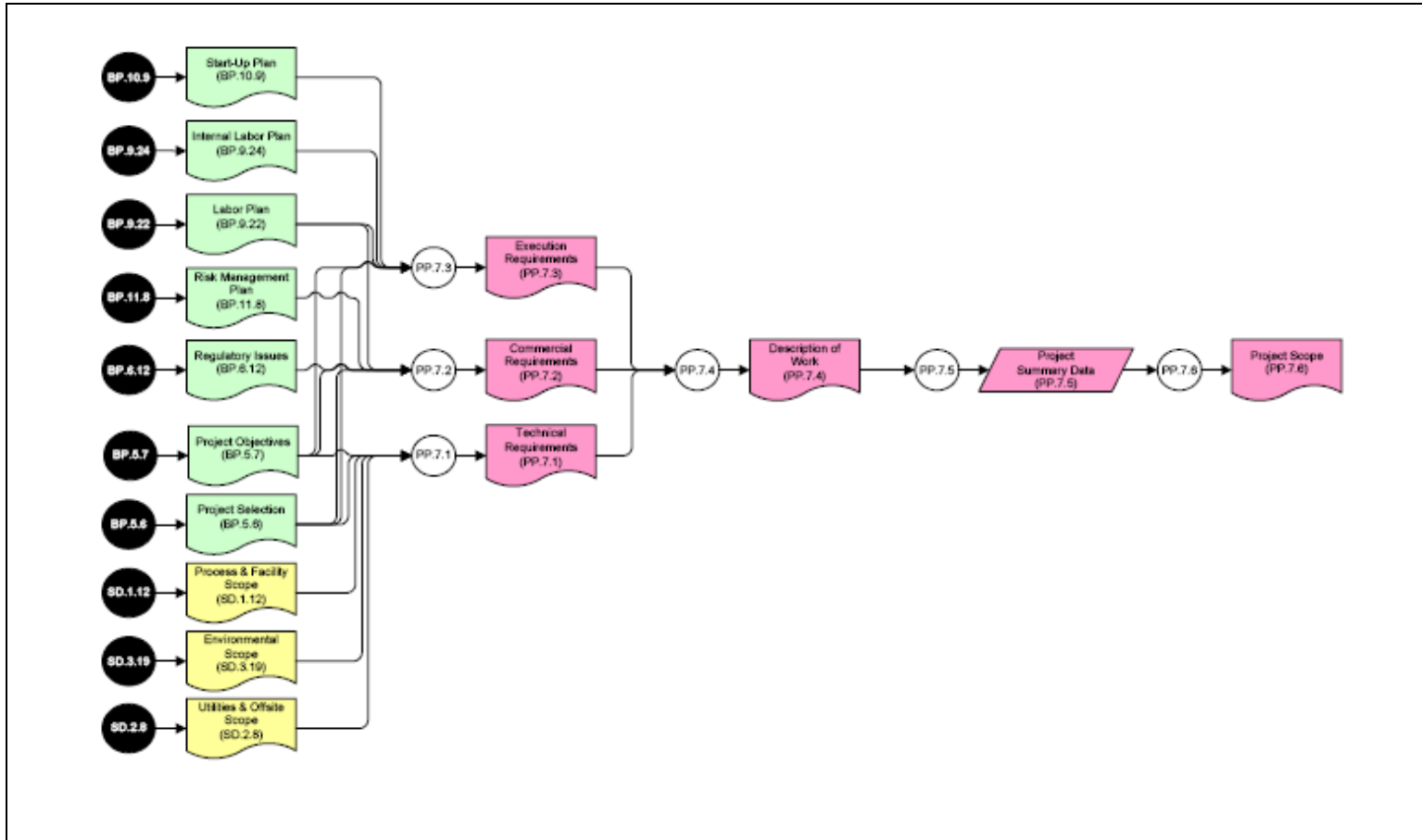
A is complete and in the proper format, and Data B are available. Similarly, Task C cannot begin until Task B has been executed.

Figure 6.1 Information Flow Diagram Logic Example



An example of an information flow diagram is depicted in Figure 6.2. The micro level diagram tasks are identified by circles and contain the same alpha-numeric numbering system utilized by the micro level diagrams. All documents used are identified by a box with the bottom line being curved. Similarly, the data is identified by a parallelogram. The document/data and the micro level task outlining where the information originated are identified within the box.

Figure 6.2 Sample Information Flow Diagram



The information flow diagrams utilize the same process flow as the critical path method. Each task or piece of information is linked to its successor through arrows. Flow is executed from left to right. Prior to the first task execution, all the information required to execute the task is identified. Then, when all information is ready for use, the first activity can be executed. When completed, the information generated by the task is identified just to the right of the task (circle). This information is then linked to the next task. This process is repeated for all 33 information flow activities. All 33 information flow diagrams are located in Appendix E.

The value added of these diagrams allows the project team to have a graphical depiction of the information flow within front end planning. Currently, no research has identified the information flow requirements for front end planning. This vacancy is filled by the information flow tables. However, the information flow diagrams also fill this gap by providing the same information identified in the information flow tables, but in a graphical format. Additionally, it is recommended that project planning teams utilize this tool during front end planning to allow the teams to have all the information flow requirements for a typically planned EPC project.

Most Utilized Information Requirements

As previously identified, an analysis of the information flow tables was performed to identify information that were most utilized. After the sort, nine

information requirements were identified as being utilized more often during front end planning. These nine information requirements are identified in Table 6.4.

Table 6.4 Most Utilized Information Requirements

No.	Activity	Description	Number of Activities that Utilize the Information	Percent Used
1	BP.5.7	Final Project Objectives List	15	45%
2	BP.1.14	Business Objectives Letter	13	39%
3	PP.7.6	Preliminary Project Scope	13	39%
4	BP.2.6	Project Alternatives Report	11	33%
5	SD.2.8	Utilities & Offsite Scope Document	10	30%
6	SD.1.12	Process & Facility Planning Scope	9	27%
7	BP.11.8	Risk Management Plan	7	21%
8	SD.1.13	Conceptual Schedule & Estimate Document	7	21%
9	SD.3.19	Environmental Scope	7	21%

This table identifies the activity where the information originated, the piece of information, the number of information flow activities that utilized the information, and the overall percent of information flow activities in which these were used. The table only identifies the information requirements that were utilized by more than 20%. As illustrated in the table, the final project objectives list is utilized by fifteen of the 33 information flow activities. This document identifies the specific objectives for the project once the final project site has been selected from among alternatives. This document is critical to the rest of the front end planning process in that the other activities refer to the project objectives for guidance. Failure to understand the project objectives may result in decisions that may ultimately affect satisfying them.

The business objectives letter and the preliminary project scope are the next two documents that are most utilized by the front end planning process. They are utilized by nearly 40% of activities. The business objectives letter is a document generated in one of the first activities in front end planning. This document is highly utilized because it is important for the project team to fully understand these objectives when performing front end planning. As a result, this document is utilized often through the process. Additionally, project scope is a critical document used in front end planning. Many decisions regarding the project are based upon the preliminary project scope. Without this document, decisions may be made that adversely affect attainment of specific objectives.

The project alternatives report, process & facility planning scope , and the utilities & offsite scope document are utilized by roughly one-third of the front end planning activities. The project alternatives report results in the identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies. The process and facility planning scope determines the requirements for acquiring and maintaining the physical location, process equipment, and physical infrastructure of the project. Similarly, the offsite scope document determines the requirements for power, water, sewer and other utilities and/or infrastructure, as well as other support facilities not part of the immediate location.

The project alternatives report has the potential for a huge impact upon front end planning. Simply, if the wrong alternatives are identified, then all the

effort succeeding this activity will be for naught. In addition, the process and facility planning and the utilities and offsite scope documents provide greater scope definition to the project. Therefore, it is important that these pieces of information be readily available for the remaining front end planning activities

The remaining pieces of information are the risk management plan, conceptual schedule & estimate document, and the environmental scope. Over one-fifth of the front end planning activities utilized these pieces of information. The risk management plan document identifies a procedure by which to mitigate risk for the project. The conceptual schedule and estimate document provides a preliminary estimate and duration for the project. Lastly, the environmental scope provides greater scope definition if regards to environmental impacts of the project.

Additional analysis of these nine documents identified that they are generated early in the front end planning process. This indicates that the information generated early in the planning process is utilized throughout front end planning. Therefore, other information, though not indicated in Table 6.9, may impact front end planning due to poor utilization later in the process. As a result, care must be utilized during front end planning to ensure that all information through front end planning is properly managed to ensure that the information is available when needed, where needed, and in the proper format.

Additional analysis of the six critical activities and the nine most utilized documents identified similarities between the two recommendations. Activities BP.2 and SD.2, both identified as being critical to front end planning, generate

documents that were identified to be utilized by roughly one third of the information flow activities. This indicates that these two activities, and the information generated from these activities, may be critical for successful front end planning.

Conclusion

The information flow activities diagram identifies the logic flow of the activities that generate and utilize information within the front end planning process. This research report utilized previous research as a benchmark for the creation of this diagram. Additionally, the tasks necessary to execute an information flow activity are illustrated in the micro level diagrams. For each of the information flow activities there exists a micro level diagram. As a result of these diagrams, all the tasks, and their logical sequence, is identified for a typical EPC construction project.

All the information requirements for front end planning of a typical project are identified by the information flow tables and information flow diagrams. Planners will have all the necessary information needed to successfully plan a project. In addition, utilizing the information flow tables and the information flow diagrams provides front end planners all the tasks and information items needed to execute front end planning. And, when used in conjunction with the macro and micro level diagrams, provides a detailed roadmap of the front end planning process and the information flow within it.

The literature review in this dissertation identified that there is no research that identifies the information requirements for front end planning. The information flow tables and information flow diagrams address this need by providing a 'roadmap' of the information within front end planning. This dissertation provide significant contributions to the construction industry by allowing project teams to know the information requirements for front end planning prior to execution of the process.

The information identified in this dissertation is intended to identify the flow of information through a typically planned project. It is recommended that each organization review these documents and make necessary changes to fit their individual process.

CHAPTER VII

CONCLUSIONS & RECOMMENDATIONS

Introduction

This research was undertaken to better understand the flow of information during front end planning. Additionally, this research project sought to better understand front end planning and to identify areas where it may be improved.

Recall the objectives of this research:

1. Identify the information flow activities in front end planning and their interrelationships (logic), and determine if there are duration, resource, and additional execution differences between successful and less successful projects.
2. Identify the information requirements for the front end planning activities.
3. Suggest recommendations for improving information flow to support front end planning.

A detailed methodology was conducted to ensure that each of the three research objectives was achieved. This chapter identifies, interprets, and discusses the significant findings that fulfill the research objectives.

Research Objective One Conclusions

A detailed literature review of the topic identified that previous research existed relevant to this topic, but the objectives of this research were unique. It was identified that the information flow activities had not been previously researched or identified. The research identified 33 information flow activities.

These activities are depicted in a precedence logic diagram illustrating the planning process. Furthermore, each information flow activity was decomposed into a higher level of detail. As a result, 33 micro level logic diagrams were generated that illustrate the interrelationships among the information flow tasks. The information flow activities are identified in Table 7.1. The information flow activities logic diagram is illustrated in Appendix A, while Appendix B illustrates the micro level diagrams

Table 7.1 33 Information Flow Activities for Front End Planning

Activity Code	Activity Name
BP.01	Define Business Objectives
BP.02	Identify/Select Project Alternatives
BP.03	Conduct Market Research and Analysis
BP.04	Establish Image and Public Relations
BP.05	Finalize Project Alternative
BP.06	Address Regulatory Issues
BP.07	Develop Funding Plan
BP.08	Raw Material Sourcing/Source Building Materials
BP.09	Develop Labor Plan and Address Human Resource Issues
BP.10	Define Start-Up Requirements
BP.11	Risk Mitigation Analysis
BP.12	Refine Public Relations
CS.01	Develop Contract Strategy
CS.02	Develop Bid Package Scope
CS.03	Review Potential EPC Contractor Bidders
CS.04	Select EPC Contractor Team
PP.01	Develop Preliminary Design Criteria, Including PFDs and P&IDs
PP.02	Formulate Preliminary Organization
PP.03	Complete Preliminary Estimates
PP.04	Establish Master Project Schedule
PP.05	Address Quality and Safety Issues
PP.06	Develop Preliminary Execution Plan
PP.07	Compile Project Scope
PP.08	Develop Startup Plan
SD.01	Process and Facility Planning
SD.02	Develop Utilities and Offsite Scope
SD.03	Develop Environmental Scope
SD.04	Develop Site Plan
SD.05	Detail Work Breakdown Structure
TP.01	Conduct Technical Surveys and Process Analysis
TP.02	Product Development/Identify Certification and Testing Procedures
TP.03	Obtain License Agreements
TP.04	Establish Security and Secrecy Agreement

The logic diagrams contribute significantly to the construction industry.

Very importantly, the information flow activities diagram provides a precedence

logic diagram of the front end planning process. This diagram identifies each activity and the precedence relationships with the other activities. As a result, the project team can identify the process to properly plan a typical EPC project (the diagram is not company specific).

The micro level diagrams are another key contribution. These diagrams provide the detailed logic flow diagram for each of the information flow activities at the task level. When the information flow activities diagram is combined with the micro level diagrams, the project team will know each step needed to adequately plan a typical EPC project. By following these diagrams, project teams may better utilize time and effort when planning projects. This constitutes an original contribution to the construction industry.

However, it should be understood that these diagrams only identify the information flow activities for a general EPC project and are not based solely upon a specific facility type, location, or specific construction practices. The logic diagrams are designed to identify the general logic of the information flow activities within a typical EPC project. Use of these diagrams will allow project teams to properly identify the information flow activities and tasks necessary to properly plan for EPC projects. In addition, companies may have some variation when executing these diagrams during front end planning. This results from each project having its own restrictions and requirements for information flow. As a result, it is recommended that the diagrams be altered to adequately identify these variations.

In addition to the logic diagrams, the data were analyzed to determine if there are duration, resource, and additional execution differences between successful and less successful projects. From the data analysis findings, it was identified that successful projects devoted more time and resources (both internal and external) to the execution of the information flow activities. Additionally, the findings indicated that there were execution differences between successful and less successful projects. Successful projects:

- Executed the information flow activities successfully
- The activities were not unusually complex
- The activities were executed efficiently
- The activities had all the information readily available when needed

From previous research, it has been identified that successful front end planning will result in increased project performance. The findings from this research indicate that successful projects executed some front end planning activities differently than less successful projects.

Table 7.2 identifies the mean values for successful projects for the duration and resource utilization. These values can be referenced by the project team when executing front end planning. It serves as a baseline that the project team can use to appropriate time and resources for front end planning. The values identified in the table are expressed as percentages of the total time and resources spent on FEP. It should be noted that they do not add up to 100 percent since they are the mean values of all successful project activities. These values should be used as approximations when scheduling the front end planning process. Note

that TP.04 has no values. This indicates that each project identified by the data did not need to execute this activity. This does not mean that this activity is not necessary in front end planning. Rather, this may result from companies reluctant to present data on projects where this activity is necessary.

Table 7.2 Time & Resources for Successful Projects (Perceived Effort) when Front End Planning Effectiveness and Efficiency was the Success Criterion

Activity	Description	Duration Mean Successful	Internal Mean Successful	External Mean Successful
BP.1	Define Business Objectives	4.42	5.38	14.23
BP.2	Identify/Select Project Alternatives	4.25	3.63	6.89
BP.3	Conduct Market Research and Analysis	2.86	2.77	3.78
BP.4	Establish Image and Public Relations	3.40	3.50	3.39
BP.5	Finalize Project Alternative	2.27	2.96	3.88
BP.6	Address Regulatory Issues	2.77	2.75	6.02
BP.7	Develop Funding Plan	5.44	4.64	8.35
BP.8	Raw Material Sourcing/Source Building Materials	2.47	2.47	3.67
BP.9	Develop Labor Plan and Address Human Resource Issues	2.39	2.85	1.82
BP.10	Define Start-Up Requirements	3.11	2.93	3.99
BP.11	Risk Mitigation Analysis	2.20	2.09	1.28
BP.12	Refine Public Relations	1.35	1.27	1.41
CS.1	Develop Contract Strategy	3.19	3.19	1.00
CS.2	Develop Bid Package Scope	2.84	3.55	3.86
CS.3	Review Potential EPC Contractor Bidders	1.80	2.07	1.96
CS.4	Select EPC Contractor Team	1.29	1.34	1.36
PP.1	Develop Preliminary Design Criteria, Including PFDs and P&IDs	6.09	6.14	11.15

Table 7.2 Time & Resources for Successful Projects (Perceived Effort) when Front End Planning Effectiveness and Efficiency was the Success Criterion
“Continued”

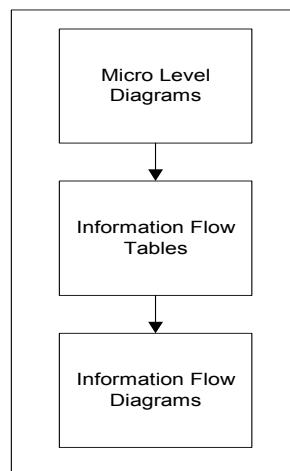
Activity	Description	Duration Mean Successful	Internal Mean Successful	External Mean Successful
PP.2	Formulate Preliminary Organization	1.40	1.46	2.03
PP.3	Complete Preliminary Estimates	6.20	7.09	9.51
PP.4	Establish Master Project Schedule	3.69	3.01	4.25
PP.5	Address Quality and Safety Issues	3.02	2.05	3.44
PP.6	Develop Preliminary Execution Plan	3.69	3.53	4.78
PP.7	Compile Project Scope	4.72	6.76	6.96
PP.8	Develop Startup Plan	1.83	1.79	2.82
SD.1	Process and Facility Planning	3.93	3.47	5.41
SD.2	Develop Utilities and Offsite Scope	2.92	2.88	6.36
SD.3	Develop Environmental Scope	2.53	2.67	2.04
SD.4	Develop Site Plan	4.39	4.00	5.79
SD.5	Detail Work Breakdown Structure	2.45	2.36	3.01
TP.1	Conduct Technical Surveys and Process Analysis	3.98	4.38	5.34
TP.2	Product Development/Identify Certification and Testing Procedures	2.47	2.16	4.27
TP.3	Obtain License Agreements	2.13	1.76	2.71
TP.4	Establish Security and Secrecy Agreement	0.00	0.00	0.00

Research Objective Two Conclusions

Research objective two was to identify the information requirements for each of the 33 information flow activities. The findings that satisfy this objective

are depicted in Figure 7.1. The micro level diagrams provide a roadmap of the tasks needed to execute each of the 33 information flow activities within front end planning. The information flow tables provide a detailed list of the information requirements for all 33 activities. The combination of the micro level diagrams and the information flow tables resulted in the creation of the information flow diagrams.

Figure 7.1– Research Objective Two Findings



Research objective two was satisfied first by the identification of the individual activity micro level diagrams. Once the diagrams were completed and revised, the creation of the information flow tables was executed. These information flow tables provide a complete listing of all the information requirements for each activity. As previously mentioned, each activity contains a table identifying the information requirements and their origin within the front end planning process. These tables are located in Appendix D, and identify the information generated and utilized for each micro level task.

However, later discussion by the research team identified that a graphical representation of the information flow may be more beneficial than tables. As a result, the information flow diagrams were created from the information flow tables and the micro level diagrams. These diagrams are a graphical depiction of the precedence logic for the information within the information flow activities. The information flow diagrams are located in Appendix E and, when used in conjunction with the information flow tables, provide an extraordinary level of detail for the information requirements for front end planning.

These information flow tables and information flow diagrams provide a significant contribution to the construction industry in addition to satisfying research objective two. No previous research conducted on front end planning has identified the information requirements to plan a typical EPC project. These two findings address this need by allowing a project planning team to have a complete listing of all the information utilized through the planning process, and a graphical depiction of when and where that information is used.

Research Objective Three Conclusions

Research objective three was to provide recommendations to improve the flow of information through front end planning. This objective was satisfied by many of the findings and diagrams previously identified in this research. Therefore, the objective of this section is to identify those diagrams and findings that may be utilized during front end planning to improve the flow of information.

The first recommendation identified by this research report is the utilization of the information flow activities diagram, the micro level diagrams, and Table 7.2 prior to execution of the front end planning process. By using these three, the planning team can adequately schedule the information flow activities needed to plan a typical EPC project. The information flow activities diagram provides the logical sequence of the steps needed to perform front end planning. Additionally, Table 7.2 recommends the amount of time and resources that should be utilized during the planning effort. These recommendations are the perceived effort values of previously planned successful projects. Lastly, the micro level diagrams provide the tasks necessary to execute all 33 information flow activities.

An additional recommendation to improve the flow of information through front end planning is for project teams to focus particularly on the six information flow activities identified by the research as being critical to effective and efficient front end planning. Previous research has indicated that effective front end planning will increase the likelihood of improved project performance. Therefore, it is recommended that planning teams take appropriate measures to successfully execute these six information flow activities when performing front end planning. The information flow activities are as follows:

- BP.02 – Identify/Select Project Alternatives
- BP.04 – Establish Image and Public Relations
- BP.10 – Define Start-Up Requirements
- PP.05 – Address Quality and Safety Issues
- PP.06 – Develop Preliminary Execution Plan

- SD.02 – Develop Utilities and Offsite Scope

The final recommendation for research objective three is to utilize the information flow tables and the information flow diagrams. The information flow table provides the information requirements for all 33 information flow activities. In these diagrams, the information requirement is identified along with the source of the information. In addition, the information flow diagrams provide a graphical illustration of the information requirements and the tasks necessary to execute an information flow diagram. This tool is very beneficial in that it identifies the specific information requirements, where the information is generated, where the information is utilized, the micro level diagram tasks, and the logical flow of the information requirements through front end planning. It is recommended that planning teams utilize these diagrams to identify where information is needed, and from where the information is generated.

Research objective three was to provide recommendations to improve the flow of information through front end planning. This research identified multiple methods that satisfy this objective. Each recommendation identified above identifies a tool or deliverable that will help front end planning teams. These recommendations are provided for a typical EPC project. Planning teams should review the tools and modify them for their specific project.

Benefits to the Construction Industry

As identified in the literature review, front end planning and information have the potential to have large impacts on project performance. Similarly, no literature was found that links information flow to the front end planning process. Therefore, this research addresses this need by providing key findings that identify the information flow within front end planning. These include:

- Information Flow Activities Diagram
- Micro Level Diagrams
- Information Flow Tables
- Information Flow Diagrams
- Execution differences between successful and less successful projects
- Critical activities within front end planning
- Most utilized information entities
- Front end planning roadmap

Information Flow Activities Diagram

The information flow activities diagram identifies the main activities, and their logical flow, of a typically planned project. Previous research conducted on this topic indicated that CII had identified the typical activities required for the complete construction process. The front end planning activities in this diagram were used as a basis for the creation of the information flow activities diagram identified within this research. The information flow activities diagram identifies

33 activities that comprise the flow of information within the front end planning process.

Micro Level Diagrams

Currently, no research exists that provides a high level of detail of the tasks necessary to execute front end planning. The micro level diagrams generated in this research address this need. For each of the 33 information flow activities, a micro level diagram was generated. Within each micro level diagram the tasks necessary to execute the activity are identified and placed in their logical order. Using these diagrams allows project planning teams to have a logical flow diagram of every task needed to execute a typically planned EPC project.

Information Flow Tables

As identified by Bjork (2003) who references work by Egan (1998), "... many believe that more efficient information management is a primary mechanism for the construction industry to increase its productivity." However, no research has been conducted to identify the information requirements in front end planning. The information flow tables identified in this research provide a listing of all the information requirements to plan a typical project. Furthermore, these tables identify the information requirements on a task level, and link the information to each task within the micro level diagrams. Lastly, the tables are sorted to allow users to identify what information is used and what information is generated within the table. As a result, all the information utilized in front end

planning is known prior to execution of front end planning, and a project team can create an information management system suitable to their specific project.

Information Flow Diagrams

The information flow tables contribute to the construction industry by providing a list of all the information requirements in front end planning. Similarly, the micro level diagrams provide a detailed logical flow of the tasks for front end planning that did not exist prior to this research. The information flow diagrams link these two research findings together and provide logic flow of the information and the tasks for each of the 33 information flow activities. This contribution to the construction industry provides an additional tool for planning projects and allows the planning team to know when and where information is needed in the planning process.

Execution Differences Between Successful and Less successful Projects

Previous research identified that effective front end planning can reduce project risk, cost performance increases by as much as 20%, and schedule improvement by as much as 40% (Hamilton & Gibson, 1996). However, no research has been conducted to identify whether successful projects executed front end planning differently from less successful projects. Through the statistical analysis performed in this research, it was identified from the data that successful projects execute front end planning differently than less successful projects with respect to the information flow activities. These differences include

more time spent and more resources utilized. These findings contribute to the construction industry by identifying that more effort needs to be utilized while planning EPC projects.

Critical Activities within Front End Planning

Previous research has indicated that successful execution of front end planning will enhance project performance. Additionally, front end planning has continuously been benchmarked to validate these conclusions and recommendations. Similarly, CII indicates that the entire process is important, and any oversight within the process may reduce the effectiveness of front end planning.

Currently, no research exists that seeks to identify the probability that any specific activities within the process have a higher possibility of affecting project performance. This research addresses this need by identifying activities, through statistical analysis and consensus with industry practitioners, that are critical to project success.

Most Utilized Information Entities

The information flow tables and the information flow diagrams contribute to the construction industry by identifying the information requirements for front end planning. Building upon this contribution, an analysis of the information flow tables found that there were information entities that are utilized more often throughout the planning process. Therefore, this finding contributes to the

construction industry by providing recommendations that special attention be utilized when creating documents, storing for later use, and in clearly communicating the information be utilized for these documents. Since the majority of these documents are utilized by 1/3 of the information flow activities, these documents can impact successful execution of front end planning.

Front End Planning Roadmap

In 1995, CII published a reference manual on the topic of front end planning (called pre-project planning at the time) (CII,1995). In this report, the definition of front end planning was discussed, the major components of the process identified, and statistical data indicating that front end planning can improve project performance. Through the years, the front end planning process has evolved to improve upon previous research. However, no research has provided a detailed description of the planning process. This current research addresses this need by providing a front end planning ‘roadmap’ of the entire process.

This roadmap is comprised of all the previous contributions identified above. By utilizing all the findings in this research, a project planning team will have: (1) all the major information flow activities of front end planning; (2) all the tasks needed to execute each of the activities; (3) all the information requirements for front end planning (in both table format and graphical); (4) identification of which activities are critical; AND (5) which information entities

are highly utilized within the process. As a result, a project planning team will have the necessary information needed to plan a typical EPC project.

Future Research

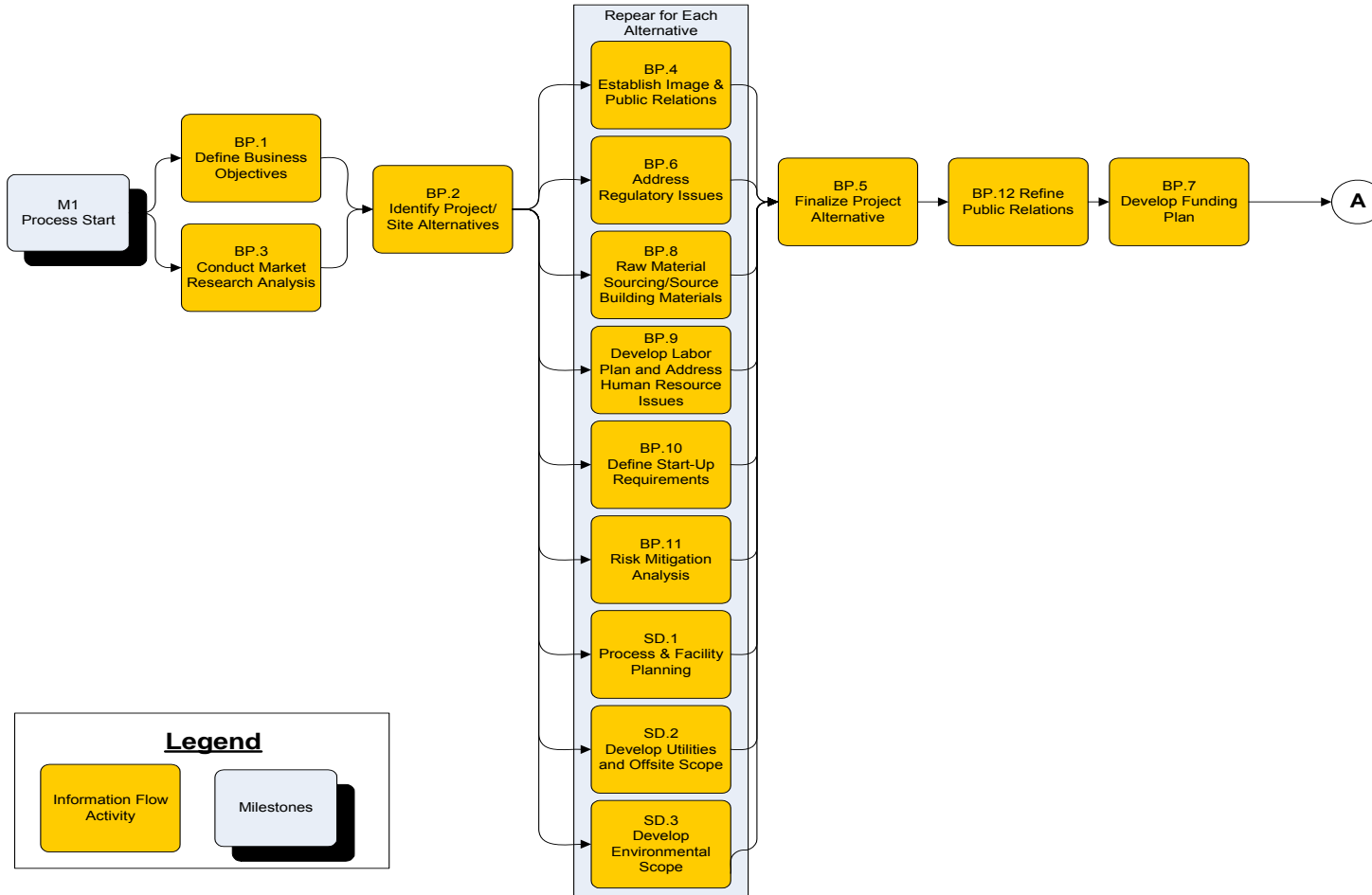
There are many avenues that exist for future research based upon this topic. First, the breakdown of the construction types identified that nearly one-half of the construction was “New Construction” and the other half “Maintenance/Renovation/Retrofit”. As a result, the data analysis performed during this research report could seek to identify statistical differences between construction types (commercial versus industrial). Additional research may also include information flow through the other aspects of the project delivery process. These include material management, design, construction, and operation/maintenance. These phases are also information intensive and a similar methodology may be implemented.

APPENDICES

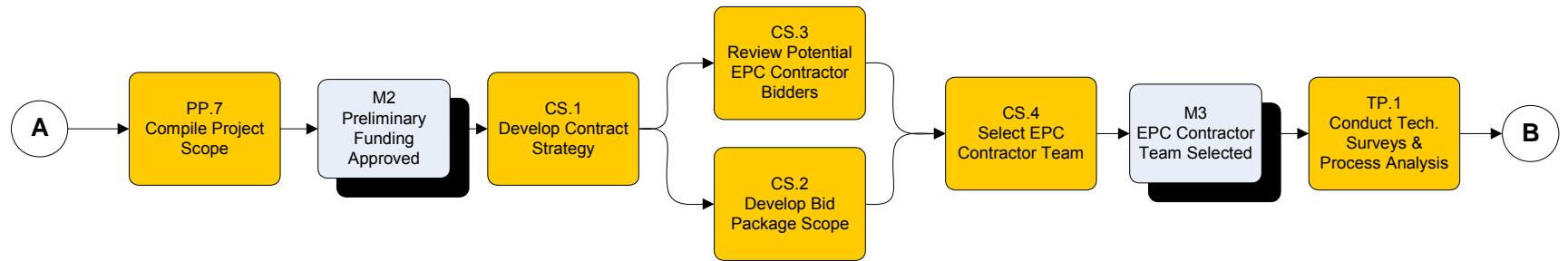
Appendix A

Information Flow Activities Diagram

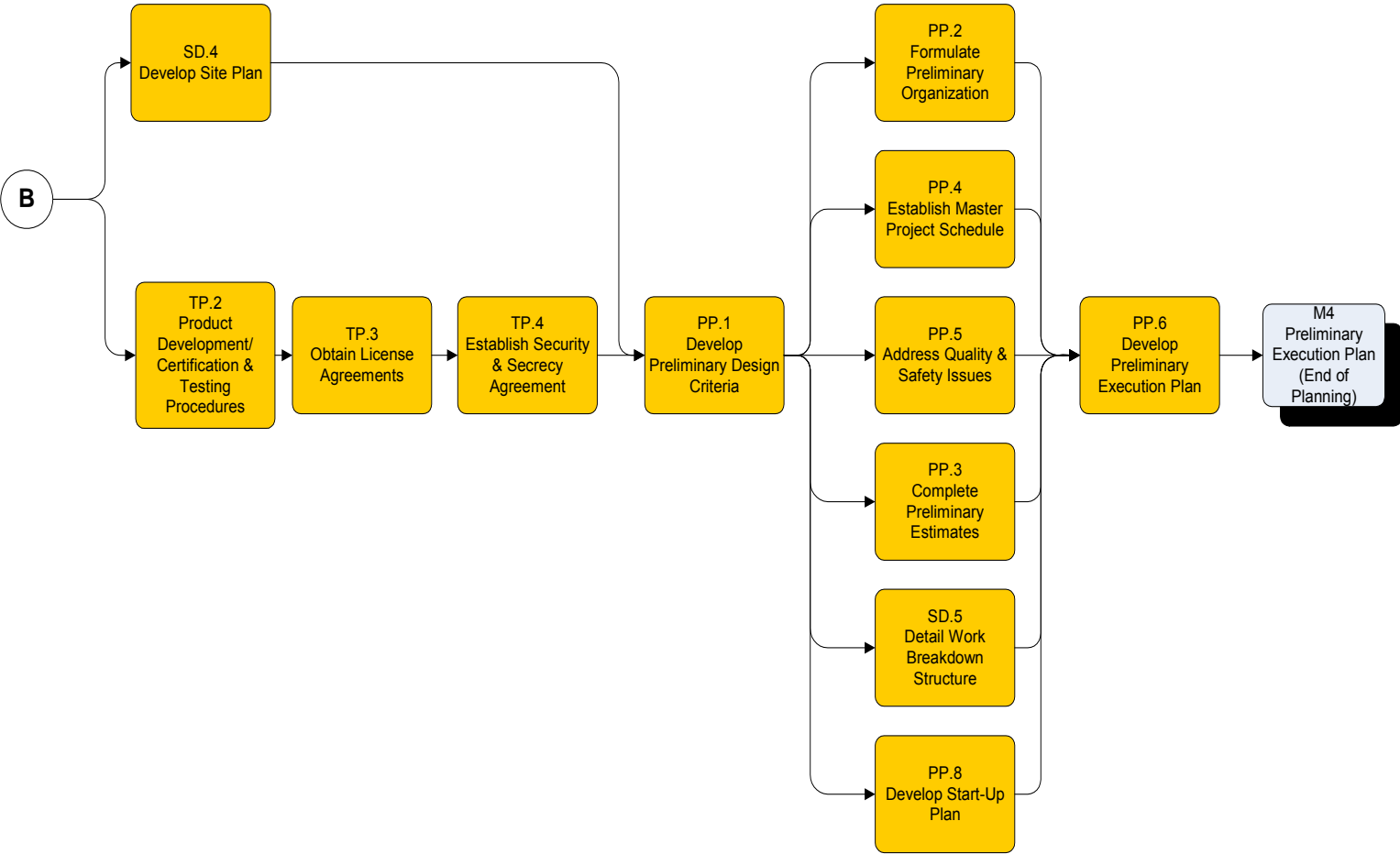
Information Flow Activities Diagram



Information Flow Activities Diagram



Information Flow Activities Diagram

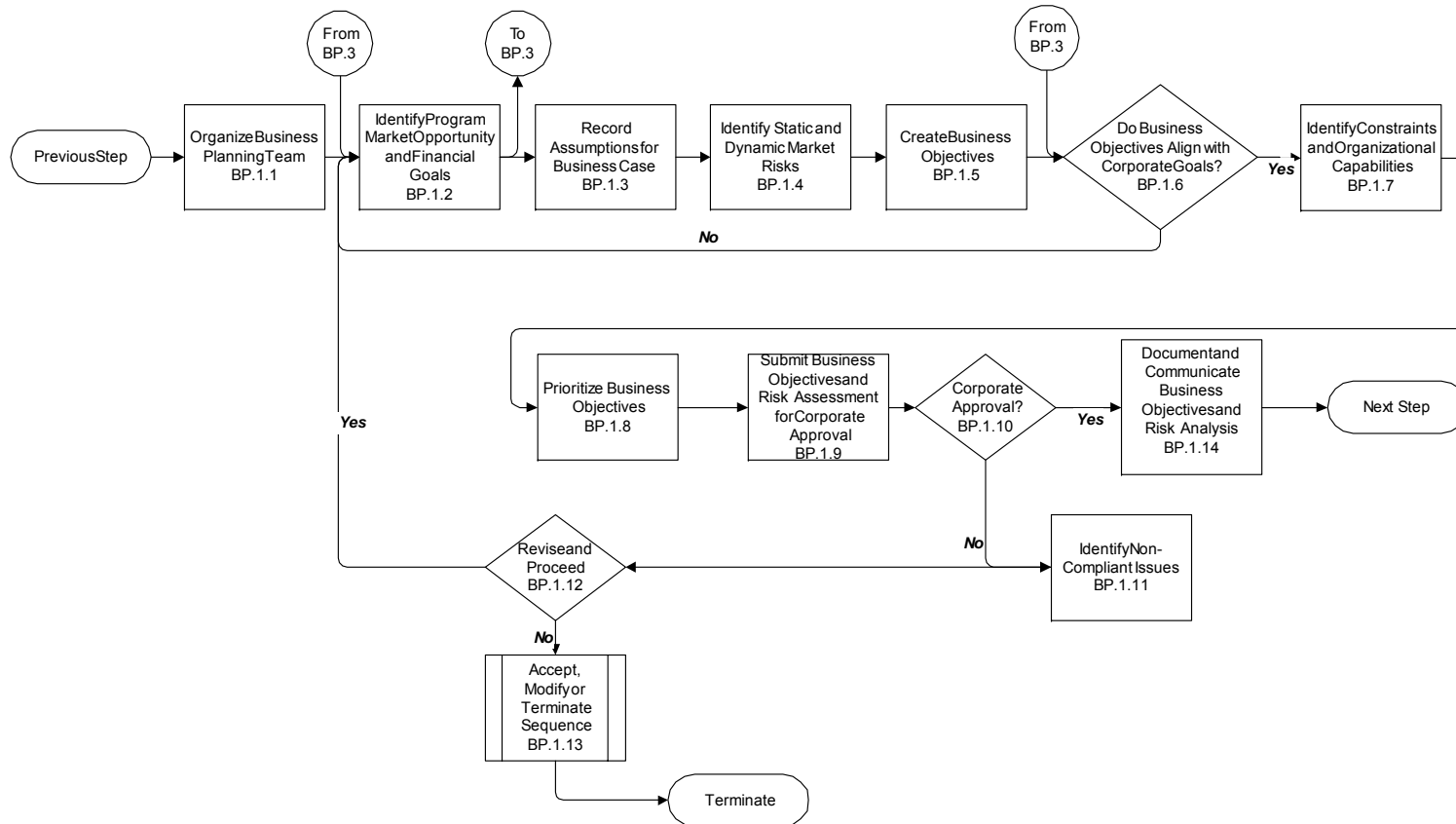


Appendix B

Micro Level Diagrams

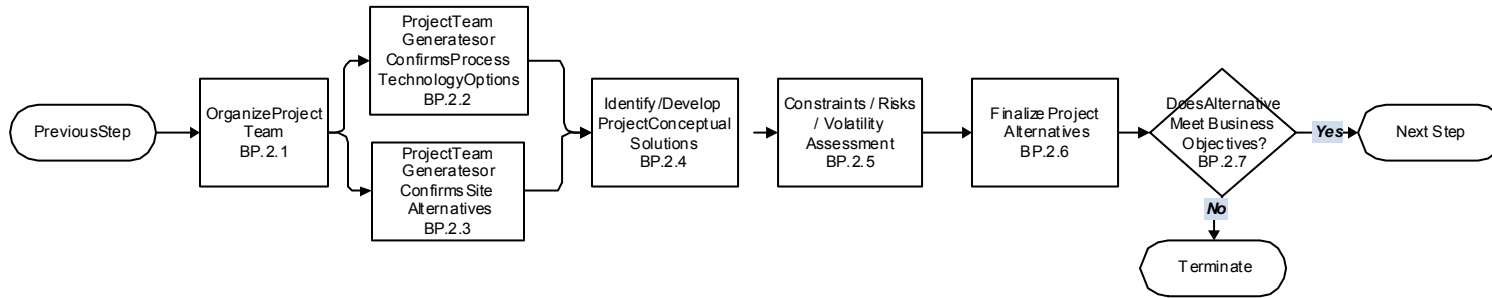
BP.1 Define Business Objectives

Identification and prioritization of specific corporate business related objectives pertaining to the development of a capital project.



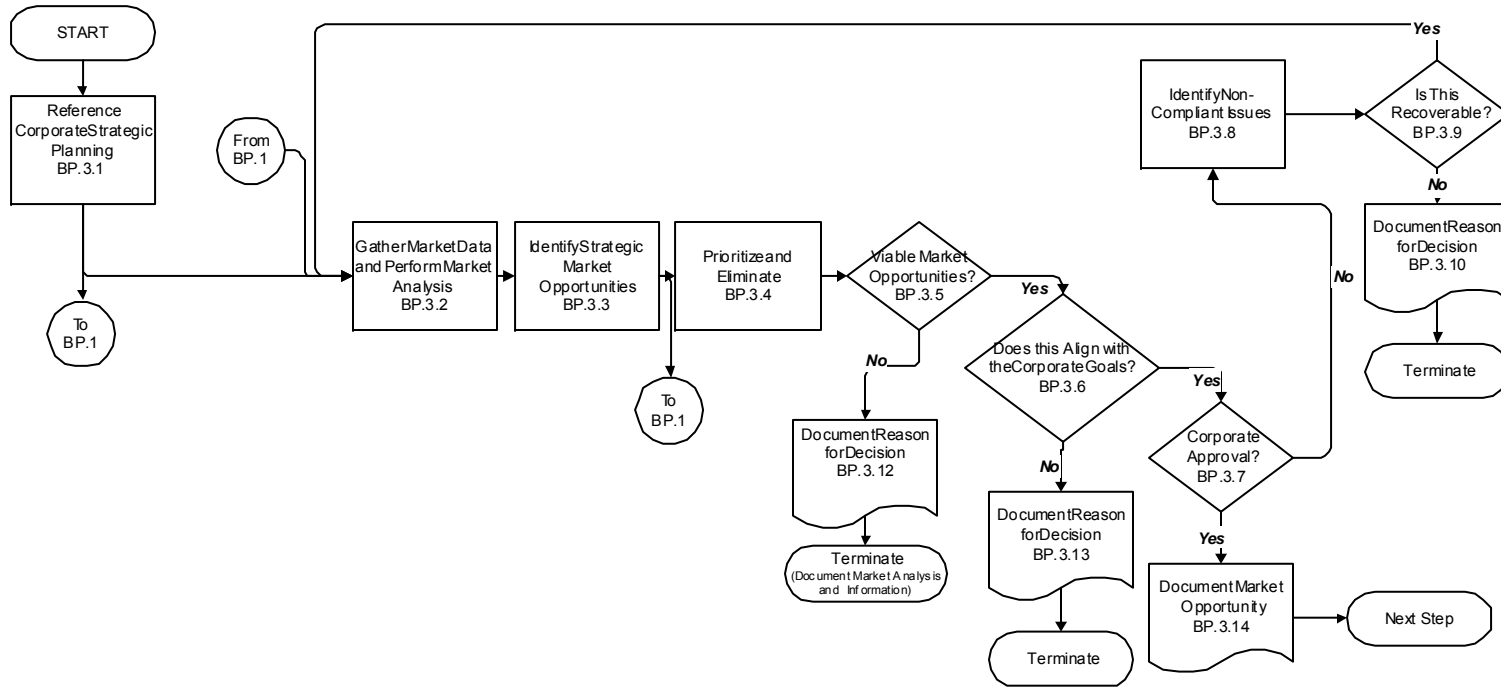
BP.2 Identify/Select Project Alternatives

Identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies.



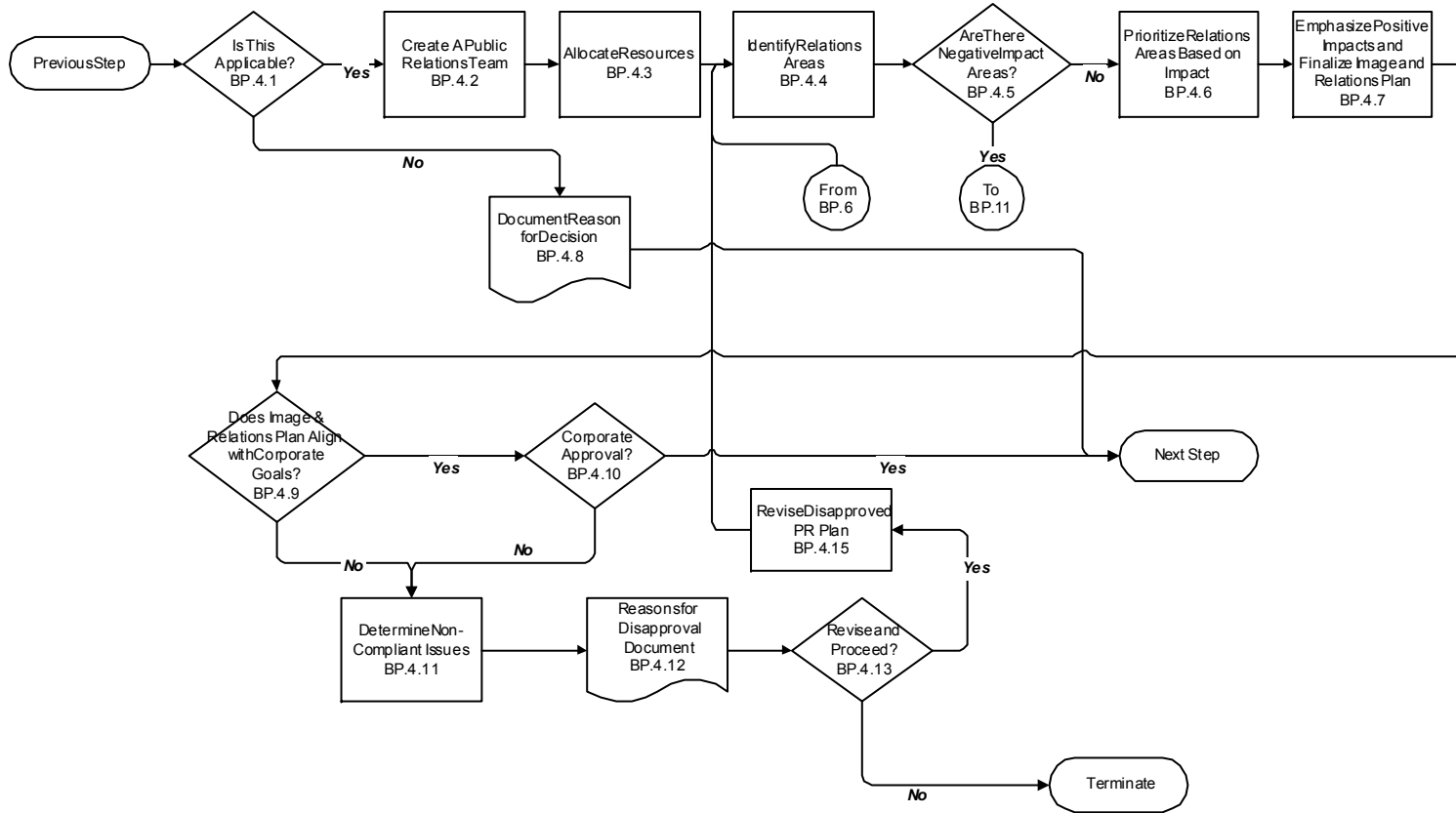
BP.3 Conduct Market Research and Analysis

Those activities required to initially determine whether a new facility, or plant expansion, is needed and corporately beneficial, and should be approved for project initiation. Pre-existing corporate information useful to the decision making, such as historical cost data and project performance histories, are made available.



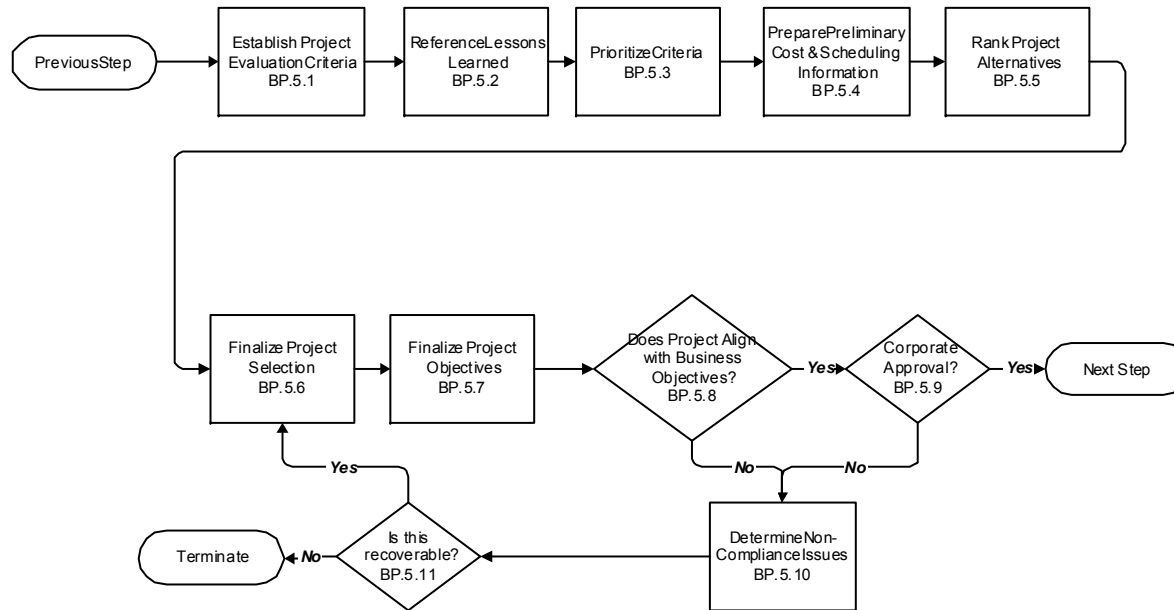
BP.4 Establish Image and Public Relations

Activities initiated to establish a positive corporate image in a project locale to improve public relations and to demonstrate the benefits of a proposed project to a local community, municipality, or governing body. Potentially negative project impacts are identified and corporate strategies appropriate to mitigate such impacts are formulated.



BP.5 Finalize Project Alternatives

Selection of a final project site from among alternatives. Site selection is predicated on physical suitability, availability, cost, environmental considerations, and other related business objectives defined by the owner.

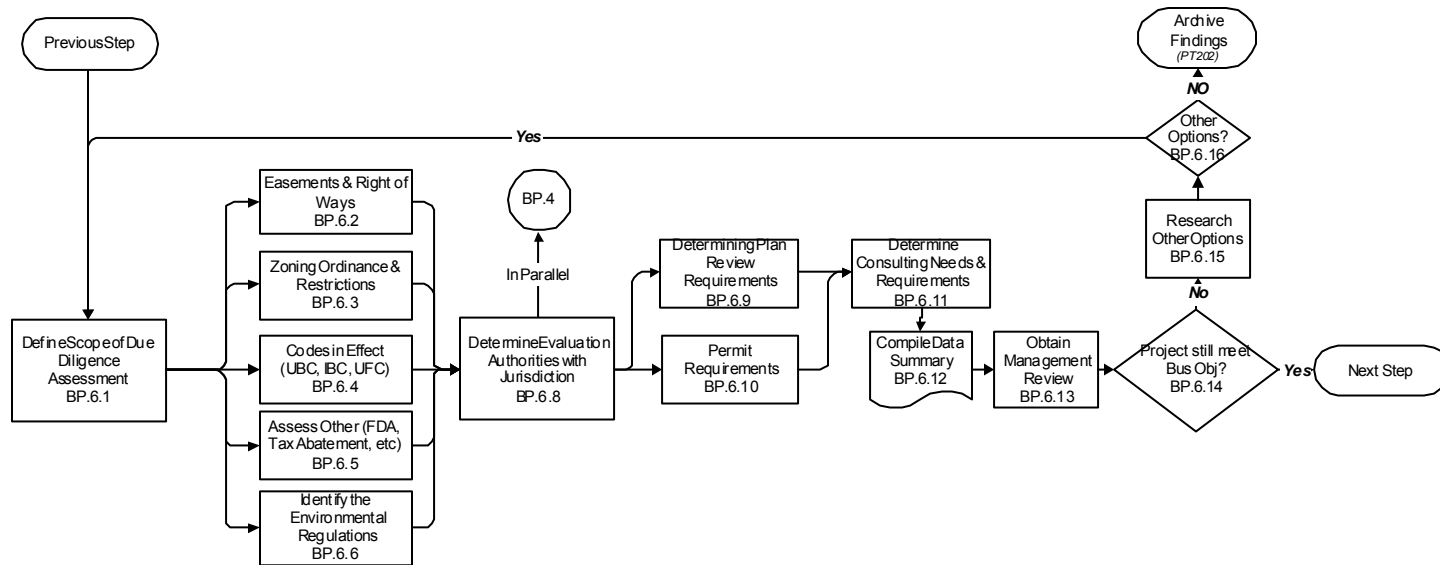


BP.6 – Address Regulatory Issues

4-6-06

Activities initiated to address regulatory issues and reporting requirements necessary for a project's development. Regulatory agencies may be at the local, state, or federal level of government. Required actions to ensure project compliance during the construction phase and during plant operations are identified and undertaken by the appropriate party.

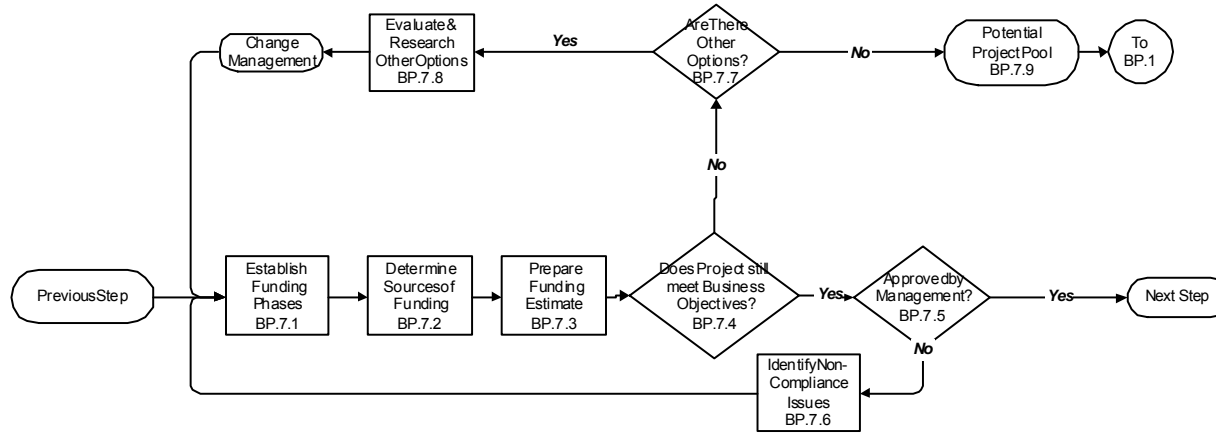
169



BP.7 – Develop Funding Plan

9-20-05

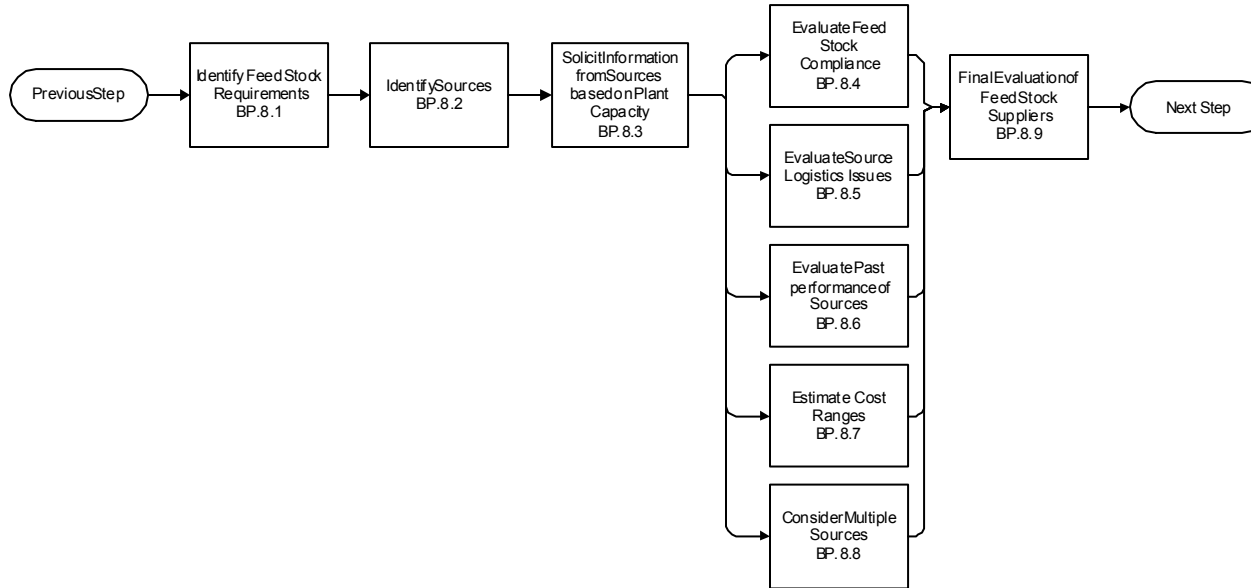
Financial appropriation plan and timetable, or the authorized allocation of funds for a specific project as currently envisioned and to assure the project still satisfies the business objectives.



BP.8 – Raw Material Sourcing

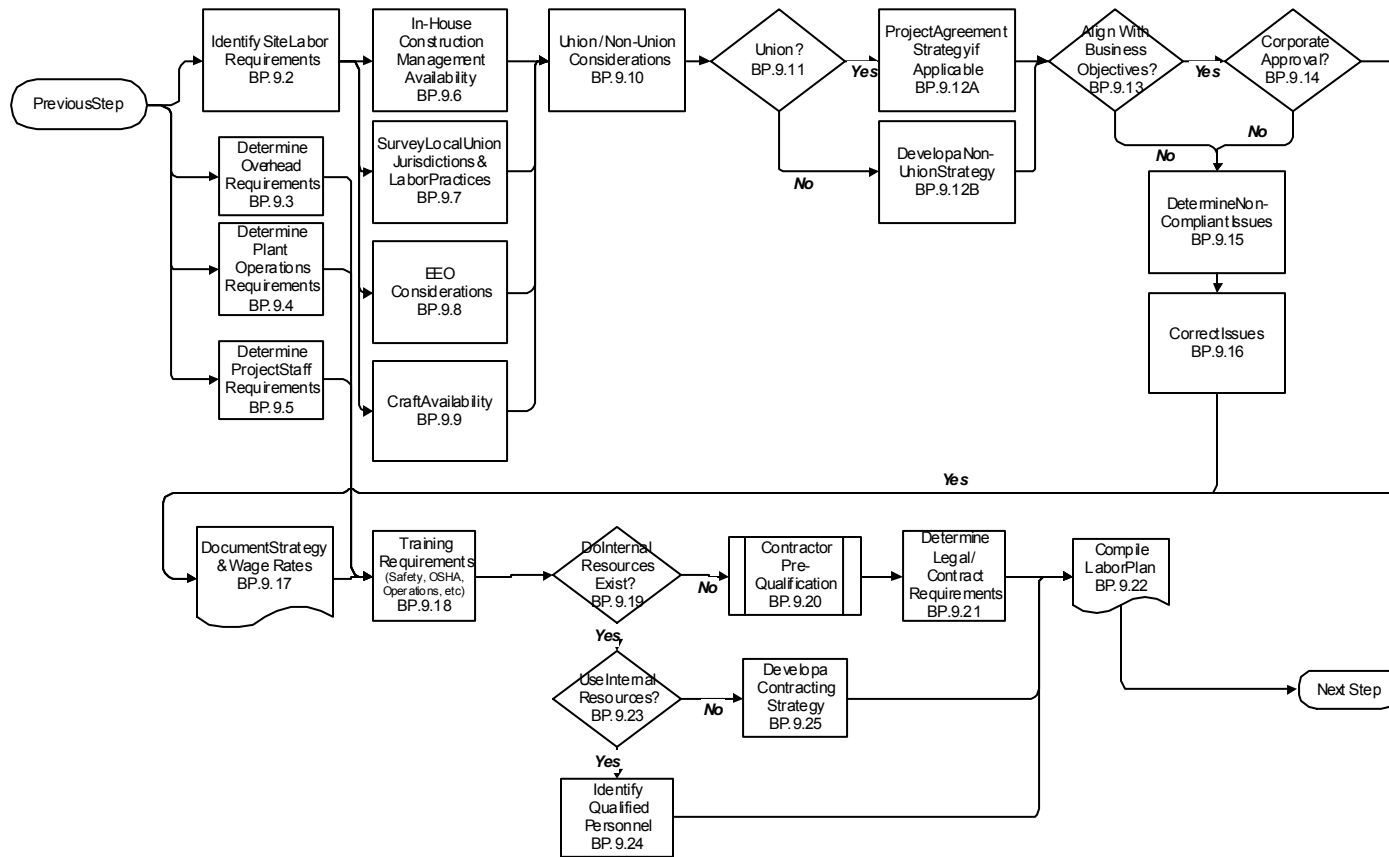
9-20-05

The process of determining qualified sources of raw materials to support plant operations. Modes of delivery, scheduled quantities, cost, storage requirements, and other such issues are considered.



BP.9 – Develop Labor Plan and Address Human Resource Issues

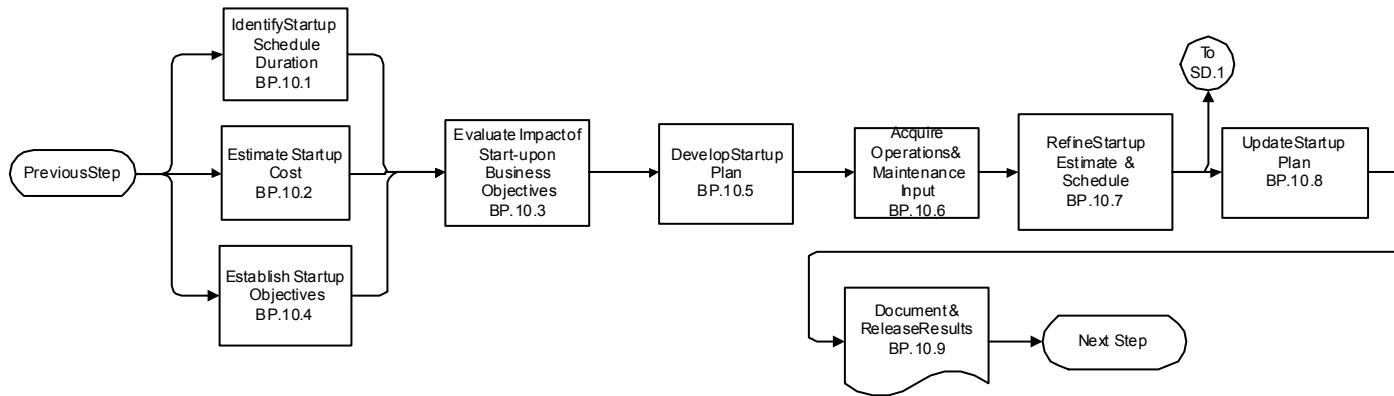
Includes personnel administration and definition of administrative procedures. May include requirements for project staffing for all project phases and plant operation. Source of labor and adequacy of supply are determined. Human resource issues are evaluated to establish project policy.



BP.10 Develop Startup Requirements

9-19-2005

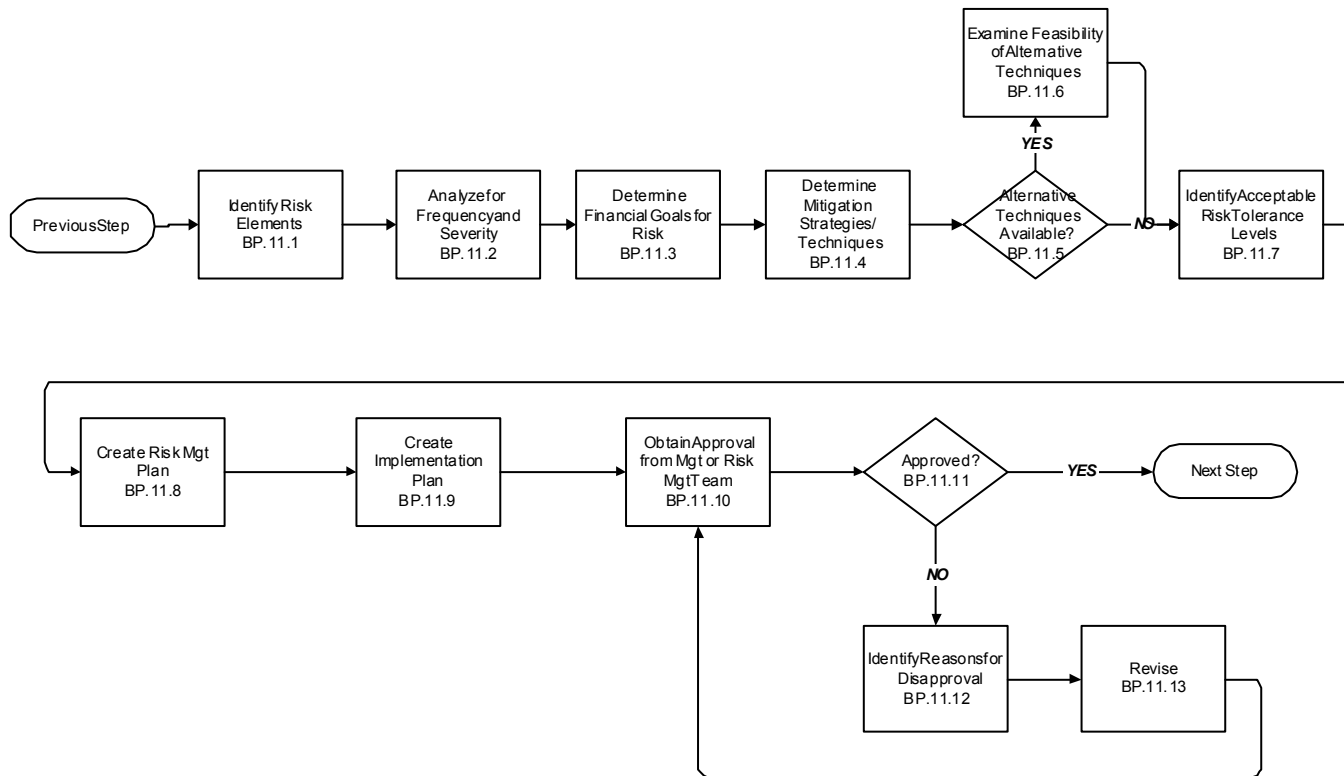
The process of early definition and planning of plant start-up requirements to ensure smooth transition from the construction phase to plant operations.



BP.11 Risk Mitigation Analysis

As of 2-10-06

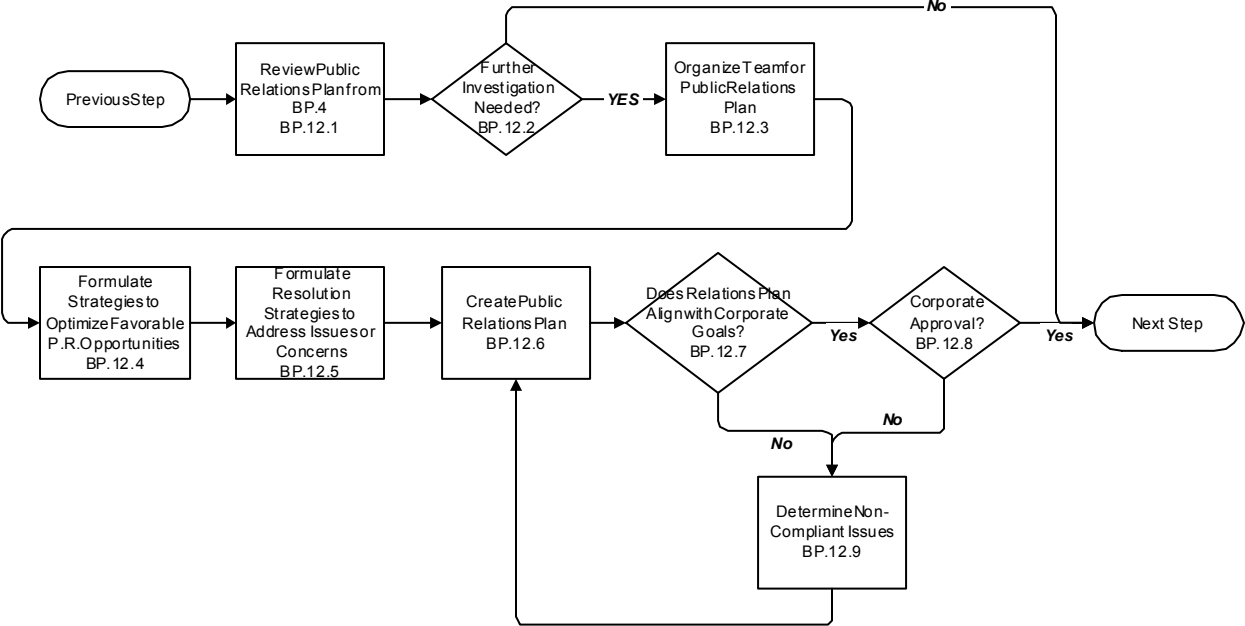
Collection of initial technical information that may be in the form of drawings, engineering specifications, and other information formats that is used to define plant components and process requirements.



BP.12 Refine Public Relations

9-20-05

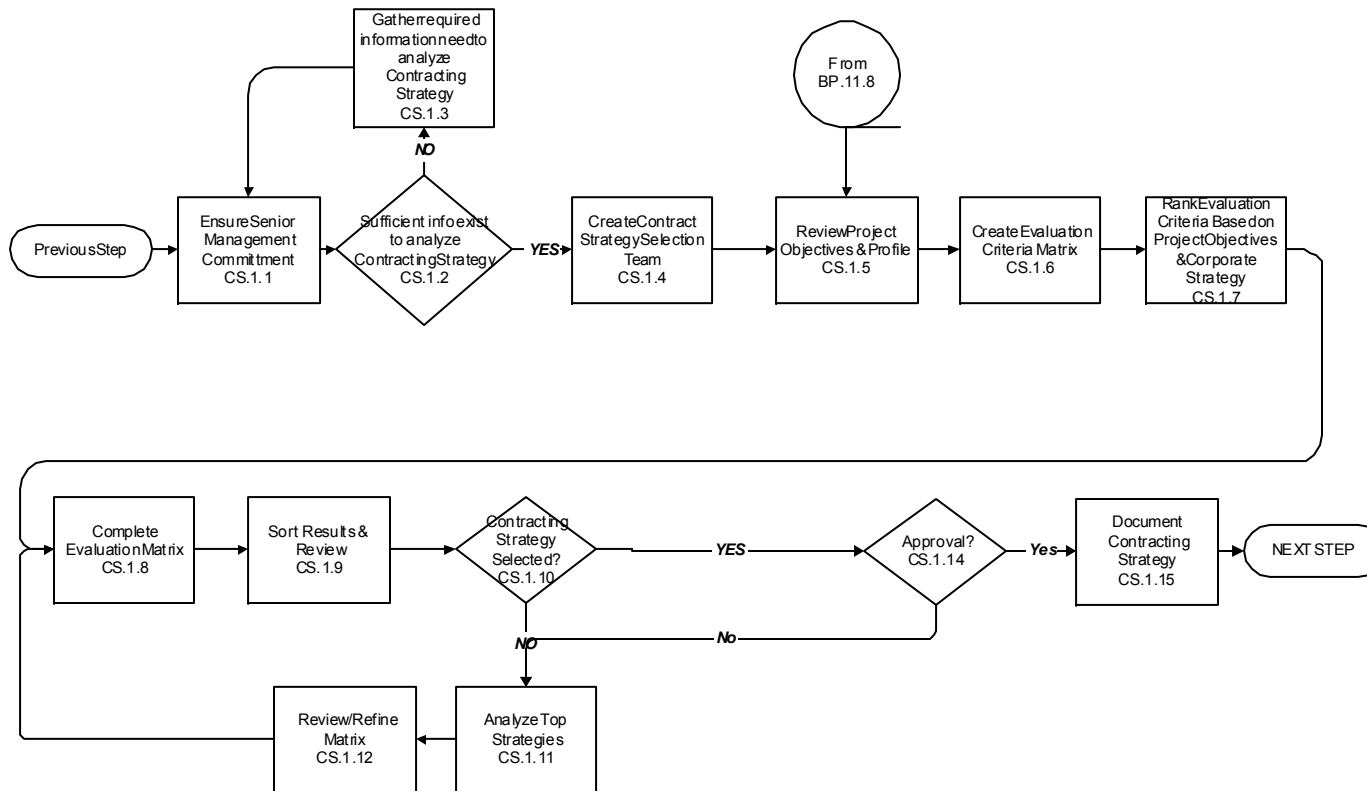
Finalize publicrelations plan based upon which project alternative was selected. This is a more detailed PR plan then designated in BP.5



CS.1 Develop Contract Strategy

11-14-2006

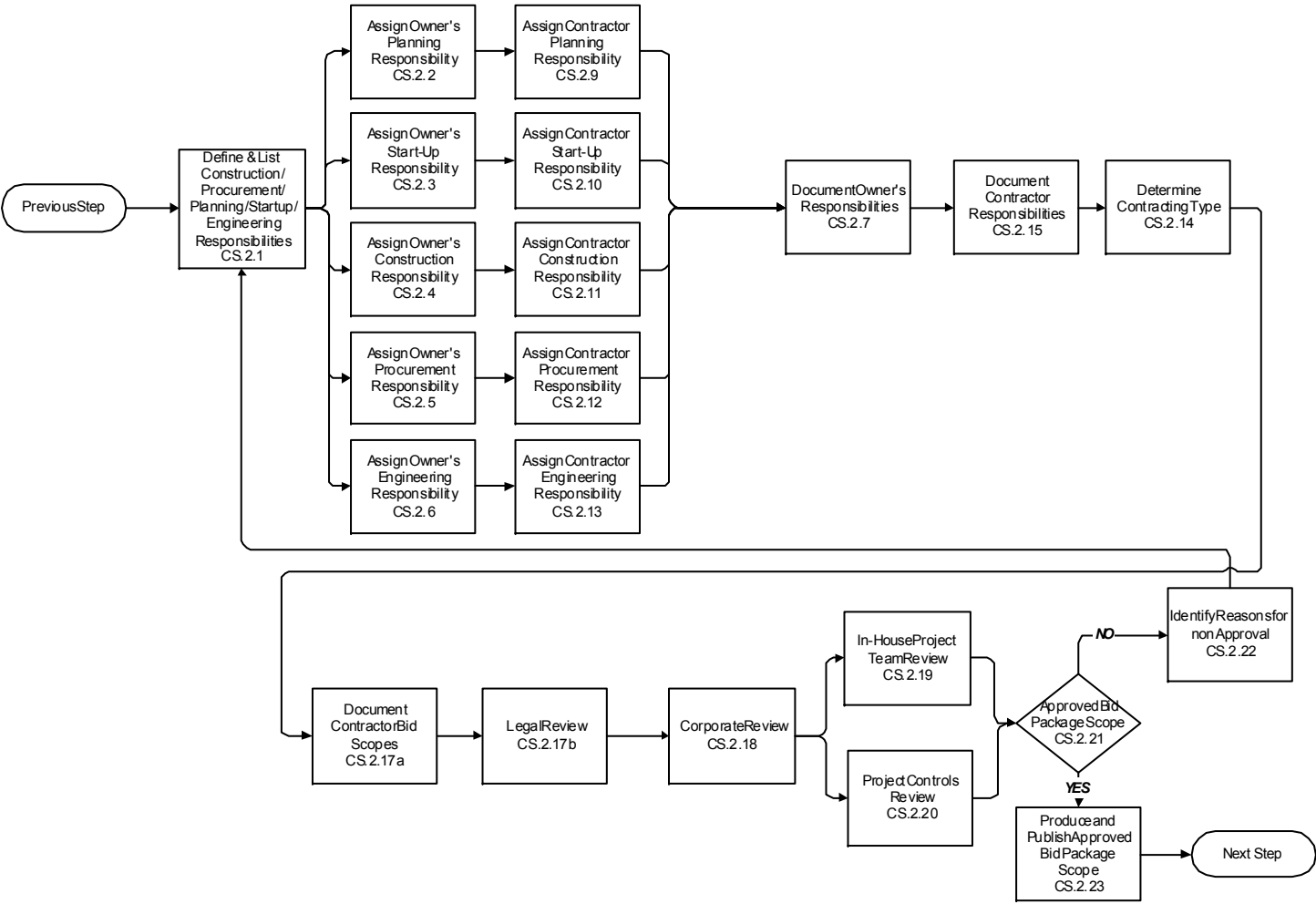
Identification of the major components in the engineering, procurement, and construction concerning responsibilities, scope and costs to achieve the best overall project objectives.



CS.2 Develop Bid Package Scope

11-14-2006

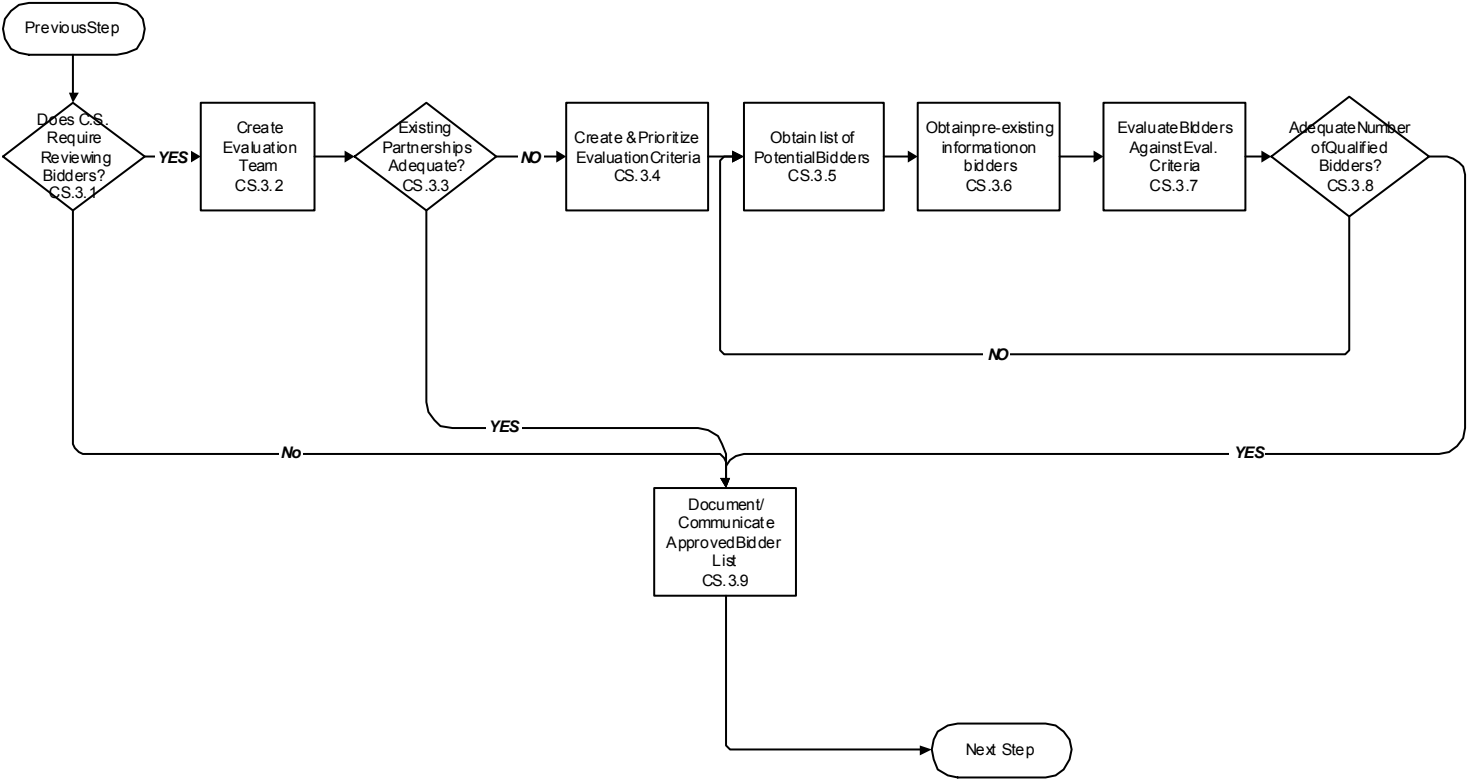
Identification of the major components of equipment procurement and construction concerning scope and responsibilities.



CS.3 Review Potential Contractor Bidders

9/22/2006

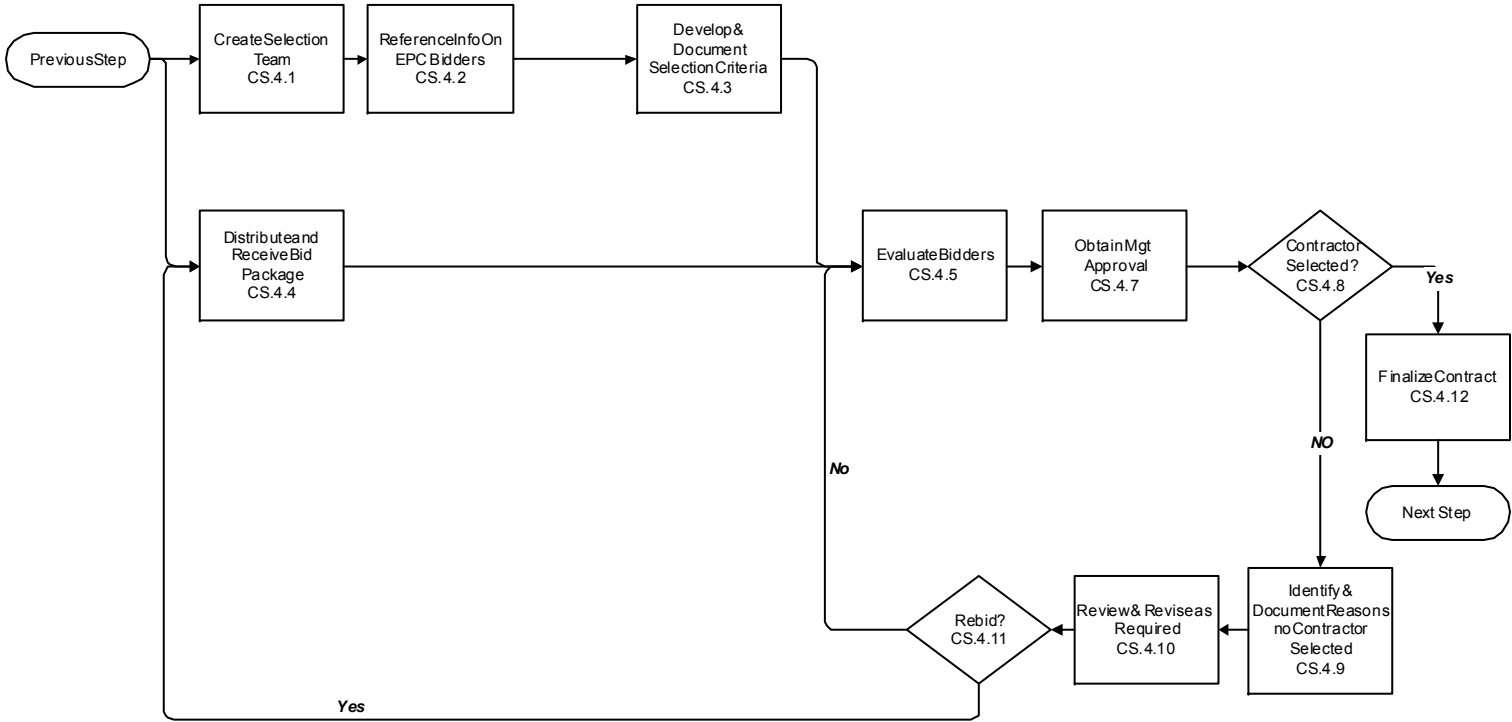
The process of screening contractors by the project owner, according to a given set of criteria, in order to determine their competence to perform the work if awarded the contract. The organizations' constructability programs or accomplishments may be a factor that is considered in this evaluation. Includes approved bidders list - List of a group of Suppliers or Subcontractors that have been approved to provide bids or quotations for materials or services for a particular single package.



CS.4 Select Contractor Team

9/22/2006

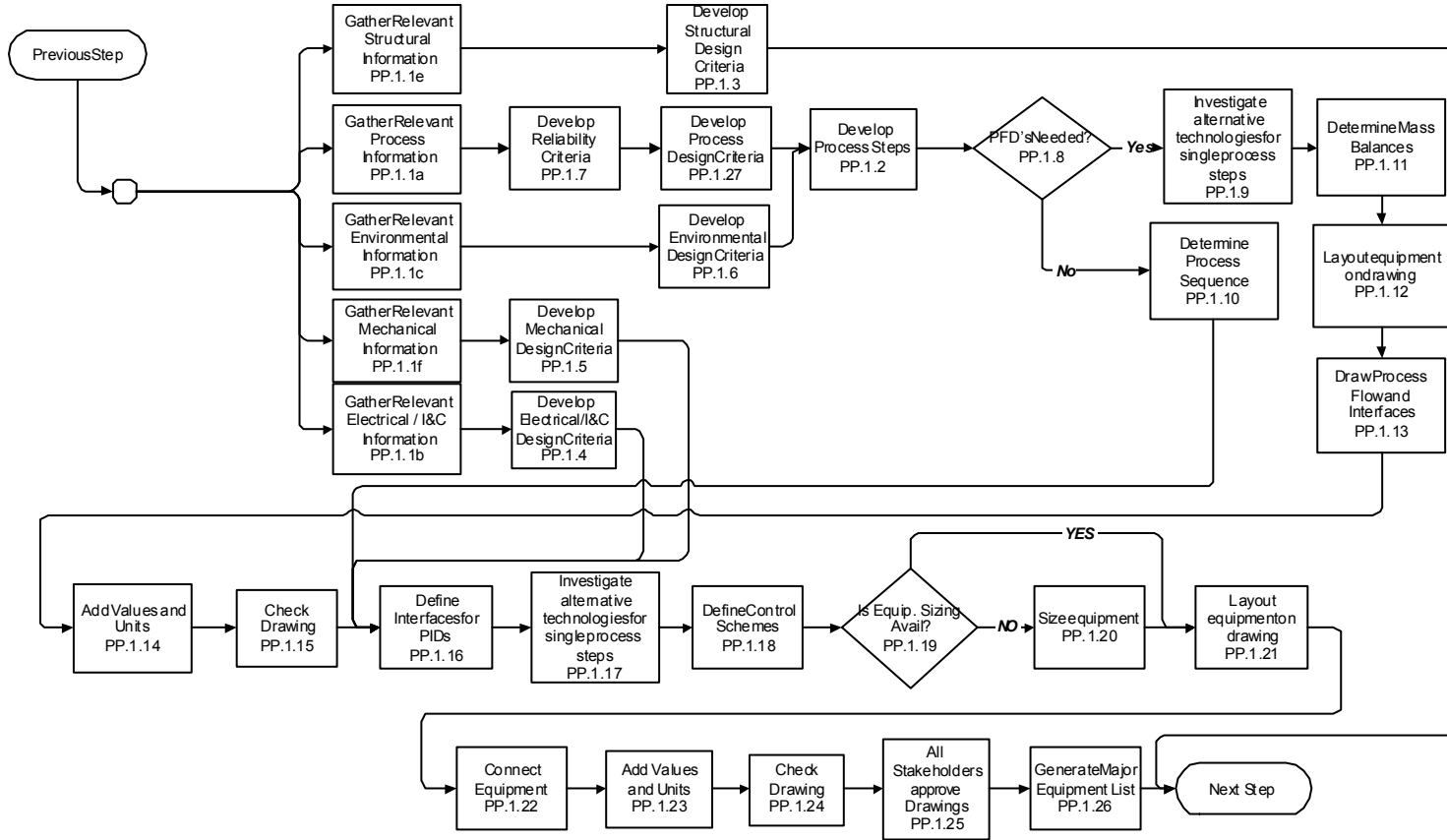
Selection of one firm or a team of firms for the actual engineering, procurement, and construction process.



PP.1 - Develop Preliminary Design Criteria including PFD's and PID's (schematic)

2-10-2006

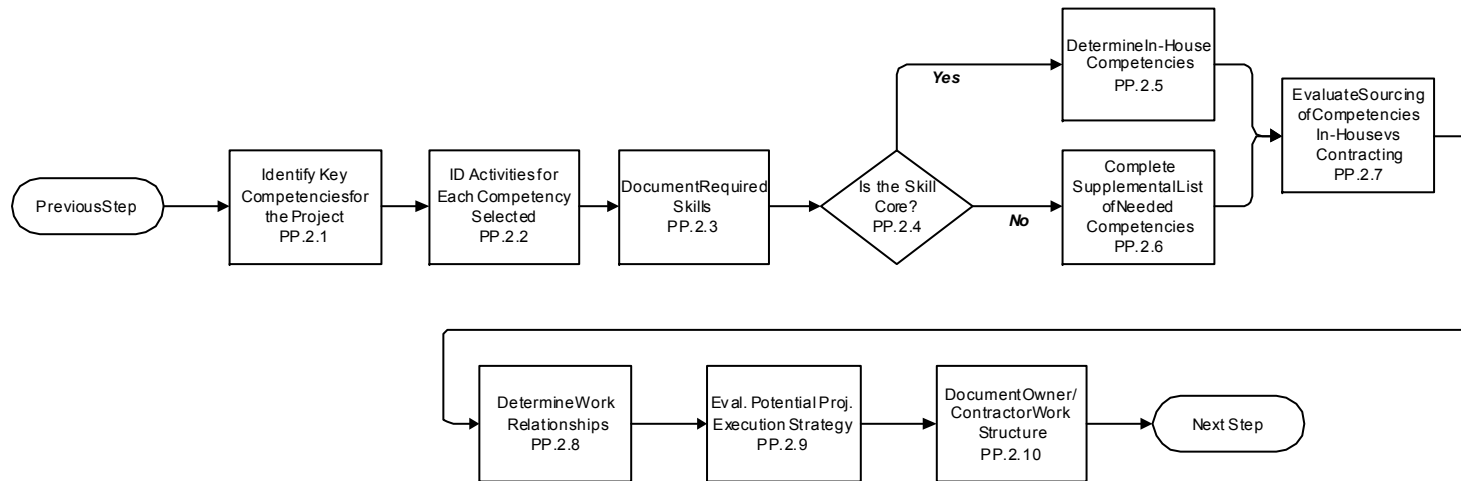
Activities in the Pre-Project Planning phase which provide general design criteria and project objectives used as the basis for developing the project design concept(s). After this process is complete, the design progresses to the level where detail design calculations and construction documentation can be begun.



PP.2 - Formulate Preliminary Organization

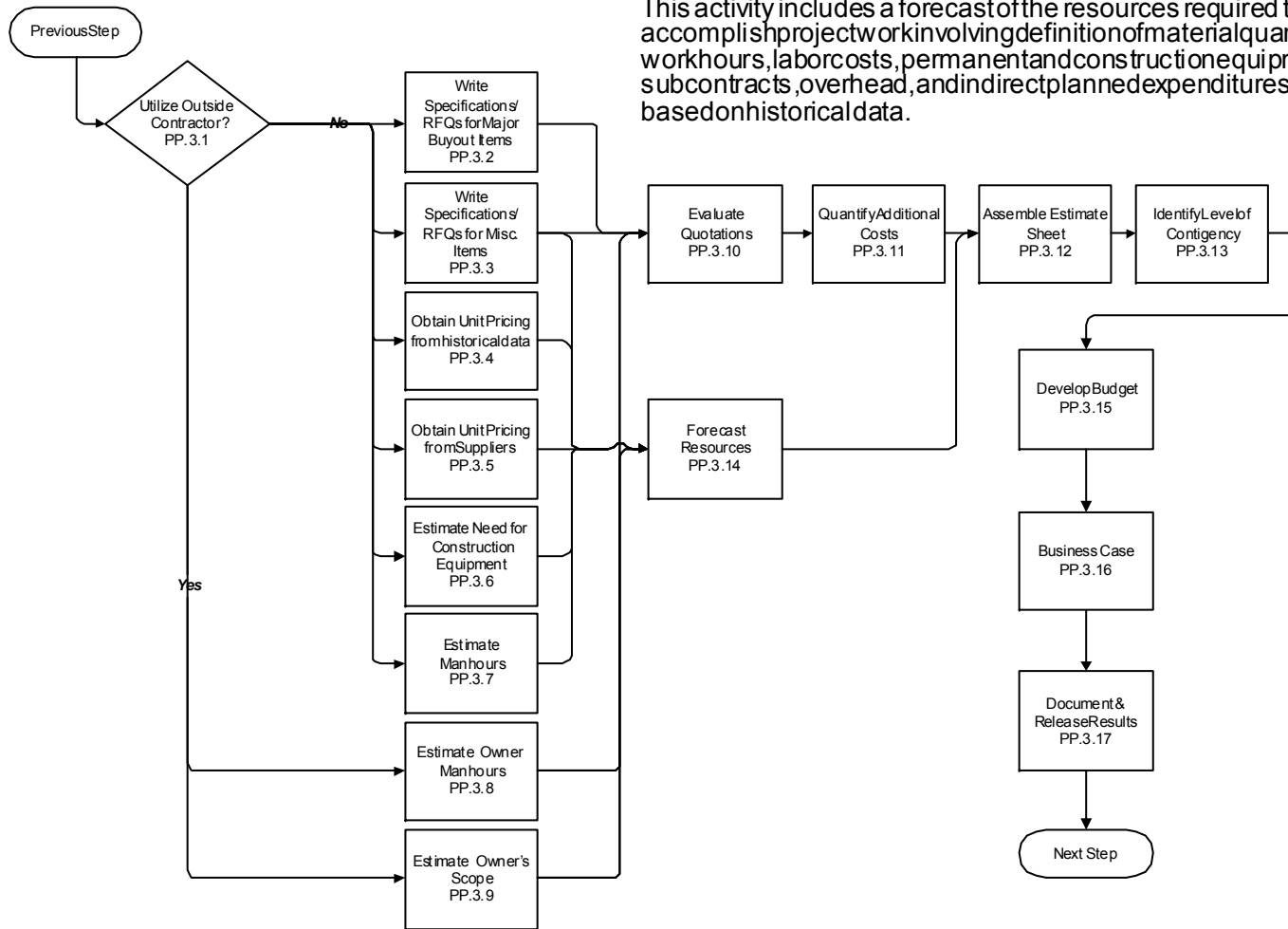
Development of senior management assignments and project responsibilities for design and construction.

Condensed CII Best Practice



PP.3 Complete Preliminary Estimates

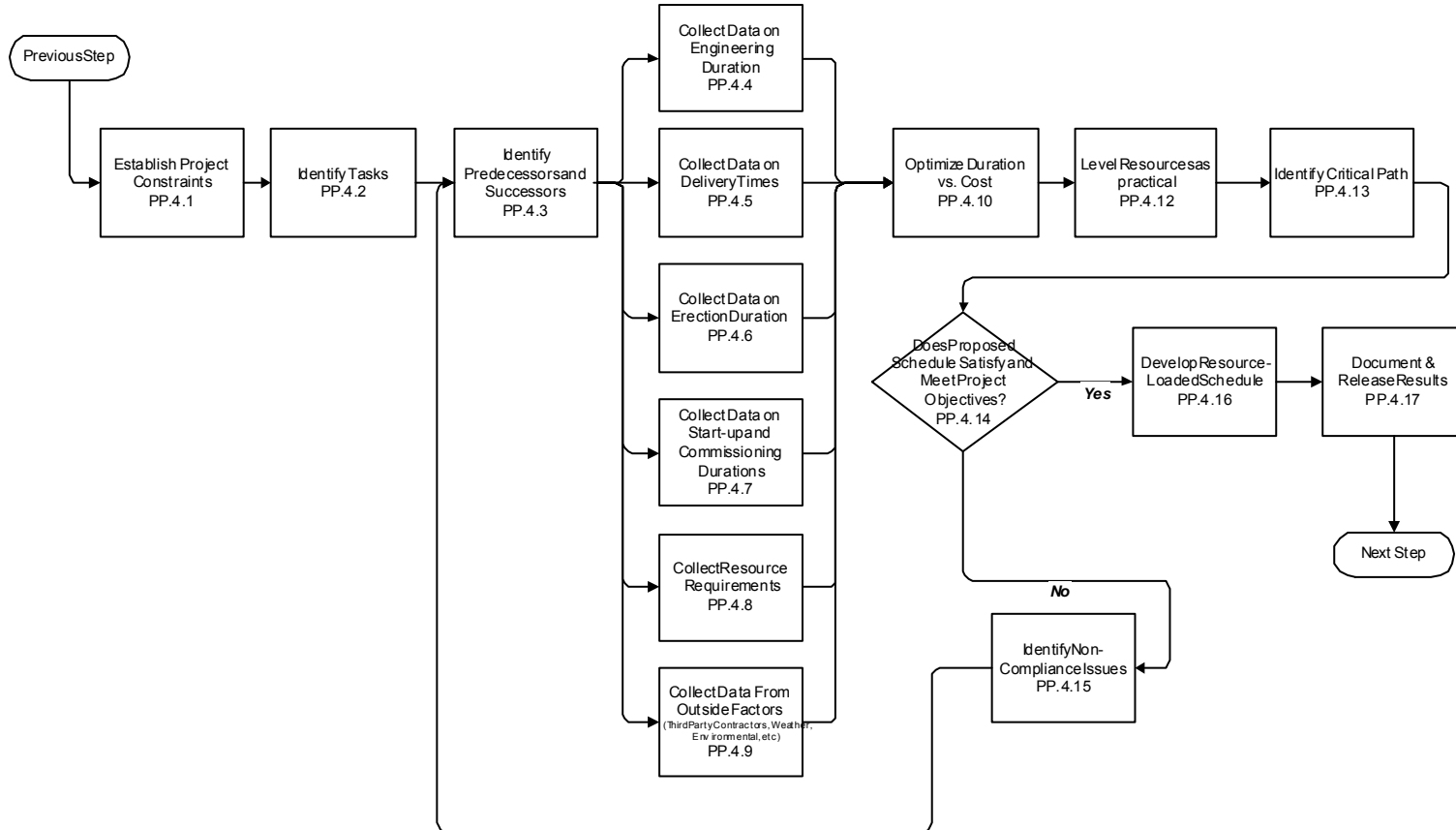
Development of estimated cost and labor-hours to complete the work. Includes obtaining external pricing information for major equipment, materials and services from potential consultants, suppliers, and others to prepare an estimate. Typically developed to the accuracy requirements of the project owner. This activity includes a forecast of the resources required to accomplish project work involving definition of material quantities, work hours, labor costs, permanent and construction equipment, subcontracts, overhead, and indirect planned expenditures, often based on historical data.



PP.4 Establish Master Project Schedule

7-19-05

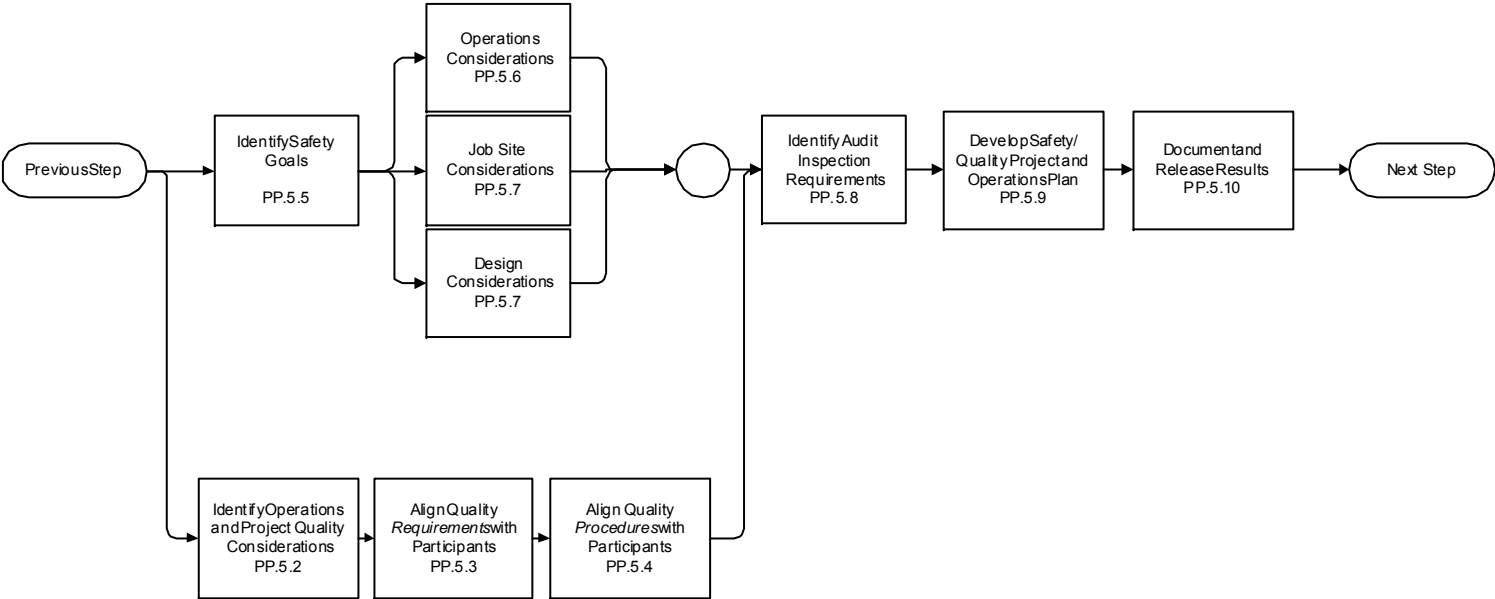
Development of a standard sequenced task logic network reflecting the major control activities and relationships between Engineering, Procurement, and Construction, and Start-up. A preliminary schedule; the result of applying known, contractual, or tentative dates to the sequence of work prior to resource scheduling.



PP.5 Address Quality and Safety Issues

7-19-05

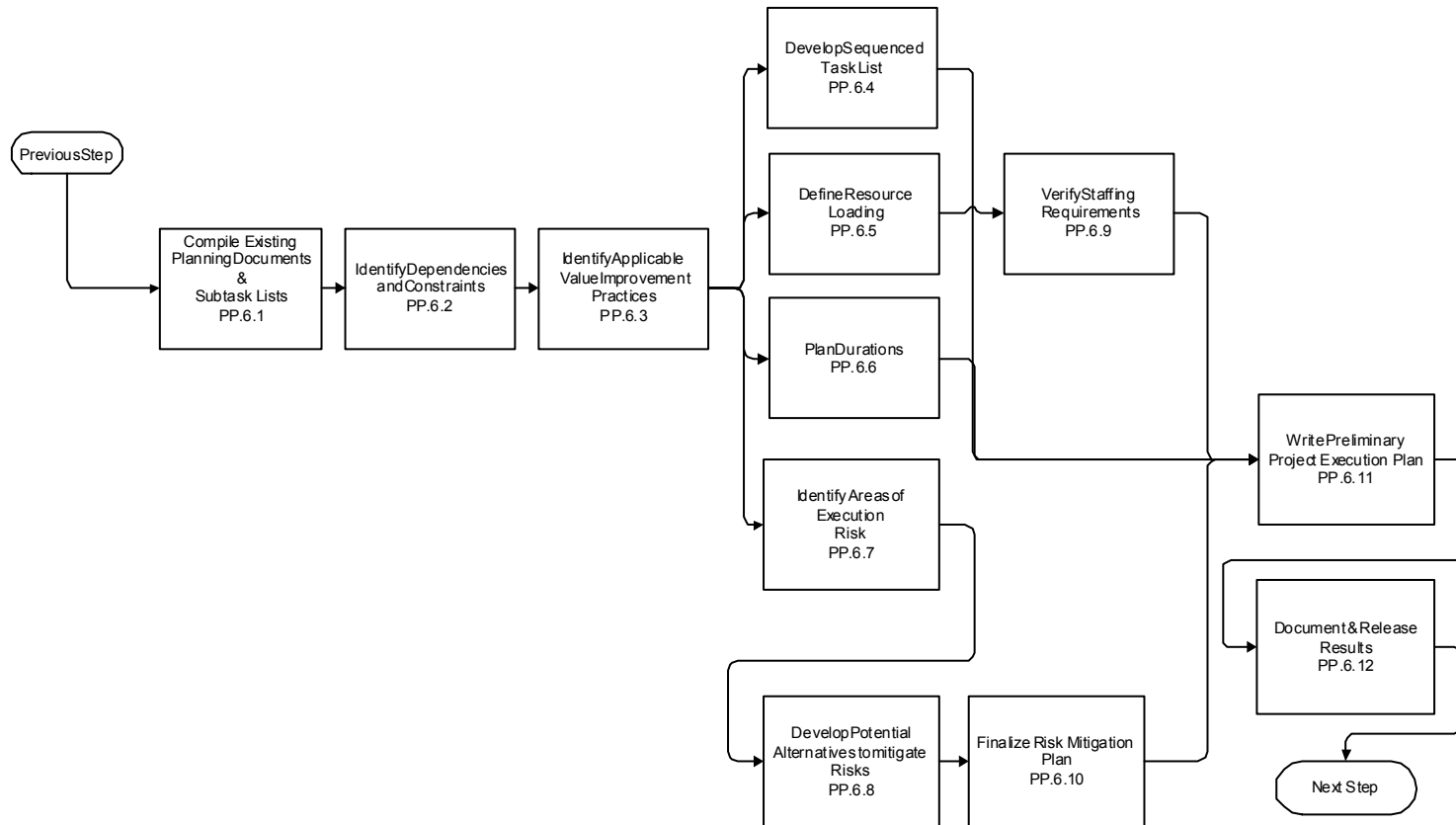
Development of quality and safety management systems; development of procedures for quality and safety improvement processes.



PP.6 Develop Preliminary Execution Plan

7-19-05

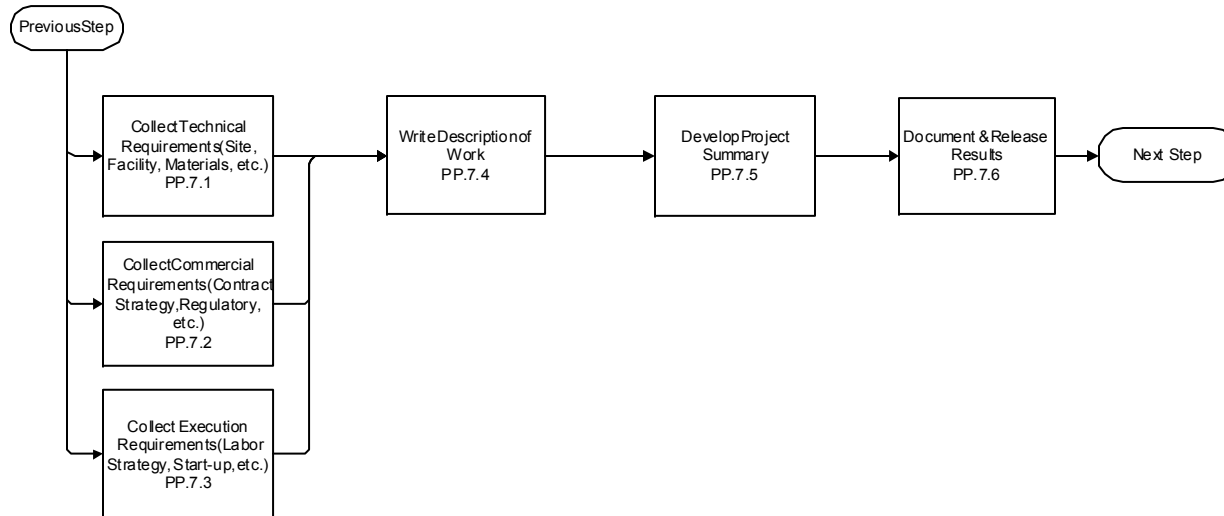
The dependencies and constraints are identified from the task lists, standard logic diagram, and deliverables to produce a sequenced task list replicating a logic diagram. Includes preliminary resource loading to define internal and external staffing and other -resource requirements to accomplish individual or groups of tasks. Also includes an estimated duration for completing the task consistent with the resources applied. A key project management tool enabling the project manager to delineate, in as much detail as required, the plan for executing a project and by this means advise all concerned departments and individuals in the company of the requirements, responsibilities and assignments for carrying out the task. An integrated and coordinated program for completing all project activities.



PP.7 Compile Project Scope

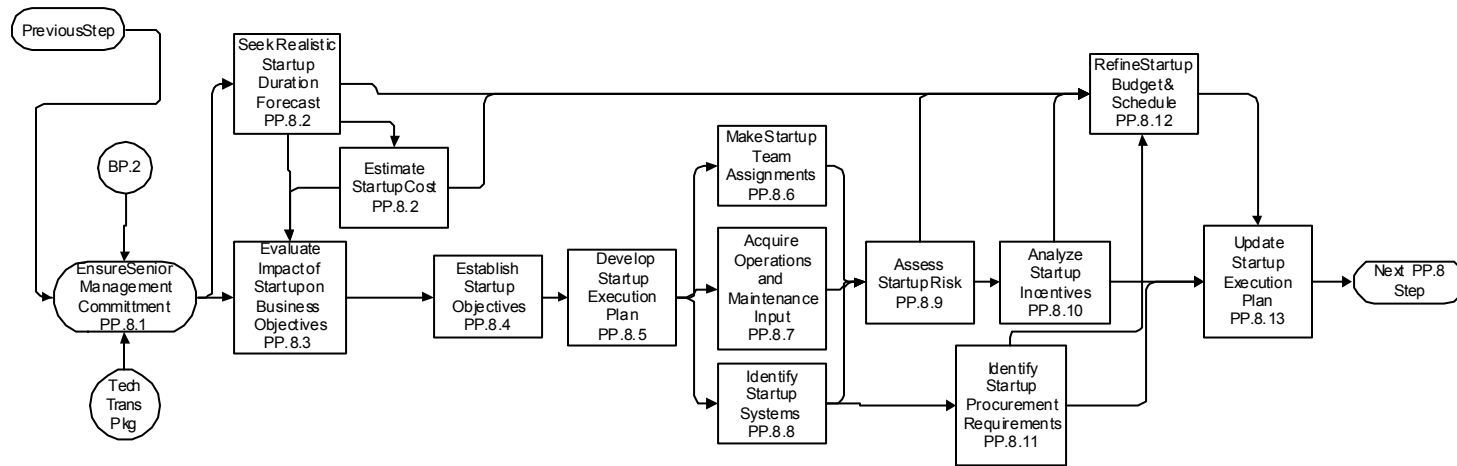
7-19-05

Consolidation of facility scope plan activities and feedback of technical, commercial, and project execution requirements from instructions and/or consultation with the client. Written description of work provides sufficient detail for identification of project tasks, sequence, and relationships. Develop preliminary summary of project characteristics, contractual arrangements, and related project information.



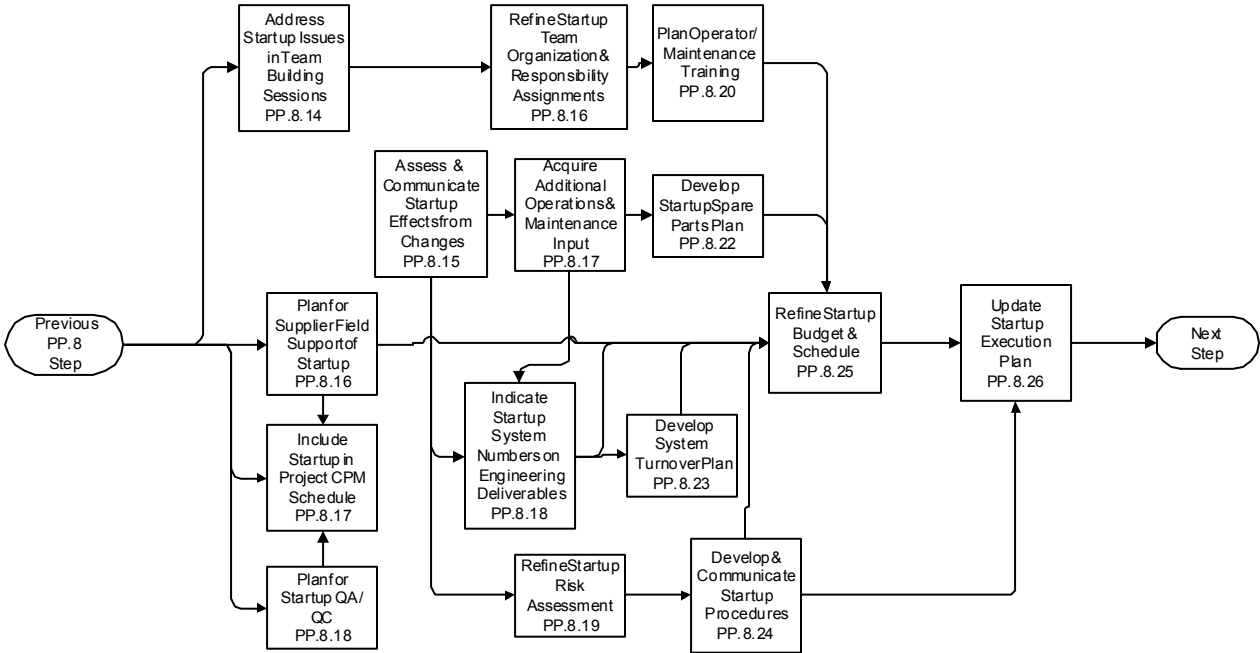
PP.8 Page 1 – Define Start-up Requirements

Development of facility start-up plan which defines required activities, sequence of execution, and assignment of responsibilities.



PP.8 Page 2 – Define Start-up Requirements

188

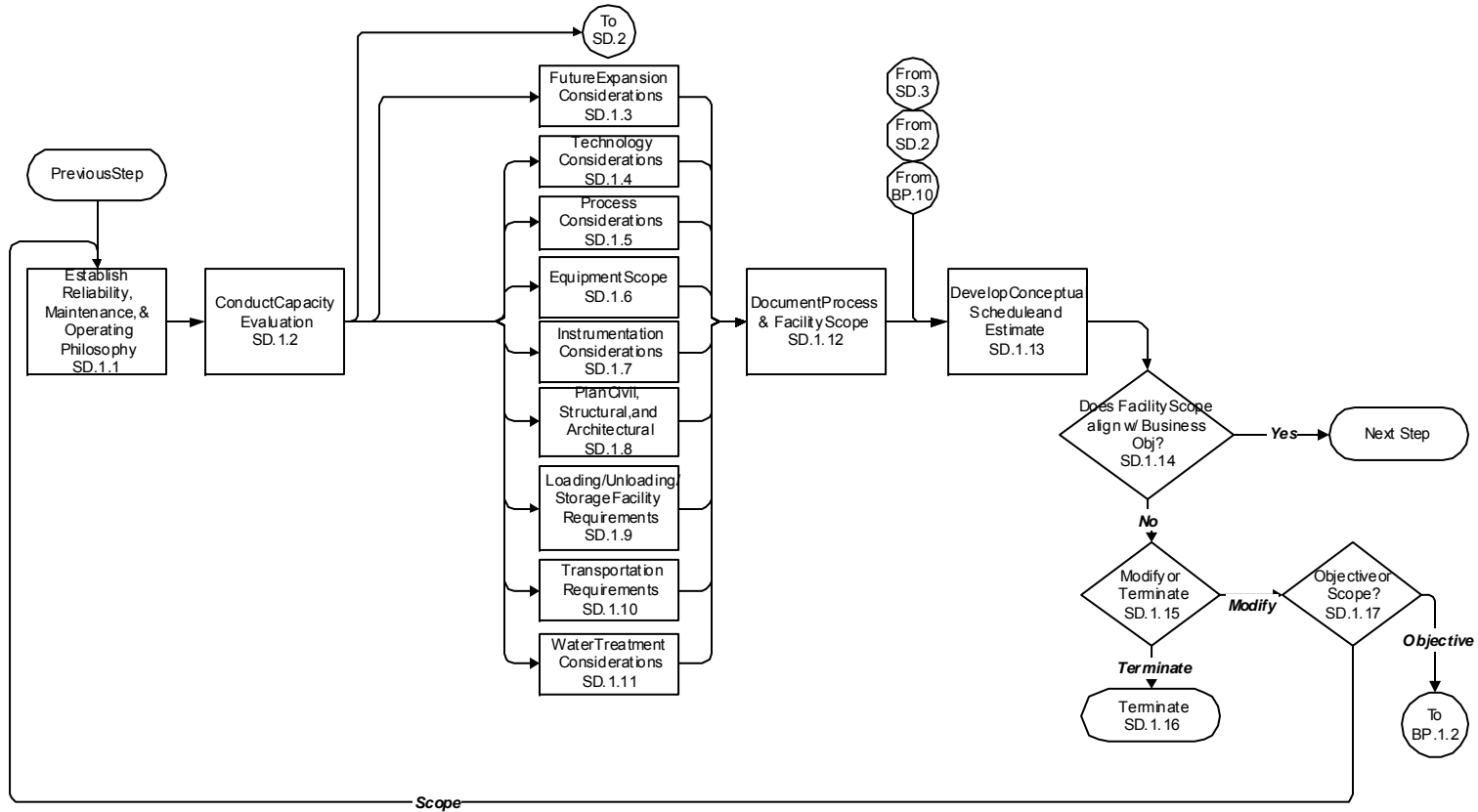


SD.1 Process and Facility Planning

Determine the requirements for acquiring and maintaining the physical location, process equipment, and physical infrastructure of the project.

9-20-05

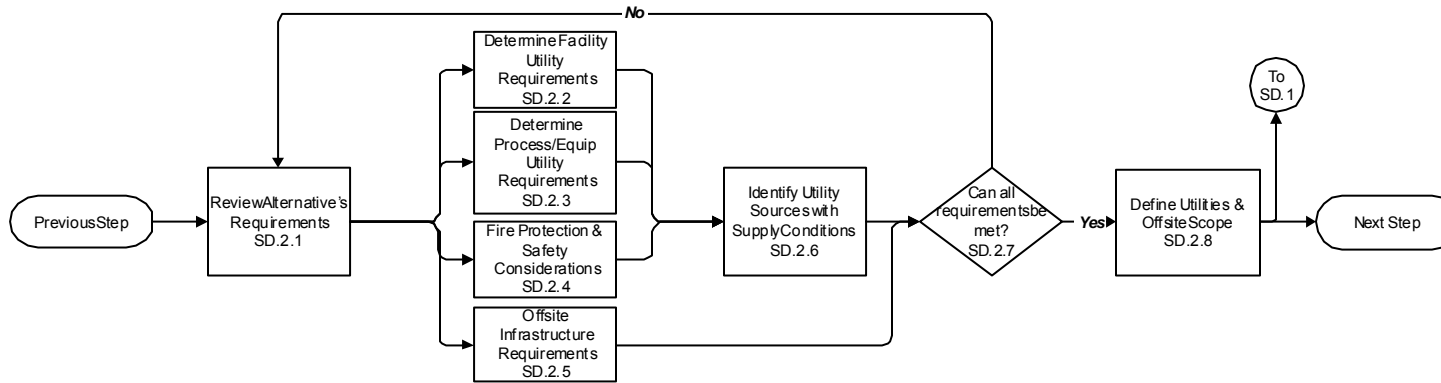
189



SD.2 Develop Utilities and Offsite Scope

Determine the requirements for power, water, sewer and other utilities and/or infrastructure, as well as other support facilities not part of the immediate location.

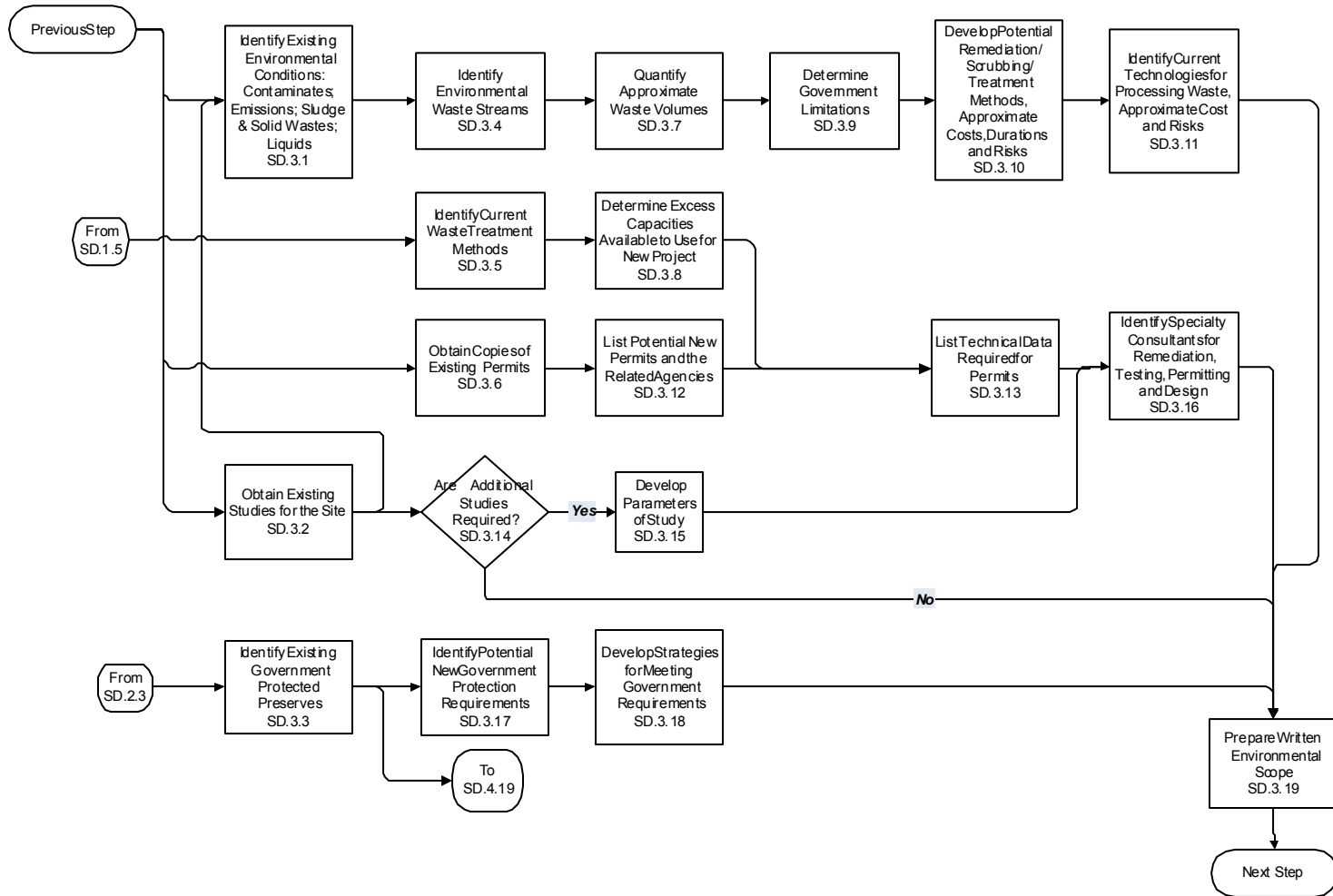
9-20-05



SD.3 – Develop Environmental Scope

5/18/2006

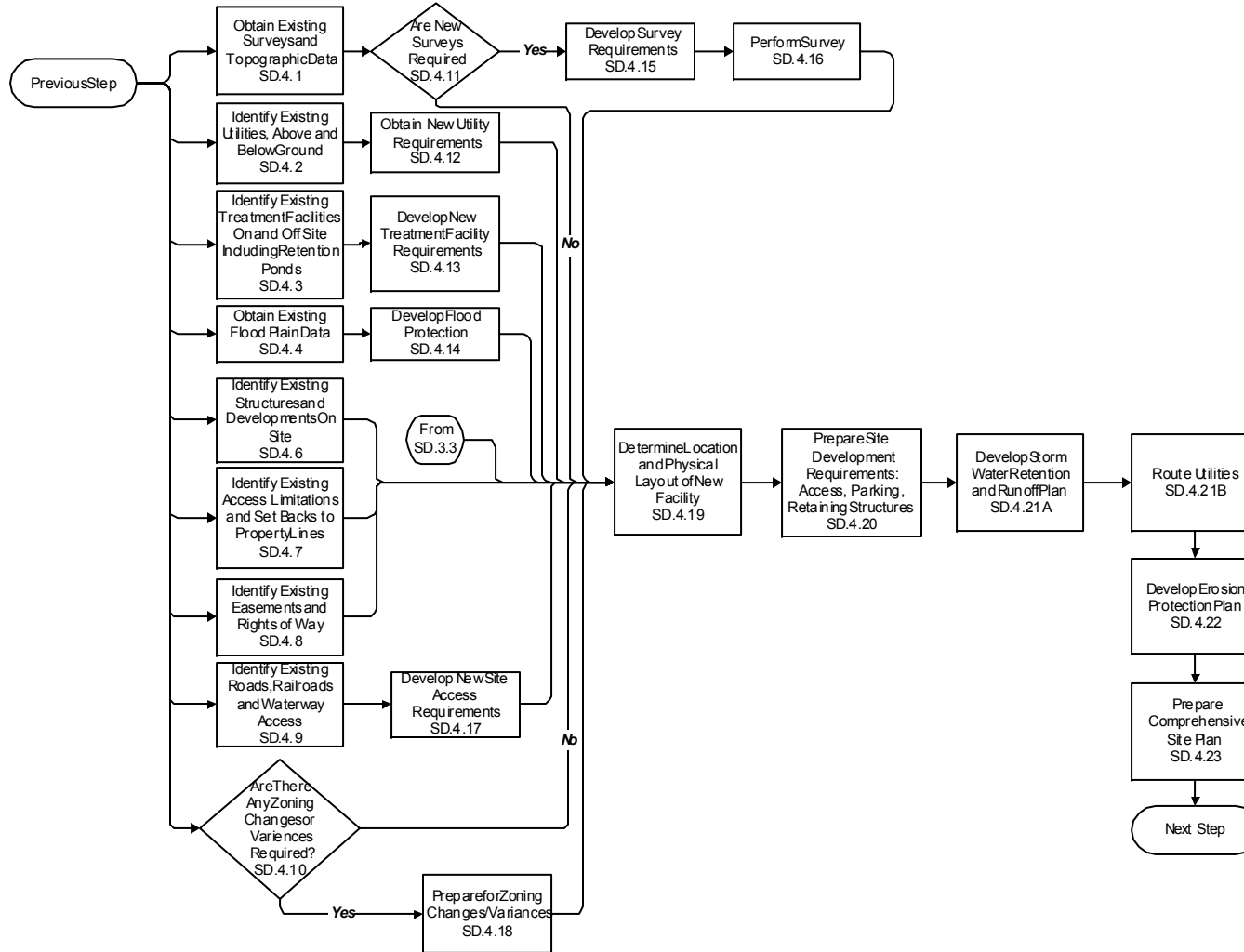
Determine the extent of environmental work such as remediation, assessments, wetlands, and other considerations.



SD.4 – Develop Site Plan

11-14-2006

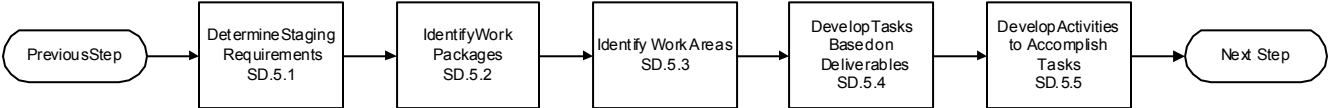
Determine the location and physical layout of facilities, utilities, infrastructure and other support processes or structures.



SD.5 – Detail Work Breakdown Structure

As of 7-19-05

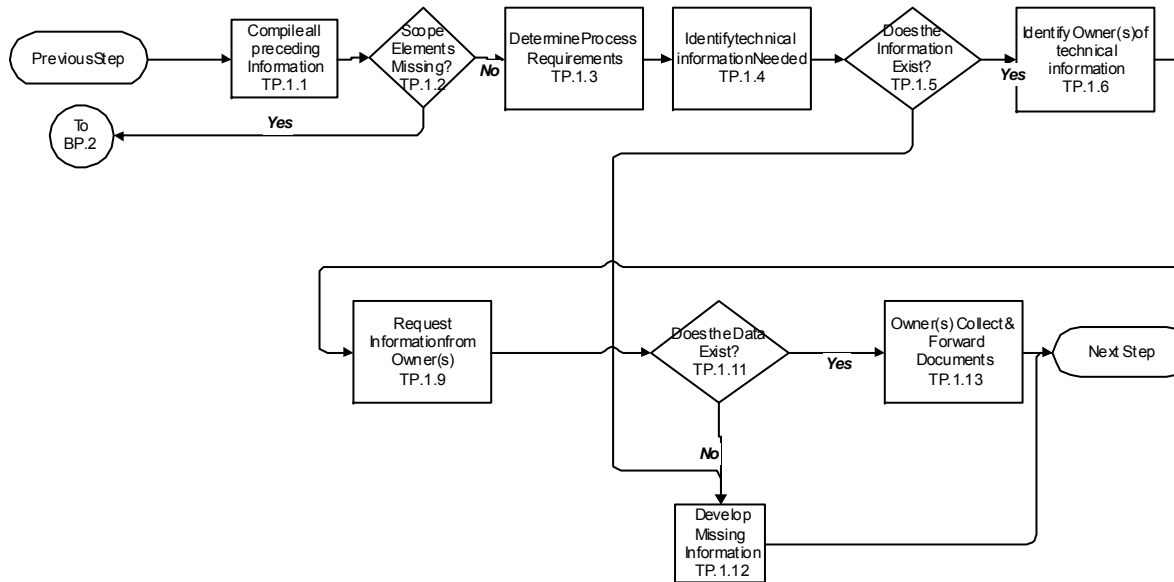
Preparation of a list of tasks and deliverables that break the work scope into manageable work pieces, including time and cost aspects.



TP.1 – Conduct Technical Surveys & Process Analysis

11-14-2006

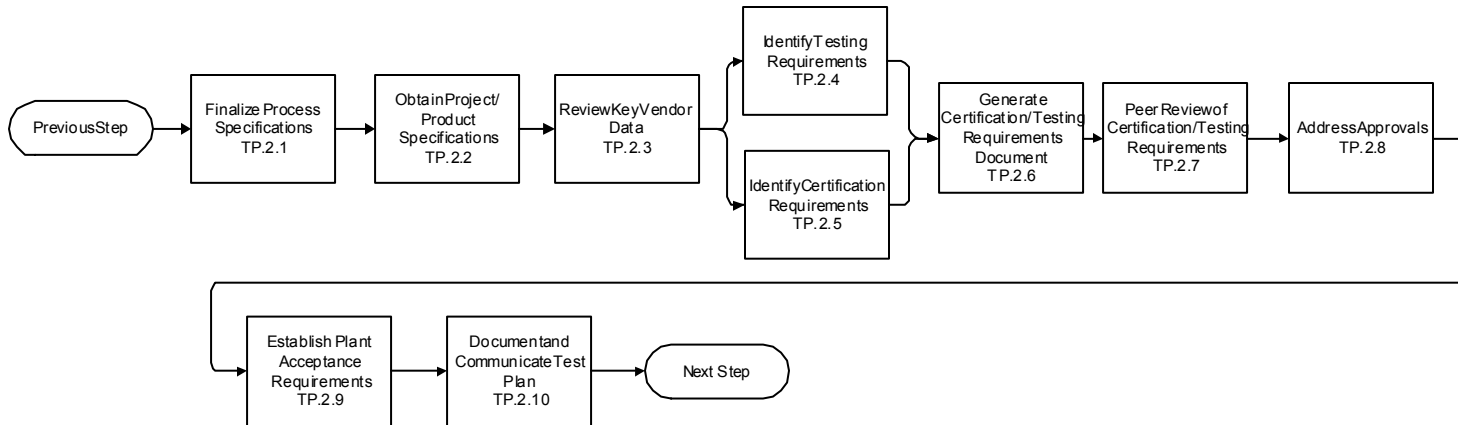
Collection of initial technical information that may be in the form of drawings, engineering specifications, and other information formats that is used to define plant components and process requirements.



TP.2 Product Development/Identify Certification and Testing Procedures

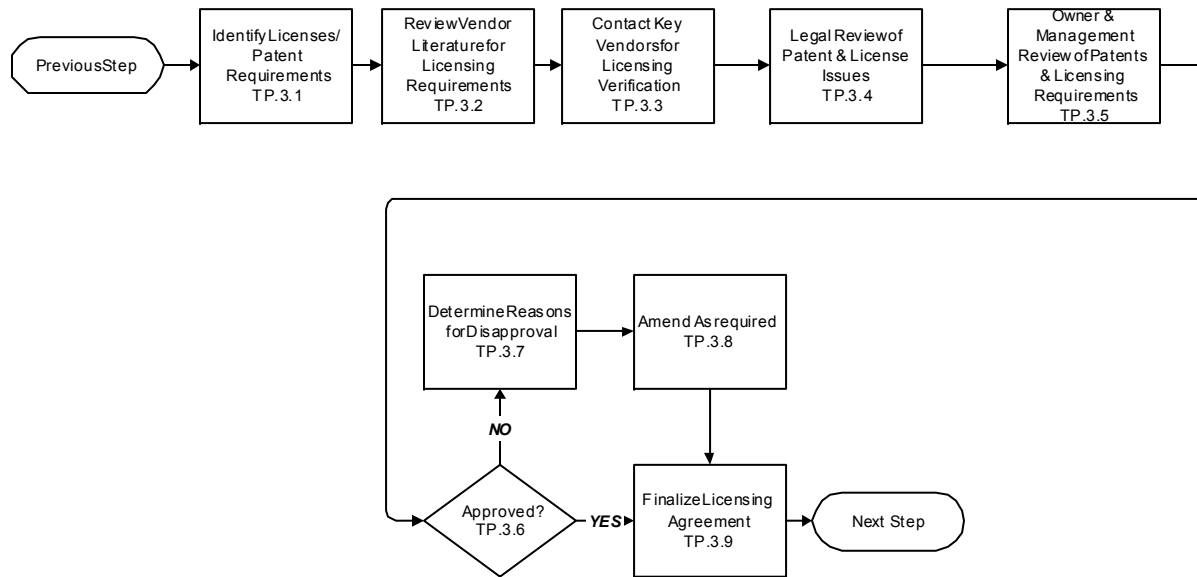
10-12-2005

Collection of initial technical information that may be in the form of drawings, engineering specifications, and other information forms that is used to define plant components and process requirements



TP.3 Obtain License Agreements

Activities to secure appropriate patents and licenses for processes and products associated with the project's development and life-cycle operation. Procedures focused on ensuring that proprietary products and processes are secure.

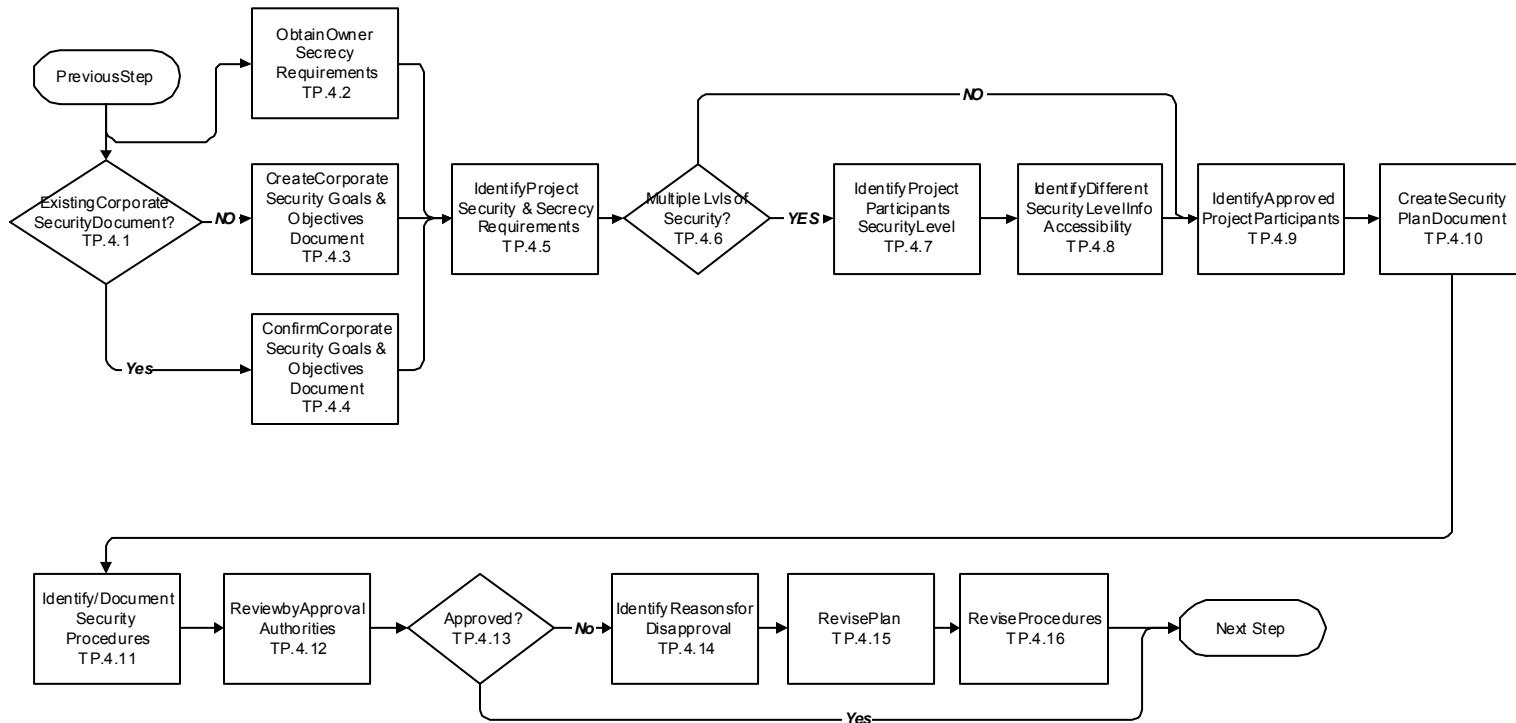


TP.4 Establish Security & Secrecy Agreement

10-12-2005

Creation of any security requirements for the project among project participants. Establishment of differing security levels for project where required.

197



Appendix C
Survey Instrument

**Construction Industry Institute Research Team 221
Information Flow to Support Planning
Data Collection Survey**

Research Objectives:

- To identify how the flow of information management during the pre-project planning process can be improved to benefit overall project success.
- To seek proactive strategies to better manage information exchange activities that impact the likely critical path of a project.
- To create a methodology for effectively managing the information flow during the planning process to enhance project performance.

Survey Objectives:

- To collect data pertaining to the activity durations and total labor hours expended during the pre-project planning process for a recently completed construction project.
- To collect supplementary, subjective opinions related to the execution of pre-project planning activities. Specifically the opinion assessments will address:
 1. Whether or not the activity was successfully completed
 2. The extent to which the activity was unusually complex
 3. How efficiently the activity was performed. (The extent to which the activity was performed using a reasonable allocation of resources.)
 4. Whether or not information, documents, and data were readily available.

Instructions:

Begin the survey by completing the project profile. Then, study the pre-project planning activities with accompanying descriptions, and record the duration and total labor hours expended internally by the owner and externally by designers, constructors, or consultants. After the labor hours and durations are completed, answer the four questions by placing checks in the appropriate boxes. Complete these steps for all 32 pre-project planning activities. Below are some guidelines to aid in the completion of the survey.

- The survey can be completed by both owner and contractor companies. Contractors may have to partner with an owner company to access the data needed.
- The survey can be completed for any recently completed project.
- The research team prefers to collect data from different projects within a company. Multiple surveys completed on the same project are not as beneficial as different projects.
- Please completely fill out the survey. Incomplete surveys cannot be used.
- Multiple persons can complete one survey if they were involved in the same project. This may be especially helpful if all of the information is not known by one person.
- Data from poor projects and good projects is accepted.

Sample Survey Form:

A sample completed form precedes the survey form.

Survey Return:

Thank you for taking the time to complete this survey and supporting CII research. If you have any questions, please contact the research team representative who requested the completed survey.

All completed surveys should be returned to:

Dr. W. Edward Back
Room 100 Lowry Hall
Department of Civil Engineering
Clemson University
Clemson, South Carolina 29634-0912

Or

wmeback@clemson.edu

All company and personal information will be removed prior to report distribution.

Project Profile

Company Name:

Contact Name:

Contact Email:

Contact Phone Number:

Project Name/Identifier:

Project Location:

Industry Sector: Government Industrial/Manufacturing
 Infrastructure Other
 Commercial/Building

Project Type New Construction
Maintenance/Renovation/Retrofit

Date of Project Completion:

Total Installed Cost:

Completed Sample of the Survey

Pre-Project Planning Activities	Estimated Activity Duration (Days)	Estimated Total Labor Hours		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
		Owner	External <i>(Designer, Constructor, or Consultant)</i>						
PPP.BP.1 Define Business Objectives Identification and prioritization of specific corporate business related objectives pertaining to the development of a capital project.	5	O 40	E 10						
1. This activity was successfully executed.							x		
2. This activity was unusually complex due to project requirements.								x	
3. This activity was executed efficiently.					x				
4. The information, documents, and data requirements were readily available for this activity.				x					
PPP.BP.2 Identify/Select Project Alternatives Identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies.	7	O 100	E 20						
1. This activity was successfully executed.								x	
2. This activity was unusually complex due to project requirements.				x					
3. This activity was executed efficiently.				x					
4. The information, documents, and data requirements were readily available for this activity.							x		
PPP.BP.3 Conduct Market Research and Analysis Those activities required to initially determine whether a new facility, or plant expansion, is needed and corporately beneficial, and should be approved for project initiation. Pre-existing corporate information useful to the decision making, such as historical cost data and project performance histories, are made available.	2	O 70	E 0						
1. This activity was successfully executed.				x					
2. This activity was unusually complex due to project requirements.				x					
3. This activity was executed efficiently.				x					
4. The information, documents, and data requirements were readily available for this activity.				x					

Front End Planning Activities		Estimated Activity Duration (Days)	Estimated Total Labor Hours		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A					
			Owner	External (Designer, Contractor, or Consultant)											
PPP.BP.1	Define Business Objectives Identification and prioritization of specific corporate business related objectives pertaining to the development of a capital project.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.BP.2	Identify/Select Project Alternatives Identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.BP.3	Conduct Market Research and Analysis Those activities required to initially determine whether a new facility, or plant expansion, is needed and corporately beneficial, and should be approved for project initiation. Pre-existing corporate information useful to the decision making, such as historical cost data and project performance histories, are made available.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														

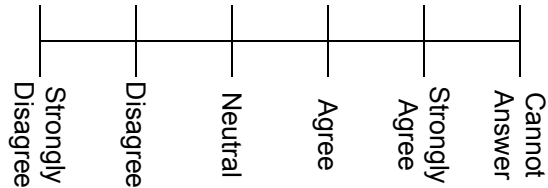
Front End Planning Activities		Estimated Activity Duration (Days)	Estimated Total Labor Hours		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A					
			Owner	External <i>(Designer, Constructor, or Consultant)</i>											
PPP.BP.10	Define Start-up Requirements The process of early definition and planning of plant start-up requirements to ensure smooth transition from the construction phase to plant operations.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.BP.11	Risk Mitigation Analysis The process of identifying risk elements, severity, and frequency. This process also includes determining risk mitigation techniques for the project.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.BP.12	Refine Public Relations Finalize public relations plan based upon which project alternative was selected.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														

Front End Planning Activities		Estimated Activity Duration (Days)	Estimated Total Labor Hours		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A					
			Owner	External (Designer, Contractor, or Consultant)											
PPP.SD.1	Process and Facility Planning Determine the requirements for acquiring and maintaining the physical location, process equipment, and physical infrastructure of the project.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.SD.2	Develop Utilities and Offsite Scope Determine the requirements for power, water, sewer, and other utilities and/or infrastructure, as well as other support facilities not part of the immediate location.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														
PPP.SD.3	Develop Environmental Scope Determine the extent of environmental work such as remediation, assessments, wetlands, and other considerations.		O	E											
	1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.														

Front End Planning Activities		Estimated Activity Duration (Days)	Estimated Total Labor Hours		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
			Owner	External (Designer, Constructor, or Consultant)						
PPP.SD.4	Develop Site Plan Determine the location and physical layout of facilities, utilities, infrastructure and other support processes or structures.		O	E						
1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.										
PPP.SD.5	Detail Work Breakdown Structure Preparation of a list of tasks and deliverables that break the work scope into manageable work pieces, including time and cost aspects.		O	E						
1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.										
PPP.TP.1	Conduct Technical Surveys & Process Analysis Collection of initial technical information that may be in the form of drawings, engineering specifications, and other information formats that is used to define plant components and process requirements.		O	E						
1. This activity was successfully executed. 2. This activity was unusually complex due to project requirements. 3. This activity was executed efficiently. 4. The information, documents, and data requirements were readily available for this activity.										

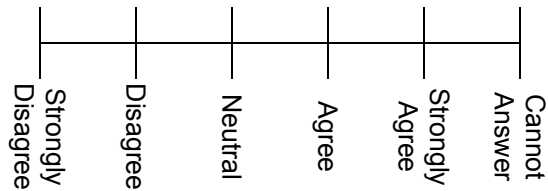
Overall Project Assessment

1. The corporate business drivers were adequately defined (market penetration, throughput, ROI etc).



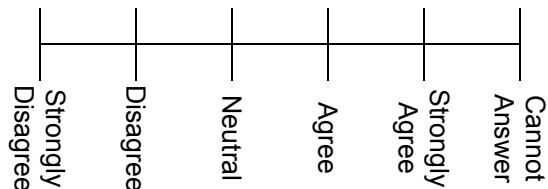
Comments: _____

2. The corporate business drivers were adequately documented and communicated.



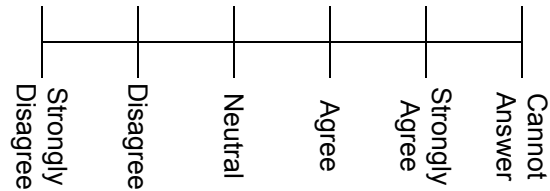
Comments: _____

3. The corporate business drivers were attained (cost, schedule, market share, relations, output.).



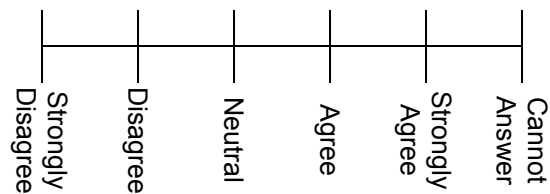
Comments: _____

4. The project objectives were satisfied (cost, schedule, safety, quality).



Comments: _____

5. The pre-project planning process was effective and efficient.



Comments: _____

Planning Execution Components and Strategies

1. Was this project executed utilizing a partnering strategy?

Yes No

2. Does this project encompass relatively new process technologies?

Yes No

3. Was this project impacted by a high degree of government regulation (permitting, hazardous materials, environmental impacts)?

Yes No

4. Was the pre-project planning process satisfactory?

Yes No

5. Was this project executed in an unusually dynamic risk environment (severe fluctuations in market demand, raw materials sourcing, etc.)?

Yes No

Appendix D

Information Flow Tables

BP.01 – Define Business Objectives

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.1.1	Ext	Team Charter Template			
BP.1.1	Ext			Potential Team Member Work Load	
BP.1.1	Ext	Alignment Worksheets			
BP.1.1	Ext	Project Team Resumes			
BP.1.1			Business Planning Team Charter		
BP.1.2	BP.1.1	Business Planning Team Charter			
BP.1.2	Ext	Corporate Goals			
BP.1.2	Ext			Market Data & Core Competencies	
BP.1.2			Market Opportunities & Financial Goals		
BP.1.3	BP.1.2	Market Opportunities & Financial Goals			
BP.1.3			Assumptions for Market Opportunities List		
BP.1.4	BP.3.3	Market Opportunities			
BP.1.4	Ext	Corporate Risk Plan			
BP.1.4	Ext	Assumptions for Market Opportunities			
BP.1.4	Ext			Market Data & Historical Risk Factors	
BP.1.4			Initial Risk and Volatility Analysis		
BP.1.5	BP.1.2	Market Opportunities & Financial Goals			
BP.1.5	BP.1.3	Assumptions for Market Opportunities			
BP.1.5	BP.1.4	Initial Risk and Volatility Analysis			
BP.1.5	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.1.5			Initial Business Objectives Letter		
BP.1.6	BP.1.5	Initial Business Objectives Letter			
BP.1.6	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.1.6					Business Objectives Alignment with Corporate Goals Decision
BP.1.7	BP.1.2	Market Opportunities & Financial Goals			
BP.1.7	BP.1.4	Initial Risk and Volatility Analysis			
BP.1.7	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.1.7	Ext			Core Competencies	
BP.1.7			Constraints and Organizational Capabilities		
BP.1.8	BP.1.4	Initial Risk and Volatility Analysis			
BP.1.8	BP.1.5	Initial Business Objectives Letter			

BP.01 – Define Business Objectives “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.1.8	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.1.8			Modified Business Objectives Letter		
BP.1.9	BP.1.8	Modified Business Objectives Letter			
BP.1.9			Pre-Approved Business Objectives Letter		
BP.1.10	BP.1.9	Pre-Approved Business Objectives Letter			
BP.1.10	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.1.10					Corporate Approval Decision
BP.1.10	BP.11.13	Revised Implementation Plan			
BP.1.11	BP.1.10			Corporate Approval Decision	
BP.1.11	BP.1.9	Pre-Approved Business Objectives Letter			
BP.1.11					Non-Compliant Issues
BP.1.12	BP.1.11			Non-Compliant Issues	
BP.1.12	BP.1.9	Pre-Approved Business Objectives Letter			
BP.1.12					Revise & Proceed Document
BP.1.13	BP.1.9	Pre-Approved Business Objectives Letter			
BP.1.13					Accept, Modify, Or Terminate Decision
BP.1.14	BP.1.4	Initial Risk and Volatility Analysis			
BP.1.14	BP.1.9	Pre-Approved Business Objectives Letter			
BP.1.14			Final Business Objectives Letter		

BP.02 – Identify/Select Project Alternatives

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.2.1	Ext	Alignment Tools			
BP.2.1	Ext			Potential Team Member Work Load	
BP.2.1	Ext	Project Team Resumes			
BP.2.1	Ext	Team Charter Template			
BP.2.1			Project Team Charter		
BP.2.2	BP.2.1	Project Team Charter			
BP.2.2	Ext	Technology Alternatives/Proposals			
BP.2.2			Technology Alternatives/Proposal Assessment		
BP.2.3	BP.2.1	Project Team Charter			
BP.2.3	BP.3.14	Market Opportunity Report			
BP.2.3	Ext			Transportation Data	
BP.2.3	Ext			Logistics Data	
BP.2.3	Ext			Raw Material Source	
BP.2.3	Ext			Labor Resources	
BP.2.3	Ext			Location	
BP.2.3	Ext			Resource Availability	
BP.2.3			Site Alternatives Report		
BP.2.4	BP.1.14	Business Objective Letter			
BP.2.4	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.4	BP.1.7	Constraints & Capabilities			
BP.2.4	BP.2.2	Technology Alternatives/Proposals			
BP.2.4	BP.2.3	Site Alternatives Report			
BP.2.4	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.2.4			Conceptual Solutions Report		
BP.2.5	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.5	BP.1.7	Constraints & Capabilities			
BP.2.5			Risk and Volatility Analysis		
BP.2.6	BP.2.2	Technology Alternatives/Proposals			
BP.2.6	BP.2.3	Site Alternatives Report			
BP.2.6	BP.2.4	Conceptual Solutions Report			
BP.2.6	BP.2.5	Risk and Volatility Analysis			
BP.2.6			Project Alternatives Report		
BP.2.7	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.7	BP.2.6	Project Alternatives Report			
BP.2.7	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.2.7					Alternatives Business Objectives Decision

BP.03 – Conduct Market Research and Analysis

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.3.1	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.1					Corporate Strategic Plan Reference Data
BP.3.2	BP.1.2	Market Opportunities & Financial Goals			
BP.3.2	BP.3.1			Corporate Strategic Plan Reference Data	
BP.3.2			Market Analysis Report		
BP.3.3	BP.3.2	Market Analysis Report			
BP.3.3	Ext			Market Data	
BP.3.3	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.3			Market Opportunities		
BP.3.4	BP.3.3	Market Opportunities			
BP.3.4	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.4			Prioritized Market Opportunities List		
BP.3.5	BP.3.3	Market Opportunities			
BP.3.5					Decision on Viable Market Opportunities
BP.3.6	BP.3.3	Market Opportunities			
BP.3.6	BP.3.5			Decision on Viable Market Opportunities	
BP.3.6	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.6					Alignment with Corporate Goals
BP.3.7	BP.3.2	Market Analysis Report			
BP.3.7	BP.3.3	Market Opportunities			
BP.3.7	BP.3.6			Corporate Goals Decision	
BP.3.7	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.7					Approved Market Opportunity List
BP.3.8	BP.3.3	Market Opportunities			
BP.3.8	BP.3.3	Market Opportunities			
BP.3.8	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.8			Non Compliant Issues		
BP.3.9	BP.3.8	Non Compliant Issues			
BP.3.9					Recoverable Decision
BP.3.10			Justification for Disapproval Based On Non-Compliant Issues		
BP.3.10	BP.3.8	Non Compliant Issues			
BP.3.10	BP.3.9			Recoverable Decision	
BP.3.12	BP.3.3	Market Opportunities			
BP.3.12	BP.3.5			Decision on Viable Market Opportunities	
BP.3.12	BP.3.5			Decision on Viable Market Opportunities	

BP.03 – Conduct Market Research and Analysis “Continued”\

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.3.12	Ext	Corporate Strategic Plan and Corporate Goals			
BP.3.12			Resean for Proceed Disapproval Document		
BP.3.13	BP.3.3	Market Opportunities			
BP.3.13	BP3.6			Alignment with Corporate Goals Decision	
BP.3.13	ext	Corporate Strategic Plan and Corporate Goals			
BP.3.13			Reason for Corporate Goals Alignment Disapproval Document		
BP.3.14	BP.3.4	Prioritized Market Opportunities List			
BP.3.14	BP.3.7			Approved Market Opportunity List	
BP.3.14			Final Market Opportunities Report		

BP.04 – Establish Image and Public Relations

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.4.1	BP.5.7	Final Project Objectives List			
BP.4.1	CS.1.15	Contracting Strategy Report			
BP.4.1	Ext			Historical Data	
BP.4.1	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.1	PP.7.6	Preliminary Project			
BP.4.1					Decision Data
BP.4.2	BP.4.1			Decision Data	
BP.4.2	Ext	Resumes			
BP.4.2	Ext			Project Team Work Load	
BP.4.2			Team List		
BP.4.3	BP.2.1	Team Roster			
BP.4.3			Resource Allocation Document		
BP.4.4	BP.2.6	Project Alternatives Report			
BP.4.4	BP.4.3	Resource Allocation Document			
BP.4.4	BP.5.7	Final Project Objectives List			
BP.4.4	CS.1.15	Contracting Strategy Report			
BP.4.4	Ext			Historical Data	
BP.4.4	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.4	PP.7.6	Preliminary Project Scope			
BP.4.4			Public Relation Areas Document		
BP.4.5	BP.4.4	Public Relation Areas Document			
BP.4.5					Decision on Negative Impact Areas
BP.4.6	BP.4.4	Public Relation Areas Document			
BP.4.6	BP.4.5			Decision on Negative Impact Areas	
BP.4.6			Modified PR Areas Document		
BP.4.7	BP.2.6	Project Alternatives Report			
BP.4.7	BP.4.6	Modified PR Areas Document			
BP.4.7	BP.5.7	Final Project Objectives List			
BP.4.7	CS.1.15	Contracting Strategy Report			
BP.4.7	PP.7.6	Preliminary Project Scope			
BP.4.7			Finalized PR Plan		
BP.4.8	BP.4.1			Decision Data	
BP.4.8			Document for no PR Plan		
BP.4.9	BP.2.6	Project Alternatives Report			
BP.4.9	BP.4.6	Modified PR Areas Document			

BP.04 – Establish Image and Public Relations “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.4.9	BP.5.7	Final Project Objectives List			
BP.4.9	CS.1.15	Contracting Strategy Report			
BP.4.9	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.9	PP.7.6	Preliminary Project Scope			
BP.4.9					Decision
BP.4.10	BP.4.7	Final PR Plan			
BP.4.10	BP.4.9			Decision	
BP.4.10			Approved PR Plan		
BP.4.11	BP.2.6	Project Alternatives Report			
BP.4.11	BP.4.6	Modified PR Areas Document			
BP.4.11	BP.4.9			Decision	
BP.4.11	BP.5.7	Final Project Objectives List			
BP.4.11	CS.1.15	Contracting Strategy Report			
BP.4.11	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.11	PP.7.6	Preliminary Project Scope			
BP.4.11					Reasons for Disapproval
BP.4.12	BP.4.11			Reasons for Disapproval	
BP.4.12			Reasons For Disapproval Document		
BP.4.13	BP.4.12	Reasons for Disapproval Document			
BP.4.13					Decision to Revise PR Plan
BP.4.15			Revised PR Plan		

BP.05 – Finalize Project Alternatives

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.5.1	BP.10.9	Start-Up Requirements			
BP.5.1	BP.11.8	Risk Management Plan			
BP.5.1	BP.11.9	Risk Mitigation Implementation Plan			
BP.5.1	BP.4.6	Modified PR Areas Document			
BP.5.1	BP.6.10			Permit Requirements	
BP.5.1	BP.6.11	List of Necessary Consultants			
BP.5.1	BP.6.9			Plan Review Requirements	
BP.5.1	BP.8.9	Final Evaluation of Feed Stock Suppliers			
BP.5.1	BP.9.22	Labor Plan			
BP.5.1	PP.7.6	Preliminary Project Scope			
BP.5.1	SD.1.12	Process & Facility Planning Scope			
BP.5.1	SD.1.13	Conceptual Schedule & Estimate Document			
BP.5.1	SD.2.8	Utilities and Offsite Scope Document			
BP.5.1	SD.3.19	Environmental Scope			
BP.5.1			Evaluation Criteria Report		
BP.5.2	BP.5.1	Evaluation Criteria Report			
BP.5.2			Lessons Learned Report		
BP.5.3	BP.5.1	Evaluation Criteria Report			
BP.5.3	BP.5.2	Lessons Learned Report			
BP.5.3			Refined Evaluation Criteria Report		
BP.5.4	SD.1.13	Conceptual Schedule & Estimate Document			
BP.5.4			Preliminary Cost and Schedule		
BP.5.5	BP.2.6	Project Alternatives Report			
BP.5.5	BP.5.3	Refined Evaluation Criteria Report			
BP.5.5			Ranked Project Alternatives Report		
BP.5.6	BP.2.6	Project Alternatives Report			
BP.5.6	BP.5.3	Refined Evaluation Criteria Report			
BP.5.6	BP.5.5	Ranked Project Alternatives Report			
BP.5.6			Finalized Project Selection Report		
BP.5.7	BP.10.9	Start-Up Requirements			
BP.5.7	BP.11.8	Risk Management Plan			
BP.5.7	BP.11.9	Risk Mitigation Implementation Plan			
BP.5.7	BP.2.6	Project Alternatives Report			
BP.5.7	BP.4.6	Modified PR Areas Document			
BP.5.7	BP.5.3	Refined Evaluation Criteria Report			

BP.05 – Finalize Project Alternatives “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.5.7	BP.5.6	Finalized Project Selection Report			
BP.5.7	BP.6.10			Permit Requirements	
BP.5.7	BP.6.11	List of Necessary Consultants			
BP.5.7	BP.6.9			Plan Review Requirements	
BP.5.7	BP.8.9	Final Evaluation of Feed Stock Suppliers			
BP.5.7	BP.9.22	Labor Plan			
BP.5.7	PP.7.6	Preliminary Project Scope			
BP.5.7	SD.1.12	Process & Facility Planning Scope			
BP.5.7	SD.1.13	Conceptual Schedule & Estimate Document			
BP.5.7	SD.2.8	Utilities and Offsite Scope Document			
BP.5.7	SD.3.19	Environmental Scope			
BP.5.7			Final Project Objectives Document		
BP.5.8	BP.1.14	Business Objective Letter			
BP.5.8	BP.5.7	Final Project Objectives List			
BP.5.8					Decision
BP.5.9	BP.5.7	Final Project Objectives List			
BP.5.9	BP.5.8			Decision	
BP.5.9	Ext	Corporate Strategic Plan and Corporate Goals			
BP.5.11					Decision
BP.5.10	BP.1.14	Business Objective Letter			
BP.5.10	BP.5.7	Final Project Objectives List			
BP.5.10	BP.5.8			Decision	
BP.5.10	BP.5.9			Decision	
BP.5.10	Ext	Corporate Strategic Plan and Corporate Goals			
BP.5.10			Non-Compliance Issues Report		
BP.5.11	BP.1.14	Business Objective Letter			
BP.5.11	BP.5.7	Final Project Objectives List			
BP.5.11	Ext	Corporate Strategic Plan and Corporate Goals			
BP.5.11					Decision

BP.06 – Address Regulatory Issues

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.6.1	BP.1.14	Business Objective Letter			
BP.6.1	BP.2.6	Project Alternatives Report			
BP.6.1			Scope of Due Diligence		
BP.6.2	BP.6.1	Scope of Due Diligence			
BP.6.2					Easements & Rights of Way
BP.6.3	BP.6.1	Scope of Due Diligence			
BP.6.3					Zoning Ordinance & Restrictions
BP.6.4	BP.6.1	Scope of Due Diligence			
BP.6.4					Codes in Effect
BP.6.5	BP.6.1	Scope of Due Diligence			
BP.6.5					Other (FDA, Tax Abatement, etc)
BP.6.6	BP.6.1	Scope of Due Diligence			
BP.6.6					Environmental Regulations
BP.6.8	BP.6.2			Easements & Rights of Way	
BP.6.8	BP.6.3			Zoning Ordinance & Restrictions	
BP.6.8	BP.6.4			Codes in Effect	
BP.6.8	BP.6.5			Other (FDA, Tax Abatement, etc)	
BP.6.8	BP.6.6			Environmental Regulations	
BP.6.8	Ext	Phone Book			
BP.6.8					Collection of Contacts of Authorities with Jurisdiction
BP.6.9	BP.6.2			Easements & Rights of Way	
BP.6.9	BP.6.3			Zoning Ordinance & Restrictions	
BP.6.9	BP.6.4			Codes in Effect	
BP.6.9	BP.6.5			Other (FDA, Tax Abatement, etc)	
BP.6.9	BP.6.6			Environmental Regulations	
BP.6.9	BP.6.8			Collection of Contacts of Authorities with Jurisdiction	
BP.6.9					Plan Review Requirements
BP.6.10	BP.6.2			Easements & Rights of Way	
BP.6.10	BP.6.3			Zoning Ordinance & Restrictions	
BP.6.10	BP.6.4			Codes in Effect	
BP.6.10	BP.6.5			Other (FDA, Tax Abatement, etc)	
BP.6.10	BP.6.6			Environmental Regulations	
BP.6.10	BP.6.8			Collection of Contacts of Authorities with Jurisdiction	
BP.6.10					Permit Requirements
BP.6.11	BP.6.10			Permit Requirements	
BP.6.11	BP.6.9			Plan Review Requirements	

BP.06 – Address Regulatory Issues “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.6.11					List of Necessary Consultants
BP.6.12	BP.6.1	Scope of Due Diligence			
BP.6.12	BP.6.10			Permit Requirements	
BP.6.12	BP.6.11	List of Necessary Consultants			
BP.6.12	BP.6.2			Easements & Rights of Way	
BP.6.12	BP.6.3			Zoning Ordinance & Restrictions	
BP.6.12	BP.6.4			Codes in Effect	
BP.6.12	BP.6.5			Other (FDA, Tax Abatement, etc)	
BP.6.12	BP.6.6			Environmental Regulations	
BP.6.12	BP.6.8			Collection of Contacts of Authorities with Jurisdiction	
BP.6.12	BP.6.9			Plan Review Requirements	
BP.6.12			Regulatory Summary		
BP.6.13	BP.6.12	List of Applicable Regulations			
BP.6.13			Regulatory Summary for Management Review		
BP.6.14	BP.6.13	Regulatory Summary for Management Review			
BP.6.14					Regulatory Summary Decision
BP.6.15	BP.2.4	Conceptual Solutions Report			
BP.6.15	BP.6.12	List of Applicable Regulations			
BP.6.15					Alternate Options
BP.6.16	BP.6.15			Alternate Options	
BP.6.16					Decision

BP.07 – Develop Funding Plan

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.7.1	Ext	Financial Governance Policy			
BP.7.1					Funding Phases
BP.7.2	Ext	Financial Governance Policy			
BP.7.2					Sources of Funding
BP.7.3	BP.10.7	Start Up Budget			
BP.7.3	BP.10.7			Modified Schedule	
BP.7.3	BP.11.8	Risk Management Plan			
BP.7.3	BP.5.4	Preliminary Cost and Schedule			
BP.7.3	BP.8.7	Raw Material Estimate			
BP.7.3	BP.9.17	Strategy & Wage Rates			
BP.7.3	SD.1.13	Conceptual Schedule & Estimate Document			
BP.7.3	SD.2.8	Utilities and Offsite Scope Document			
BP.7.3	SD.3.11	Costs and Risks Report			
BP.7.3			Funding Estimate		
BP.7.4	BP.1.14	Business Objective Letter			
BP.7.4	BP.12.4	Favorable P.R. Opportunities Study			
BP.7.4	BP.12.8	P.R. Approval Memo			
BP.7.4	BP.3.7	Market Opportunities Report			
BP.7.4	BP.5.1	Evaluation Criteria			
BP.7.4	BP.5.7	Final Project Objectives List			
BP.7.4					Decision
BP.7.5	BP.7.4			Decision	
BP.7.5			Project Funding Request		
BP.7.6	BP.1.14	Business Objective Letter			
BP.7.6	BP.3.7	Market Opportunities Report			
BP.7.6	BP.5.7	Final Project Objectives List			
BP.7.6			Project Non-compliance Report		
BP.7.7	BP.2.6	Project Alternatives Report			
BP.7.7	BP.7.4			Decision	
BP.7.7					Decision
BP.7.8	BP.2.6	Project Alternatives Report			
BP.7.8	BP.3.14	Market Opportunity Report			
BP.7.8	BP.5.6	Finalized Project Selection Report			
BP.7.8			Other Options Report		
BP.7.9	BP.7.7		Return to Potential Project Pool Memo		
BP.7.9					Decision

BP.08 – Raw Material Sourcing/Source Building Materials

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.8.1	BP.5.9			Decision	
BP.8.1	BP.7.5	Funding Plan			
BP.8.1			Feed Stock Requirements		
BP.8.2	BP.8.1	Feed Stock Requirements			
BP.8.2	EXT			Supply Chain Alternatives	
BP.8.2			Sourcing Document		
BP.8.3	BP.8.2	Sourcing Document			
BP.8.3			Modified Sourcing Document		
BP.8.4	BP.8.3	Modified Sourcing Document			
BP.8.4					Feed Stock Compliance
BP.8.5	BP.8.3	Modified Sourcing Document			
BP.8.5					Logistics Issues
BP.8.6	BP.8.3	Modified Sourcing Document			
BP.8.6					Supplier Performance
BP.8.7	BP.8.3	Modified Sourcing Document			
BP.8.7					Cost Ranges
BP.8.8	BP.8.4			Feed Stock Compliance	
BP.8.8	BP.8.5			Logistics Issues	
BP.8.8	BP.8.6			Supplier Performance	
BP.8.8	BP.8.7	Raw Material Estimate			
BP.8.8			Modified Sourcing Document		
BP.8.9	BP.8.8	Modified Sourcing Document			
BP.8.9			Final Sourcing Document		

BP.09 – Develop Labor Plan and Address Human Resource Issues

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.9.2	BP.2.6	Project Alternatives Report			
BP.9.2	Ext			Historical Labor Data	
BP.9.2			Site Labor Requirements		
BP.9.3	BP.2.6	Project Alternatives Report			
BP.9.3	Ext			Historical Overhead Data	
BP.9.3			Overhead Requirements		
BP.9.4	BP.2.6	Project Alternatives Report			
BP.9.4	Ext			Historical Plant Operations Data	
BP.9.4			Plant Operations Requirements		
BP.9.5	BP.2.6	Project Alternatives Report			
BP.9.5	Ext			Historical Project Staffing Data	
BP.9.5			Project Staffing Requirements		
BP.9.6	BP.9.2	Site Labor Requirements			
BP.9.6			Construction Management Availability		
BP.9.7	BP.9.2	Site Labor Requirements			
BP.9.7			Local Union & Labor Practices Survey		
BP.9.8	BP.9.2	Site Labor Requirements			
BP.9.8			EEO Report		
BP.9.9	BP.9.2	Site Labor Requirements			
BP.9.9			Craft Availability Report		
BP.9.10	BP.9.6	Construction Management Availability			
BP.9.10	BP.9.7	Local Union & Labor Practices Survey			
BP.9.10	BP.9.8	EEO Report			
BP.9.10	BP.9.9	Craft Availability Report			
BP.9.10			Union/Non-Union Report		
BP.9.11	BP.9.10	Union/Non-Union Report			
BP.9.11					Union Decision
BP.9.12A	BP.9.11			Union Decision	
BP.9.12A	BP.9.10	Union/Non-Union Report			
BP.9.12A			Union Project Agreement Strategy		
BP.9.12B	BP.9.11			Union Decision	
BP.9.12B	BP.9.10	Union/Non-Union Report			
BP.9.12B			Non-Union Strategy		
BP.9.13	BP.9.12A	Union Project Agreement Strategy			

BP.09 – Develop Labor Plan and Address Human Resource Issues “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.9.13	BP.9.12B	Non-Union Strategy			
BP.9.13					Business Objectives Alignment Decision
BP.9.14	BP.9.12A	Union Project Agreement Strategy			
BP.9.14	BP.9.12B	Non-Union Strategy			
BP.9.14	BP.9.13			Business Objectives Alignment Decision	
BP.9.14					Corporate Approval Decision
BP.9.15	BP.9.12A	Union Project Agreement Strategy			
BP.9.15	BP.9.12B	Non-Union Strategy			
BP.9.15	BP.9.13			Business Objectives Alignment Decision	
BP.9.15	BP.9.14			Corporate Approval Decision	
BP.9.15			Noncompliant Issues Report		
BP.9.16	BP.9.15	Noncompliant Issues Report			
BP.9.16			Corrected Issues Report		
BP.9.17	BP.9.12A	Union Project Agreement Strategy			
BP.9.17	BP.9.12.B	Non-Union Strategy			
BP.9.17	BP.9.14			Corporate Approval Decision	
BP.9.17	BP.9.16	Corrected Issues Report			
BP.9.17			Strategy & Wage Rates Document		
BP.9.18	BP.9.3	Overhead Requirements			
BP.9.18	BP.9.4	Plant Operations Requirements			
BP.9.18	BP.9.5	Project Staffing Requirements			
BP.9.18	BP.9.17	Strategy & Wage Rates Document			
BP.9.18			Training Requirements		
BP.9.19	BP.9.18	Training Requirements			
BP.9.19					Internal Resources Decision
BP.9.20	BP.9.17	Strategy & Wage Rates Document			
BP.9.20	BP.9.18	Training Requirements			
BP.9.20	BP.9.19			Internal Resources Decision	
BP.9.20			Contractor Pre-Qualification Document		
BP.9.21	BP.9.20	Contractor Pre-Qualification Document			
BP.9.21			Legal/Contract Requirements		
BP.9.22	BP.9.21	Legal/Contract Requirements			
BP.9.22	BP.9.24	Qualified Personnel Report			
BP.9.22	BP.9.25	Contracting Strategy Report			
BP.9.22			Labor Plan		
BP.9.23	BP.9.19			Internal Resources Decision	
BP.9.23					Internal Resources Usage Decision
BP.9.24	BP.9.17	Strategy & Wage Rates Document			
BP.9.24	BP.9.18	Training Requirements			

BP.09 – Develop Labor Plan and Address Human Resource Issues “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.9.24	BP.9.23			Internal Resources Usage Decision	
BP.9.24			Qualified Personnel Report		
BP.9.25	BP.9.17	Strategy & Wage Rates Document			
BP.9.25	BP.9.18	Training Requirements			
BP.9.25	BP.9.23			Internal Resources Usage Decision	
BP.9.25			Contracting Strategy Report		

BP.10 – Define Start-Up Requirements

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.10.1	BP.2.6	Project Alternatives Report			
BP.10.1	SD.1.13	Conceptual Schedule & Estimate Document			
BP.10.1					Schedule Duration Data
BP.10.2	BP.10.1			Schedule Duration Data	
BP.10.2	BP.9.22	Labor Plan			
BP.10.2	BP.9.4			Plant Operations Requirement Data	
BP.10.2	BP.9.5			Staff Requirements	
BP.10.2			Estimated Startup Cost		
BP.10.3	BP.1.14	Business Objective Letter			
BP.10.3	BP.10.1			Schedule Duration Data	
BP.10.3	BP.10.2	Estimated Startup Cost			
BP.10.3					Business Objectives Evaluation
BP.10.4	BP.1.14	Business Objective Letter			
BP.10.4	BP.10.1			Schedule Duration Data	
BP.10.4	BP.10.2	Estimated Startup Cost			
BP.10.4	BP.10.3			Objectives Evaluation	
BP.10.4			Preliminary Startup Objectives		
BP.10.5	BP.10.1			Schedule Duration Data	
BP.10.5	BP.10.2	Estimated Startup Cost			
BP.10.5	BP.10.4	Preliminary Start-Up Objectives			
BP.10.5			Startup Plan		
BP.10.6	BP.10.5	Startup Plan			
BP.10.6	External			Plant Comments	
BP.10.6	External			Verbal Comments	
BP.10.6	External			Plant Information	
BP.10.6					Maintenance Input
BP.10.7	BP.10.1			Schedule Duration Data	
BP.10.7	BP.10.2	Estimated Startup Cost			
BP.10.7	BP.10.6			Maintenance Input	
BP.10.7					Modified Schedule Duration Data
BP.10.7			Modified Startup Cost Estimate		
BP.10.8	BP.10.5	Startup Plan			
BP.10.8	BP.10.6			Maintenance Input	
BP.10.8	BP.10.7	Modified Startup Cost Estimate			
BP.10.8	BP.10.7			Modified Schedule	
BP.10.8					Startup Plan Data
BP.10.9	BP.10.5	Startup Plan			
BP.10.9	BP.10.6			Maintenance Input	
BP.10.9	BP.10.7	Modified Startup Cost Estimate			
BP.10.9	BP.10.7			Modified Schedule	
BP.10.9	BP.10.8	Start-up Plan			
BP.10.9			Revised Startup Plan		

BP.11 – Risk Mitigation Analysis

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.11.1	Ext	Startup Requirements			
BP.11.1			Risk Elements		
BP.11.2	BP.11.1	Risk Elements			
BP.11.2					Results
BP.11.2			Modified Risk Elements		
BP.11.3	BP.11.2	Modified Risk Elements			
BP.11.3	BP.11.2			Frequency and Severity Results	
BP.11.3					Financial Goals for Risk
BP.11.4	BP.11.2	Modified Risk Elements			
BP.11.4	BP.11.2			Frequency and Severity Results	
BP.11.4	BP.11.3			Financial Goals for Risk	
BP.11.4					Mitigation Strategies and Techniques
BP.11.5	BP.11.2	Modified Risk Elements			
BP.11.5	BP.11.2			Frequency and Severity Results	
BP.11.5	BP.11.3			Financial Goals for Risk	
BP.11.5	BP.11.4			Mitigation Strategies and Techniques	
BP.11.5					Alternative Techniques Decision
BP.11.6	BP.11.2	Modified Risk Elements			
BP.11.6	BP.11.2			Frequency and Severity Results	
BP.11.6	BP.11.3			Financial Goals for Risk	
BP.11.6	BP.11.5			Alternative Techniques Decision	
BP.11.6					Alternative Techniques Feasibility
BP.11.7	BP.11.2	Modified Risk Elements			
BP.11.7	BP.11.2			Frequency and Severity Results	
BP.11.7	BP.11.3			Financial Goals for Risk	
BP.11.7	BP.11.4			Mitigation Strategies and Techniques	
BP.11.7	BP.11.5			Alternative Techniques Decision	
BP.11.7	BP.11.6			Alternative Techniques Feasibility	
BP.11.7					Acceptable Risk Tolerance Levels
BP.11.8	BP.11.07	Modified Risk Elements		Acceptable Risk Tolerance Levels	
BP.11.8	BP.11.2	Modified Risk Elements			
BP.11.8	BP.11.2			Frequency and Severity Results	
BP.11.8			Risk Mgmt Plan		
BP.11.9	BP.11.08	Risk Mgmt Plan			
BP.11.9			Implementation Plan		
BP.11.10	BP.11.09	Implementation Plan			
BP.11.10			Implementation Plan for Mgt Approval		
BP.11.11	BP.11.10	Implementation Plan for Mgt Approval			
BP.11.11					Approval Decision
BP.11.12	BP.11.10	Implementation Plan for Mgt Approval			
BP.11.12	BP.11.11			Approval Decision	
BP.11.12			Document		
BP.11.13	BP.11.12	Disapproval Reasons			
BP.11.13	BP.11.9	Risk Mitigation Implementation Plan			
BP.11.13			Revised Implementation Plan		

BP.12 – Refine Public Relations

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.12.1	BP.4.7	Public Relations Plan			
BP.12.1					Analysis Summary
BP.12.2	BP.12.1			Analysis Summary	
BP.12.2					Further Investigation Needed Decision
BP.12.3	BP.12.2			Further Investigation Needed Decision	
BP.12.3			Team Charter		
BP.12.3			Team Roster		
BP.12.4	BP.12.3	Team Charter			
BP.12.4	BP.12.3	Team Roster			
BP.12.4	BP.4.7	Public Relations Plan			
BP.12.4	BP.12.1	Analysis Summary			
BP.12.4			Favorable P.R. Opportunities Study		
BP.12.5	BP.2.5	Risk and Volatility Analysis			
BP.12.5	BP.6.12	Regulatory Summary			
BP.12.5	SD3.4	Environmental Waste Report			
BP.12.5	SD.3.18	Environmental Strategy Report			
BP.12.5	BP.12.4	Favorable P.R. Opportunities Study			
BP.12.5			P.R. Resolution Strategy Report		
BP.12.6	BP.4.7	Public Relations Plan			
BP.12.6	BP.12.1	Analysis Summary			
BP.12.6	BP.12.4	Favorable P.R. Opportunities Study			
BP.12.6	BP.12.5	P.R. Resolution Strategy Report			
BP.12.6			Finalized P.R. Plan		
BP.12.7	BP.1.14	Business Objectives Letter			
BP.12.7	BP.4.12	Reasons for Disapproval			
BP.12.7					Decision
BP.12.8	BP.12.7			Decision	
BP.12.8			P.R. Corporate Approval Memo		
BP.12.9	BP.12.7			Decision	
BP.12.9			P.R. Non-Compliance Report		

CS.01 – Develop Contract Strategy

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.1.1	BP.11.8	Risk Management Plan			
		Justification for Disapproval Based Upon Corporate Goals			
CS.1.1	BP.3.13	Final Project Objectives List			
CS.1.1	BP.5.7	Funding Estimate			
CS.1.1	BP.7.3				
CS.1.1	PP.7.5			Project Summary Data	
CS.1.1	SD.1.13	Conceptual Schedule & Estimate Document			
CS.1.1	SD.2.8	Utilities and Offsite Scope Document			
CS.1.1	SD.3.19	Environmental Scope			
CS.1.1					Senior Management Commitment
CS.1.2	SD.3.19	Environmental Scope			
CS.1.2					Sufficient Information Decision
CS.1.3	BP.11.8	Risk Management Plan			
		Justification for Disapproval Based Upon Corporate Goals			
CS.1.3	BP.3.13	Final Project Objectives List			
CS.1.3	BP.5.7	Funding Estimate			
CS.1.3	BP.7.3				
CS.1.3	CS.1.2			Contracting Strategy Decision	
CS.1.3	PP.7.5			Project Summary Data	
CS.1.3	SD.1.13	Conceptual Schedule & Estimate Document			
CS.1.3	SD.2.8	Utilities and Offsite Scope Document			
CS.1.3	SD.3.19	Environmental Scope			
CS.1.3			Missing Contracting Strategy Information		
CS.1.4	CS.1.2			Sufficient Information Decision	
CS.1.4	Ext	Project Team Resumes			
CS.1.4	Ext	Alignment Tools			
CS.1.4	Ext			Project Team Work Load	
CS.1.4			Contracting Strategy Selection Team		
CS.1.5	BP.11.8	Risk Management Plan			
		Justification for Disapproval Based Upon Corporate Goals			
CS.1.5	BP.3.13	Final Project Objectives List			
CS.1.5			Project Objectives & Profile Document		
CS.1.6	CS.1.5	Project Objectives & Profile Document			
CS.1.6			Evaluation Criteria Matrix		
CS.1.7	BP.1.14	Business Objective Letter			
CS.1.7	BP.5.7	Final Project Objectives List			
CS.1.7	CS.1.6	Evaluation Criteria Matrix			
CS.1.7			Ranked Evaluation Criteria Matrix		
CS.1.8	CS.1.7	Ranked Evaluation Criteria Matrix			
CS.1.8	CS.1.8	Completed Evaluation Matrix			
CS.1.8			Completed Evaluation Matrix		
CS.1.9	CS.1.8	Completed Evaluation Matrix			

CS.01 – Develop Contract Strategy “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.1.9			Sorted & Reviewed Evaluation Matrix		
CS.1.10	CS.1.9	Evaluation Matrix			
CS.1.10					Contracting Strategy Selection Decision
CS.1.11	CS.1.10			Contracting Strategy Selection Decision	
CS.1.11	CS.1.9	Sorted & Reviewed Evaluation Matrix			
CS.1.11			Analyzed Top Strategies Document		
CS.1.12	CS.1.11	Analyzed Top Strategies Document			
CS.1.12			Refined Evaluation Matrix		
CS.1.14	CS.1.10			Contracting Strategy Selection Decision	
CS.1.14	CS.1.9	Sorted & Reviewed Evaluation Matrix			
CS.1.14					Contracting Stragey Decision
CS.1.15	CS.1.14			Contracting Stragey Decision	
CS.1.15	CS.1.8	Completed Evaluation Matrix			
CS.1.15	CS.1.9	Sorted & Reviewed Evaluation Matrix			
CS.1.15			Contracting Strategy Document		

CS.02 – Develop Bid Package Scope

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.2.1	BP.1.14	Business Objective Letter			
CS.2.1	BP.10.7	Start Up Budget			
CS.2.1	BP.10.7			Modified Schedule	
CS.2.1	BP.10.9	Start-Up Requirements			
CS.2.1	BP.5.7	Final Project Objectives List			
CS.2.1	PP.7.6	Preliminary Project Scope			
CS.2.1	SD.1.12	Process & Facility Planning Scope			
CS.2.1	SD.1.13	Conceptual Schedule & Estimate Document			
CS.2.1	SD.2.8	Utilities and Offsite Scope Document			
CS.2.1	SD.3.19	Environmental Scope			
CS.2.1			Responsibilities List		
CS.2.2	CS.2.1	Responsibilities List			
CS.2.2					Owner's Planning Responsibilities List
CS.2.3	CS.2.1	Responsibilities List			
CS.2.3					Owner's Startup Responsibilities List
CS.2.4	CS.2.1	Responsibilities List			
CS.2.4					Owner's Construction Responsibilities List
CS.2.5	CS.2.1	Responsibilities List			
CS.2.5					Owner's Procurement Responsibilities List
CS.2.6	CS.2.1	Responsibilities List			
CS.2.6					Owner's Engineering Responsibilities List
CS.2.7	CS.2.2			Owner's Planning Responsibilities List	
CS.2.7	CS.2.3	Owner Start-Up Responsibilities			
CS.2.7	CS.2.4	Owner's Construction Responsibilities List			
CS.2.7	CS.2.5			Owner's Procurement Responsibilities List	
CS.2.7	CS.2.6	Owner's Engineering Responsibilities List			
CS.2.7			Owner's Responsibility Document		
CS.2.9	CS.2.1	Responsibilities List			
CS.2.9	CS.2.2			Owner's Planning Responsibilities List	
CS.2.9					Contractor's Planning Responsibilities List
CS.2.10	CS.2.1	Responsibilities List			
CS.2.10	CS.2.3	Owner Start-Up Responsibilities			
CS.2.10					Contractor's Startup Responsibilities List
CS.2.11	CS.2.1	Responsibilities List			
CS.2.11	CS.2.4	Owner's Construction Responsibilities List			
CS.2.11					Contractor's Construction Responsibilities List
CS.2.12	CS.2.1	Responsibilities List			
CS.2.12	CS.2.5	Owner's Procurement Responsibilities List			
CS.2.12					Contractor's Procurement Responsibilities List

CS.02 – Develop Bid Package Scope “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.2.13	CS.2.1	Responsibilities List			
CS.2.13					Owner's Engineering Responsibilities List
CS.2.13					Contractor's Engineering Responsibilities List
CS.2.14	CS.1.15	Contracting Strategy Report			
CS.2.14	CS.1.8	Completed Evaluation Matrix			
CS.2.14					Contracting Type
CS.2.15	CS.2.10	Contractory Start-Up Responsibilities			
CS.2.15	CS.2.11			Contractor's Construction Responsibilities List	
CS.2.15	CS.2.12			Contractor's Procurement Responsibilities List	
CS.2.15	CS.2.13			Contractor's Engineering Responsibilities List	
CS.2.15	CS.2.9	Contractor's Planning Responsibilities List			
CS.2.15			Contractors Responsibility Document		
CS.2.17A	CS.1.15	Contracting Strategy Report			
CS.2.17A	CS.2.14			Contracting Type	
CS.2.17A	CS.2.15	Contractor Responsibilities Document			
CS.2.17A			Contractor Bid Scope Document(s)		
CS.2.17B	CS.1.15	Contracting Strategy Report			
CS.2.17B	CS.2.15	Contractor Responsibilities Document			
CS.2.17B	CS.2.17a	Contractor Bid Scope Document(s)			
CS.2.17b					Legal Review
CS.2.18	CS.1.15	Contracting Strategy Report			
CS.2.18	CS.2.15	Contractor Responsibilities Document			
CS.2.18	CS.2.17b			Legal Review	
CS.2.18					Corporate Review of Bid Package Scope
CS.2.19	CS.1.15	Contracting Strategy Report			
CS.2.19	CS.2.15	Contractor Responsibilities Document			
CS.2.19	CS.2.17a	Contractor Bid Scope Document(s)			
CS.2.19	CS.2.17b			Legal Review	
CS.2.19	CS.2.18			Corporate Review for Bid Package Scope	
CS.2.19					In House Project Team Review
CS.2.20	CS.1.15	Contracting Strategy Report			

CS.02 – Develop Bid Package Scope “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.2.20	CS.2.15	Contractor Responsibilities Document			
CS.2.20	CS.2.17a	Contractor Bid Scope Document(s)			
CS.2.20	CS.2.18			Corporate Review for Bid Package Scope	
CS.2.20					Project Controls Review
CS.2.21	CS.2.17b			Legal Review	
CS.2.21	CS.2.18			Corporate Review for Bid Package Scope	
CS.2.21	CS.2.19			In House Project Team Review	
CS.2.21	CS.2.20			Project Controls Review	
CS.2.21					Decision for Bid Package Scope
CS.2.21			Approved Bid Package		
CS.2.22	CS.2.17b			Legal Review	
CS.2.22	CS.2.18			Corporate Review for Bid Package Scope	
CS.2.22	CS.2.21			Decision for Bid Package Scope	
CS.2.22			Bid Package Non Approval Document		
CS.2.22					
CS.2.23	CS.2.17A	Contractor Bid Scope Document(s)			
CS.2.23	CS.2.21			Decision for Bid Package Scope	
CS.2.23			Approved Bid Package Scope		

CS.03 – Review Potential EPC Contractor Bidders

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.3.1	CS.1.15	Contracting Strategy Report			
CS.3.1					Decision on Reviewing Bidders
CS.3.2	BP.2.1	Project Team Charter			
CS.3.2	CS.3.1			Decision on Reviewing Bidders	
CS.3.2	Ext	Project Team Resumes			
CS.3.2			Selection Team		
CS.3.3	CS.1.15	Contracting Strategy Report			
CS.3.3	CS.3.2	Selection Team			
CS.3.3					Decision on Reviewing Existing Partnerships
CS.3.4	BP.5.7	Final Project Objectives List			
CS.3.4	CS.1.15	Contracting Strategy Report			
CS.3.4	CS.3.3			Decision on Reviewing Existing Partnerships	
CS.3.4	Ext	Historical Data			
CS.3.4	PP.7.6	Preliminary Project Scope			
CS.3.4			Bidder Evaluation Matrix		
CS.3.5	Ext			Potential Bidders	
CS.3.5			Potential Bidders List		
CS.3.6	CS.3.4	Bidder Evaluation Matrix			
CS.3.6	CS.3.5	Potential Bidders List			
CS.3.6	Ext			Evaluations	
CS.3.6	Ext			Performance Ratings	
CS.3.6	Ext			Number of Change Orders	
CS.3.6	Ext			Early/Late Completion Ratio	
CS.3.6	Ext			RFIs	
CS.3.6	Ext			Current Work Load	
CS.3.6	Ext			QA Plan	
CS.3.6	Ext			Safety Record	
CS.3.6	Ext			Financial Statements	
CS.3.6			Completed Bidders Evaluation Matrix		
CS.3.7	CS.3.6	Completed Bidder Evaluation Matrix			
CS.3.7			Modified Bidder Evaluation Matrix		
CS.3.8	CS.3.7	Modified Bidder Evaluation Matrix			
CS.3.8					Adequate Number of Qualified Bidders Decision
CS.3.9	CS.3.1			Decision on Reviewing Bidders	
CS.3.9	CS.3.3			Decision on Reviewing Existing Partnerships	
CS.3.9	CS.3.8			Adequate Number of Qualified Bidders Decision	
CS.3.9	CS.3.8			Adequate Number of Qualified Bidders Decision	
CS.3.9			Approved Bidder List		

CS.04 – Select EPC Contractor Bidders

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
CS.4.1	BP.2.1	Project Team Charter			
CS.4.1	Ext	Project Team Resumes			
CS.4.1			Selection Team		
CS.4.2	CS.3.7	Modified Bidder Evaluation Matrix			
CS.4.2					EPC Bidders Information
CS.4.3	BP.5.7	Final Project Objectives List			
CS.4.3	CS.1.15	Contracting Strategy Report			
CS.4.3	CS.2.23	Approved Bid Package			
CS.4.3	Ext			Historical Data	
CS.4.3	PP.7.6	Preliminary Project Scope			
CS.4.3			Selection Criteria Report		
CS.4.4	CS.2.23	Approved Bid Package			
CS.4.4	CS.4.11			Rebid Decision	
CS.4.4			EPC Proposals		
CS.4.5	BP.10.7	Start Up Budget			
CS.4.5	BP.10.7			Modified Schedule	
CS.4.5	BP.5.7	Final Project Objectives List			
CS.4.5	CS.1.15	Contracting Strategy Report			
CS.4.5	CS.2.23	Approved Bid Package			
CS.4.5	CS.4.11			Rebid Decision	
CS.4.5	CS.4.4	EPC Proposals			
CS.4.5	Ext			Historical Data	
CS.4.5	PP.7.6	Preliminary Project Scope			
CS.4.5	SD.1.13	Conceptual Schedule & Estimate Document			
CS.4.5			Bid Evaluation & Recommendation		
CS.4.7	CS.4.5	Bid Evaluation & Recommendation			
CS.4.7					Approval Decision
CS.4.8	CS.4.7			Approval Decision	
CS.4.8					Contractor Selection Decision
CS.4.9	CS.4.5	Bid Evaluation & Recommendation			
CS.4.9	CS.4.8			Contractor Selection Decision	
CS.4.10	CS.4.5	Bid Evaluation & Recommendation			
CS.4.10	CS.4.9	Reasons for Disapproval			
CS.4.10			Modified Evaluation Criteria Matrix		
CS.4.11	CS.4.10	Modified Evaluation Criteria Matrix			
CS.4.11					Rebid Decision
CS.4.12	CS.4.10	Modified Evaluation Criteria Matrix			
CS.4.12			Approved EPC Contract		

PP.01 – Develop Preliminary Design Criteria, Including PFD’s and P&ID’s

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.1.1a	PP.7.6	Preliminary Project Scope			
PP.1.1a	SD.1.12	Process & Facility Planning Scope			
PP.1.1a	SD.2.8	Utilities and Offsite Scope Document			
PP.1.1a	SD.3.19	Environmental Scope			
PP.1.1a	SD.4.23	Comprehensive Site Plan			
PP.1.1a	TP.1.13	Supplemental Technical Information			
PP.1.1a			Compiled Relevant Process Information		
PP.1.1b	PP.7.6	Preliminary Project Scope			
PP.1.1b	SD.1.12	Process & Facility Planning Scope			
PP.1.1b	SD.2.8	Utilities and Offsite Scope Document			
PP.1.1b	SD.3.19	Environmental Scope			
PP.1.1b	SD.4.23	Comprehensive Site Plan			
PP.1.1b	TP.1.13	Supplemental Technical Information			
PP.1.1b			Compiled Relevant Electrical/I&C Information		
PP.1.1c	PP.7.6	Preliminary Project Scope			
PP.1.1c	SD.1.12	Process & Facility Planning Scope			
PP.1.1c	SD.2.8	Utilities and Offsite Scope Document			
PP.1.1c	SD.3.19	Environmental Scope			
PP.1.1c	SD.4.23	Comprehensive Site Plan			
PP.1.1c	TP.1.13	Supplemental Technical Information			
PP.1.1c			Compiled Relevant Environmental Information		
PP.1.1e	PP.7.6	Preliminary Project Scope			
PP.1.1e	SD.1.12	Process & Facility Planning Scope			
PP.1.1e	SD.2.8	Utilities and Offsite Scope Document			
PP.1.1e	SD.3.19	Environmental Scope			
PP.1.1e	SD.4.23	Comprehensive Site Plan			
PP.1.1e	TP.1.13	Supplemental Technical Information			
PP.1.1e			Compiled Relevant Structural Information		
PP.1.1f	PP.7.6	Preliminary Project Scope			
PP.1.1f	SD.1.12	Process & Facility Planning Scope			
PP.1.1f	SD.2.8	Utilities and Offsite Scope Document			
PP.1.1f	SD.3.19	Environmental Scope			
PP.1.1f	SD.4.23	Comprehensive Site Plan			

PP.01 – Develop Preliminary Design Criteria, Including PFD’s and P&ID’s
 “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.1.1f	TP.1.13	Supplemental Technical Information			
PP.1.1f			Compiled Relevant Mechanical Information		
PP.1.2	PP.1.27	Process Design Criteria			
PP.1.2	PP.1.6	Environmental Design Criteria			
PP.1.2			Process Steps Document		
PP.1.3	PP.1.1e	Compiled Relevant Structural Information			
PP.1.3			Structural Design Criteria		
PP.1.4	PP.1.1b	Compiled Relevant Electrical/I&C Information			
PP.1.4			Electrical/I&C Information Document		
PP.1.5	PP.1.1f	Compiled Relevant Mechanical Information			
PP.1.5			Mechanical Design Criteria Document		
PP.1.6	PP.1.1c	Compiled Relevant Environmental Information			
PP.1.6			Environmental Design Document		
PP.1.7	PP.1.1a	Compiled Relevant Process Information			
PP.1.7			Reliability Criteria Document		
PP.1.8	PP.1.2	Process Steps Document			
PP.1.8					PFD's Needed Decision
PP.1.9	PP.1.2	Process Steps Document			
PP.1.9	PP.1.8			PFD's Needed Decision	
PP.1.9			Alternative Technology Investigation Report		
PP.1.10	PP.1.2	Process Steps Document			
PP.1.10	PP.1.8			PFD's Needed Decision	
PP.1.10			Process Sequence Document		
PP.1.11	PP.1.9	Alternative Technology Investigation Report			
PP.1.11			Mass Balance Document		
PP.1.12	PP.1.11	Mass Balance Document			
PP.1.12	PP.1.2	Process Steps Document			
PP.1.12	PP.1.9	Alternative Technology Investigation Report			
PP.1.12			Preliminary Equipment Layout Document		
PP.1.13	PP.1.11	Mass Balance Document			
PP.1.13	PP.1.12	Preliminary Equipment Layout Document			

PP.01 – Develop Preliminary Design Criteria, Including PFD’s and P&ID’s
 “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.1.13			Process Flow & Interface Document		
PP.1.14	PP.1.11	Mass Balance Document			
PP.1.14	PP.1.13	Process Flow & Interface Document			
PP.1.14			Process Flow Diagram		
PP.1.15	PP.1.11	Mass Balance Document		Process Design Criteria Data	
PP.1.15	PP.1.14	Process Flow Diagram			
PP.1.15	PP.1.2	Process Steps Document			
PP.1.15	PP.1.27	Process Design Criteria			
PP.1.15			Checked Process Flow Diagram		
PP.1.16	PP.1.14	Process Flow Diagram			
PP.1.16	PP.1.4	Electrical/I&C Information Document			
PP.1.16	PP.1.5	Mechanical Design Criteria Document			
PP.1.16			Interface Information for P&ID's		
PP.1.17	Ext	Existing Technology			
PP.1.17	PP.1.2	Process Steps Document			
PP.1.17	PP.1.27	Process Design Criteria			
PP.1.17			Alternative Technology Investigation Report		
PP.1.18	PP.1.14	Process Flow Diagram			
PP.1.18	PP.1.4	Electrical/I&C Information Document			
PP.1.18	PP.1.5	Mechanical Design Criteria Document			
PP.1.18			Control Schemes		
PP.1.19	PP.1.18	Control Schemes			
PP.1.19					Equipment Sizing Decision
PP.1.20	PP.1.11	Mass Balance Document			
PP.1.20	PP.1.19			Equipment Sizing Decision	
PP.1.20	PP.1.27	Process Design Criteria			
PP.1.20			Equipment Sizing Document		
PP.1.21	PP.1.11	Mass Balance Document			
PP.1.21	PP.1.19			Equipment Sizing Decision	
PP.1.21	PP.1.2	Process Steps Document			
PP.1.21	PP.1.9	Alternative Technology Investigation Report			
PP.1.21			Preliminary P&ID's		
PP.1.22	PP.1.11	Mass Balance Document			
PP.1.22	PP.1.12	Preliminary Equipment Layout Document			
PP.1.22	PP.1.21	Preliminary P&ID's			
PP.1.22			Equipment Connections		
PP.1.23	PP.1.11	Mass Balance Document			
PP.1.23	PP.1.22	Equipment Connections			

PP.01 – Develop Preliminary Design Criteria, Including PFD’s and P&ID’s
 “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.1.23			P&ID		
PP.1.24	PP.1.11	Mass Balance Document			
PP.1.24	PP.1.14	Process Flow Diagram			
PP.1.24	PP.1.2	Process Steps Document			
PP.1.24	PP.1.23	P&ID			
PP.1.24	PP.1.27	Process Design Criteria			
PP.1.24			Checked P&ID Document		
PP.1.25	PP.1.24	Checked P&ID Document			
PP.1.25			Approved P&ID Document		
PP.1.26	PP.1.25	Approved P&ID Document			
PP.1.26	PP.7.6	Preliminary Project Scope			
PP.1.26			Equipment List		
PP.1.27	BP.5.7	Final Project Objectives List			
PP.1.27	PP.1.7	Reliability Criteria			
PP.1.27	PP.6.10	Risk Mitigation Plan			
PP.1.27	PP.7.6	Preliminary Project Scope			
PP.1.27	SD.1.12	Process & Facility Planning Scope			
PP.1.27	SD.2.8	Utilities and Offsite Scope Document			
PP.1.27	SD.3.19	Environmental Scope			
PP.1.27	TP.1.13	Supplemental Technical Information			
PP.1.27			Design Criteria Document		

PP.02 – Formulate Preliminary Organization

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.2.1	Ext	Previous org charts for			
PP.2.1	Ext	Project Team Resumes			
PP.2.1	Ext	Company Directory			
PP.2.1	PP.7.6	Preliminary Project Scope			
PP.2.1			List of Key Competencies		
PP.2.2	PP.2.1	List of Competencies			
PP.2.2	PP.7.6	Preliminary Project Scope			
PP.2.2	SD.5.5	Work Breakdown Structure			
PP.2.2			Activity List		
PP.2.3	PP.2.2	Activity List			
PP.2.3	PP.7.6	Preliminary Project Scope			
PP.2.3			Position Responsibility Descriptions		
PP.2.4	PP.2.3	Position Responsibility Descriptions			
PP.2.4					Skill Core Decision
PP.2.5	Ext	Project Team Resumes			
PP.2.5	PP.2.4			Skill Core Decision	
PP.2.5			Internal Competencies List		
PP.2.6	PP.2.3	Position Responsibility Descriptions			
PP.2.6	PP.2.4			Skill Core Decision	
PP.2.6			Project Positions List		
PP.2.7	PP.2.5	Internal Competencies List			
PP.2.7	PP.2.6	Project Positions List			
PP.2.7			Detailed Competencies Report		
PP.2.8	PP.2.7	Detailed Competencies Report			
PP.2.8			Preliminary Org Chart		
PP.2.9	PP.2.8	Preliminary Org Chart			
PP.2.9	PP.6.12	Project Execution Plan			
PP.2.9			Evaluated Potential Project Execution Strategies		
PP.2.10	PP.2.7.a	Detailed Competencies Report			
PP.2.10	PP.2.8	Preliminary Org Chart			
PP.2.10	PP.2.8	Preliminary Org Chart	Project Org Chart, Project Responsibility Matrix		
PP.2.10	PP.2.6	Project Positions List			

PP.03 – Complete Preliminary Estimates

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.3.1	Ext	Bidders List			
PP.3.1					Utilization of Outside Contractor Decision
PP.3.2	Ext	Bidders List			
PP.3.2	Ext			Supplier Qualifications, Lessons Learned	
PP.3.2	PP.1.26	Equipment List			
PP.3.2	SD.4.23	Comprehensive Site Plan			
PP.3.2			Specifications/RFQs for Major Items		
PP.3.3	Ext	Bidders List			
PP.3.3	Ext			Supplier Qualifications, Lessons Learned	
PP.3.3	SD.4.23	Comprehensive Site Plan			
PP.3.3	TP.1.3	Process Requirements Document			
PP.3.3			Specifications/RFQs for Misc Items		
PP.3.4	Ext	Historical Quotes			
PP.3.4	Ext			Historical Unit Pricing	
PP.3.4					Escalated historical unit pricing
PP.3.5	Ext	Current Quotes			
PP.3.5	Ext	Bidders List			
PP.3.5	Ext			Current Unit Pricing, Supplier Qualifications, Lessons Learned	
PP.3.5					Escalated current unit pricing
PP.3.6	CS.2.23	Approved Bid Package			
PP.3.6	Ext	Constructability Review			
PP.3.6	Ext			Verbal Estimates	
PP.3.6	PP.7.6	Preliminary Project Scope			
PP.3.6	SD.4.23	Comprehensive Site Plan			
PP.3.6			Construction Equipment Plan		
PP.3.7	Ext			Manhour estimates from similar previous jobs	
PP.3.7	PP.2.10	Project Org Chart			
PP.3.7	PP.7.6	Preliminary Project Scope			
PP.3.7	SD.5.5	Work Breakdown Structure			
PP.3.7			Manhour estimate		
PP.3.8	Ext			Manhour estimates from similar previous jobs	
PP.3.8	PP.2.10	Project Org Chart			
PP.3.8	PP.7.6	Preliminary Project Scope			
PP.3.8	SD.5.5	Work Breakdown Structure			
PP.3.8			Owner Manhour Estimate		
PP.3.9	PP.7.6	Preliminary Project Scope			
PP.3.9			Owners Scope Estimate		
PP.3.10	CS.4.12	Contractor Selection Specifications, RFQs, Quotations			
PP.3.10	PP.3.2				

PP.03 – Complete Preliminary Estimates “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.3.10	PP.3.3	Specifications, RFQs, Quotations			
PP.3.10	PP.3.9	Owners Scope Estimate			
PP.3.10			Equipment Supplier List / Decision Matrices		
PP.3.11	PP.3.10	Equipment Supplier List / Decision Matrices			
PP.3.11	Ext			Historical Cost	
PP.3.11					Additional Cost
PP.3.12	Ext			Additional Cost, Escalated historical unit pricing, Escalated current unit pricing	
PP.3.12	PP.3.10	Equipment Supplier List / Decision Matrices			
PP.3.12	PP.3.14	Resource Forecast			
PP.3.12	PP.3.6	Construction Equipment Plan			
PP.3.12	PP.3.7	Manhour Estimate			
PP.3.12	PP.3.9	Owners Scope Estimate			
PP.3.12			Estimate Sheet of direct and indirect costs		
PP.3.13	PP.3.12	Estimate Sheet of direct and indirect costs			
PP.3.13	PP.6.10	Risk Mitigation Plan			
PP.3.13					Project contingency % and cost
PP.3.14	CS.2.23	Approved Bid Package			
PP.3.14	Ext			Escalated historical unit pricing, Escalated Current unit pricing	
PP.3.14	PP.3.3	Specifications, RFQs, Quotations			
PP.3.14	PP.3.6	Construction Equipment Plan			
PP.3.14	PP.3.7	Manhour Estimate			
PP.3.14	PP.3.8	Owner Manhour Estimate			
PP.3.14	PP.3.9	Owners Scope Estimate			
PP.3.14	PP.7.6	Preliminary Project Scope			
PP.3.14	SD.4.23	Comprehensive Site Plan			
PP.3.14			Resource forecast		
PP.3.15	BP.1.14	Business Objective Letter			
PP.3.15	PP.3.12	Estimate Sheet of direct and indirect costs			
PP.3.15					Value of assets to be retired, associated expenses
PP.3.15					Project Budget Data
PP.3.15	Ext			Project contingency % and cost	
PP.3.16	BP.1.14	Business Objective Letter			
PP.3.16	BP.5.7	Final Project Objectives List			
PP.3.16	PP.3.15	Project Budget			
PP.3.16					Business Case Data
PP.3.17	PP.3.16			Business Case Data	
PP.3.17			Business Case Document, Project Budget, Project Estimate		

PP.04 – Establish Master Project Schedule

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.4.1	BP.1.14	Business Objective Letter			
PP.4.1	BP.5.7	Final Project Objectives List			
PP.4.1					Project Constraints
PP.4.2	PP.1.26	Equipment List			
PP.4.2	PP.7.6	Preliminary Project Scope			
PP.4.2	SD.1.12	Process & Facility Planning Scope			
PP.4.2	SD.2.8	Utilities and Offsite Scope Document			
PP.4.2	SD.3.19	Environmental Scope			
PP.4.2	SD.4.23	Comprehensive Site Plan			
PP.4.2	SD.5.5	Work Breakdown Structure			
PP.4.2			Task List		
PP.4.3	PP.4.1			Project Constraints	
PP.4.3	PP.4.2	Task List			
PP.4.3			Predecessors and Successors List and Graphics		
PP.4.4	Ext			Historical Data on Engineering Durations	
PP.4.4	PP.1.26	Equipment List			
PP.4.4	PP.4.3	Predecessors and Successors List and Graphics			
PP.4.4	PP.7.6	Preliminary Project Scope			
PP.4.4	SD.4.23	Comprehensive Site Plan			
PP.4.4					Engineering Durations
PP.4.5	BP.8.9	Final Evaluation of Feed Stock Suppliers			
PP.4.5	PP.3.2	Specifications, RFQs, Quotations			
PP.4.5	PP.3.3	Specifications, RFQs, Quotations			
PP.4.5	PP.4.3	Predecessors and Successors List and Graphics			
PP.4.5	PP.7.6	Preliminary Project Scope			
PP.4.5					Delivery Times
PP.4.6	BP.9.22	Labor Plan			
PP.4.6	PP.3.7	Manhour Estimate			
PP.4.6	PP.3.8	Owner Manhour Estimate			
PP.4.6	PP.4.3	Predecessors and Successors List and Graphics			
PP.4.6	PP.7.6	Preliminary Project Scope			
PP.4.6	SD.5.5	Work Breakdown Structure			
PP.4.6	Ext			Historical Erection Durations	
PP.4.6					Erection Durations
PP.4.7	PP.4.3	Predecessors and Successors List and Graphics			

PP.04 – Establish Master Project Schedule “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.4.7	PP.7.6	Preliminary Project Scope			
PP.4.7	PP.8.26	Start-Up Execution Plan			
PP.4.7	SD.5.5	Work Breakdown Structure			
PP.4.7				Historical Start-up/Commissioning Durations	
PP.4.7					Start-up/Commissioning Durations
PP.4.8	BP.10.8	Start-up Plan			
PP.4.8	BP.9.22	Labor Plan			
PP.4.8	PP.2.8	Preliminary Organization			
PP.4.8	PP.3.14	Resource forecast			
PP.4.8	PP.4.3	Predecessors and Successors List and Graphics			
PP.4.8	PP.7.6	Preliminary Project Scope			
PP.4.8	SD.5.5	Work Breakdown Structure			
PP.4.8			Resource Requirements		
PP.4.9	Ext			Outside Factors	
PP.4.9					Outside Factors
PP.4.10	BP.5.7	Final Project Objectives List			
PP.4.10	PP.3.15	Project Budget			
PP.4.10	PP.4.4			Engineering Durations	
PP.4.10	PP.4.5			Delivery Times	
PP.4.10	PP.4.6			Erection Durations	
PP.4.10	PP.4.7			Start-up/Commissioning Durations	
PP.4.10	PP.4.8	Resource Requirements			
PP.4.10	PP.4.9			Outside Factors	
PP.4.10			Optimized Schedule		
PP.4.12	PP.4.10	Optimized Schedule			
PP.4.12	PP.4.8	Resource Requirements			
PP.4.12			Optimized Schedule with Levelized Resources		
PP.4.13	PP.4.12	Optimized Schedule with Levelized Resources			
PP.4.13	PP.4.3	Predecessors and Successors List and Graphics			
PP.4.13			Critical Path Schedule		
PP.4.15	BP.5.7	Final Project Objectives List			
PP.4.15	PP.2.8	Preliminary Organization			
PP.4.15	PP.4.1			Project Constraints	
PP.4.15	PP.4.13	Critical Path Schedule			
PP.4.15	SD.5.5	Work Breakdown Structure			
PP.4.15			Non-Compliance Issues		
PP.4.16	PP.4.10	Optimized Schedule			
PP.4.16	PP.4.12	Optimized Schedule with Levelized Resources			
PP.4.16	PP.4.13	Critical Path Schedule			
PP.4.16				Resource Loaded Schedule Data	
PP.4.17	PP.4.16			Resource Loaded Schedule Data	
PP.4.17			Resource Loaded Schedule		

PP.05 – Address Quality and Safety Issues

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.5.2	BP.5.7	Final Project Objectives List			
PP.5.2	BP.6.12	List of Applicable Regulations			
PP.5.2	TP.2.10	Project Certification Needs & Test Plan			
PP.5.2	Ext	Corporate Quality Guidelines			
PP.5.2					Project Quality Considerations
PP.5.3	PP.5.2			Project Quality Considerations	
PP.5.3			Project Quality Requirements		
PP.5.4	PP.5.2			Project Quality Considerations	
PP.5.4	PP.5.3	Project Quality Requirements			
PP.5.4			Quality Procedures		
PP.5.5	BP.10.8	Start-up Plan			
PP.5.5	BP.11.8	Risk Management Plan			
PP.5.5	BP.5.7	Final Project Objectives List			
PP.5.5	BP.6.12	List of Applicable Regulations			
PP.5.5	BP.9.22	Labor Plan			
PP.5.5	CS.4.12	EPC Contract			
PP.5.5	PP.4.17	Resource Loaded Schedule			
PP.5.5	SD.4.23	Comprehensive Site Plan			
PP.5.5		Corporate Safety Guidelines			
PP.5.5			Safety Goals		
PP.5.6	BP.5.7	Final Project Objectives List			
PP.5.6	BP.6.12	List of Applicable Regulations			
PP.5.6	PP.5.5	Safety Goals			
PP.5.6					Operations Safety Considerations
PP.5.7a	BP.6.12	List of Applicable Regulations			
PP.5.7a	PP.5.5	Safety Goals			
PP.5.7a	SD.4.23	Comprehensive Site Plan			
PP.5.7a					Job Site Safety Considerations
PP.5.7b	BP.6.12	List of Applicable Regulations			
PP.5.7b	PP.1.25	Approved P&ID Document			
PP.5.7b	PP.5.5	Safety Goals			
PP.5.7b					Design Safety Considerations
PP.5.7b			Updated Design Drawings		
PP.5.8	BP.6.12	List of Applicable Regulations			
PP.5.8	PP.5.3	Project Quality Requirements			
PP.5.8	PP.5.4	Quality Procedures			
PP.5.8	PP.5.6			Operations Safety Considerations	
PP.5.8	PP.5.7a			Job Site Safety Considerations	
PP.5.8	PP.5.7b			Design Safety Considerations	
PP.5.8	PP.7.6	Preliminary Project Scope			

PP.05 – Address Quality and Safety Issues “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.5.9	PP.5.4	Quality Procedures			
PP.5.9	PP.5.6			Operations Safety Considerations	
PP.5.9	PP.5.7			Job Site Safety Considerations	
PP.5.9	PP.5.8			Design Safety Considerations	
PP.5.9	PP.5.8			Design Safety Considerations	
PP.5.9					Project Safety/Quality Plan Data
PP.5.10	PP.5.9			Project Safety/Quality Plan Data	
PP.5.10			Project Safety/Quality Plan		

PP.06 – Develop Preliminary Execution Plan

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.6.1	BP.1.14	Business Objective Letter			
PP.6.1	BP.10.8	Start-up Plan			
PP.6.1	BP.11.8	Risk Management Plan			
PP.6.1	BP.5.7	Final Project Objectives List			
PP.6.1	BP.6.12	List of Applicable Regulations			
PP.6.1	BP.7.3	Funding Estimate			
PP.6.1	BP.8.9	Final Evaluation of Feed Stock Suppliers			
PP.6.1	BP.9.22	Labor Plan			
PP.6.1	CS.4.12	EPC Contract			
PP.6.1	PP.2.10	Project Org Chart			
PP.6.1	PP.3.15	Project Budget			
PP.6.1	PP.3.17	Preliminary Estimate			
PP.6.1	PP.4.17	Resource Loaded Schedule			
PP.6.1	PP.5.10	Project Safety/Quality Plan			
PP.6.1	PP.7.6	Preliminary Project Scope			
PP.6.1	PP.1.25	Design Drawings			
PP.6.1	SD.4.23	Comprehensive Site Plan			
PP.6.1	SD.5.5	Work Breakdown Structure			
PP.6.1					Execution Plan Data
PP.6.2	PP.6.1			Execution Plan Data	
PP.6.2					Dependencies & Constraints
PP.6.3	PP.6.1			Execution Plan Data	
PP.6.3	PP.6.2			Dependencies & Constraints	
PP.6.3					Value Improvement Practices
PP.6.4	PP.4.17	Resource Loaded Schedule			
PP.6.4	PP.6.1			Execution Plan Data	
PP.6.4	PP.6.3			Value Improvement Practices	
PP.6.4	SD.5.5	Work Breakdown Structure			
PP.6.4			Sequenced Task List		
PP.6.5	PP.2.10	Project Org Chart			
PP.6.5	PP.4.17	Resource Loaded Schedule			
PP.6.5	PP.6.1			Execution Plan Data	
PP.6.5	PP.6.3			Value Improvement Practices	
PP.6.5			Resource Loading		
PP.6.6	BP.10.8	Start-up Plan			
PP.6.6	PP.4.17	Resource Loaded Schedule			
PP.6.6	PP.6.1			Execution Plan Data	
PP.6.6	PP.6.3			Value Improvement Practices	
PP.6.6	PP.6.4	Sequenced Task List			
PP.6.6	PP.6.5	Resource Loading			
PP.6.6			Durations		
PP.6.7	BP.11.8	Risk Management Plan			
PP.6.7	PP.6.1			Execution Plan Data	
PP.6.7					Execution Risks
PP.6.8	PP.6.7			Execution Risks	
PP.6.8					Risk Mitigation Alternates

PP.06 – Develop Preliminary Execution Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.6.9	PP.6.1			Execution Plan Data	
PP.6.9	PP.6.5	Resource Loading			
PP.6.9			Verified Staffing Requirements		
PP.6.10	BP.11.8	Risk Management Plan			
PP.6.10	PP.6.8			Risk Mitigation Alternates	
PP.6.10			Final Risk Management Plan		
PP.6.11	PP.6.1			Execution Plan Data	
PP.6.11	PP.6.10	Risk Mitigation Plan			
PP.6.11	PP.6.4	Sequenced Task List		Execution Plan Data	
PP.6.11	PP.6.6	Durations			
PP.6.11	PP.6.9	Verified Staffing Requirements			
PP.6.11					Project Execution Plan Data
PP.6.12	PP.6.11			Project Execution Plan Data	
PP.6.12			Project Execution Plan		

PP.07 – Compile Project Scope

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.7.1	BP.5.6	Finalized Project Selection Report			
PP.7.1	SD.1.12	Process & Facility Planning Scope			
PP.7.1	SD.2.8	Utilities and Offsite Scope Document			
PP.7.1	SD.3.19	Environmental Scope			
PP.7.1			Technical Requirements		
PP.7.2	BP.11.8	Risk Management Plan			
PP.7.2	BP.5.6	Finalized Project Selection Report			
PP.7.2	BP.5.7	Final Project Objectives List			
PP.7.2	BP.6.12	List of Applicable Regulations			
PP.7.2	BP.9.22	Labor Plan			
PP.7.2			Commercial Requirements		
PP.7.3	BP.10.9	Start-Up Requirements			
PP.7.3	BP.5.6	Finalized Project Selection Report			
PP.7.3	BP.5.7	Final Project Objectives List			
PP.7.3	BP.9.22	Labor Plan			
PP.7.3	BP.9.24	Internal Labor Plan			
PP.7.3			Execution Requirements		
PP.7.4	PP.7.1	Technical Requirements			
PP.7.4	PP.7.2	Commercial Requirements			
PP.7.4	PP.7.3	Execution Requirements			
PP.7.4			Description of Work		
PP.7.5	PP.7.4	Description of Work			
PP.7.5					Project Summary Data
PP.7.6	PP.7.5			Project Summary Data	
PP.7.6			Project Scope		

PP.08 – Develop Start-Up Plan

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.8.1	BP.2.6	Project Alternatives Report			
PP.8.1	PP.7.6	Preliminary Project Scope			
PP.8.1					Senior Management Commitment
PP.8.2	BP.9.22	Labor Plan			
PP.8.2	PP.1.26	Equipment List			
PP.8.2	PP.4.7			Start-up/Commissioning Durations	
PP.8.2			Start-Up Duration Forecast		
PP.8.2A	BP.9.22	Labor Plan			
PP.8.2A	PP.4.17	Resource Loaded Schedule			
PP.8.2A	PP.8.2	Start-Up Duration Forecast			
PP.8.2A			Estimated Start-Up Cost		
PP.8.3	PP.3.17	Preliminary Estimate			
PP.8.3	PP.8.2	Start-Up Duration Forecast			
PP.8.3	PP.8.2A	Estimated Start-Up Cost			
PP.8.3					Economic Impact of Start-Up
PP.8.4	BP.1.14	Business Objective Letter			
PP.8.4	BP.10.4	Preliminary Start-Up Objectives			
PP.8.4	BP.5.7	Final Project Objectives List			
PP.8.4	PP.1.26	Equipment List			
PP.8.4	PP.8.3			Economic Impact of Start-Up	
PP.8.4			Start-Up Objectives		
PP.8.5	BP.10.4	Preliminary Start-Up Objectives			
PP.8.5	PP.4.17	Resource Loaded Schedule			
PP.8.5	PP.8.2	Start-Up Duration Forecast			
PP.8.5	PP.8.4	Start-Up Objectives			
PP.8.5			Start-Up Execution Plan		
PP.8.6	BP.9.22	Labor Plan			
PP.8.6	PP.2.10	Project Org Chart			
PP.8.6	PP.8.5	Start-Up Execution Plan			
PP.8.6			Start-Up Team Assignments		
PP.8.7	BP.10.6			Maintenance Input	
PP.8.7	PP.8.5	Start-Up Execution Plan			
PP.8.7					Operations/Maintenance Input
PP.8.8	PP.8.5	Start-Up Execution Plan			
PP.8.8	SD.5.5	Work Breakdown Structure			
PP.8.8			Start-Up Systems		
PP.8.9	BP.11.8	Risk Management Plan			
PP.8.9	PP.1.26	Equipment List			
PP.8.9	PP.4.17	Resource Loaded Schedule			
PP.8.9	PP.5.10	Project Safety/Quality Plan			
PP.8.9	PP.8.5	Start-Up Execution Plan			
PP.8.9	PP.8.6	Start-Up Team Assignments			
PP.8.9	PP.8.7			Operations/Maintenance Input	
PP.8.9	PP.8.8	Start-Up Systems			
PP.8.9					

PP.08 – Develop Start-Up Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.8.10	BP.9.22	Labor Plan			
PP.8.10	PP.8.5	Start-Up Execution Plan			
PP.8.10	PP.8.9	Start-Up Risk Assessment			
PP.8.10					Analysis of Start-Up Incentives
PP.8.11	BP.8.9	Final Evaluation of Feed Stock Suppliers			
PP.8.11	CS.2.10	Contractory Start-Up Responsibilities			
PP.8.11	CS.2.3	Owner Start-Up Responsibilities			
PP.8.11	PP.1.26	Equipment List			
PP.8.11	PP.8.8	Start-Up Systems			
PP.8.11			Start-Up Procurement Requirements		
PP.8.12	PP.3.17	Preliminary Estimate			
PP.8.12	PP.4.17	Resource Loaded Schedule			
PP.8.12	PP.8.10	Start-Up Incentives			
PP.8.12	PP.8.11	Start-Up Procurement Requirements			
PP.8.12	PP.8.2	Start-Up Duration Forecast			
PP.8.12	PP.8.2A	Estimated Start-Up Cost			
PP.8.12	PP.8.9	Start-Up Risk Assessment			
PP.8.12			Refined Start-Up Budget/Schedule		
PP.8.13	PP.8.10	Analysis of Start-Up Incentives			
PP.8.13	PP.8.11	Start-Up Procurement Requirements			
PP.8.13	PP.8.12	Refined Start-Up Budget/Schedule			
PP.8.13	PP.8.5	Start-Up Execution Plan			
PP.8.13			Updated Start-Up Execution Plan		
PP.8.14	PP.8.13	Updated Start-Up Execution Plan			
PP.8.14	PP.8.6	Start-Up Team Assignments			
PP.8.14					Potential Solutions to Start-Up Issues
PP.8.15	PP.8.13	Updated Start-Up Execution Plan			
PP.8.15					Assessment of Start-Up Plan Changes
PP.8.16	CS.2.10	Contractory Start-Up Responsibilities			
PP.8.16	CS.4.12	EPC Contract			
PP.8.16	PP.8.13	Updated Start-Up Execution Plan			
PP.8.16A	CS.2.10	Contractory Start-Up Responsibilities			
PP.8.16A	CS.2.3	Owner Start-Up Responsibilities			
PP.8.16A	CS.4.12	EPC Contract			
PP.8.16A	PP.8.14				Potential Solutions to Start-Up Issues
PP.8.16A	PP.8.6	Start-Up Team Assignments			
PP.8.16A			Updated Team Member Responsibilities		
PP.8.17	PP.4.17	Resource Loaded Schedule			

PP.08 – Develop Start-Up Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.8.17	PP.8.13	Updated Start-Up Execution Plan			
PP.8.17	PP.8.16	Supplier Support Plan			
PP.8.17	PP.8.18	QA/QC Start-Up Plan			
PP.8.17			Updated Project Schedule		
PP.8.17A	PP.8.13	Updated Start-Up Execution Plan			
PP.8.17A	PP.8.15			Assessment of Start-Up Plan Changes	
PP.8.17A					Operations/Maintenance Input
PP.8.18	PP.5.10	Project Safety/Quality Plan			
PP.8.18	PP.8.13	Updated Start-Up Execution Plan			
PP.8.18			QA/QC Start-Up Plan		
PP.8.18A	PP.1.26	Equipment List			
PP.8.18A	PP.8.13	Updated Start-Up Execution Plan			
PP.8.18A	PP.8.15			Assessment of Start-Up Plan Changes	
PP.8.18A	PP.8.17A			Operations/Maintenance Input	
PP.8.18A			Updated Engineering Deliverables		
PP.8.19	PP.8.13	Updated Start-Up Execution Plan			
PP.8.19	PP.8.15			Assessment of Start-Up Plan Changes	
PP.8.19	PP.8.9	Start-Up Risk Assessment			
PP.8.19			Updated Start-Up Risk Plan		
PP.8.20	BP.9.18	Training Requirements			
PP.8.20	PP.8.13	Updated Start-Up Execution Plan			
PP.8.20	PP.8.16A	Updated Team Member Responsibilities			
PP.8.20	PP.8.17A			Operations/Maintenance Input	
PP.8.20	PP.8.7			Operations/Maintenance Input	
PP.8.20			Operations/Maintenance Training Plan		
PP.8.22	PP.1.26	Equipment List			
PP.8.22	PP.8.11	Start-Up Procurement Requirements			
PP.8.22	PP.8.13	Updated Start-Up Execution Plan			
PP.8.22	PP.8.17A	Operations/Maintenance Input			
PP.8.22			Spare Parts Plan		
PP.8.23	CS.2.10	Contractory Start-Up Responsibilities			
PP.8.23	CS.2.3	Owner Start-Up Responsibilities			
PP.8.23	PP.1.26	Equipment List			
PP.8.23	PP.4.17	Resource Loaded Schedule			
PP.8.23	PP.8.13	Updated Start-Up Execution Plan			
PP.8.23	PP.8.18A	Updated Engineering Deliverables			
PP.8.23	PP.8.8	Start-Up Systems			
PP.8.23			System Turnover Plan		

PP.08 – Develop Start-Up Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.8.24	PP.5.4	Quality Procedures			
PP.8.24	PP.8.13	Updated Start-Up Execution Plan			
PP.8.24	PP.8.19	Start-Up Risk Assessment			
PP.8.24					Updated Start-Up Execution Plan Data
PP.8.25	PP.8.12	Refined Start-Up Budget/Schedule			
PP.8.25	PP.8.16	Supplier Support Plan			
PP.8.25	PP.8.17A			Operations/Maintenance Input	
PP.8.25	PP.8.18A	Updated Engineering Deliverables			
PP.8.25	PP.8.20	Operations/Maintenance Training Plan			
PP.8.25	PP.8.22	Spare Parts Plan			
PP.8.25	PP.8.23	System Turnover Plan			
PP.8.25	PP.8.24	Updated Start-Up Execution Plan			
PP.8.25			Refined Start-Up Budget/Schedule		
PP.8.26	PP.8.24			Updated Start-Up Execution Plan Data	
PP.8.26	PP.8.25	Refined Start-Up Budget/Schedule			
PP.8.26			Updated Start-Up Execution Plan		

SD.01 – Process and Facility Planning

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.1.1	Ext	Multi-Discipline Corporate Best Practices for Reliability			
SD.1.1					Data Set
SD.1.2	SD.1.12	Process & Facility Planning Scope			
SD.1.2	BP.1.14	Business Objective Letter			
SD.1.2	Ext			Existing Plant Capacity Data	
SD.1.2	BP.3.14			Final Market Opportunities Report	
SD.1.2	BP.6.6			Environmental Regulations	
SD.1.2	Ext			Vendor Data	
SD.1.2			Capacity Evaluation		
SD.1.3	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.3	BP.1.14				
SD.1.3	Ext			Site Analysis	
SD.1.3					Future Expansion Scope Data
SD.1.4	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.4	BP.1.14				
SD.1.4	Ext			Vendor Data	
SD.1.4	Ext			Trial Analysis	
SD.1.4					Technology Considerations Scope Data
SD.1.5	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.5	BP.1.14				
SD.1.5	Ext			Vendor Data	
SD.1.5	Ext			Trial Analysis	
SD.1.5					Process Considerations Scope Data
SD.1.6	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.6	BP.1.14				
SD.1.6	Ext			Vendor Data	
SD.1.6	Ext			Trial Analysis	
SD.1.6					Equipment Scope Data
SD.1.7	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.7	BP.1.14				
SD.1.7	Ext			Vendor Data	
SD.1.7	Ext			Trial Analysis	
SD.1.7					Instrumentation Considerations Scope Data
SD.1.8	SD.1.2	Capacity Evaluation Business Objective Letter			
SD.1.8	BP.1.14				
SD.1.8	Ext			Vendor Data	
SD.1.8	Ext			Trial Analysis	
SD.1.8					Civil, Structural and Architectural Scope Data

SD.01 – Process and Facility Planning “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.1.9	Ext	Logistics Plan			
SD.1.9	Ext			Raw Material Contractor Data	
SD.1.9	Ext			Transportation Contract Data	
SD.1.9					Loading/Unloading/Storage Facility Requirements Scope Data
SD.1.10		Logistics Plan			
SD.1.10	BP.2.6	Project Alternatives Report		Site Analysis	
SD.1.10	BP.8.9	Final Sourcing Document			
SD.1.10	Ext			Transportation Contract Data	
SD.1.10					Transportation Requirements Scope Data
SD.1.11	BP.2.6	Project Alternatives Report		Site Analysis	
SD.1.11					Water Treatment Considerations Scope Data
SD.1.12	SD.2.8	Utilities and Offsite Scope Document			
SD.1.12			Facilities Scope Document		
SD.1.13	BP.10.2	Estimated Startup Cost			
SD.1.13	SD.1.12	Process & Facility Planning Scope			
SD.1.13	SD.2.8	Utilities and Offsite Scope Document (
SD.1.13	SD.1.12	Environmental Scope Documentment			
SD.1.13			Conceptual Schedule and Estimate		
SD.1.14	SD.1.12	Process & Facility Planning Scope			
SD.1.14	SD.1.13	Conceptual Schedule & Estimate Document			
SD.1.14					Alignment Decision
SD.1.15				Alignment Decision	
SD.1.15					Modify/Terminate Decision
SD.1.16				Modify/Terminate Decision	
SD.1.16			Closure Notification		
SD.1.17	SD.1.15			Modify/Terminate Decision	
SD.1.17					Objective or Scope Decision

SD.02 – Develop Utilities and Offsite Scope

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.2.1	SD.2.1	Capacity Evaluation			
SD.2.1					Requirements Data
SD.2.2	SD.1.2	Capacity Evaluation			
SD.2.2					Facility Utility Requirements Data
SD.2.3	SD.1.2	Capacity Evaluation			
SD.2.3					Process/Equipment Utility Requirements Data
SD.2.4	SD.1.2	Capacity Evaluation			
SD.2.4					Fire Protection & Safety Data
SD.2.5	SD.1.2	Capacity Evaluation			
SD.2.5					Offsite Infrastructure Data
SD.2.6	BP.5.7	Final Project Objectives List			
SD.2.6					Utility Sources and Supply Data
SD.2.7	SD.2.2			Facility Utility Requirements Data	
SD.2.7	SD.2.3			Process/Equipment Utility Requirements Data	
SD.2.7	SD.2.4			Fire Protection & Safety Data	
SD.2.7	SD.2.5			Offsite Infrastructure Data	
SD.2.7	SD.2.6			Utility Sources and Supply Data	
SD.2.7					Decision
SD.2.8	SD.2.5			Offsite Infrastructure Data	
SD.2.8	SD.2.6			Utility Sources and Supply Data	
SD.2.8	SD.2.7			Decision	
SD.2.8			Utilities and Offsite Scope Document		

SD.03 – Develop Environmental Scope

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.3.1	BP.2.3	Site Alternatives Report			
SD.3.1	TP.1.13	Supplemental Technical Information			
SD.3.1					Environmental Conditions and Waste Data
SD.3.2	BP.2.3	Site Alternatives Report			
SD.3.2	TP.1.13	Supplemental Technical Information			
SD.3.2			Existing Site Studies Document		
SD.3.3	BP.2.3	Site Alternatives Report			
SD.3.3			Government Protected Perserves List		
SD.3.4	BP.2.3	Site Alternatives Report			
SD.3.4	SD.3.10			Environmental Conditions and Waste Data	
SD.3.4	TP.1.13	Supplemental Technical Information			
SD.3.4			Environmental Waste Report		
SD.3.5	BP.2.3	Site Alternatives Report			
SD.3.5	SD.1.5			Process Considerations Scope Data	
SD.3.5	TP.1.13	Supplemental Technical Information			
SD.3.5					Current Treatment Methods List
SD.3.6	BP.2.3	Site Alternatives Report			
SD.3.6	TP.1.13	Supplemental Technical Information			
SD.3.6					Permitted Capacities List
SD.3.7	SD.1.12	Process & Facility Planning Scope			
SD.3.7	SD.3.1			Environmental Conditions and Waste Data	
SD.3.7	SD.3.4	Environmental Waste Report			
SD.3.7			Waste Volume Calculations		
SD.3.8	SD.3.5			Current Treatment Methods List	
SD.3.8	SD.3.7	Waste Volume Calculations			
SD.3.8			Available Capacity Calculations		
SD.3.9	BP.6.12	List of Applicable Regulations			
SD.3.9	SD.3.7	Waste Volume Calculations			
SD.3.9			Government Limitations		
SD.3.10	BP.6.12	List of Applicable Regulations			
SD.3.10	Ext			Vendor Data	
SD.3.10			Feasibility Study and Alternative Methods		
SD.3.11	SD.3.10	Feasibility Study and Alternative Methods			
SD.3.11	Ext			Vendor Data	
SD.3.11			Costs and Risks		
SD.3.12	BP.6.12	List of Applicable Regulations			
SD.3.12	SD.1.12	Process & Facility Planning Scope			
SD.3.12	SD.3.6			Permitted Capacity	

SD.03 – Develop Environmental Scope “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.3.12	SD.3.7	Waste Volume Calculations			
SD.3.12					Possible Permits and Agencies
SD.3.13	SD.1.12	Process & Facility Planning Scope			
SD.3.13	SD.3.12	Potential Permits and Agencies			
SD.3.13	SD.3.8	Available Volume Calculations			
SD.3.13					Technical Data Required
SD.3.14	BP.2.3	Site Alternatives Report			
SD.3.14	SD.1.12	Process & Facility Planning Scope			
SD.3.14					Decision
SD.3.15	BP.2.3	Site Alternatives Report			
SD.3.15	BP.2.6	Project Alternatives Report			
SD.3.15	SD.1.12	Process & Facility Planning Scope			
SD.3.15	SD.3.14			Decision	
SD.3.15			Parameters of Study, Samples Analysis Plan		
SD.3.16	SD.3.1	Existing Waste Report			
SD.3.16	SD.3.13			Technical Data Required	
SD.3.16	SD.3.14			Decision	
SD.3.16	SD.3.15	Parameters of Study			
SD.3.16			List of Consultants		
SD.3.17	Ext			Regulations and Pending Legislation	
SD.3.17	SD.3.3	Protected Preserves List			
SD.3.17					Potential Rules and Regulations
SD.3.18	SD.3.17			Potential Rules and Regulations	
SD.3.18	SD.3.3	Protected Preserves List			
SD.3.18			Strategy Report		
SD.3.19	BP.2.3	Site Alternatives Report			
SD.3.19	BP.2.6	Project Alternatives Report			
SD.3.19	BP.6.12	List of Applicable Regulations			
SD.3.19	SD.1.12	Process & Facility Planning Scope			
SD.3.19	SD.3.1			Environmental Conditions and Waste Data	
SD.3.19	SD.3.10	Feasibility Study of Alternate Methods			
SD.3.19	SD.3.11	Cost and Risk Analysis			
SD.3.19	SD.3.12			Possible Permits and Agencies	
SD.3.19	SD.3.13			Technical Data Required	
SD.3.19	SD.3.15	Parameters of Study, Analysis, Plans			
SD.3.19	SD.3.16	List of Consultants			
SD.3.19	SD.3.17			Potential Rules and Regulations	
SD.3.19	SD.3.18	Strategy Report			
SD.3.19	SD.3.4	Environmental Waste Report			
SD.3.19	SD.3.5			Current Treatment Methods List	
SD.3.19	SD.3.6			Permitted Capacity	

SD.03 – Develop Environmental Scope “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.3.19	SD.3.7	Waste Volume Calculations			
SD.3.19	SD.3.8	Available Volume Calculations			
SD.3.19	TP.1.13	Supplemental Technical Information			
SD.3.19			Environmental Scope		

SD.04 – Develop Site Plan

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.4.1	Ext	Land Surveys			
SD.4.1	Ext	Topographic Data			
SD.4.1			Collection of Surveys and Topographic Data		
SD.4.2	Ext	Existing Utilities Locations Report			
SD.4.2	Ext			Existing Utilities Locations Data	
SD.4.2			Collection of Utilities and Locations		
SD.4.3	Ext			Existing Treatment Facilities Data	
SD.4.3			Existing Treatment Facilities List		
SD.4.4	Ext			Existing Flood Plain Data	
SD.4.4			Flood Plain Report		
SD.4.6	Ext			Existing Structures Development Data	
SD.4.6			Existing Structures Development Report		
SD.4.7	Ext			Access Limitations and Set Backs data	
SD.4.7			Access Limitations and Set Backs Report		
SD.4.8	Ext			Easements and Rights of Way Data	
SD.4.8			Easements and Rights of Way Report		
SD.4.9	Ext			Roads, Railroads and Waterways Access Data	
SD.4.9			Roads, Railroads and Waterways Access Report		
SD.4.10	Ext			Zoning Data	
SD.4.10	SD.1.12	Process & Facility Planning Scope			
SD.4.10					Zoning Requirements Decision
SD.4.11	SD.1.12	Process & Facility Planning Scope			
SD.4.11	SD.4.1	Collection of Surveys and Topographic Data			
SD.4.11					New Survey Decision
SD.4.12	SD.4.2	Collection of Utilities and Locations			
SD.4.12	SD.2.8	Utilities and Offsite Scope Document			
SD.4.12			New Utility Requirements Report		
SD.4.13	SD.4.3	Existing Treatment Facilities List			
SD.4.13	SD.1.12	Process & Facility Planning Scope			
SD.4.13	SD.2.8	Utilities and Offsite Scope Document			
SD.4.13	SD.3.19	Environmental Scope			
SD.4.13			New Treatment Facility Requirements Report		
SD.4.14	SD.4.4	Flood Plain Report			
SD.4.14	SD.3.19	Environmental Scope			
SD.4.14	SD.4.1	Collection of Surveys and Topographic Data			
SD.4.14			Flood Protection Report		
SD.4.15	SD.4.11			New Survey Decision	

SD.04 – Develop Site Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.4.15	SD.1.12	Process & Facility Planning Scope			
SD.4.15	SD.4.1	Collection of Surveys and Topographic Data			
SD.4.15			Additional Survey Requirements		
SD.4.16	SD.4.15	Additional Survey Requirements			
SD.4.16	SD.4.1	Collection of Surveys and Topographic Data			
SD.4.16			Additional Site Survey		
SD.4.17	SD.4.9	Roads, Railroads and Waterways Access Report			
SD.4.17	SD.1.12	Process & Facility Planning Scope			
SD.4.17	SD.3.19	Environmental Scope			
SD.4.17			New Site Access Requirement Report		
SD.4.18	SD.4.10			Zoning Requirements Decision	
SD.4.18	Ext			Zoning Data	
SD.4.18	SD.1.12	Process & Facility Planning Scope			
SD.4.18			Zoning Changes/Variances		
SD.4.19					
SD.4.19	SD.3.3	Protected Preserves List			
SD.4.19	SD.4.10			Zoning Requirements Decision	
SD.4.19	SD.4.11			New Survey Decision	
SD.4.19	SD.4.12	New Utility Requirements Report			
SD.4.19	SD.4.13	New Treatment Facility Requirements Report			
SD.4.19	SD.4.14	Flood Protection Report			
SD.4.19	SD.4.16	Additional Site Survey			
SD.4.19	SD.4.17	New Site Access Requirement Report			
SD.4.19	SD.4.18	Zoning Changes/Variances			
SD.4.19	SD.4.6	Existing Structures Development Report			
SD.4.19	SD.4.7	Access Limitations and Set Backs Report			
SD.4.19	SD.4.8	Easements and Rights of Way Report			
SD.4.19			Location and Physical Layout of Facility		
SD.4.20	SD.4.19	Location and Physical Layout of Facility			
SD.4.20			Site Development Requirements		
SD.4.21A	SD.4.19	Location and Physical Layout of Facility			
SD.4.21A	SD.4.20	Site Development Requirements			
SD.4.21A			Storm Water Retention & Runoff Plan		
SD.4.21B	SD.4.19	Location and Physical Layout of Facility			
SD.4.21B	SD.4.21A	Storm Water Retention & Runoff Plan			
SD.4.21B			Utilities Routing		
SD.4.22	SD.4.19	Location and Physical Layout of Facility			

SD.04 – Develop Site Plan “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.4.22	SD.4.21A	Storm Water Retention & Runoff Plan			
SD.4.22	SD.4.21B	Utilities Routing			
SD.4.22			Erosion Protection Plan		
SD.4.23	SD.4.19	Location and Physical Layout of Facility			
SD.4.23	SD.4.22	Erosion Protection Plan			
SD.4.23			Site Plan		

SD.05 – Detail Work Breakdown Structure

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.5.1	BP.2.6	Project Alternatives Report			
SD.5.1	PP.4.17	Resource Loaded Schedule			
SD.5.1	PP.5.10	Project Safety/Quality Plan			
SD.5.1	SD.1.12	Process & Facility Planning Scope			
SD.5.1	SD.2.8	Utilities and Offsite Scope Document			
SD.5.1	SD.3.19	Environmental Scope			
SD.5.1	SD.4.23	Comprehensive Site Plan			
SD.5.1	TP.1.13	Supplemental Technical Information			
SD.5.1			Staging Plan		
SD.5.2	BP.2.6	Project Alternatives Report			
SD.5.2	PP.4.17	Resource Loaded Schedule			
SD.5.2	PP.5.10	Project Safety/Quality Plan			
SD.5.2	SD.1.12	Process & Facility Planning Scope			
SD.5.2	SD.2.8	Utilities and Offsite Scope Document			
SD.5.2	SD.3.19	Environmental Scope			
SD.5.2	SD.4.23	Comprehensive Site Plan			
SD.5.2	SD.5.1	Staging Plan			
SD.5.2	TP.1.13	Supplemental Technical Information			
SD.5.2			Work Packages		
SD.5.3	BP.2.6	Project Alternatives Report			
SD.5.3	PP.4.17	Resource Loaded Schedule			
SD.5.3	PP.5.10	Project Safety/Quality Plan			
SD.5.3	SD.1.12	Process & Facility Planning Scope			
SD.5.3	SD.2.8	Utilities and Offsite Scope Document			
SD.5.3	SD.3.19	Environmental Scope			
SD.5.3	SD.4.23	Comprehensive Site Plan			
SD.5.3	SD.5.2	Work Packages			
SD.5.3	TP.1.13	Supplemental Technical Information			
SD.5.3			Work Area Document		
SD.5.4	BP.2.6	Project Alternatives Report			
SD.5.4	PP.4.17	Resource Loaded Schedule			
SD.5.4	PP.5.10	Project Safety/Quality Plan			
SD.5.4	SD.1.12	Process & Facility Planning Scope			
SD.5.4	SD.2.8	Utilities and Offsite Scope Document			
SD.5.4	SD.3.19	Environmental Scope			
SD.5.4	SD.4.23	Comprehensive Site Plan			

SD.05 – Detail Work Breakdown Structure “Continued”

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.5.4	SD.5.1	Staging Plan			
SD.5.4	SD.5.2	Work Packages			
SD.5.4	SD.5.3	Work Area Document			
SD.5.4	TP.1.13	Supplemental Technical Information			
SD.5.4			Task List		
SD.5.5	BP.2.6	Project Alternatives Report			
SD.5.5	PP.4.17	Resource Loaded Schedule			
SD.5.5	PP.5.10	Project Safety/Quality Plan			
SD.5.5	SD.1.12	Process & Facility Planning Scope			
SD.5.5	SD.2.8	Utilities and Offsite Scope Document			
SD.5.5	SD.3.19	Environmental Scope			
SD.5.5	SD.4.23	Comprehensive Site Plan			
SD.5.5	SD.5.1	Staging Plan			
SD.5.5	SD.5.2	Work Packages			
SD.5.5	SD.5.3	Work Area Document			
SD.5.5	SD.5.4	Task List			
SD.5.5	TP.1.13	Supplemental Technical Information			
SD.5.5			Work Breakdown Structure		

TP.01 – Conduct Technical Surveys and Process Analysis

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
TP.1.1	PP.7.1	Technical Requirements			
TP.1.1			Compiled Technical Requirements		
TP.1.2	TP.1.1	Compiled Technical Requirements			
TP.1.2					Decision on Scope Elements Missing
TP.1.3	TP.1.2	Decision on Scope Elements Missing			
TP.1.3			Process Requirements Document		
TP.1.4	TP.1.1	Compiled Technical Requirements			
TP.1.4	TP.1.3	Process Requirements Document			
TP.1.4			Technical Information Needs List		
TP.1.5	TP.1.4	Technical Information Needs List			
TP.1.5					Needed Information Existence Decision
TP.1.6	TP.1.5			Needed Information Existence Decision	
TP.1.6					Technical Information Owner List
TP.1.9	TP.1.3	Process Requirements Document			
TP.1.9	TP.1.4	Technical Information Needs List			
TP.1.9	TP.1.6			Technical Information Owner List	
TP.1.9					Information Request
TP.1.11	TP.1.4	Technical Information Needs List			
TP.1.11	TP.1.9			Information Request	
TP.1.11					Existing Data Decision
TP.1.12	TP.1.11			Existing Data Decision	
TP.1.12	TP.1.3	Process Requirements Document			
TP.1.12	TP.1.4	Technical Information Needs List			
TP.1.12			Supplemental Technical Information		
TP.1.13	Ext	External Technical Information			
TP.1.13	TP.1.11			Existing Data Decision	
TP.1.13	TP.1.3	Process Requirements Document			
TP.1.13	TP.1.4	Technical Information Needs List			
TP.1.13			Supplemental Technical Information		

TP.02 – Product Development/Identify Certification and Testing Procedures

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
TP.2.1	TP.1.13	Supplemental Technical Information			
TP.2.1	TP.1.3	Process Requirements Document			
TP.2.1			List of Process Requirements		
TP.2.2	TP.1.6			Technical Informaiton Owner List	
TP.2.2	TP.1.9			Information Request	
TP.2.2	TP.2.1	List of Process Requirements			
TP.2.2			Project/Product Specifications		
TP.2.3	TP.1.6			Technical Informaiton Owner List	
TP.2.3	TP.1.9			Information Request	
TP.2.3	TP.2.1	List of Process Requirements			
TP.2.3	TP.2.2	Project/Product Specifications			
TP.2.3					Reviewed Key Vendor Data
TP.2.4	TP.1.4	Technical Information Needs List			
TP.2.4	TP.1.9			Information Request	
TP.2.4	TP.2.2	Project/Product Specifications			
TP.2.4	TP.2.3			Reviewed Key Vendor Data	
TP.2.4					Testing Requirements
TP.2.5	TP.1.4	Technical Information Needs List			
TP.2.5	TP.1.9			Information Request	
TP.2.5	TP.2.2	Project/Product Specifications			
TP.2.5	TP.2.3			Reviewed Key Vendor Data	
TP.2.5					Certification Requirements
TP.2.6	TP.2.4			Testing Requirements	
TP.2.6	TP.2.5			Certification Requirements	
TP.2.6			Certification & Testing Requirements Document		
TP.2.7	TP.2.6	Certification & Testing Requirements Document			
TP.2.7			Feedback to Project Staff		
TP.2.8	TP.2.7	Feedback to Project Staff			
TP.2.8					Approved Addresses
TP.2.9	TP.2.8			Approved Addresses	
TP.2.9			List Plant Acceptance Requirements		
TP.2.10	TP.2.9	List Plant Acceptance Requirements			
TP.2.10			Project Certification Needs & Test Plan		

TP.03 – Obtain License Agreements

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
TP.3.1	TP.2.1	List of Process Requirements			
TP.3.1	TP.2.2	Project/Product Specifications			
TP.3.1	TP.2.3			Reviewed Key Vendor Data	
TP.3.1					License Patent Requirements
TP.3.2	TP.3.1			License Patent Requirements	
TP.3.2			Reviewed Vendor Literature Document		
TP.3.3	TP.3.2	Reviewed Vendor Literature Document			
TP.3.3			Key Vendor Verification List		
TP.3.4	Ext	Document of compiled Patents & Licenses			
TP.3.4			List of compiled Patents & Licenses		
TP.3.5	TP.3.3	Key Vendor Verification List			
TP.3.5	TP.3.4	List of compiled Patents & Licenses			
TP.3.5			Reviewed Patent & Licensing Requirements		
TP.3.6	TP.3.5	Reviewed Patent & Licensing Requirements			
TP.3.6					Approved Licencies & Patents Decision
TP.3.7	TP.3.6			Approved Licencies & Patents Decision	
TP.3.7	TP.3.5	Reviewed Patent & Licensing Requirements			
TP.3.7			Reasons for Disapproval		
TP.3.8	TP.3.7	Reasons for Disapproval			
TP.3.8			Amended Patent & Licensing List		
TP.3.9	TP.3.6			Approved Licencies & Patents Decision	
TP.3.9	TP.3.8	Amended Patent & Licensing List			
TP.3.9			Finalized List of Licencies & Patents		

TP.04 – Establish Security and Secrecy Agreement

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
TP.4.1	TP.2.10	Project Certification Needs & Test Plan			
TP.4.1	TP.3.9	Finalized List of Licenses & Patents			
TP.4.1					
TP.4.2	Ext	Requirements			
TP.4.2			List of Owner Secrecy Requirements		
TP.4.3	Ext			Corporate Security Plan	
TP.4.3	TP.4.1			Security Document Decision	
TP.4.3			Security & Secrecy Goals & Objectives List		
TP.4.4	Ext	Document			
TP.4.4	TP.4.1			Security Document Decision	
TP.4.4			Preliminary Approval Document		
TP.4.5	TP.4.2	List of Owner Secrecy Requirements			
TP.4.5	TP.4.3	Security & Secrecy Goals & Objectives List			
TP.4.5	TP.4.4	Compiled Project Security & Secrecy Requirements			
TP.4.5			List of Security Levels Required		
TP.4.6	TP.4.5	List of Security Levels Required			
TP.4.6					Multiple Levels of Security Decision
TP.4.7	TP.4.5	List of Security Levels Required			
TP.4.7	TP.4.6			Multiple Levels of Security Decision	
TP.4.7			Security Levels Document		
TP.4.8	TP.4.7	Security Levels Document			
TP.4.8			Identify Specific Staff Security Level		
TP.4.9	TP.4.8	Identify Specific Staff Security Level			
TP.4.9			Identify Approved Project Staff		
TP.4.10	TP.3.5	Reviewed Patent & Licensing Requirements			
TP.4.10	TP.4.9	Identify Approved Project Staff			
TP.4.10			Compiled Security Plan Document		
TP.4.11	TP.4.10	Compiled Security Plan Document			
TP.4.11			List Implementation of Security Procedures		
TP.4.12	TP.4.11	List Implementation of Security Procedures			
TP.4.12			Plan		
TP.4.13	TP.4.12	Feedback Regarding Plan			
TP.4.13					Approved Decision
TP.4.14	TP.4.13			Approved Decision	
TP.4.14			Recovery Plan		
TP.4.15	TP.4.14	Recovery Plan			
TP.4.15			Revised / Updated Security & Secrecy Plan		
TP.4.16	TP.4.15	Revised / Updated Security & Secrecy Plan			
TP.4.16	TP.4.15	Revised / Updated Security & Secrecy Plan			

Appendix E

Information Flow Diagrams

Information flow diagrams are located in the supplemental file. The file name is information flow diagrams.

Appendix F

Normalized Data Values

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
1	BP.01	30	280	160	2.60	6.79	3.59
1	BP.02	5	80	40	0.43	1.94	0.90
1	BP.03	25	240	160	2.17	5.82	3.59
1	BP.04	5	24	0	0.43	0.58	0.00
1	BP.05	30	160	40	2.60	3.88	0.90
1	BP.06	30	240	460	2.60	5.82	10.33
1	BP.07	30	240	0	2.60	5.82	0.00
1	BP.08	15	120	200	1.30	2.91	4.49
1	BP.09	0	0	0	0.00	0.00	0.00
1	BP.10	3	32	56	0.26	0.78	1.26
1	BP.11	5	84	32	0.43	2.04	0.72
1	BP.12	0	0	0	0.00	0.00	0.00
1	CS.01	30	70	60	2.60	1.70	1.35
1	CS.02	60	76	80	5.20	1.84	1.80
1	CS.03	15	16	96	1.30	0.39	2.16
1	CS.04	15	50	80	1.30	1.21	1.80
1	PP.01	90	160	200	7.81	3.88	4.49
1	PP.02	15	40	120	1.30	0.97	2.69
1	PP.03	60	80	220	5.20	1.94	4.94
1	PP.04	5	30	80	0.43	0.73	1.80
1	PP.05	5	48	84	0.43	1.16	1.89
1	PP.06	15	80	160	1.30	1.94	3.59
1	PP.07	60	84	184	5.20	2.04	4.13
1	PP.08	60	200	160	5.20	4.85	3.59
1	SD.01	60	16	120	5.20	0.39	2.69
1	SD.02	30	16	120	2.60	0.39	2.69
1	SD.03	45	100	160	3.90	2.43	3.59
1	SD.04	15	60	160	1.30	1.46	3.59
1	SD.05	5	16	48	0.43	0.39	1.08
1	TP.01	150	880	374	13.01	21.35	8.40
1	TP.02	150	240	400	13.01	5.82	8.98
1	TP.03	90	360	400	7.81	8.73	8.98
1	TP.04	0	0	0	0.00	0.00	0.00
		1153	4122	4454	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
2	BP.01	30	7	0	1.56	1.87	0.00
2	BP.02	90	7	0	4.67	1.87	0.00
2	BP.03	60	4	0	3.12	1.07	0.00
2	BP.04	180	36	0	9.35	9.63	0.00
2	BP.05	0	0	0	0.00	0.00	0.00
2	BP.06	30	4	0	1.56	1.07	0.00
2	BP.07	180	36	0	9.35	9.63	0.00
2	BP.08	60	18	0	3.12	4.81	0.00
2	BP.09	60	14	0	3.12	3.74	0.00
2	BP.10	60	14	0	3.12	3.74	0.00
2	BP.11	0	0	0	0.00	0.00	0.00
2	BP.12	0	0	0	0.00	0.00	0.00
2	CS.01	90	18	0	4.67	4.81	0.00
2	CS.02	90	36	0	4.67	9.63	0.00
2	CS.03	90	14	0	4.67	3.74	0.00
2	CS.04	0	0	0	0.00	0.00	0.00
2	PP.01	90	14	0	4.67	3.74	0.00
2	PP.02	30	7	0	1.56	1.87	0.00
2	PP.03	6	21	0	0.31	5.61	0.00
2	PP.04	180	21	0	9.35	5.61	0.00
2	PP.05	180	14	0	9.35	3.74	0.00
2	PP.06	90	18	0	4.67	4.81	0.00
2	PP.07	90	11	0	4.67	2.94	0.00
2	PP.08	0	0	0	0.00	0.00	0.00
2	SD.01	0	0	0	0.00	0.00	0.00
2	SD.02	0	0	0	0.00	0.00	0.00
2	SD.03	30	7	0	1.56	1.87	0.00
2	SD.04	90	21	0	4.67	5.61	0.00
2	SD.05	90	11	0	4.67	2.94	0.00
2	TP.01	0	0	0	0.00	0.00	0.00
2	TP.02	30	21	0	1.56	5.61	0.00
2	TP.03	0	0	0	0.00	0.00	0.00
2	TP.04	0	0	0	0.00	0.00	0.00
		1926	374	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
3	BP.01	30	2	0	6.07	1.10	0.00
3	BP.02	15	11	0	3.04	6.04	0.00
3	BP.03	0	0	0	0.00	0.00	0.00
3	BP.04	60	9	0	12.15	4.95	0.00
3	BP.05	15	2	0	3.04	1.10	0.00
3	BP.06	15	2	0	3.04	1.10	0.00
3	BP.07	15	9	0	3.04	4.95	0.00
3	BP.08	10	4	0	2.02	2.20	0.00
3	BP.09	10	4	0	2.02	2.20	0.00
3	BP.10	25	11	0	5.06	6.04	0.00
3	BP.11	15	9	0	3.04	4.95	0.00
3	BP.12	0	0	0	0.00	0.00	0.00
3	CS.01	25	11	0	5.06	6.04	0.00
3	CS.02	15	9	0	3.04	4.95	0.00
3	CS.03	30	11	0	6.07	6.04	0.00
3	CS.04	0	0	0	0.00	0.00	0.00
3	PP.01	15	11	0	3.04	6.04	0.00
3	PP.02	8	2	0	1.62	1.10	0.00
3	PP.03	15	9	0	3.04	4.95	0.00
3	PP.04	8	4	0	1.62	2.20	0.00
3	PP.05	8	2	0	1.62	1.10	0.00
3	PP.06	25	6	0	5.06	3.30	0.00
3	PP.07	45	21	0	9.11	11.54	0.00
3	PP.08	10	4	0	2.02	2.20	0.00
3	SD.01	10	2	0	2.02	1.10	0.00
3	SD.02	0	0	0	0.00	0.00	0.00
3	SD.03	25	11	0	5.06	6.04	0.00
3	SD.04	10	4	0	2.02	2.20	0.00
3	SD.05	15	4	0	3.04	2.20	0.00
3	TP.01	10	6	0	2.02	3.30	0.00
3	TP.02	10	2	0	2.02	1.10	0.00
3	TP.03	0	0	0	0.00	0.00	0.00
3	TP.04	0	0	0	0.00	0.00	0.00
		494	182	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
4	BP.01	0	0	0	0.00	0.00	0.00
4	BP.02	40	160	227	4.88	4.47	4.89
4	BP.03	0	0	0	0.00	0.00	0.00
4	BP.04	40	40	0	4.88	1.12	0.00
4	BP.05	20	10	0	2.44	0.28	0.00
4	BP.06	80	64	91	9.76	1.79	1.96
4	BP.07	0	0	0	0.00	0.00	0.00
4	BP.08	0	0	0	0.00	0.00	0.00
4	BP.09	0	0	0	0.00	0.00	0.00
4	BP.10	0	0	0	0.00	0.00	0.00
4	BP.11	20	16	23	2.44	0.45	0.50
4	BP.12	20	2	0	2.44	0.06	0.00
4	CS.01	20	16	23	2.44	0.45	0.50
4	CS.02	20	16	23	2.44	0.45	0.50
4	CS.03	20	16	23	2.44	0.45	0.50
4	CS.04	20	80	114	2.44	2.24	2.45
4	PP.01	80	2000	2840	9.76	55.90	61.15
4	PP.02	0	0	0	0.00	0.00	0.00
4	PP.03	40	200	284	4.88	5.59	6.12
4	PP.04	20	120	170	2.44	3.35	3.66
4	PP.05	80	20	28	9.76	0.56	0.60
4	PP.06	20	32	45	2.44	0.89	0.97
4	PP.07	80	250	355	9.76	6.99	7.64
4	PP.08	10	16	23	1.22	0.45	0.50
4	SD.01	40	40	57	4.88	1.12	1.23
4	SD.02	20	40	57	2.44	1.12	1.23
4	SD.03	10	16	23	1.22	0.45	0.50
4	SD.04	20	32	45	2.44	0.89	0.97
4	SD.05	20	16	23	2.44	0.45	0.50
4	TP.01	40	120	170	4.88	3.35	3.66
4	TP.02	40	256	0	4.88	7.15	0.00
4	TP.03	0	0	0	0.00	0.00	0.00
4	TP.04	0	0	0	0.00	0.00	0.00
		820	3578	4644	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
5	BP.01	60	7	0	1.06	2.02	0.00
5	BP.02	540	14	5	9.57	4.05	5.21
5	BP.03	0	0	0	0.00	0.00	0.00
5	BP.04	180	7	0	3.19	2.02	0.00
5	BP.05	180	11	0	3.19	3.18	0.00
5	BP.06	30	4	1	0.53	1.16	1.04
5	BP.07	540	14	5	9.57	4.05	5.21
5	BP.08	180	4	1	3.19	1.16	1.04
5	BP.09	180	4	1	3.19	1.16	1.04
5	BP.10	90	4	1	1.60	1.16	1.04
5	BP.11	360	7	2	6.38	2.02	2.08
5	BP.12	60	11	0	1.06	3.18	0.00
5	CS.01	270	25	8	4.79	7.23	8.33
5	CS.02	270	25	8	4.79	7.23	8.33
5	CS.03	180	14	5	3.19	4.05	5.21
5	CS.04	90	7	0	1.60	2.02	0.00
5	PP.01	360	28	9	6.38	8.09	9.38
5	PP.02	180	7	2	3.19	2.02	2.08
5	PP.03	180	11	7	3.19	3.18	7.29
5	PP.04	360	7	0	6.38	2.02	0.00
5	PP.05	180	18	6	3.19	5.20	6.25
5	PP.06	180	21	7	3.19	6.07	7.29
5	PP.07	360	32	11	6.38	9.25	11.46
5	PP.08	90	7	2	1.60	2.02	2.08
5	SD.01	90	21	7	1.60	6.07	7.29
5	SD.02	90	4	0	1.60	1.16	0.00
5	SD.03	0	0	0	0.00	0.00	0.00
5	SD.04	90	7	2	1.60	2.02	2.08
5	SD.05	90	7	0	1.60	2.02	0.00
5	TP.01	90	14	5	1.60	4.05	5.21
5	TP.02	90	4	1	1.60	1.16	1.04
5	TP.03	0	0	0	0.00	0.00	0.00
5	TP.04	0	0	0	0.00	0.00	0.00
		5640	346	96	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
6	BP.01	50	200	50	2.72	4.84	2.39
6	BP.02	100	300	0	5.43	7.26	0.00
6	BP.03	120	300	150	6.52	7.26	7.18
6	BP.04	40	50	0	2.17	1.21	0.00
6	BP.05	70	150	50	3.80	3.63	2.39
6	BP.06	50	80	10	2.72	1.94	0.48
6	BP.07	60	100	0	3.26	2.42	0.00
6	BP.08	30	40	100	1.63	0.97	4.79
6	BP.09	40	40	0	2.17	0.97	0.00
6	BP.10	50	60	20	2.72	1.45	0.96
6	BP.11	100	100	40	5.43	2.42	1.92
6	BP.12	15	20	0	0.82	0.48	0.00
6	CS.01	40	70	0	2.17	1.69	0.00
6	CS.02	25	80	30	1.36	1.94	1.44
6	CS.03	40	40	30	2.17	0.97	1.44
6	CS.04	40	100	20	2.17	2.42	0.96
6	PP.01	100	280	200	5.43	6.78	9.58
6	PP.02	50	120	10	2.72	2.91	0.48
6	PP.03	100	200	60	5.43	4.84	2.87
6	PP.04	60	120	140	3.26	2.91	6.70
6	PP.05	60	60	40	3.26	1.45	1.92
6	PP.06	50	240	200	2.72	5.81	9.58
6	PP.07	40	180	80	2.17	4.36	3.83
6	PP.08	40	200	0	2.17	4.84	0.00
6	SD.01	80	160	0	4.35	3.87	0.00
6	SD.02	40	150	240	2.17	3.63	11.49
6	SD.03	20	20	28	1.09	0.48	1.34
6	SD.04	60	160	10	3.26	3.87	0.48
6	SD.05	70	100	400	3.80	2.42	19.16
6	TP.01	120	300	40	6.52	7.26	1.92
6	TP.02	50	80	40	2.72	1.94	1.92
6	TP.03	30	30	100	1.63	0.73	4.79
6	TP.04	0	0	0	0.00	0.00	0.00
		1840	4130	2088	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
7	BP.01	1	2	0	0.07	0.26	0.00
7	BP.02	90	32	0	6.11	4.22	0.00
7	BP.03	1	2	0	0.07	0.26	0.00
7	BP.04	60	12	0	4.08	1.58	0.00
7	BP.05	15	4	0	1.02	0.53	0.00
7	BP.06	45	32	0	3.06	4.22	0.00
7	BP.07	60	32	0	4.08	4.22	0.00
7	BP.08	60	8	0	4.08	1.06	0.00
7	BP.09	40	8	0	2.72	1.06	0.00
7	BP.10	90	32	0	6.11	4.22	0.00
7	BP.11	90	8	0	6.11	1.06	0.00
7	BP.12	60	4	0	4.08	0.53	0.00
7	CS.01	30	32	0	2.04	4.22	0.00
7	CS.02	30	36	1	2.04	4.75	11.11
7	CS.03	60	16	0	4.08	2.11	0.00
7	CS.04	5	4	0	0.34	0.53	0.00
7	PP.01	60	64	0	4.08	8.44	0.00
7	PP.02	5	4	0	0.34	0.53	0.00
7	PP.03	15	32	0	1.02	4.22	0.00
7	PP.04	5	8	0	0.34	1.06	0.00
7	PP.05	60	8	0	4.08	1.06	0.00
7	PP.06	60	2	8	4.08	0.26	88.89
7	PP.07	60	132	0	4.08	17.41	0.00
7	PP.08	90	8	0	6.11	1.06	0.00
7	SD.01	90	72	0	6.11	9.50	0.00
7	SD.02	15	36	0	1.02	4.75	0.00
7	SD.03	60	36	0	4.08	4.75	0.00
7	SD.04	90	36	0	6.11	4.75	0.00
7	SD.05	5	4	0	0.34	0.53	0.00
7	TP.01	30	36	0	2.04	4.75	0.00
7	TP.02	90	16	0	6.11	2.11	0.00
7	TP.03	0	0	0	0.00	0.00	0.00
7	TP.04	0	0	0	0.00	0.00	0.00
		1472	758	9	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
8	BP.01	5	30	0	1.51	2.97	0.00
8	BP.02	2	10	0	0.60	0.99	0.00
8	BP.03	1	5	0	0.30	0.50	0.00
8	BP.04	0	0	0	0.00	0.00	0.00
8	BP.05	0	0	0	0.00	0.00	0.00
8	BP.06	0	0	0	0.00	0.00	0.00
8	BP.07	30	60	10	9.04	5.94	2.53
8	BP.08	60	90	40	18.07	8.91	10.13
8	BP.09	1	5	5	0.30	0.50	1.27
8	BP.10	0	0	0	0.00	0.00	0.00
8	BP.11	1	10	0	0.30	0.99	0.00
8	BP.12	0	0	0	0.00	0.00	0.00
8	CS.01	30	100	50	9.04	9.90	12.66
8	CS.02	10	20	10	3.01	1.98	2.53
8	CS.03	5	40	0	1.51	3.96	0.00
8	CS.04	5	20	0	1.51	1.98	0.00
8	PP.01	0	0	0	0.00	0.00	0.00
8	PP.02	1	5	0	0.30	0.50	0.00
8	PP.03	30	100	50	9.04	9.90	12.66
8	PP.04	10	50	0	3.01	4.95	0.00
8	PP.05	30	120	90	9.04	11.88	22.78
8	PP.06	30	110	50	9.04	10.89	12.66
8	PP.07	10	40	30	3.01	3.96	7.59
8	PP.08	1	5	0	0.30	0.50	0.00
8	SD.01	20	50	50	6.02	4.95	12.66
8	SD.02	1	10	10	0.30	0.99	2.53
8	SD.03	1	10	0	0.30	0.99	0.00
8	SD.04	0	0	0	0.00	0.00	0.00
8	SD.05	1	5	0	0.30	0.50	0.00
8	TP.01	45	100	0	13.55	9.90	0.00
8	TP.02	2	15	0	0.60	1.49	0.00
8	TP.03	0	0	0	0.00	0.00	0.00
8	TP.04	0	0	0	0.00	0.00	0.00
		332	1010	395	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
9	BP.01	5	80	0	0.84	2.52	0.00
9	BP.02	2	32	0	0.34	1.01	0.00
9	BP.03	0	0	0	0.00	0.00	0.00
9	BP.04	0	0	0	0.00	0.00	0.00
9	BP.05	0	0	0	0.00	0.00	0.00
9	BP.06	20	160	0	3.38	5.04	0.00
9	BP.07	90	400	2000	15.20	12.61	27.78
9	BP.08	0	0	0	0.00	0.00	0.00
9	BP.09	20	160	160	3.38	5.04	2.22
9	BP.10	40	100	400	6.76	3.15	5.56
9	BP.11	20	40	40	3.38	1.26	0.56
9	BP.12	0	0	0	0.00	0.00	0.00
9	CS.01	20	80	0	3.38	2.52	0.00
9	CS.02	40	400	200	6.76	12.61	2.78
9	CS.03	20	80	0	3.38	2.52	0.00
9	CS.04	5	40	0	0.84	1.26	0.00
9	PP.01	60	400	1200	10.14	12.61	16.67
9	PP.02	0	0	0	0.00	0.00	0.00
9	PP.03	60	400	1200	10.14	12.61	16.67
9	PP.04	10	80	80	1.69	2.52	1.11
9	PP.05	10	80	80	1.69	2.52	1.11
9	PP.06	40	160	600	6.76	5.04	8.33
9	PP.07	10	80	160	1.69	2.52	2.22
9	PP.08	10	80	160	1.69	2.52	2.22
9	SD.01	20	40	120	3.38	1.26	1.67
9	SD.02	0	0	0	0.00	0.00	0.00
9	SD.03	20	40	120	3.38	1.26	1.67
9	SD.04	20	40	160	3.38	1.26	2.22
9	SD.05	20	80	160	3.38	2.52	2.22
9	TP.01	20	80	160	3.38	2.52	2.22
9	TP.02	10	40	200	1.69	1.26	2.78
9	TP.03	0	0	0	0.00	0.00	0.00
9	TP.04	0	0	0	0.00	0.00	0.00
		592	3172	7200	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
10	BP.01	180	40	0	5.63	0.75	0.00
10	BP.02	180	40	20	5.63	0.75	0.37
10	BP.03	180	80	40	5.63	1.50	0.74
10	BP.04	0	0	0	0.00	0.00	0.00
10	BP.05	0	0	0	0.00	0.00	0.00
10	BP.06	180	80	0	5.63	1.50	0.00
10	BP.07	180	120	500	5.63	2.26	9.26
10	BP.08	0	0	0	0.00	0.00	0.00
10	BP.09	30	80	0	0.94	1.50	0.00
10	BP.10	60	400	200	1.88	7.52	3.70
10	BP.11	300	200	100	9.39	3.76	1.85
10	BP.12	0	0	0	0.00	0.00	0.00
10	CS.01	30	80	0	0.94	1.50	0.00
10	CS.02	30	120	400	0.94	2.26	7.41
10	CS.03	10	200	0	0.31	3.76	0.00
10	CS.04	365	400	0	11.42	7.52	0.00
10	PP.01	120	600	600	3.76	11.28	11.11
10	PP.02	30	80	0	0.94	1.50	0.00
10	PP.03	120	400	800	3.76	7.52	14.81
10	PP.04	120	100	100	3.76	1.88	1.85
10	PP.05	120	80	80	3.76	1.50	1.48
10	PP.06	120	100	40	3.76	1.88	0.74
10	PP.07	120	120	480	3.76	2.26	8.89
10	PP.08	60	600	600	1.88	11.28	11.11
10	SD.01	0	0	0	0.00	0.00	0.00
10	SD.02	180	480	800	5.63	9.02	14.81
10	SD.03	180	300	100	5.63	5.64	1.85
10	SD.04	0	0	0	0.00	0.00	0.00
10	SD.05	120	500	300	3.76	9.40	5.56
10	TP.01	180	120	240	5.63	2.26	4.44
10	TP.02	0	0	0	0.00	0.00	0.00
10	TP.03	0	0	0	0.00	0.00	0.00
10	TP.04	0	0	0	0.00	0.00	0.00
		3195	5320	5400	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
11	BP.01	40	320	0	8.58	17.86	0.00
11	BP.02	0	0	0	0.00	0.00	0.00
11	BP.03	40	320	0	8.58	17.86	0.00
11	BP.04	40	320	0	8.58	17.86	0.00
11	BP.05	0	0	0	0.00	0.00	0.00
11	BP.06	5	20	40	1.07	1.12	1.68
11	BP.07	10	80	0	2.15	4.46	0.00
11	BP.08	5	20	40	1.07	1.12	1.68
11	BP.09	10	0	80	2.15	0.00	3.36
11	BP.10	10	40	80	2.15	2.23	3.36
11	BP.11	3	8	24	0.64	0.45	1.01
11	BP.12	3	24	0	0.64	1.34	0.00
11	CS.01	5	40	40	1.07	2.23	1.68
11	CS.02	0	0	0	0.00	0.00	0.00
11	CS.03	0	0	0	0.00	0.00	0.00
11	CS.04	0	0	0	0.00	0.00	0.00
11	PP.01	30	240	0	6.44	13.39	0.00
11	PP.02	5	40	0	1.07	2.23	0.00
11	PP.03	40	160	320	8.58	8.93	13.42
11	PP.04	40	80	320	8.58	4.46	13.42
11	PP.05	20	0	160	4.29	0.00	6.71
11	PP.06	20	0	160	4.29	0.00	6.71
11	PP.07	20	80	160	4.29	4.46	6.71
11	PP.08	10	0	80	2.15	0.00	3.36
11	SD.01	20	0	160	4.29	0.00	6.71
11	SD.02	0	0	0	0.00	0.00	0.00
11	SD.03	0	0	0	0.00	0.00	0.00
11	SD.04	0	0	0	0.00	0.00	0.00
11	SD.05	60	0	480	12.88	0.00	20.13
11	TP.01	10	0	80	2.15	0.00	3.36
11	TP.02	20	0	160	4.29	0.00	6.71
11	TP.03	0	0	0	0.00	0.00	0.00
11	TP.04	0	0	0	0.00	0.00	0.00
		466	1792	2384	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
12	BP.01	0	0	0	0.00	0.00	0.00
12	BP.02	0	0	0	0.00	0.00	0.00
12	BP.03	0	0	0	0.00	0.00	0.00
12	BP.04	30	160	160	2.42	3.07	1.94
12	BP.05	0	0	0	0.00	0.00	0.00
12	BP.06	90	480	480	7.26	9.21	5.83
12	BP.07	60	320	0	4.84	6.14	0.00
12	BP.08	0	0	0	0.00	0.00	0.00
12	BP.09	30	160	0	2.42	3.07	0.00
12	BP.10	30	160	80	2.42	3.07	0.97
12	BP.11	90	160	320	7.26	3.07	3.88
12	BP.12	30	160	160	2.42	3.07	1.94
12	CS.01	60	320	160	4.84	6.14	1.94
12	CS.02	60	320	160	4.84	6.14	1.94
12	CS.03	10	80	40	0.81	1.54	0.49
12	CS.04	5	40	0	0.40	0.77	0.00
12	PP.01	180	320	60	14.52	6.14	0.73
12	PP.02	30	160	0	2.42	3.07	0.00
12	PP.03	180	720	3600	14.52	13.82	43.69
12	PP.04	10	80	80	0.81	1.54	0.97
12	PP.05	0	0	0	0.00	0.00	0.00
12	PP.06	5	40	0	0.40	0.77	0.00
12	PP.07	20	160	160	1.61	3.07	1.94
12	PP.08	0	0	0	0.00	0.00	0.00
12	SD.01	10	40	40	0.81	0.77	0.49
12	SD.02	0	0	0	0.00	0.00	0.00
12	SD.03	180	720	1440	14.52	13.82	17.48
12	SD.04	90	450	900	7.26	8.64	10.92
12	SD.05	10	40	40	0.81	0.77	0.49
12	TP.01	30	120	360	2.42	2.30	4.37
12	TP.02	0	0	0	0.00	0.00	0.00
12	TP.03	0	0	0	0.00	0.00	0.00
12	TP.04	0	0	0	0.00	0.00	0.00
		1240	5210	8240	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
13	BP.01	20	40	0	0.73	1.03	0.00
13	BP.02	60	120	20	2.19	3.09	0.87
13	BP.03	0	0	0	0.00	0.00	0.00
13	BP.04	720	400	80	26.23	10.31	3.50
13	BP.05	90	80	8	3.28	2.06	0.35
13	BP.06	360	400	200	13.11	10.31	8.74
13	BP.07	180	200	20	6.56	5.15	0.87
13	BP.08	0	0	0	0.00	0.00	0.00
13	BP.09	180	200	0	6.56	5.15	0.00
13	BP.10	0	0	0	0.00	0.00	0.00
13	BP.11	0	0	0	0.00	0.00	0.00
13	BP.12	0	0	0	0.00	0.00	0.00
13	CS.01	90	200	40	3.28	5.15	1.75
13	CS.02	90	200	40	3.28	5.15	1.75
13	CS.03	90	200	40	3.28	5.15	1.75
13	CS.04	90	200	40	3.28	5.15	1.75
13	PP.01	60	120	40	2.19	3.09	1.75
13	PP.02	60	80	0	2.19	2.06	0.00
13	PP.03	30	120	240	1.09	3.09	10.49
13	PP.04	45	120	240	1.64	3.09	10.49
13	PP.05	60	120	40	2.19	3.09	1.75
13	PP.06	10	40	40	0.36	1.03	1.75
13	PP.07	90	400	80	3.28	10.31	3.50
13	PP.08	0	0	0	0.00	0.00	0.00
13	SD.01	0	0	0	0.00	0.00	0.00
13	SD.02	90	200	200	3.28	5.15	8.74
13	SD.03	90	120	240	3.28	3.09	10.49
13	SD.04	120	200	400	4.37	5.15	17.48
13	SD.05	0	0	0	0.00	0.00	0.00
13	TP.01	90	80	200	3.28	2.06	8.74
13	TP.02	30	40	80	1.09	1.03	3.50
13	TP.03	0	0	0	0.00	0.00	0.00
13	TP.04	0	0	0	0.00	0.00	0.00
		2745	3880	2288	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
14	BP.01	730	29200	14600	5.04	6.61	5.32
14	BP.02	0	0	0	0.00	0.00	0.00
14	BP.03	0	0	0	0.00	0.00	0.00
14	BP.04	730	29200	8000	5.04	6.61	2.92
14	BP.05	0	0	0	0.00	0.00	0.00
14	BP.06	2920	58400	58400	20.14	13.21	21.28
14	BP.07	200	8000	0	1.38	1.81	0.00
14	BP.08	300	4000	8000	2.07	0.90	2.92
14	BP.09	50	2000	400	0.34	0.45	0.15
14	BP.10	180	2400	4800	1.24	0.54	1.75
14	BP.11	30	600	600	0.21	0.14	0.22
14	BP.12	3600	144000	2400	24.84	32.58	0.87
14	CS.01	100	4000	0	0.69	0.90	0.00
14	CS.02	240	5600	8000	1.66	1.27	2.92
14	CS.03	300	12000	2000	2.07	2.71	0.73
14	CS.04	180	7200	0	1.24	1.63	0.00
14	PP.01	730	24000	29200	5.04	5.43	10.64
14	PP.02	60	2400	0	0.41	0.54	0.00
14	PP.03	210	1200	8400	1.45	0.27	3.06
14	PP.04	180	7200	4000	1.24	1.63	1.46
14	PP.05	30	1200	600	0.21	0.27	0.22
14	PP.06	150	4000	2000	1.03	0.90	0.73
14	PP.07	730	14600	29200	5.04	3.30	10.64
14	PP.08	120	4800	4800	0.83	1.09	1.75
14	SD.01	0	0	0	0.00	0.00	0.00
14	SD.02	730	12000	29200	5.04	2.71	10.64
14	SD.03	365	8000	14600	2.52	1.81	5.32
14	SD.04	730	20000	29200	5.04	4.52	10.64
14	SD.05	900	36000	16000	6.21	8.14	5.83
14	TP.01	0	0	0	0.00	0.00	0.00
14	TP.02	0	0	0	0.00	0.00	0.00
14	TP.03	0	0	0	0.00	0.00	0.00
14	TP.04	0	0	0	0.00	0.00	0.00
		14495	442000	274400	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
15	BP.01	10	80	20	2.25	6.25	0.96
15	BP.02	60	200	1000	13.48	15.63	48.08
15	BP.03	0	0	0	0.00	0.00	0.00
15	BP.04	0	0	0	0.00	0.00	0.00
15	BP.05	0	0	0	0.00	0.00	0.00
15	BP.06	30	120	40	6.74	9.38	1.92
15	BP.07	45	100	200	10.11	7.81	9.62
15	BP.08	0	0	0	0.00	0.00	0.00
15	BP.09	60	40	120	13.48	3.13	5.77
15	BP.10	0	0	0	0.00	0.00	0.00
15	BP.11	10	40	80	2.25	3.13	3.85
15	BP.12	0	0	0	0.00	0.00	0.00
15	CS.01	15	80	40	3.37	6.25	1.92
15	CS.02	60	200	100	13.48	15.63	4.81
15	CS.03	0	0	0	0.00	0.00	0.00
15	CS.04	10	40	40	2.25	3.13	1.92
15	PP.01	0	0	0	0.00	0.00	0.00
15	PP.02	0	0	0	0.00	0.00	0.00
15	PP.03	30	40	120	6.74	3.13	5.77
15	PP.04	30	40	120	6.74	3.13	5.77
15	PP.05	5	20	20	1.12	1.56	0.96
15	PP.06	0	0	0	0.00	0.00	0.00
15	PP.07	60	200	100	13.48	15.63	4.81
15	PP.08	0	0	0	0.00	0.00	0.00
15	SD.01	0	0	0	0.00	0.00	0.00
15	SD.02	0	0	0	0.00	0.00	0.00
15	SD.03	10	40	40	2.25	3.13	1.92
15	SD.04	0	0	0	0.00	0.00	0.00
15	SD.05	10	40	40	2.25	3.13	1.92
15	TP.01	0	0	0	0.00	0.00	0.00
15	TP.02	0	0	0	0.00	0.00	0.00
15	TP.03	0	0	0	0.00	0.00	0.00
15	TP.04	0	0	0	0.00	0.00	0.00
		445	1280	2080	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
16	BP.01	30	60	0	6.28	8.11	0.00
16	BP.02	10	20	20	2.09	2.70	5.41
16	BP.03	0	0	0	0.00	0.00	0.00
16	BP.04	0	0	0	0.00	0.00	0.00
16	BP.05	45	40	80	9.41	5.41	21.62
16	BP.06	10	30	0	2.09	4.05	0.00
16	BP.07	45	60	20	9.41	8.11	5.41
16	BP.08	5	20	0	1.05	2.70	0.00
16	BP.09	0	0	0	0.00	0.00	0.00
16	BP.10	1	5	0	0.21	0.68	0.00
16	BP.11	20	20	30	4.18	2.70	8.11
16	BP.12	0	0	0	0.00	0.00	0.00
16	CS.01	30	30	0	6.28	4.05	0.00
16	CS.02	20	60	10	4.18	8.11	2.70
16	CS.03	1	5	0	0.21	0.68	0.00
16	CS.04	5	20	0	1.05	2.70	0.00
16	PP.01	30	30	30	6.28	4.05	8.11
16	PP.02	5	15	0	1.05	2.03	0.00
16	PP.03	20	50	20	4.18	6.76	5.41
16	PP.04	20	30	20	4.18	4.05	5.41
16	PP.05	30	40	10	6.28	5.41	2.70
16	PP.06	60	40	0	12.55	5.41	0.00
16	PP.07	30	40	10	6.28	5.41	2.70
16	PP.08	1	5	0	0.21	0.68	0.00
16	SD.01	15	40	60	3.14	5.41	16.22
16	SD.02	5	30	10	1.05	4.05	2.70
16	SD.03	0	0	0	0.00	0.00	0.00
16	SD.04	20	20	30	4.18	2.70	8.11
16	SD.05	0	0	0	0.00	0.00	0.00
16	TP.01	20	30	20	4.18	4.05	5.41
16	TP.02	0	0	0	0.00	0.00	0.00
16	TP.03	0	0	0	0.00	0.00	0.00
16	TP.04				0.00	0.00	0.00
		478	740	370	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
17	BP.01	8	80	0	4.71	4.15	0.00
17	BP.02	4	40	4	2.35	2.07	5.41
17	BP.03	6	60	0	3.53	3.11	0.00
17	BP.04	5	50	0	2.94	2.59	0.00
17	BP.05	2	20	0	1.18	1.04	0.00
17	BP.06	6	40	20	3.53	2.07	27.03
17	BP.07	7	50	20	4.12	2.59	27.03
17	BP.08	1	10	0	0.59	0.52	0.00
17	BP.09	0	0	0	0.00	0.00	0.00
17	BP.10	10	100	0	5.88	5.18	0.00
17	BP.11	3	30	0	1.76	1.55	0.00
17	BP.12	0	0	6	0.00	0.00	8.11
17	CS.01	8	80	0	4.71	4.15	0.00
17	CS.02	7	70	0	4.12	3.63	0.00
17	CS.03	2	20	0	1.18	1.04	0.00
17	CS.04	5	50	0	2.94	2.59	0.00
17	PP.01	8	80	0	4.71	4.15	0.00
17	PP.02	4	40	0	2.35	2.07	0.00
17	PP.03	15	250	0	8.82	12.95	0.00
17	PP.04	10	120	0	5.88	6.22	0.00
17	PP.05	6	80	4	3.53	4.15	5.41
17	PP.06	7	100	0	4.12	5.18	0.00
17	PP.07	8	120	0	4.71	6.22	0.00
17	PP.08	6	80	10	3.53	4.15	13.51
17	SD.01	3	30	0	1.76	1.55	0.00
17	SD.02	2	20	5	1.18	1.04	6.76
17	SD.03	4	50	0	2.35	2.59	0.00
17	SD.04	8	80	0	4.71	4.15	0.00
17	SD.05	5	60	0	2.94	3.11	0.00
17	TP.01	6	80	5	3.53	4.15	6.76
17	TP.02	4	40	0	2.35	2.07	0.00
17	TP.03	0	0	0	0.00	0.00	0.00
17	TP.04	0	0	0	0.00	0.00	0.00
		170	1930	74	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
18	BP.01	5	40	0	1.63	2.03	0.00
18	BP.02	5	60	0	1.63	3.04	0.00
18	BP.03	3	24	0	0.98	1.22	0.00
18	BP.04	40	100	160	13.07	5.07	14.04
18	BP.05	10	80	0	3.27	4.06	0.00
18	BP.06	10	160	0	3.27	8.11	0.00
18	BP.07	2	20	0	0.65	1.01	0.00
18	BP.08	3	30	0	0.98	1.52	0.00
18	BP.09	2	16	0	0.65	0.81	0.00
18	BP.10	2	20	0	0.65	1.01	0.00
18	BP.11	5	40	0	1.63	2.03	0.00
18	BP.12	5	80	0	1.63	4.06	0.00
18	CS.01	30	120	160	9.80	6.09	14.04
18	CS.02	5	50	0	1.63	2.54	0.00
18	CS.03	2	20	0	0.65	1.01	0.00
18	CS.04	1	8	0	0.33	0.41	0.00
18	PP.01	28	160	160	9.15	8.11	14.04
18	PP.02	3	24	0	0.98	1.22	0.00
18	PP.03	40	100	160	13.07	5.07	14.04
18	PP.04	20	100	140	6.54	5.07	12.28
18	PP.05	2	16	0	0.65	0.81	0.00
18	PP.06	10	80	40	3.27	4.06	3.51
18	PP.07	8	60	40	2.61	3.04	3.51
18	PP.08	2	20	0	0.65	1.01	0.00
18	SD.01	2	16	0	0.65	0.81	0.00
18	SD.02	10	80	40	3.27	4.06	3.51
18	SD.03	5	40	0	1.63	2.03	0.00
18	SD.04	15	120	80	4.90	6.09	7.02
18	SD.05	5	40	20	1.63	2.03	1.75
18	TP.01	20	200	100	6.54	10.14	8.77
18	TP.02	5	40	40	1.63	2.03	3.51
18	TP.03	1	8	0	0.33	0.41	0.00
18	TP.04				0.00	0.00	0.00
		306	1972	1140	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
19	BP.01	1	8	0	1.72	1.34	0.00
19	BP.02	0	0	0	0.00	0.00	0.00
19	BP.03	2	20	0	3.45	3.36	0.00
19	BP.04	2	20	0	3.45	3.36	0.00
19	BP.05	0	0	0	0.00	0.00	0.00
19	BP.06	3	40	0	5.17	6.71	0.00
19	BP.07	1	20	0	1.72	3.36	0.00
19	BP.08	0	0	0	0.00	0.00	0.00
19	BP.09	0	0	0	0.00	0.00	0.00
19	BP.10	2	20	0	3.45	3.36	0.00
19	BP.11	2	8	0	3.45	1.34	0.00
19	BP.12	0	0	0	0.00	0.00	0.00
19	CS.01	2	20	0	3.45	3.36	0.00
19	CS.02	3	40	0	5.17	6.71	0.00
19	CS.03	1	10	0	1.72	1.68	0.00
19	CS.04	2	20	0	3.45	3.36	0.00
19	PP.01	10	60	0	17.24	10.07	0.00
19	PP.02	1	10	0	1.72	1.68	0.00
19	PP.03	4	50	0	6.90	8.39	0.00
19	PP.04	4	40	0	6.90	6.71	0.00
19	PP.05	2	20	0	3.45	3.36	0.00
19	PP.06	4	40	0	6.90	6.71	0.00
19	PP.07	5	80	0	8.62	13.42	0.00
19	PP.08	2	20	0	3.45	3.36	0.00
19	SD.01	0	0	0	0.00	0.00	0.00
19	SD.02	0	0	0	0.00	0.00	0.00
19	SD.03	0	0	0	0.00	0.00	0.00
19	SD.04	0	0	0	0.00	0.00	0.00
19	SD.05	2	20	0	3.45	3.36	0.00
19	TP.01	2	20	0	3.45	3.36	0.00
19	TP.02	1	10	0	1.72	1.68	0.00
19	TP.03	0	0	0	0.00	0.00	0.00
19	TP.04				0.00	0.00	0.00
		58	596	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
20	BP.01	60	200	300	10.34	7.21	22.64
20	BP.02	100	50	150	17.24	1.80	11.32
20	BP.03	150	150	500	25.86	5.41	37.74
20	BP.04	30	150	300	5.17	5.41	22.64
20	BP.05	0	0	0	0.00	0.00	0.00
20	BP.06	20	75	25	3.45	2.70	1.89
20	BP.07	10	50	0	1.72	1.80	0.00
20	BP.08	10	125	0	1.72	4.50	0.00
20	BP.09	0	0	0	0.00	0.00	0.00
20	BP.10	0	0	0	0.00	0.00	0.00
20	BP.11	0	0	0	0.00	0.00	0.00
20	BP.12	0	0	0	0.00	0.00	0.00
20	CS.01	10	100	0	1.72	3.60	0.00
20	CS.02	10	50	0	1.72	1.80	0.00
20	CS.03	10	75	0	1.72	2.70	0.00
20	CS.04	10	50	0	1.72	1.80	0.00
20	PP.01	30	250	0	5.17	9.01	0.00
20	PP.02	10	100	0	1.72	3.60	0.00
20	PP.03	10	150	0	1.72	5.41	0.00
20	PP.04	5	50	0	0.86	1.80	0.00
20	PP.05	10	50	0	1.72	1.80	0.00
20	PP.06	0	0	0	0.00	0.00	0.00
20	PP.07	20	250	0	3.45	9.01	0.00
20	PP.08	5	50	0	0.86	1.80	0.00
20	SD.01	20	50	50	3.45	1.80	3.77
20	SD.02	10	50	0	1.72	1.80	0.00
20	SD.03	10	150	0	1.72	5.41	0.00
20	SD.04	10	350	0	1.72	12.61	0.00
20	SD.05	0	0	0	0.00	0.00	0.00
20	TP.01	0	0	0	0.00	0.00	0.00
20	TP.02	0	0	0	0.00	0.00	0.00
20	TP.03	20	200	0	3.45	7.21	0.00
20	TP.04				0.00	0.00	0.00
		580	2775	1325	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
21	BP.01	1	24	0	0.30	0.64	0.00
21	BP.02	5	40	0	1.51	1.06	0.00
21	BP.03	5	80	0	1.51	2.13	0.00
21	BP.04	8	200	0	2.41	5.32	0.00
21	BP.05	10	160	0	3.01	4.26	0.00
21	BP.06	15	240	0	4.52	6.38	0.00
21	BP.07	10	80	0	3.01	2.13	0.00
21	BP.08	5	80	0	1.51	2.13	0.00
21	BP.09	0	0	0	0.00	0.00	0.00
21	BP.10	3	24	0	0.90	0.64	0.00
21	BP.11	0	0	0	0.00	0.00	0.00
21	BP.12	2	96	0	0.60	2.55	0.00
21	CS.01	20	480	0	6.02	12.77	0.00
21	CS.02	1	20	0	0.30	0.53	0.00
21	CS.03	3	72	0	0.90	1.91	0.00
21	CS.04	0	0	0	0.00	0.00	0.00
21	PP.01	80	700	0	24.10	18.62	0.00
21	PP.02	2	20	0	0.60	0.53	0.00
21	PP.03	80	600	0	24.10	15.96	0.00
21	PP.04	2	20	0	0.60	0.53	0.00
21	PP.05	1	8	0	0.30	0.21	0.00
21	PP.06	20	180	0	6.02	4.79	0.00
21	PP.07	5	80	0	1.51	2.13	0.00
21	PP.08	10	80	0	3.01	2.13	0.00
21	SD.01	5	100	0	1.51	2.66	0.00
21	SD.02	2	16	0	0.60	0.43	0.00
21	SD.03	2	20	0	0.60	0.53	0.00
21	SD.04	10	80	0	3.01	2.13	0.00
21	SD.05	3	30	0	0.90	0.80	0.00
21	TP.01	20	200	0	6.02	5.32	0.00
21	TP.02	2	30	0	0.60	0.80	0.00
21	TP.03	0	0	0	0.00	0.00	0.00
21	TP.04				0.00	0.00	0.00
		332	3760	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
22	BP.01	0	80	0	0.00	0.56	0.00
22	BP.02	0	320	0	0.00	2.25	0.00
22	BP.03	0	400	200	0.00	2.82	8.70
22	BP.04	0	200	100	0.00	1.41	4.35
22	BP.05	0	400	0	0.00	2.82	0.00
22	BP.06	0	800	0	0.00	5.63	0.00
22	BP.07	0	600	200	0.00	4.23	8.70
22	BP.08	0	200	0	0.00	1.41	0.00
22	BP.09	0	100	0	0.00	0.70	0.00
22	BP.10	0	40	0	0.00	0.28	0.00
22	BP.11	0	600	200	0.00	4.23	8.70
22	BP.12	0	160	0	0.00	1.13	0.00
22	CS.01	0	400	0	0.00	2.82	0.00
22	CS.02	0	600	0	0.00	4.23	0.00
22	CS.03	0	100	0	0.00	0.70	0.00
22	CS.04	0	200	0	0.00	1.41	0.00
22	PP.01	0	2000	0	0.00	14.08	0.00
22	PP.02	0	100	0	0.00	0.70	0.00
22	PP.03	0	1500	700	0.00	10.56	30.43
22	PP.04	0	400	100	0.00	2.82	4.35
22	PP.05	0	100	0	0.00	0.70	0.00
22	PP.06	0	600	0	0.00	4.23	0.00
22	PP.07	0	400	0	0.00	2.82	0.00
22	PP.08	0	200	0	0.00	1.41	0.00
22	SD.01	0	200	100	0.00	1.41	4.35
22	SD.02	0	400	200	0.00	2.82	8.70
22	SD.03	0	1200	400	0.00	8.45	17.39
22	SD.04	0	400	0	0.00	2.82	0.00
22	SD.05	0	900	0	0.00	6.34	0.00
22	TP.01	0	400	100	0.00	2.82	4.35
22	TP.02	0	200	0	0.00	1.41	0.00
22	TP.03	0	0	0	0.00	0.00	0.00
22	TP.04	0			0.00	0.00	0.00
		0	14200	2300	0.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
23	BP.01	5	80	0	1.13	0.69	0.00
23	BP.02	20	160	0	4.52	1.38	0.00
23	BP.03	5	80	0	1.13	0.69	0.00
23	BP.04	3	50	0	0.68	0.43	0.00
23	BP.05	10	240	0	2.26	2.07	0.00
23	BP.06	5	40	0	1.13	0.34	0.00
23	BP.07	5	40	0	1.13	0.34	0.00
23	BP.08	3	40	0	0.68	0.34	0.00
23	BP.09	1	8	0	0.23	0.07	0.00
23	BP.10	20	160	0	4.52	1.38	0.00
23	BP.11	20	160	0	4.52	1.38	0.00
23	BP.12	2	16	0	0.45	0.14	0.00
23	CS.01	20	320	0	4.52	2.76	0.00
23	CS.02	20	600	0	4.52	5.17	0.00
23	CS.03	5	20	0	1.13	0.17	0.00
23	CS.04	0	0	0	0.00	0.00	0.00
23	PP.01	40	3000	0	9.05	25.85	0.00
23	PP.02	5	20	0	1.13	0.17	0.00
23	PP.03	40	3000	0	9.05	25.85	0.00
23	PP.04	15	140	0	3.39	1.21	0.00
23	PP.05	3	15	0	0.68	0.13	0.00
23	PP.06	20	300	0	4.52	2.59	0.00
23	PP.07	20	1000	0	4.52	8.62	0.00
23	PP.08	5	15	0	1.13	0.13	0.00
23	SD.01	20	100	0	4.52	0.86	0.00
23	SD.02	10	10	0	2.26	0.09	0.00
23	SD.03	10	20	0	2.26	0.17	0.00
23	SD.04	40	1000	0	9.05	8.62	0.00
23	SD.05	5	10	0	1.13	0.09	0.00
23	TP.01	40	600	0	9.05	5.17	0.00
23	TP.02	20	300	0	4.52	2.59	0.00
23	TP.03	5	60	0	1.13	0.52	0.00
23	TP.04				0.00	0.00	0.00
		442	11604	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
24	BP.01	0	0	0	0.00	0.00	0.00
24	BP.02	60	50	500	7.26	1.82	3.10
24	BP.03	40	600	40	4.84	21.79	0.25
24	BP.04	20	40	400	2.42	1.45	2.48
24	BP.05	1	8	8	0.12	0.29	0.05
24	BP.06	50	20	500	6.05	0.73	3.10
24	BP.07	10	0	80	1.21	0.00	0.50
24	BP.08	5	8	80	0.61	0.29	0.50
24	BP.09	1	8	8	0.12	0.29	0.05
24	BP.10	50	1000	1000	6.05	36.31	6.21
24	BP.11	0	0	0	0.00	0.00	0.00
24	BP.12	10	200	50	1.21	7.26	0.31
24	CS.01	10	0	300	1.21	0.00	1.86
24	CS.02	100	200	2000	12.11	7.26	12.41
24	CS.03	5	0	100	0.61	0.00	0.62
24	CS.04	0	0	0	0.00	0.00	0.00
24	PP.01	175	0	5000	21.19	0.00	31.03
24	PP.02	1	0	8	0.12	0.00	0.05
24	PP.03	20	0	500	2.42	0.00	3.10
24	PP.04	20	20	300	2.42	0.73	1.86
24	PP.05	5	0	100	0.61	0.00	0.62
24	PP.06	10	0	80	1.21	0.00	0.50
24	PP.07	60	0	1000	7.26	0.00	6.21
24	PP.08	20	100	200	2.42	3.63	1.24
24	SD.01	5	80	80	0.61	2.90	0.50
24	SD.02	5	0	40	0.61	0.00	0.25
24	SD.03	20	100	400	2.42	3.63	2.48
24	SD.04	60	100	2000	7.26	3.63	12.41
24	SD.05	1	0	8	0.12	0.00	0.05
24	TP.01	20	200	1000	2.42	7.26	6.21
24	TP.02	40	20	320	4.84	0.73	1.99
24	TP.03	2	0	10	0.24	0.00	0.06
24	TP.04				0.00	0.00	0.00
		826	2754	16112	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
25	BP.01	60	960	0	2.58	2.10	0.00
25	BP.02	45	360	0	1.94	0.79	0.00
25	BP.03	180	2880	0	7.74	6.29	0.00
25	BP.04	30	240	0	1.29	0.52	0.00
25	BP.05	30	480	0	1.29	1.05	0.00
25	BP.06	15	40	0	0.65	0.09	0.00
25	BP.07	30	480	0	1.29	1.05	0.00
25	BP.08	5	40	0	0.22	0.09	0.00
25	BP.09	20	80	0	0.86	0.17	0.00
25	BP.10	120	1920	0	5.16	4.19	0.00
25	BP.11	90	720	0	3.87	1.57	0.00
25	BP.12	5	40	0	0.22	0.09	0.00
25	CS.01	30	240	0	1.29	0.52	0.00
25	CS.02	90	7200	0	3.87	15.72	0.00
25	CS.03	60	9600	0	2.58	20.96	0.00
25	CS.04	45	1440	0	1.94	3.14	0.00
25	PP.01	120	7680	0	5.16	16.77	0.00
25	PP.02	10	40	0	0.43	0.09	0.00
25	PP.03	90	2880	0	3.87	6.29	0.00
25	PP.04	120	2880	0	5.16	6.29	0.00
25	PP.05	30	480	0	1.29	1.05	0.00
25	PP.06	15	80	0	0.65	0.17	0.00
25	PP.07	365	2800	0	15.70	6.11	0.00
25	PP.08	60	320	0	2.58	0.70	0.00
25	SD.01	120	300	0	5.16	0.66	0.00
25	SD.02	60	160	0	2.58	0.35	0.00
25	SD.03	180	500	0	7.74	1.09	0.00
25	SD.04	180	320	0	7.74	0.70	0.00
25	SD.05	30	160	0	1.29	0.35	0.00
25	TP.01	30	160	0	1.29	0.35	0.00
25	TP.02	60	320	0	2.58	0.70	0.00
25	TP.03	0	0	0	0.00	0.00	0.00
25	TP.04				0.00	0.00	0.00
		2325	45800	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
26	BP.01	10	80	20	1.35	12.23	33.33
26	BP.02	5	40	0	0.68	6.12	0.00
26	BP.03	5	40	0	0.68	6.12	0.00
26	BP.04	10	80	0	1.35	12.23	0.00
26	BP.05	3	24	0	0.41	3.67	0.00
26	BP.06	5	40	0	0.68	6.12	0.00
26	BP.07	40	0	0	5.41	0.00	0.00
26	BP.08	1	0	0	0.14	0.00	0.00
26	BP.09	1	0	0	0.14	0.00	0.00
26	BP.10	2.5	20	10	0.34	3.06	16.67
26	BP.11	10	80	0	1.35	12.23	0.00
26	BP.12	5	40	0	0.68	6.12	0.00
26	CS.01	0.5	4	0	0.07	0.61	0.00
26	CS.02	0	0	0	0.00	0.00	0.00
26	CS.03	0	0	0	0.00	0.00	0.00
26	CS.04	0	0	0	0.00	0.00	0.00
26	PP.01	20	160	0	2.70	24.46	0.00
26	PP.02	2	16	0	0.27	2.45	0.00
26	PP.03	80	0	0	10.81	0.00	0.00
26	PP.04	40	0	0	5.41	0.00	0.00
26	PP.05	40	20	20	5.41	3.06	33.33
26	PP.06	20	10	10	2.70	1.53	16.67
26	PP.07	40	0	0	5.41	0.00	0.00
26	PP.08	100	0	0	13.51	0.00	0.00
26	SD.01	80	0	0	10.81	0.00	0.00
26	SD.02	40	0	0	5.41	0.00	0.00
26	SD.03	80	0	0	10.81	0.00	0.00
26	SD.04	40	0	0	5.41	0.00	0.00
26	SD.05	20	0	0	2.70	0.00	0.00
26	TP.01	40	0	0	5.41	0.00	0.00
26	TP.02	0	0	0	0.00	0.00	0.00
26	TP.03	0	0	0	0.00	0.00	0.00
26	TP.04	0	0	0	0.00	0.00	0.00
		740	654	60	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
27	BP.01	60	500	1000	4.01	10.81	6.24
27	BP.02	30	200	200	2.01	4.32	1.25
27	BP.03	60	250	1000	4.01	5.41	6.24
27	BP.04	100	100	1000	6.69	2.16	6.24
27	BP.05	75	250	1000	5.02	5.41	6.24
27	BP.06	20	150	500	1.34	3.24	3.12
27	BP.07	30	75	250	2.01	1.62	1.56
27	BP.08	5	100	100	0.33	2.16	0.62
27	BP.09	0	0	0	0.00	0.00	0.00
27	BP.10	30	300	600	2.01	6.49	3.74
27	BP.11	40	100	800	2.68	2.16	4.99
27	BP.12	25	250	50	1.67	5.41	0.31
27	CS.01	10	0	150	0.67	0.00	0.94
27	CS.02	30	0	200	2.01	0.00	1.25
27	CS.03	30	50	250	2.01	1.08	1.56
27	CS.04	30	10	80	2.01	0.22	0.50
27	PP.01	180	150	1000	12.04	3.24	6.24
27	PP.02	50	100	600	3.34	2.16	3.74
27	PP.03	45	100	800	3.01	2.16	4.99
27	PP.04	90	40	1000	6.02	0.86	6.24
27	PP.05	75	300	1000	5.02	6.49	6.24
27	PP.06	100	250	1000	6.69	5.41	6.24
27	PP.07	100	500	1000	6.69	10.81	6.24
27	PP.08	30	100	250	2.01	2.16	1.56
27	SD.01	0	0	0	0.00	0.00	0.00
27	SD.02	30	0	100	2.01	0.00	0.62
27	SD.03	60	250	500	4.01	5.41	3.12
27	SD.04	90	200	1000	6.02	4.32	6.24
27	SD.05	10	0	50	0.67	0.00	0.31
27	TP.01	50	300	300	3.34	6.49	1.87
27	TP.02	10	0	250	0.67	0.00	1.56
27	TP.03	0	0	0	0.00	0.00	0.00
27	TP.04				0.00	0.00	0.00
		1495	4625	16030	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
28	BP.01	90	100	10	11.29	7.50	0.69
28	BP.02	0	0	0	0.00	0.00	0.00
28	BP.03	60	80	40	7.53	6.00	2.75
28	BP.04	10	20	0	1.25	1.50	0.00
28	BP.05	0	0	0	0.00	0.00	0.00
28	BP.06	60	40	0	7.53	3.00	0.00
28	BP.07	30	60	0	3.76	4.50	0.00
28	BP.08	1	40	40	0.13	3.00	2.75
28	BP.09	0	0	0	0.00	0.00	0.00
28	BP.10	60	100	30	7.53	7.50	2.07
28	BP.11	0	0	0	0.00	0.00	0.00
28	BP.12	0	0	0	0.00	0.00	0.00
28	CS.01	30	40	20	3.76	3.00	1.38
28	CS.02	30	32	120	3.76	2.40	8.26
28	CS.03	10	40	20	1.25	3.00	1.38
28	CS.04	10	72	32	1.25	5.40	2.20
28	PP.01	90	200	300	11.29	14.99	20.66
28	PP.02	5	20	0	0.63	1.50	0.00
28	PP.03	20	40	200	2.51	3.00	13.77
28	PP.04	30	60	60	3.76	4.50	4.13
28	PP.05	60	20	0	7.53	1.50	0.00
28	PP.06	10	20	40	1.25	1.50	2.75
28	PP.07	0	0	0	0.00	0.00	0.00
28	PP.08	30	120	0	3.76	9.00	0.00
28	SD.01	1	10	0	0.13	0.75	0.00
28	SD.02	30	40	80	3.76	3.00	5.51
28	SD.03	10	20	0	1.25	1.50	0.00
28	SD.04	30	80	160	3.76	6.00	11.02
28	SD.05	30	20	180	3.76	1.50	12.40
28	TP.01	60	60	120	7.53	4.50	8.26
28	TP.02	0	0	0	0.00	0.00	0.00
28	TP.03	0	0	0	0.00	0.00	0.00
28	TP.04				0.00	0.00	0.00
		797	1334	1452	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
29	BP.01	90	100	0	15.99	26.60	0.00
29	BP.02	30	10	20	5.33	2.66	8.06
29	BP.03	1	4	0	0.18	1.06	0.00
29	BP.04	30	8	0	5.33	2.13	0.00
29	BP.05	0	0	0	0.00	0.00	0.00
29	BP.06	0	0	0	0.00	0.00	0.00
29	BP.07	30	8	0	5.33	2.13	0.00
29	BP.08	30	10	10	5.33	2.66	4.03
29	BP.09	0	0	0	0.00	0.00	0.00
29	BP.10	90	40	0	15.99	10.64	0.00
29	BP.11	90	40	0	15.99	10.64	0.00
29	BP.12	0	0	0	0.00	0.00	0.00
29	CS.01	30	8	4	5.33	2.13	1.61
29	CS.02	14	40	20	2.49	10.64	8.06
29	CS.03	1	4	2	0.18	1.06	0.81
29	CS.04	1	8	8	0.18	2.13	3.23
29	PP.01	30	10	30	5.33	2.66	12.10
29	PP.02	0	0	0	0.00	0.00	0.00
29	PP.03	30	8	80	5.33	2.13	32.26
29	PP.04	14	20	10	2.49	5.32	4.03
29	PP.05	0	0	0	0.00	0.00	0.00
29	PP.06	1	4	4	0.18	1.06	1.61
29	PP.07	2	12	12	0.36	3.19	4.84
29	PP.08	2	10	0	0.36	2.66	0.00
29	SD.01	14	12	0	2.49	3.19	0.00
29	SD.02	14	0	8	2.49	0.00	3.23
29	SD.03	0	0	0	0.00	0.00	0.00
29	SD.04	14	8	20	2.49	2.13	8.06
29	SD.05	0	0	0	0.00	0.00	0.00
29	TP.01	5	12	20	0.89	3.19	8.06
29	TP.02	0	0	0	0.00	0.00	0.00
29	TP.03	0	0	0	0.00	0.00	0.00
29	TP.04				0.00	0.00	0.00
		563	376	248	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
30	BP.01	180	500	0	16.22	20.76	0.00
30	BP.02	4	32	32	0.36	1.33	1.62
30	BP.03	5	40	40	0.45	1.66	2.02
30	BP.04	5	40	0	0.45	1.66	0.00
30	BP.05	30	60	60	2.70	2.49	3.03
30	BP.06	60	60	60	5.41	2.49	3.03
30	BP.07	10	80	40	0.90	3.32	2.02
30	BP.08	4	32	0	0.36	1.33	0.00
30	BP.09	5	40	0	0.45	1.66	0.00
30	BP.10	5	40	40	0.45	1.66	2.02
30	BP.11	5	80	40	0.45	3.32	2.02
30	BP.12	30	120	0	2.70	4.98	0.00
30	CS.01	30	150	240	2.70	6.23	12.14
30	CS.02	20	60	60	1.80	2.49	3.03
30	CS.03	30	90	50	2.70	3.74	2.53
30	CS.04	5	40	40	0.45	1.66	2.02
30	PP.01	40	24	240	3.60	1.00	12.14
30	PP.02	5	40	20	0.45	1.66	1.01
30	PP.03	30	80	160	2.70	3.32	8.09
30	PP.04	15	10	30	1.35	0.42	1.52
30	PP.05	20	40	40	1.80	1.66	2.02
30	PP.06	30	120	120	2.70	4.98	6.07
30	PP.07	10	40	40	0.90	1.66	2.02
30	PP.08	5	40	20	0.45	1.66	1.01
30	SD.01	5	40	20	0.45	1.66	1.01
30	SD.02	60	120	240	5.41	4.98	12.14
30	SD.03	2	20	0	0.18	0.83	0.00
30	SD.04	10	40	80	0.90	1.66	4.05
30	SD.05	15	120	10	1.35	4.98	0.51
30	TP.01	60	100	240	5.41	4.15	12.14
30	TP.02	15	30	15	1.35	1.25	0.76
30	TP.03	360	80	0	32.43	3.32	0.00
30	TP.04				0.00	0.00	0.00
		1110	2408	1977	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
31	BP.01	500	1000	0	31.23	53.02	0.00
31	BP.02	0	0	0	0.00	0.00	0.00
31	BP.03	0	0	0	0.00	0.00	0.00
31	BP.04	90	100	250	5.62	5.30	25.75
31	BP.05	30	50	40	1.87	2.65	4.12
31	BP.06	60	20	0	3.75	1.06	0.00
31	BP.07	30	40	10	1.87	2.12	1.03
31	BP.08	30	40	10	1.87	2.12	1.03
31	BP.09	0	0	0	0.00	0.00	0.00
31	BP.10	300	100	0	18.74	5.30	0.00
31	BP.11	60	40	0	3.75	2.12	0.00
31	BP.12	0	0	0	0.00	0.00	0.00
31	CS.01	5	20	5	0.31	1.06	0.51
31	CS.02	60	80	40	3.75	4.24	4.12
31	CS.03	7	24	0	0.44	1.27	0.00
31	CS.04	7	4	0	0.44	0.21	0.00
31	PP.01	30	16	40	1.87	0.85	4.12
31	PP.02	2	4	0	0.12	0.21	0.00
31	PP.03	30	40	40	1.87	2.12	4.12
31	PP.04	7	10	10	0.44	0.53	1.03
31	PP.05	3	24	16	0.19	1.27	1.65
31	PP.06	5	10	10	0.31	0.53	1.03
31	PP.07	30	40	24	1.87	2.12	2.47
31	PP.08	5	24	16	0.31	1.27	1.65
31	SD.01	100	80	300	6.25	4.24	30.90
31	SD.02	0	0	0	0.00	0.00	0.00
31	SD.03	0	0	0	0.00	0.00	0.00
31	SD.04	0	0	0	0.00	0.00	0.00
31	SD.05	30	40	0	1.87	2.12	0.00
31	TP.01	180	80	160	11.24	4.24	16.48
31	TP.02	0	0	0	0.00	0.00	0.00
31	TP.03	0	0	0	0.00	0.00	0.00
31	TP.04	0	0	0	0.00	0.00	0.00
		1601	1886	971	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
32	BP.01	20	80	0	10.53	18.06	0.00
32	BP.02	10	40	0	5.26	9.03	0.00
32	BP.03	5	20	0	2.63	4.51	0.00
32	BP.04	1	5	0	0.53	1.13	0.00
32	BP.05	0	0	0	0.00	0.00	0.00
32	BP.06	2	10	0	1.05	2.26	0.00
32	BP.07	10	20	0	5.26	4.51	0.00
32	BP.08	0	0	0	0.00	0.00	0.00
32	BP.09	0	0	0	0.00	0.00	0.00
32	BP.10	20	80	0	10.53	18.06	0.00
32	BP.11	0	0	0	0.00	0.00	0.00
32	BP.12	0	0	0	0.00	0.00	0.00
32	CS.01	10	15	0	5.26	3.39	0.00
32	CS.02	0	0	0	0.00	0.00	0.00
32	CS.03	0	0	0	0.00	0.00	0.00
32	CS.04	5	5	10	2.63	1.13	1.30
32	PP.01	20	20	100	10.53	4.51	13.02
32	PP.02	1	5	10	0.53	1.13	1.30
32	PP.03	30	100	300	15.79	22.57	39.06
32	PP.04	5	10	100	2.63	2.26	13.02
32	PP.05	10	10	20	5.26	2.26	2.60
32	PP.06	1	8	8	0.53	1.81	1.04
32	PP.07	10	10	100	5.26	2.26	13.02
32	PP.08	20	0	100	10.53	0.00	13.02
32	SD.01	0	0	0	0.00	0.00	0.00
32	SD.02	0	0	0	0.00	0.00	0.00
32	SD.03	0	0	0	0.00	0.00	0.00
32	SD.04	0	0	0	0.00	0.00	0.00
32	SD.05	10	5	20	5.26	1.13	2.60
32	TP.01	0	0	0	0.00	0.00	0.00
32	TP.02	0	0	0	0.00	0.00	0.00
32	TP.03	0	0	0	0.00	0.00	0.00
32	TP.04				0.00	0.00	0.00
		190	443	768	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
33	BP.01	30	720	0	5.04	9.35	0.00
33	BP.02	20	640	0	3.36	8.31	0.00
33	BP.03	10	80	40	1.68	1.04	0.33
33	BP.04	20	640	60	3.36	8.31	0.49
33	BP.05	20	640	40	3.36	8.31	0.33
33	BP.06	30	480	40	5.04	6.23	0.33
33	BP.07	10	320	80	1.68	4.16	0.65
33	BP.08	5	80	20	0.84	1.04	0.16
33	BP.09	0	0	0	0.00	0.00	0.00
33	BP.10	20	320	0	3.36	4.16	0.00
33	BP.11	20	160	0	3.36	2.08	0.00
33	BP.12	10	80	0	1.68	1.04	0.00
33	CS.01	15	480	120	2.52	6.23	0.98
33	CS.02	20	160	640	3.36	2.08	5.21
33	CS.03	10	100	320	1.68	1.30	2.60
33	CS.04	10	40	120	1.68	0.52	0.98
33	PP.01	20	60	640	3.36	0.78	5.21
33	PP.02	20	80	480	3.36	1.04	3.91
33	PP.03	30	60	960	5.04	0.78	7.81
33	PP.04	20	50	320	3.36	0.65	2.60
33	PP.05	20	100	240	3.36	1.30	1.95
33	PP.06	15	90	240	2.52	1.17	1.95
33	PP.07	10	100	240	1.68	1.30	1.95
33	PP.08	5	160	10	0.84	2.08	0.08
33	SD.01	75	1200	3600	12.61	15.58	29.29
33	SD.02	10	40	120	1.68	0.52	0.98
33	SD.03	5	50	25	0.84	0.65	0.20
33	SD.04	60	480	3600	10.08	6.23	29.29
33	SD.05	10	160	240	1.68	2.08	1.95
33	TP.01	15	30	60	2.52	0.39	0.49
33	TP.02	30	100	30	5.04	1.30	0.24
33	TP.03	0	0	6	0.00	0.00	0.05
33	TP.04	0	0	0	0.00	0.00	0.00
		595	7700	12291	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
34	BP.01	20	32	128	2.21	1.26	2.67
34	BP.02	0	0	0	0.00	0.00	0.00
34	BP.03	80	96	544	8.84	3.78	11.37
34	BP.04	30	156	84	3.31	6.13	1.76
34	BP.05	90	108	612	9.94	4.25	12.79
34	BP.06	110	132	748	12.15	5.19	15.63
34	BP.07	45	72	288	4.97	2.83	6.02
34	BP.08	15	95	24	1.66	3.74	0.50
34	BP.09	0	0	0	0.00	0.00	0.00
34	BP.10	0	0	0	0.00	0.00	0.00
34	BP.11	0	0	0	0.00	0.00	0.00
34	BP.12	0	0	0	0.00	0.00	0.00
34	CS.01	15	96	24	1.66	3.78	0.50
34	CS.02	15	96	84	1.66	3.78	1.76
34	CS.03	60	366	144	6.63	14.39	3.01
34	CS.04	15	96	24	1.66	3.78	0.50
34	PP.01	90	288	432	9.94	11.33	9.03
34	PP.02	5	20	20	0.55	0.79	0.42
34	PP.03	60	120	360	6.63	4.72	7.52
34	PP.04	45	110	250	4.97	4.33	5.22
34	PP.05	45	140	220	4.97	5.51	4.60
34	PP.06	45	200	160	4.97	7.86	3.34
34	PP.07	30	120	120	3.31	4.72	2.51
34	PP.08	30	80	160	3.31	3.15	3.34
34	SD.01	0	0	0	0.00	0.00	0.00
34	SD.02	0	0	0	0.00	0.00	0.00
34	SD.03	0	0	0	0.00	0.00	0.00
34	SD.04	0	0	0	0.00	0.00	0.00
34	SD.05	0	0	0	0.00	0.00	0.00
34	TP.01	0	0	0	0.00	0.00	0.00
34	TP.02	60	120	360	6.63	4.72	7.52
34	TP.03	0	0	0	0.00	0.00	0.00
34	TP.04				0.00	0.00	0.00
		905	2543	4786	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
35	BP.01	46	60	0	18.85	8.67	0.00
35	BP.02	22	51	0	9.02	7.37	0.00
35	BP.03	7	21	0	2.87	3.03	0.00
35	BP.04	24	30	0	9.84	4.34	0.00
35	BP.05	0	0	0	0.00	0.00	0.00
35	BP.06	1	18	0	0.41	2.60	0.00
35	BP.07	3	18	0	1.23	2.60	0.00
35	BP.08	8	33	0	3.28	4.77	0.00
35	BP.09	0	0	0	0.00	0.00	0.00
35	BP.10	11	44	0	4.51	6.36	0.00
35	BP.11	0	0	0	0.00	0.00	0.00
35	BP.12	0	0	0	0.00	0.00	0.00
35	CS.01	7	44	0	2.87	6.36	0.00
35	CS.02	0	0	0	0.00	0.00	0.00
35	CS.03	0	0	0	0.00	0.00	0.00
35	CS.04	0	0	0	0.00	0.00	0.00
35	PP.01	44	30	0	18.03	4.34	0.00
35	PP.02	0	0	0	0.00	0.00	0.00
35	PP.03	24	56	0	9.84	8.09	0.00
35	PP.04	6	39	0	2.46	5.64	0.00
35	PP.05	4	18	0	1.64	2.60	0.00
35	PP.06	4	25	0	1.64	3.61	0.00
35	PP.07	1	18	0	0.41	2.60	0.00
35	PP.08	2	14	0	0.82	2.02	0.00
35	SD.01	4	20	0	1.64	2.89	0.00
35	SD.02	6	21	0	2.46	3.03	0.00
35	SD.03	1	9	0	0.41	1.30	0.00
35	SD.04	18	114	0	7.38	16.47	0.00
35	SD.05	0	0	0	0.00	0.00	0.00
35	TP.01	1	9	0	0.41	1.30	0.00
35	TP.02	0	0	0	0.00	0.00	0.00
35	TP.03	0	0	0	0.00	0.00	0.00
35	TP.04	0	0	0	0.00	0.00	0.00
		244	692	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
36	BP.01	10	80	0	5.17	5.46	0.00
36	BP.02	0	0	0	0.00	0.00	0.00
36	BP.03	2	16	0	1.03	1.09	0.00
36	BP.04	60	480	0	31.01	32.74	0.00
36	BP.05	5	40	0	2.58	2.73	0.00
36	BP.06	2	4	0	1.03	0.27	0.00
36	BP.07	3	24	0	1.55	1.64	0.00
36	BP.08	10	80	24	5.17	5.46	42.86
36	BP.09	0	0	0	0.00	0.00	0.00
36	BP.10	3	24	0	1.55	1.64	0.00
36	BP.11	0	0	0	0.00	0.00	0.00
36	BP.12	0	0	0	0.00	0.00	0.00
36	CS.01	10	80	0	5.17	5.46	0.00
36	CS.02	10	80	0	5.17	5.46	0.00
36	CS.03	0	0	0	0.00	0.00	0.00
36	CS.04	0	0	0	0.00	0.00	0.00
36	PP.01	3	24	0	1.55	1.64	0.00
36	PP.02	3	24	0	1.55	1.64	0.00
36	PP.03	0	0	0	0.00	0.00	0.00
36	PP.04	0	12	0	0.00	0.82	0.00
36	PP.05	0	0	0	0.00	0.00	0.00
36	PP.06	0	0	0	0.00	0.00	0.00
36	PP.07	10	60	0	5.17	4.09	0.00
36	PP.08	3	20	0	1.55	1.36	0.00
36	SD.01	40	300	0	20.67	20.46	0.00
36	SD.02	8	60	0	4.13	4.09	0.00
36	SD.03	0.5	4	0	0.26	0.27	0.00
36	SD.04	4	30	0	2.07	2.05	0.00
36	SD.05	3	24	0	1.55	1.64	0.00
36	TP.01	4	0	32	2.07	0.00	57.14
36	TP.02	0	0	0	0.00	0.00	0.00
36	TP.03	0	0	0	0.00	0.00	0.00
36	TP.04	0	0	0	0.00	0.00	0.00
		193.5	1466	56	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
37	BP.01	60	200	0	31.17	18.87	0.00
37	BP.02	5	24	0	2.60	2.26	0.00
37	BP.03	3	6	0	1.56	0.57	0.00
37	BP.04	40	300	0	20.78	28.30	0.00
37	BP.05	2	10	0	1.04	0.94	0.00
37	BP.06	0	0	0	0.00	0.00	0.00
37	BP.07	3	20	0	1.56	1.89	0.00
37	BP.08	2	16	0	1.04	1.51	0.00
37	BP.09	0	0	0	0.00	0.00	0.00
37	BP.10	20	120	0	10.39	11.32	0.00
37	BP.11	0	0	0	0.00	0.00	0.00
37	BP.12	5	24	0	2.60	2.26	0.00
37	CS.01	1	8	0	0.52	0.75	0.00
37	CS.02	1	8	0	0.52	0.75	0.00
37	CS.03	0.5	4	0	0.26	0.38	0.00
37	CS.04	0	0	0	0.00	0.00	0.00
37	PP.01	3	20	0	1.56	1.89	0.00
37	PP.02	1	6	0	0.52	0.57	0.00
37	PP.03	4	30	0	2.08	2.83	0.00
37	PP.04	3	20	0	1.56	1.89	0.00
37	PP.05	0	0	0	0.00	0.00	0.00
37	PP.06	0	0	0	0.00	0.00	0.00
37	PP.07	5	30	0	2.60	2.83	0.00
37	PP.08	2	10	0	1.04	0.94	0.00
37	SD.01	10	60	0	5.19	5.66	0.00
37	SD.02	4	30	0	2.08	2.83	0.00
37	SD.03	1	4	0	0.52	0.38	0.00
37	SD.04	4	30	0	2.08	2.83	0.00
37	SD.05	10	60	0	5.19	5.66	0.00
37	TP.01	3	20	0	1.56	1.89	0.00
37	TP.02	0	0	0	0.00	0.00	0.00
37	TP.03	0	0	0	0.00	0.00	0.00
37	TP.04	0	0	0	0.00	0.00	0.00
		192.5	1060	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
38	BP.01	30	200	0	16.04	21.74	0.00
38	BP.02	3	16	0	1.60	1.74	0.00
38	BP.03	1	6	0	0.53	0.65	0.00
38	BP.04	60	300	0	32.09	32.61	0.00
38	BP.05	0	0	0	0.00	0.00	0.00
38	BP.06	5	30	0	2.67	3.26	0.00
38	BP.07	10	0	0	5.35	0.00	0.00
38	BP.08	2	0	0	1.07	0.00	0.00
38	BP.09	0	0	0	0.00	0.00	0.00
38	BP.10	6	40	0	3.21	4.35	0.00
38	BP.11	0	0	0	0.00	0.00	0.00
38	BP.12	3	16	0	1.60	1.74	0.00
38	CS.01	3	16	0	1.60	1.74	0.00
38	CS.02	3	16	0	1.60	1.74	0.00
38	CS.03	2	10	0	1.07	1.09	0.00
38	CS.04	1	4	0	0.53	0.43	0.00
38	PP.01	0	0	0	0.00	0.00	0.00
38	PP.02	3	16	0	1.60	1.74	0.00
38	PP.03	15	60	0	8.02	6.52	0.00
38	PP.04	3	16	0	1.60	1.74	0.00
38	PP.05	1	6	0	0.53	0.65	0.00
38	PP.06	0	0	0	0.00	0.00	0.00
38	PP.07	15	80	0	8.02	8.70	0.00
38	PP.08	3	20	0	1.60	2.17	0.00
38	SD.01	3	12	0	1.60	1.30	0.00
38	SD.02	4	20	0	2.14	2.17	0.00
38	SD.03	2	10	0	1.07	1.09	0.00
38	SD.04	4	20	0	2.14	2.17	0.00
38	SD.05	3	0	0	1.60	0.00	0.00
38	TP.01	0	0	0	0.00	0.00	0.00
38	TP.02	2	6	0	1.07	0.65	0.00
38	TP.03	0	0	0	0.00	0.00	0.00
38	TP.04	0	0	0	0.00	0.00	0.00
		187	920	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
39	BP.01	0	0	0	0.00	0.00	0.00
39	BP.02	0	0	0	0.00	0.00	0.00
39	BP.03	8	52	0	0.20	0.42	0.00
39	BP.04	30	40	0	0.75	0.32	0.00
39	BP.05	0	0	0	0.00	0.00	0.00
39	BP.06	12	192	0	0.30	1.55	0.00
39	BP.07	10	0	0	0.25	0.00	0.00
39	BP.08	2	56	0	0.05	0.45	0.00
39	BP.09	0	0	0	0.00	0.00	0.00
39	BP.10	425	1100	0	10.60	8.89	0.00
39	BP.11	30	300	0	0.75	2.42	0.00
39	BP.12	0	0	0	0.00	0.00	0.00
39	CS.01	5	100	0	0.12	0.81	0.00
39	CS.02	15	124	0	0.37	1.00	0.00
39	CS.03	0	0	0	0.00	0.00	0.00
39	CS.04	0	0	0	0.00	0.00	0.00
39	PP.01	22	616	0	0.55	4.98	0.00
39	PP.02	2	8	0	0.05	0.06	0.00
39	PP.03	350	1600	0	8.73	12.92	0.00
39	PP.04	1120	700	0	27.92	5.65	0.00
39	PP.05	2	8	0	0.05	0.06	0.00
39	PP.06	0	0	0	0.00	0.00	0.00
39	PP.07	820	6300	0	20.44	50.89	0.00
39	PP.08	0	0	0	0.00	0.00	0.00
39	SD.01	105	88	0	2.62	0.71	0.00
39	SD.02	0	0	0	0.00	0.00	0.00
39	SD.03	10	24	0	0.25	0.19	0.00
39	SD.04	790	400	0	19.70	3.23	0.00
39	SD.05	33	72	0	0.82	0.58	0.00
39	TP.01	220	600	0	5.48	4.85	0.00
39	TP.02	0	0	0	0.00	0.00	0.00
39	TP.03	0	0	0	0.00	0.00	0.00
39	TP.04	0	0	0	0.00	0.00	0.00
		4011	12380	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
40	BP.01	3	26	0	4.89	2.08	0.00
40	BP.02	6	79	0	9.79	6.30	0.00
40	BP.03	1	26	0	1.63	2.08	0.00
40	BP.04	6	106	0	9.79	8.46	0.00
40	BP.05	0	0	0	0.00	0.00	0.00
40	BP.06	4	70	0	6.53	5.59	0.00
40	BP.07	7	194	0	11.42	15.48	0.00
40	BP.08	1	26	0	1.63	2.08	0.00
40	BP.09	0	0	0	0.00	0.00	0.00
40	BP.10	8	70	0	13.05	5.59	0.00
40	BP.11	2	9	0	3.26	0.72	0.00
40	BP.12	0	0	0	0.00	0.00	0.00
40	CS.01	1	30	0	1.63	2.39	0.00
40	CS.02	1	35	0	1.63	2.79	0.00
40	CS.03	0	0	0	0.00	0.00	0.00
40	CS.04	0	0	0	0.00	0.00	0.00
40	PP.01	2	44	0	3.26	3.51	0.00
40	PP.02	0.6	18	0	0.98	1.44	0.00
40	PP.03	4	109	0	6.53	8.70	0.00
40	PP.04	4.8	132	0	7.83	10.53	0.00
40	PP.05	0.4	5	0	0.65	0.40	0.00
40	PP.06	0.6	18	0	0.98	1.44	0.00
40	PP.07	2	90	0	3.26	7.18	0.00
40	PP.08	0.2	12	0	0.33	0.96	0.00
40	SD.01	0.7	11	0	1.14	0.88	0.00
40	SD.02	0	0	0	0.00	0.00	0.00
40	SD.03	0	0	0	0.00	0.00	0.00
40	SD.04	0	0	0	0.00	0.00	0.00
40	SD.05	2	46	0	3.26	3.67	0.00
40	TP.01	4	97	0	6.53	7.74	0.00
40	TP.02	0	0	0	0.00	0.00	0.00
40	TP.03	0	0	0	0.00	0.00	0.00
40	TP.04	0	0	0	0.00	0.00	0.00
		61.3	1253	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
41	BP.01	101	2323	361	21.40	26.70	57.95
41	BP.02	13	924	53	2.75	10.62	8.51
41	BP.03	29	176	0	6.14	2.02	0.00
41	BP.04	88	915	0	18.64	10.52	0.00
41	BP.05	0	0	0	0.00	0.00	0.00
41	BP.06	57	704	0	12.08	8.09	0.00
41	BP.07	2	3	5	0.42	0.03	0.80
41	BP.08	3	79	0	0.64	0.91	0.00
41	BP.09	0	0	0	0.00	0.00	0.00
41	BP.10	44	889	72	9.32	10.22	11.56
41	BP.11	22	546	35	4.66	6.28	5.62
41	BP.12	6	211	0	1.27	2.43	0.00
41	CS.01	4	62	0	0.85	0.71	0.00
41	CS.02	5	97	0	1.06	1.11	0.00
41	CS.03	0	0	0	0.00	0.00	0.00
41	CS.04	0	0	0	0.00	0.00	0.00
41	PP.01	7	136	97	1.48	1.56	15.57
41	PP.02	2	35	0	0.42	0.40	0.00
41	PP.03	11	494	0	2.33	5.68	0.00
41	PP.04	7	146	0	1.48	1.68	0.00
41	PP.05	1	11	0	0.21	0.13	0.00
41	PP.06	11	132	0	2.33	1.52	0.00
41	PP.07	9	123	0	1.91	1.41	0.00
41	PP.08	5	70	0	1.06	0.80	0.00
41	SD.01	18	106	0	3.81	1.22	0.00
41	SD.02	2	35	0	0.42	0.40	0.00
41	SD.03	1	9	0	0.21	0.10	0.00
41	SD.04	9	202	0	1.91	2.32	0.00
41	SD.05	8	158	0	1.69	1.82	0.00
41	TP.01	7	114	0	1.48	1.31	0.00
41	TP.02	0	0	0	0.00	0.00	0.00
41	TP.03	0	0	0	0.00	0.00	0.00
41	TP.04	0	0	0	0.00	0.00	0.00
		472	8700	623	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
42	BP.01	6	282	88	5.04	9.04	12.04
42	BP.02	12	187	53	10.08	6.00	7.25
42	BP.03	1	35	9	0.84	1.12	1.23
42	BP.04	11	132	14	9.24	4.23	1.92
42	BP.05	0	0	0	0.00	0.00	0.00
42	BP.06	14	113	0	11.76	3.62	0.00
42	BP.07	4	123	88	3.36	3.94	12.04
42	BP.08	4	62	0	3.36	1.99	0.00
42	BP.09	0	0	0	0.00	0.00	0.00
42	BP.10	8	317	123	6.72	10.17	16.83
42	BP.11	7	194	18	5.88	6.22	2.46
42	BP.12	8	123	26	6.72	3.94	3.56
42	CS.01	7	62	0	5.88	1.99	0.00
42	CS.02	3	130	26	2.52	4.17	3.56
42	CS.03	0	0	0	0.00	0.00	0.00
42	CS.04	0	0	0	0.00	0.00	0.00
42	PP.01	4	74	141	3.36	2.37	19.29
42	PP.02	2	26	0	1.68	0.83	0.00
42	PP.03	7	539	70	5.88	17.29	9.58
42	PP.04	4	134	9	3.36	4.30	1.23
42	PP.05	1	44	0	0.84	1.41	0.00
42	PP.06	3	88	18	2.52	2.82	2.46
42	PP.07	2	70	0	1.68	2.25	0.00
42	PP.08	1	35	12	0.84	1.12	1.64
42	SD.01	2	40	18	1.68	1.28	2.46
42	SD.02	2	30	0	1.68	0.96	0.00
42	SD.03	1	14	0	0.84	0.45	0.00
42	SD.04	2	106	0	1.68	3.40	0.00
42	SD.05	2	70	0	1.68	2.25	0.00
42	TP.01	1	88	18	0.84	2.82	2.46
42	TP.02	0	0	0	0.00	0.00	0.00
42	TP.03	0	0	0	0.00	0.00	0.00
42	TP.04				0.00	0.00	0.00
		119	3118	731	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
43	BP.01	1	8	0	2.50	3.09	0.00
43	BP.02	1	8	0	2.50	3.09	0.00
43	BP.03	1	8	0	2.50	3.09	0.00
43	BP.04	1	8	0	2.50	3.09	0.00
43	BP.05	0	0	0	0.00	0.00	0.00
43	BP.06	1	8	0	2.50	3.09	0.00
43	BP.07	1	8	0	2.50	3.09	0.00
43	BP.08	1	8	0	2.50	3.09	0.00
43	BP.09	0	0	0	0.00	0.00	0.00
43	BP.10	1	8	0	2.50	3.09	0.00
43	BP.11	0	0	0	0.00	0.00	0.00
43	BP.12	0	0	0	0.00	0.00	0.00
43	CS.01	1	8	0	2.50	3.09	0.00
43	CS.02	0	0	0	0.00	0.00	0.00
43	CS.03	0	0	0	0.00	0.00	0.00
43	CS.04	0	0	0	0.00	0.00	0.00
43	PP.01	1	8	0	2.50	3.09	0.00
43	PP.02	1	8	0	2.50	3.09	0.00
43	PP.03	1	8	0	2.50	3.09	0.00
43	PP.04	1	8	0	2.50	3.09	0.00
43	PP.05	0	0	0	0.00	0.00	0.00
43	PP.06	0	0	0	0.00	0.00	0.00
43	PP.07	10	55	0	25.00	21.24	0.00
43	PP.08	1	8	0	2.50	3.09	0.00
43	SD.01	4	23	0	10.00	8.88	0.00
43	SD.02	3	15	0	7.50	5.79	0.00
43	SD.03	3	15	0	7.50	5.79	0.00
43	SD.04	4	23	0	10.00	8.88	0.00
43	SD.05	1	8	0	2.50	3.09	0.00
43	TP.01	1	8	0	2.50	3.09	0.00
43	TP.02	0	0	0	0.00	0.00	0.00
43	TP.03	0	0	0	0.00	0.00	0.00
43	TP.04	0	0	0	0.00	0.00	0.00
		40	259	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
44	BP.01	6	30	0	3.02	3.00	0.00
44	BP.02	6	30	0	3.02	3.00	0.00
44	BP.03	6	30	0	3.02	3.00	0.00
44	BP.04	6	30	0	3.02	3.00	0.00
44	BP.05	0	0	0	0.00	0.00	0.00
44	BP.06	6	30	0	3.02	3.00	0.00
44	BP.07	6	30	0	3.02	3.00	0.00
44	BP.08	6	30	0	3.02	3.00	0.00
44	BP.09	0	0	0	0.00	0.00	0.00
44	BP.10	6	30	0	3.02	3.00	0.00
44	BP.11	0	0	0	0.00	0.00	0.00
44	BP.12	0	0	0	0.00	0.00	0.00
44	CS.01	6	30	0	3.02	3.00	0.00
44	CS.02	0	0	0	0.00	0.00	0.00
44	CS.03	0	0	0	0.00	0.00	0.00
44	CS.04	0	0	0	0.00	0.00	0.00
44	PP.01	6	30	0	3.02	3.00	0.00
44	PP.02	6	30	0	3.02	3.00	0.00
44	PP.03	6	30	0	3.02	3.00	0.00
44	PP.04	6	30	0	3.02	3.00	0.00
44	PP.05	0	0	0	0.00	0.00	0.00
44	PP.06	0	0	0	0.00	0.00	0.00
44	PP.07	43	220	0	21.61	22.00	0.00
44	PP.08	6	30	0	3.02	3.00	0.00
44	SD.01	18	90	0	9.05	9.00	0.00
44	SD.02	12	60	0	6.03	6.00	0.00
44	SD.03	12	60	0	6.03	6.00	0.00
44	SD.04	18	90	0	9.05	9.00	0.00
44	SD.05	6	30	0	3.02	3.00	0.00
44	TP.01	6	30	0	3.02	3.00	0.00
44	TP.02	0	0	0	0.00	0.00	0.00
44	TP.03	0	0	0	0.00	0.00	0.00
44	TP.04	0	0	0	0.00	0.00	0.00
		199	1000	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
45	BP.01	8	45	0	2.92	3.00	0.00
45	BP.02	8	45	0	2.92	3.00	0.00
45	BP.03	8	45	0	2.92	3.00	0.00
45	BP.04	8	45	0	2.92	3.00	0.00
45	BP.05	0	0	0	0.00	0.00	0.00
45	BP.06	8	45	0	2.92	3.00	0.00
45	BP.07	8	45	0	2.92	3.00	0.00
45	BP.08	8	45	0	2.92	3.00	0.00
45	BP.09	0	0	0	0.00	0.00	0.00
45	BP.10	8	45	0	2.92	3.00	0.00
45	BP.11	0	0	0	0.00	0.00	0.00
45	BP.12	0	0	0	0.00	0.00	0.00
45	CS.01	8	45	0	2.92	3.00	0.00
45	CS.02	0	0	0	0.00	0.00	0.00
45	CS.03	0	0	0	0.00	0.00	0.00
45	CS.04	0	0	0	0.00	0.00	0.00
45	PP.01	8	45	0	2.92	3.00	0.00
45	PP.02	8	45	0	2.92	3.00	0.00
45	PP.03	8	45	0	2.92	3.00	0.00
45	PP.04	8	45	0	2.92	3.00	0.00
45	PP.05	0	0	0	0.00	0.00	0.00
45	PP.06	0	0	0	0.00	0.00	0.00
45	PP.07	62	330	0	22.63	22.00	0.00
45	PP.08	8	45	0	2.92	3.00	0.00
45	SD.01	25	135	0	9.12	9.00	0.00
45	SD.02	17	90	0	6.20	6.00	0.00
45	SD.03	17	90	0	6.20	6.00	0.00
45	SD.04	25	135	0	9.12	9.00	0.00
45	SD.05	8	45	0	2.92	3.00	0.00
45	TP.01	8	45	0	2.92	3.00	0.00
45	TP.02	0	0	0	0.00	0.00	0.00
45	TP.03	0	0	0	0.00	0.00	0.00
45	TP.04	0	0	0	0.00	0.00	0.00
		274	1500	0	100.00	100.00	0.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
46	BP.01	150	10	0	4.86	0.21	0.00
46	BP.02	30	50	0	0.97	1.03	0.00
46	BP.03	50	4	0	1.62	0.08	0.00
46	BP.04	150	400	0	4.86	8.21	0.00
46	BP.05	80	16	0	2.59	0.33	0.00
46	BP.06	0	0	0	0.00	0.00	0.00
46	BP.07	150	40	0	4.86	0.82	0.00
46	BP.08	150	80	0	4.86	1.64	0.00
46	BP.09	40	10	0	1.30	0.21	0.00
46	BP.10	150	160	0	4.86	3.28	0.00
46	BP.11	0	0	0	0.00	0.00	0.00
46	BP.12	40	3	0	1.30	0.06	0.00
46	CS.01	70	90	0	2.27	1.85	0.00
46	CS.02	100	300	0	3.24	6.16	0.00
46	CS.03	60	40	0	1.94	0.82	0.00
46	CS.04	30	144	0	0.97	2.96	0.00
46	PP.01	50	80	0	1.62	1.64	0.00
46	PP.02	25	40	0	0.81	0.82	0.00
46	PP.03	200	450	0	6.48	9.23	0.00
46	PP.04	180	160	0	5.83	3.28	0.00
46	PP.05	40	30	0	1.30	0.62	0.00
46	PP.06	90	20	0	2.92	0.41	0.00
46	PP.07	260	1766	0	8.43	36.24	0.00
46	PP.08	60	20	0	1.94	0.41	0.00
46	SD.01	260	500	0	8.43	10.26	0.00
46	SD.02	100	100	0	3.24	2.05	0.00
46	SD.03	70	20	0	2.27	0.41	0.00
46	SD.04	260	40	0	8.43	0.82	0.00
46	SD.05	125	20	0	4.05	0.41	0.00
46	TP.01	115	280	1440	3.73	5.75	100.00
46	TP.02	0	0	0	0.00	0.00	0.00
46	TP.03	0	0	0	0.00	0.00	0.00
46	TP.04	0	0	0	0.00	0.00	0.00
		3085	4873	1440	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
47	BP.01	105	10	0	3.51	0.15	0.00
47	BP.02	30	80	0	1.00	1.22	0.00
47	BP.03	50	4	0	1.67	0.06	0.00
47	BP.04	150	700	0	5.01	10.66	0.00
47	BP.05	80	40	0	2.67	0.61	0.00
47	BP.06	0	0	0	0.00	0.00	0.00
47	BP.07	150	50	0	5.01	0.76	0.00
47	BP.08	150	150	0	5.01	2.28	0.00
47	BP.09	40	5	0	1.34	0.08	0.00
47	BP.10	150	160	0	5.01	2.44	0.00
47	BP.11	0	0	0	0.00	0.00	0.00
47	BP.12	40	3	0	1.34	0.05	0.00
47	CS.01	70	90	0	2.34	1.37	0.00
47	CS.02	100	300	0	3.34	4.57	0.00
47	CS.03	100	40	0	3.34	0.61	0.00
47	CS.04	130	144	0	4.34	2.19	0.00
47	PP.01	50	80	0	1.67	1.22	0.00
47	PP.02	25	40	0	0.83	0.61	0.00
47	PP.03	200	650	0	6.68	9.90	0.00
47	PP.04	150	150	0	5.01	2.28	0.00
47	PP.05	40	10	0	1.34	0.15	0.00
47	PP.06	90	20	0	3.01	0.30	0.00
47	PP.07	265	2650	0	8.85	40.36	0.00
47	PP.08	60	20	0	2.00	0.30	0.00
47	SD.01	260	600	0	8.68	9.14	0.00
47	SD.02	70	100	0	2.34	1.52	0.00
47	SD.03	70	40	0	2.34	0.61	0.00
47	SD.04	130	120	0	4.34	1.83	0.00
47	SD.05	125	30	0	4.17	0.46	0.00
47	TP.01	115	280	1440	3.84	4.26	100.00
47	TP.02	0	0	0	0.00	0.00	0.00
47	TP.03	0	0	0	0.00	0.00	0.00
47	TP.04	0	0	0	0.00	0.00	0.00
		2995	6566	1440	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
48	BP.01	55	20	0	7.72	7.60	0.00
48	BP.02	1	1	0	0.14	0.38	0.00
48	BP.03	10	1	0	1.40	0.38	0.00
48	BP.04	60	64	0	8.43	24.33	0.00
48	BP.05	60	2	2	8.43	0.76	100.00
48	BP.06	0	0	0	0.00	0.00	0.00
48	BP.07	1	2	0	0.14	0.76	0.00
48	BP.08	20	6	0	2.81	2.28	0.00
48	BP.09	0	0	0	0.00	0.00	0.00
48	BP.10	60	40	0	8.43	15.21	0.00
48	BP.11	0	0	0	0.00	0.00	0.00
48	BP.12	0	0	0	0.00	0.00	0.00
48	CS.01	20	4	0	2.81	1.52	0.00
48	CS.02	20	4	0	2.81	1.52	0.00
48	CS.03	20	10	0	2.81	3.80	0.00
48	CS.04	20	16	0	2.81	6.08	0.00
48	PP.01	0	0	0	0.00	0.00	0.00
48	PP.02	30	4	0	4.21	1.52	0.00
48	PP.03	10	20	0	1.40	7.60	0.00
48	PP.04	60	12	0	8.43	4.56	0.00
48	PP.05	20	4	0	2.81	1.52	0.00
48	PP.06	30	8	0	4.21	3.04	0.00
48	PP.07	50	10	0	7.02	3.80	0.00
48	PP.08	0	0	0	0.00	0.00	0.00
48	SD.01	50	10	0	7.02	3.80	0.00
48	SD.02	20	4	0	2.81	1.52	0.00
48	SD.03	40	1	0	5.62	0.38	0.00
48	SD.04	5	3	0	0.70	1.14	0.00
48	SD.05	10	1	0	1.40	0.38	0.00
48	TP.01	40	16	0	5.62	6.08	0.00
48	TP.02	0	0	0	0.00	0.00	0.00
48	TP.03	0	0	0	0.00	0.00	0.00
48	TP.04	0	0	0	0.00	0.00	0.00
		712	263	2	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
49	BP.01	10	40	0	1.65	2.79	0.00
49	BP.02	0	0	0	0.00	0.00	0.00
49	BP.03	60	100	40	9.88	6.96	2.71
49	BP.04	40	80	24	6.59	5.57	1.63
49	BP.05	24	40	10	3.95	2.79	0.68
49	BP.06	40	24	0	6.59	1.67	0.00
49	BP.07	60	180	80	9.88	12.53	5.42
49	BP.08	2	24	0	0.33	1.67	0.00
49	BP.09	0	0	0	0.00	0.00	0.00
49	BP.10	1	8	0	0.16	0.56	0.00
49	BP.11	0	0	0	0.00	0.00	0.00
49	BP.12	10	24	0	1.65	1.67	0.00
49	CS.01	4	20	8	0.66	1.39	0.54
49	CS.02	60	40	300	9.88	2.79	20.34
49	CS.03	10	8	40	1.65	0.56	2.71
49	CS.04	2	8	8	0.33	0.56	0.54
49	PP.01	40	24	300	6.59	1.67	20.34
49	PP.02	2	8	0	0.33	0.56	0.00
49	PP.03	5	16	40	0.82	1.11	2.71
49	PP.04	20	16	40	3.29	1.11	2.71
49	PP.05	10	16	16	1.65	1.11	1.08
49	PP.06	20	160	80	3.29	11.14	5.42
49	PP.07	30	24	80	4.94	1.67	5.42
49	PP.08	8	16	5	1.32	1.11	0.34
49	SD.01	24	100	80	3.95	6.96	5.42
49	SD.02	15	40	0	2.47	2.79	0.00
49	SD.03	10	80	24	1.65	5.57	1.63
49	SD.04	20	40	160	3.29	2.79	10.85
49	SD.05	10	80	0	1.65	5.57	0.00
49	TP.01	30	100	100	4.94	6.96	6.78
49	TP.02	10	80	0	1.65	5.57	0.00
49	TP.03	30	40	40	4.94	2.79	2.71
49	TP.04	0	0	0	0.00	0.00	0.00
		607	1436	1475	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
50	BP.01	5	40	0	0.71	1.92	0.00
50	BP.02	0	0	0	0.00	0.00	0.00
50	BP.03	0	20	0	0.00	0.96	0.00
50	BP.04	20	160	0	2.85	7.68	0.00
50	BP.05	0	0	0	0.00	0.00	0.00
50	BP.06	5	40	8	0.71	1.92	0.33
50	BP.07	60	150	40	8.55	7.20	1.65
50	BP.08	10	80	20	1.42	3.84	0.83
50	BP.09	0	0	0	0.00	0.00	0.00
50	BP.10	10	80	0	1.42	3.84	0.00
50	BP.11	0	40	0	0.00	1.92	0.00
50	BP.12	0	0	0	0.00	0.00	0.00
50	CS.01	30	50	10	4.27	2.40	0.41
50	CS.02	30	100	50	4.27	4.80	2.07
50	CS.03	3	15	0	0.43	0.72	0.00
50	CS.04	5	25	0	0.71	1.20	0.00
50	PP.01	20	50	20	2.85	2.40	0.83
50	PP.02	1	10	0	0.14	0.48	0.00
50	PP.03	60	120	250	8.55	5.76	10.34
50	PP.04	90	150	300	12.82	7.20	12.41
50	PP.05	30	100	200	4.27	4.80	8.27
50	PP.06	180	250	400	25.64	12.00	16.54
50	PP.07	90	240	350	12.82	11.52	14.47
50	PP.08	15	200	300	2.14	9.60	12.41
50	SD.01	0	0	0	0.00	0.00	0.00
50	SD.02	0	0	0	0.00	0.00	0.00
50	SD.03	5	40	5	0.71	1.92	0.21
50	SD.04	3	24	15	0.43	1.15	0.62
50	SD.05	20	40	250	2.85	1.92	10.34
50	TP.01	10	60	200	1.42	2.88	8.27
50	TP.02	0	0	0	0.00	0.00	0.00
50	TP.03	0	0	0	0.00	0.00	0.00
50	TP.04	0	0	0	0.00	0.00	0.00
		702	2084	2418	100.00	100.00	100.00

		SURVEY RESPONSE DATA			NORMALIZED DATA (%)		
Survey	Activity	Duration	Resources		Duration	Resources	
			Owner	External		Owner	External
51	BP.01	2	32	0	2.13	2.65	0.00
51	BP.02	0	0	0	0.00	0.00	0.00
51	BP.03	5	80	40	5.32	6.62	13.51
51	BP.04	5	40	40	5.32	3.31	13.51
51	BP.05	0	0	0	0.00	0.00	0.00
51	BP.06	1	8	0	1.06	0.66	0.00
51	BP.07	10	160	0	10.64	13.25	0.00
51	BP.08	1	16	0	1.06	1.32	0.00
51	BP.09	0	0	0	0.00	0.00	0.00
51	BP.10	1	16	0	1.06	1.32	0.00
51	BP.11	0	0	0	0.00	0.00	0.00
51	BP.12	0	0	0	0.00	0.00	0.00
51	CS.01	2	24	0	2.13	1.99	0.00
51	CS.02	10	160	80	10.64	13.25	27.03
51	CS.03	2	24	0	2.13	1.99	0.00
51	CS.04	1	16	0	1.06	1.32	0.00
51	PP.01	10	160	40	10.64	13.25	13.51
51	PP.02	0	0	0	0.00	0.00	0.00
51	PP.03	10	80	40	10.64	6.62	13.51
51	PP.04	2	32	0	2.13	2.65	0.00
51	PP.05	0	0	0	0.00	0.00	0.00
51	PP.06	4	32	0	4.26	2.65	0.00
51	PP.07	4	32	0	4.26	2.65	0.00
51	PP.08	4	56	16	4.26	4.64	5.41
51	SD.01	1	8	0	1.06	0.66	0.00
51	SD.02	0	0	0	0.00	0.00	0.00
51	SD.03	0	0	0	0.00	0.00	0.00
51	SD.04	0	0	0	0.00	0.00	0.00
51	SD.05	4	32	0	4.26	2.65	0.00
51	TP.01	10	160	0	10.64	13.25	0.00
51	TP.02	5	40	40	5.32	3.31	13.51
51	TP.03	0	0	0	0.00	0.00	0.00
51	TP.04	0	0	0	0.00	0.00	0.00
		94	1208	296	100.00	100.00	100.00

Appendix G

Execution Difference Analysis Findings

Fisher's Exact Test Findings for Business Drivers and Four Questions

Business Drivers			
Q1 - Was the task successfully executed?			
Activity	Name	P value	
BP.11	Risk Mitigation Analysis	0.05	
			Question
			Success
			Criteria
			No
			Yes
			Total
			4
			8
			12
			2
			28
			30
			6
			36
			42
Q2 - Was the task unusually complex?			
Activity	Name	P value	
PP.03	Complete Preliminary Estimates	0.02	
			Question
			Success
			Criteria
			No
			Yes
			Total
			2
			10
			12
			19
			13
			32
			21
			23
			44
PP.06	Develop Preliminary Execution Plan	0.01	
			Question
			Success
			Criteria
			No
			Yes
			Total
			1
			10
			11
			16
			11
			27
			17
			21
			38
PP.07	Compile Project Scope	0.04	
			Question
			Success
			Criteria
			No
			Yes
			Total
			2
			9
			11
			18
			14
			32
			20
			23
			43

Fisher's Exact Test Findings for Business Drivers and Four Questions "Continued"

Business Drivers			
Q2 - Was the task unusually complex (Con't)?			
Activity	Name	P value	
SD.01	Process and Facility Planning	0.01	Question
			Success
			Criteria
			No
			Yes
			Total
			3
			8
			11
			19
			5
			24
			22
			13
			35
SD.05	Detail Work Breakdown Structure	0.00	Question
			Success
			Criteria
			No
			Yes
			Total
			1
			10
			11
			21
			8
			29
			22
			18
			40
Q3 - Was the task executed efficiently?			
Activity	Name	P value	
PP.02	Formulate Preliminary Organization	0.02	Question
			Success
			Criteria
			No
			Yes
			Total
			4
			5
			9
			2
			27
			29
			6
			32
			38
PP.08	Develop Startup Plan	0.03	Question
			Success
			Criteria
			No
			Yes
			Total
			8
			4
			12
			8
			21
			29
			16
			25
			41

Fisher's Exact Test Findings for Business Drivers and Four Questions "Continued"

Business Drivers				
Q4 - Was information readily available?				
Activity	Name	P value	Question	
PP.01	Develop Preliminary Design Criteria, Including PFDs & P&IDs	0.04	Success	
			Criteria	No Yes Total
			No	8 4 12
			Yes	8 20 28
			Total	16 24 40
PP.07	Compile Project Scope	0.03	Question	
			Success	
			Criteria	No Yes Total
			No	7 4 11
			Yes	8 24 32
			Total	15 28 43
TP.01	Conduct Technical Surveys and Process Analysis	0.03	Question	
			Success	
			Criteria	No Yes Total
			No	7 4 11
			Yes	6 20 26
			Total	13 24 37

Fisher's Exact Test Findings for Project Objectives and Four Questions

Project Objectives																							
Q1 - Was the task successfully executed?																							
Activity	Name	P value	Question																				
BP.07	Develop Funding Plan	0.03	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>4</td> <td>6</td> <td>10</td> </tr> <tr> <td>Yes</td> <td>3</td> <td>32</td> <td>35</td> </tr> <tr> <td>Total</td> <td>7</td> <td>38</td> <td>45</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	4	6	10	Yes	3	32	35	Total	7	38	45
Success																							
Criteria	No	Yes	Total																				
No	4	6	10																				
Yes	3	32	35																				
Total	7	38	45																				
BP.06	Address Regulatory Issues	0.04	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>3</td> <td>7</td> <td>10</td> </tr> <tr> <td>Yes</td> <td>1</td> <td>31</td> <td>32</td> </tr> <tr> <td>Total</td> <td>4</td> <td>38</td> <td>42</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	3	7	10	Yes	1	31	32	Total	4	38	42
Success																							
Criteria	No	Yes	Total																				
No	3	7	10																				
Yes	1	31	32																				
Total	4	38	42																				
PP.02	Formulate Preliminary Organization	0.01	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>4</td> <td>5</td> <td>9</td> </tr> <tr> <td>Yes</td> <td>1</td> <td>30</td> <td>31</td> </tr> <tr> <td>Total</td> <td>5</td> <td>35</td> <td>40</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	4	5	9	Yes	1	30	31	Total	5	35	40
Success																							
Criteria	No	Yes	Total																				
No	4	5	9																				
Yes	1	30	31																				
Total	5	35	40																				
PP.03	Complete Preliminary Estimates	0.01	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>4</td> <td>6</td> <td>10</td> </tr> <tr> <td>Yes</td> <td>1</td> <td>34</td> <td>35</td> </tr> <tr> <td>Total</td> <td>5</td> <td>40</td> <td>45</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	4	6	10	Yes	1	34	35	Total	5	40	45
Success																							
Criteria	No	Yes	Total																				
No	4	6	10																				
Yes	1	34	35																				
Total	5	40	45																				

Fisher's Exact Test Findings for Project Objectives and Four Questions "Continued"

Project Objectives			
Q1 - Was the task successfully executed (Con't)?			
Activity	Name	P value	
PP.04	Establish Master Project Schedule	0.05	Question
			Success
			Criteria No Yes Total
			No 4 6 10
			Yes 4 32 36
			Total 8 38 46
PP.05	Address Quality and Safety Issues	0.02	Question
			Success
			Criteria No Yes Total
			No 4 5 9
			Yes 2 28 30
			Total 6 33 39
PP.06	Develop Preliminary Execution Plan	0.00	Question
			Success
			Criteria No Yes Total
			No 6 3 9
			Yes 3 26 29
			Total 9 29 38
PP.07	Compile Project Scope	0.05	Question
			Success
			Criteria No Yes Total
			No 3 6 9
			Yes 2 34 36
			Total 5 40 45

Fisher's Exact Test Findings for Project Objectives and Four Questions "Continued"

Project Objectives			
Q1 - Was the task successfully executed (Con't)?			
Activity	Name	P value	
SD.01	Process and Facility Planning	0.01	Question
			Success
			Criteria
			No
			Yes
			Total
			5
			4
			9
			3
			25
			28
			8
			29
			37
SD.05	Detail Work Breakdown Structure	0.01	Question
			Success
			Criteria
			No
			Yes
			Total
			5
			4
			9
			3
			30
			33
			8
			34
			42
Q2 - Was the task unusually complex?			
Activity	Name	P value	
NONE			
Q3 - Was the task executed efficiently?			
Activity	Name	P value	
BP.01	Define Business Objectives	0.04	Question
			Success
			Criteria
			No
			Yes
			Total
			6
			3
			9
			9
			26
			35
			15
			29
			44

Fisher's Exact Test Findings for Project Objectives and Four Questions "Continued"

Project Objectives																							
Q4 - Was information readily available?																							
Activity	Name	P value	Question																				
BP.04	Establish Image and Public Relations	0.01	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>5</td> <td>0</td> <td>5</td> </tr> <tr> <td>Yes</td> <td>5</td> <td>14</td> <td>19</td> </tr> <tr> <td>Total</td> <td>10</td> <td>14</td> <td>24</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	5	0	5	Yes	5	14	19	Total	10	14	24
Success																							
Criteria	No	Yes	Total																				
No	5	0	5																				
Yes	5	14	19																				
Total	10	14	24																				
PP.06	Develop Preliminary Execution Plan	0.01	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>8</td> <td>1</td> <td>9</td> </tr> <tr> <td>Yes</td> <td>9</td> <td>20</td> <td>29</td> </tr> <tr> <td>Total</td> <td>17</td> <td>21</td> <td>38</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	8	1	9	Yes	9	20	29	Total	17	21	38
Success																							
Criteria	No	Yes	Total																				
No	8	1	9																				
Yes	9	20	29																				
Total	17	21	38																				
PP.07	Compile Project Scope	0.05	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>6</td> <td>3</td> <td>9</td> </tr> <tr> <td>Yes</td> <td>10</td> <td>26</td> <td>36</td> </tr> <tr> <td>Total</td> <td>16</td> <td>29</td> <td>45</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	6	3	9	Yes	10	26	36	Total	16	29	45
Success																							
Criteria	No	Yes	Total																				
No	6	3	9																				
Yes	10	26	36																				
Total	16	29	45																				
SD.03	Develop Environmental Scope	0.01	<table border="1"> <thead> <tr> <th colspan="4">Success</th> </tr> <tr> <th>Criteria</th> <th>No</th> <th>Yes</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>No</td> <td>6</td> <td>2</td> <td>8</td> </tr> <tr> <td>Yes</td> <td>7</td> <td>22</td> <td>29</td> </tr> <tr> <td>Total</td> <td>13</td> <td>24</td> <td>37</td> </tr> </tbody> </table>	Success				Criteria	No	Yes	Total	No	6	2	8	Yes	7	22	29	Total	13	24	37
Success																							
Criteria	No	Yes	Total																				
No	6	2	8																				
Yes	7	22	29																				
Total	13	24	37																				

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions

Front End Planning				
Q1 - Was the task successfully executed?				
Activity	Name	P value	Question	
BP.06	Address Regulatory Issues	0.04	Success	
			Criteria	No Yes Total
			No	3 7 10
			Yes	1 31 32
			Total	4 38 42
PP.03	Complete Preliminary Estimates	0.00	Question	
			Success	
			Criteria	No Yes Total
			No	4 7 11
			Yes	0 34 34
			Total	4 41 45
PP.04	Establish Master Project Schedule	0.01	Question	
			Success	
			Criteria	No Yes Total
			No	5 6 11
			Yes	2 33 35
			Total	7 39 46
PP.06	Develop Preliminary Execution Plan	0.01	Question	
			Success	
			Criteria	No Yes Total
			No	5 4 9
			Yes	3 25 28
			Total	8 29 37

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning			
Q1 - Was the task successfully executed (Con't)?			
Activity	Name	P value	
PP.07	Compile Project Scope	0.00	Question
			Success
			Criteria No Yes Total
			No 4 6 10
			Yes 0 35 35
			Total 4 41 45
SD.01	Process and Facility Planning	0.01	Question
			Success
			Criteria No Yes Total
			No 5 4 9
			Yes 3 26 29
			Total 8 30 38
SD.05	Detail Work Breakdown Structure	0.01	Question
			Success
			Criteria No Yes Total
			No 5 4 9
			Yes 3 31 34
			Total 8 35 43
Q2 - Was the task unusually complex?			
Activity	Name	P value	
TP.01	Conduct Technical Surveys and Process Analysis	0.02	Question
			Success
			Criteria No Yes Total
			No 9 0 9
			Yes 18 13 31
			Total 27 13 40

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning			
Q3 - Was the task executed efficiently?			
Activity	Name	P value	
BP.01	Define Business Objectives	0.00	Question
			Success
			Criteria No Yes Total
			No 8 3 11
			Yes 6 26 32
			Total 14 29 43
BP.02	Identify/Select Project Alternatives	0.00	Question
			Success
			Criteria No Yes Total
			No 9 2 11
			Yes 6 26 32
			Total 15 28 43
BP.03	Conduct Market Research and Analysis	0.03	Question
			Success
			Criteria No Yes Total
			No 5 3 8
			Yes 2 13 15
			Total 7 16 23
BP.07	Develop Funding Plan	0.04	Question
			Success
			Criteria No Yes Total
			No 7 4 11
			Yes 9 25 34
			Total 16 29 45

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning				
Q3 - Was the task executed efficiently(Con't)?				
Activity	Name	P value	Question	
BP.08	Raw Material Sourcing/Source Building Materials	0.04	Success	
			Criteria	No Yes Total
			No	3 2 5
			Yes	2 17 19
			Total	5 19 24
BP.11	Risk Mitigation Analysis	0.00	Question	
			Success	
			Criteria	No Yes Total
			No	7 4 11
			Yes	5 27 32
			Total	12 31 43
PP.02	Formulate Preliminary Organization	0.02	Question	
			Success	
			Criteria	No Yes Total
			No	4 5 9
			Yes	2 29 31
			Total	6 34 40
PP.03	Complete Preliminary Estimates	0.01	Question	
			Success	
			Criteria	No Yes Total
			No	6 5 11
			Yes	4 30 34
			Total	10 35 45

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning				
Q3 - Was the task executed efficiently(Con't)?				
Activity	Name	P value	Question	
PP.04	Establish Master Project Schedule	0.00	Success	
			Criteria	No Yes Total
			No	7 4 11
			Yes	3 32 35
			Total	10 36 46
PP.06	Develop Preliminary Execution Plan	0.02	Success	
			Criteria	No Yes Total
			No	7 2 9
			Yes	8 20 28
			Total	15 22 37
PP.07	Develop Funding Plan	0.00	Success	
			Criteria	No Yes Total
			No	7 3 10
			Yes	6 29 35
			Total	13 32 45
SD.01	Process and Facility Planning	0.00	Success	
			Criteria	No Yes Total
			No	9 0 9
			Yes	8 21 29
			Total	17 21 38

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning			
Q3 - Was the task executed efficiently(Con't)?			
Activity	Name	P value	Question
SD.02	Develop Utilities and Offsite Scope	0.02	Success
			Criteria No Yes Total
			No 5 3 8
			Yes 4 21 25
			Total 9 24 33
TP.01	Conduct Technical Surveys and Process Analysis	0.04	Question
			Success
			Criteria No Yes Total
			No 6 3 9
			Yes 7 24 31
			Total 13 27 40
TP.02	Product Development/Identify Certification and Testing Procedures	0.02	Question
			Success
			Criteria No Yes Total
			No 6 3 9
			Yes 7 24 31
			Total 13 27 40
Q4 - Was information readily available?			
Activity	Name	P value	Question
BP.04	Establish Image and Public Relations	0.06	Success
			Criteria No Yes Total
			No 4 1 5
			Yes 5 13 18
			Total 9 14 23

Fisher's Exact Test Findings for Front End Planning Effectiveness and Four Questions "Continued"

Front End Planning						
Q4 - Was information readily available?(Con't)?						
Activity	Name	P value	Question			
PP.05	Address Quality and Safety Issues	0.05	Success			
			Criteria	No	Yes	Total
			No	6	4	10
			Yes	6	22	28
			Total	12	26	38
BP.11	Risk Mitigation Analysis	0.02	Question			
			Success			
			Criteria	No	Yes	Total
			No	7	4	11
			Yes	7	26	33
Total	14	30	44			
SD.01	Process and Facility Planning	0.01	Question			
			Success			
			Criteria	No	Yes	Total
			No	8	1	9
			Yes	10	19	29
Total	18	20	38			

Appendix H

Follow Up Survey I Comments

Question	Comments
BP.04 - Establish Image & Public Relations	
Critical Information	Community Involvement - This information can be obtained by surveys, community meetings, and having active involvement from key stakeholders
Missing Information	Key Stakeholders, Public Relations Budget, & Poor PR Execution Plan
Tasks requiring more focus	Identifying Public Relations Area and Alignment of PR plan with Corporate and Project Goals
Causes for task inefficiency	Not involving community stakeholders, poor PR plan, failure to understand local culture, and only focusing on the positive impacts (need to identify negative impacts)
BP.10 - Define Start-Up Requirements	
Critical Information	Start up objectives, Start up plan, and Operating and Maintenance Input
Missing Information	Key vendor data, stakeholders, and insufficient start up plan
Tasks requiring more focus	Start up objectives, acquiring Operations and Maintenance input, and review of Start up plan.
Causes for task inefficiency	Insufficient attention early in the project, poor Start up plan, lack of resources, and not getting key stakeholder involvement
PP.05 - Address Quality and Safety Issues	
Critical Information	Identification of Safety Goals, safety/quality plan, and worker input
Missing Information	Construction Manager/Contractor's safety plan is deficient at startup, site conditions unknown, client safety requirements, and local requirements
Tasks requiring more focus	Identification of Safety Goals, development of the safety/quality plans, review of local conditions and requirements, and obtaining worker input
Causes for task inefficiency	Poor resource allocation, expectations not clearly defined, incomplete time for site investigation, and lack of project participants knowing and understanding corporate and project safety/quality goals
PP.06 - Develop Preliminary Execution Plan	
Critical Information	Areas of execution risk - It is important to define potential issues up front and to have a plan to react to future problems.

Missing Information	Lack of team involvement, incomplete scope definition, vendor data, and a clear definition of roles and responsibilities.
Tasks requiring more focus	Identification of areas of execution risk, creation of risk mitigation alternatives, and creation of the Project Execution Plan
Causes for task inefficiency	"Unrealistic" schedules, poor scope definition, lack of resources, and a poor risk mitigation plan
SD.02 - Develop Utilities and Offsite Scope	
Critical Information	Process/Equipment utility requirements
Missing Information	Right of way requirements, public opposition, over/under estimation of requirements
Tasks requiring more focus	Determination of process/equipment requirements
Causes for task inefficiency	Poor communication of user requirements, lack of conceptual design, and poor vendor information

Appendix I

Follow Up Survey II

Construction Industry Institute Research Team 221
Information Flow to Support Planning
Data Collection Survey

Research Objectives:

- Identify information flow activities in front end planning and determine their interrelationships (logic) to be used to identify if there are execution differences between successful and non-successful projects.
- Identify the information requirements for the macro level activities.
- AND, Suggest recommendations for improving information flow to support Pre-Project Planning.

Survey Objectives:

- To collect data pertaining to specific front end planning activities that have been identified as being critical to achieving project success.
- Validate if the following tables and diagrams adequately identify the logic flow and information requirements for a typically planned projects

Instructions:

Review each logic diagram included with this package. These activities have been identified through statistical analysis as being critical front end planning activities to achieving project success. The diagrams are the steps required to complete these activities on a typical EPC construction process. In addition, a table is provided with each diagram depicting the information requirements for each task in the diagram. Please review both the diagram and table for each activity. Then, answer the questions for each activity.

Each diagram is considered an activity. For example, BP.04 – Establish Image and Public Relations is one activity. Each box in the diagram represents a task. The completion of all the tasks for one micro diagram completes an activity. The logic flow is depicted from left to right. The arrows indicate the precedence order. The diamonds represent a decision branch. There are two possible answers for this task. An answer of ‘Yes’ will follow one path, and a ‘No’ will follow another. Please note that there are loops in the process that will return the logic flow back to a previous task.

The tables identify the information requirements. All information used by a task is identified by the document or data used column. Additionally, if a document/data is produced, it is identified by produced columns.

Survey Return:

Thank you for taking the time to complete this survey and supporting CII research. This survey should take no longer than 15 minutes. If you have any questions, please contact the research team representative who requested the completed survey. Please return the survey no later than **March 5, 2007**.

All completed surveys should be returned to:

Dr. W. Edward Back
Room 100 Lowry Hall
Department of Civil Engineering
Clemson University
Clemson, South Carolina 29634-0912

Or

wmeback@clemson.edu

All company and personal information will be removed prior to report distribution.

Activity: BP.02 – Identify/Select Project Alternatives

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

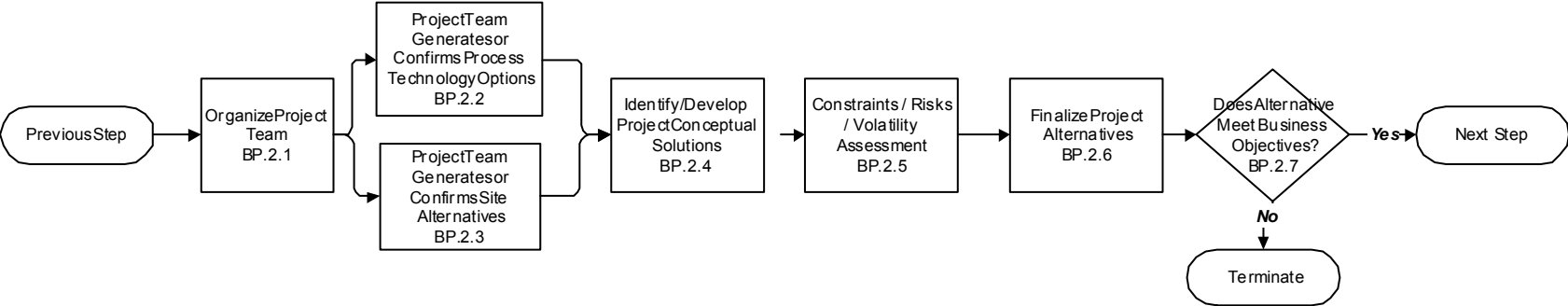
Does the information listing (documents and data) adequately identify information?

Yes No

Any additional comments:

BP.2 Identify/Select Project Alternatives

Identification of facility requirements relating to the operation of the facility over its lifetime. The facility objectives must demonstrate compliance with corporate business strategies.



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.2.1	Ext	Alignment Tools			
BP.2.1	Ext			Potential Team Member Work Load	
BP.2.1	Ext	Project Team Resumes			
BP.2.1	Ext	Team Charter Template			
BP.2.1			Project Team Charter		
BP.2.2	BP.2.1	Project Team Charter			
BP.2.2	Ext	Technology Alternatives/Proposals			
BP.2.2			Technology Alternatives/Proposal Assessment		
BP.2.3	BP.2.1	Project Team Charter			
BP.2.3	BP.3.14	Market Opportunity Report			
BP.2.3	Ext			Transportation Data	
BP.2.3	Ext			Logistics Data	
BP.2.3	Ext			Raw Material Source	
BP.2.3	Ext			Labor Resources	
BP.2.3	Ext			Location	
BP.2.3	Ext			Resource Availability	
BP.2.3			Site Alternatives Report		
BP.2.4	BP.1.14	Business Objective Letter			
BP.2.4	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.4	BP.1.7	Constraints & Capabilities			
BP.2.4	BP.2.2	Technology Alternatives/Proposals			
BP.2.4	BP.2.3	Site Alternatives Report			
BP.2.4	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.2.4			Conceptual Solutions Report		
BP.2.5	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.5	BP.1.7	Constraints & Capabilities			
BP.2.5			Risk and Volatility Analysis		
BP.2.6	BP.2.2	Technology Alternatives/Proposals			
BP.2.6	BP.2.3	Site Alternatives Report			
BP.2.6	BP.2.4	Conceptual Solutions Report			
BP.2.6	BP.2.5	Risk and Volatility Analysis			
BP.2.6			Project Alternatives Report		

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.2.7	BP.1.4	Initial Risk and Volatility Analysis			
BP.2.7	BP.2.6	Project Alternatives Report			
BP.2.7	BP.3.11	Corporate Strategic Plan & Corporate Goals			
BP.2.7					Alternatives Business Objectives Decision

Activity: BP.04 – Establish Image & Public Relations

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

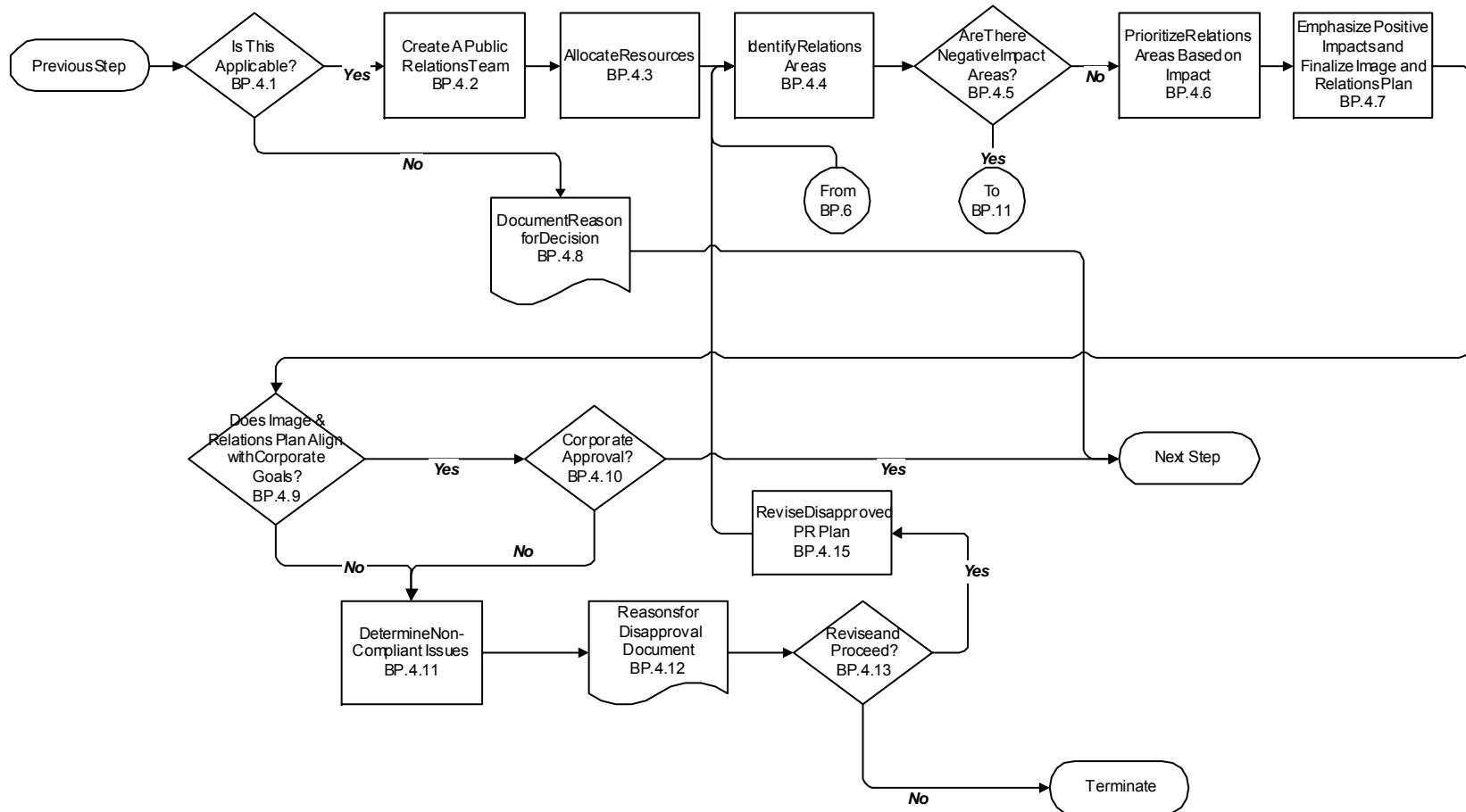
Does the information listing (documents and data) adequately identify information?

Yes No

Any additional comments:

BP.4 Establish Image and Public Relations

Activities initiated to establish a positive corporate image in a project locale to improve public relations and to demonstrate the benefits of a proposed project to a local community, municipality, or governing body. Potentially negative project impacts are identified and corporate strategies appropriate to mitigate such impacts are formulated.



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.4.1	BP.5.7	Final Project Objectives List			
BP.4.1	CS.1.15	Contracting Strategy Report			
BP.4.1	Ext			Historical Data	
BP.4.1	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.1	PP.7.6	Preliminary Project Scope			
BP.4.1					Decision Data
BP.4.2	BP.4.1			Decision Data	
BP.4.2	Ext	Resumes			
BP.4.2	Ext			Project Team Work Load	
BP.4.2			Team List		
BP.4.3	BP.2.1	Team Roster			
BP.4.3			Resource Allocation Document		
BP.4.4	BP.2.6	Project Alternatives Report			
BP.4.4	BP.4.3	Resource Allocation Document			
BP.4.4	BP.5.7	Final Project Objectives List			
BP.4.4	CS.1.15	Contracting Strategy Report			
BP.4.4	Ext			Historical Data	
BP.4.4	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.4	PP.7.6	Preliminary Project Scope			
BP.4.4			Public Relation Areas Document		
BP.4.5	BP.4.4	Public Relation Areas Document			
BP.4.5					Decision on Negative Impact Areas
BP.4.6	BP.4.4	Public Relation Areas Document			
BP.4.6	BP.4.5			Decision on Negative Impact Areas	
BP.4.6			Modified PR Areas Document		
BP.4.7	BP.2.6	Project Alternatives Report			
BP.4.7	BP.4.6	Modified PR Areas Document			
BP.4.7	BP.5.7	Final Project Objectives List			
BP.4.7	CS.1.15	Contracting Strategy Report			
BP.4.7	PP.7.6	Preliminary Project Scope			
BP.4.7			Finalized PR Plan		
BP.4.8	BP.4.1			Decision Data	
BP.4.8			Document for no PR Plan		

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.4.9	BP.2.6	Project Alternatives Report			
BP.4.9	BP.4.6	Modified PR Areas Document			
BP.4.9	BP.5.7	Final Project Objectives List			
BP.4.9	CS.1.15	Contracting Strategy Report			
BP.4.9	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.9	PP.7.6	Preliminary Project Scope			
BP.4.9					Decision
BP.4.10	BP.4.7	Final PR Plan			
BP.4.10	BP.4.9			Decision	
BP.4.10			Approved PR Plan		
BP.4.11	BP.2.6	Project Alternatives Report			
BP.4.11	BP.4.6	Modified PR Areas Document			
BP.4.11	BP.4.9			Decision	
BP.4.11	BP.5.7	Final Project Objectives List			
BP.4.11	CS.1.15	Contracting Strategy Report			
BP.4.11	Ext	Corporate Strategic Plan and Corporate Goals			
BP.4.11	PP.7.6	Preliminary Project Scope			
BP.4.11					Reasons for Disapproval
BP.4.12	BP.4.11			Reasons for Disapproval	
BP.4.12			Reasons For Disapproval Document		
BP.4.13	BP.4.12	Reasons for Disapproval Document			
BP.4.13					Decision to Revise PR Plan
BP.4.15			Revised PR Plan		

Activity: BP.10 – Develop Startup Requirements

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

Does the information listing (documents and data) adequately identify information?

Yes No

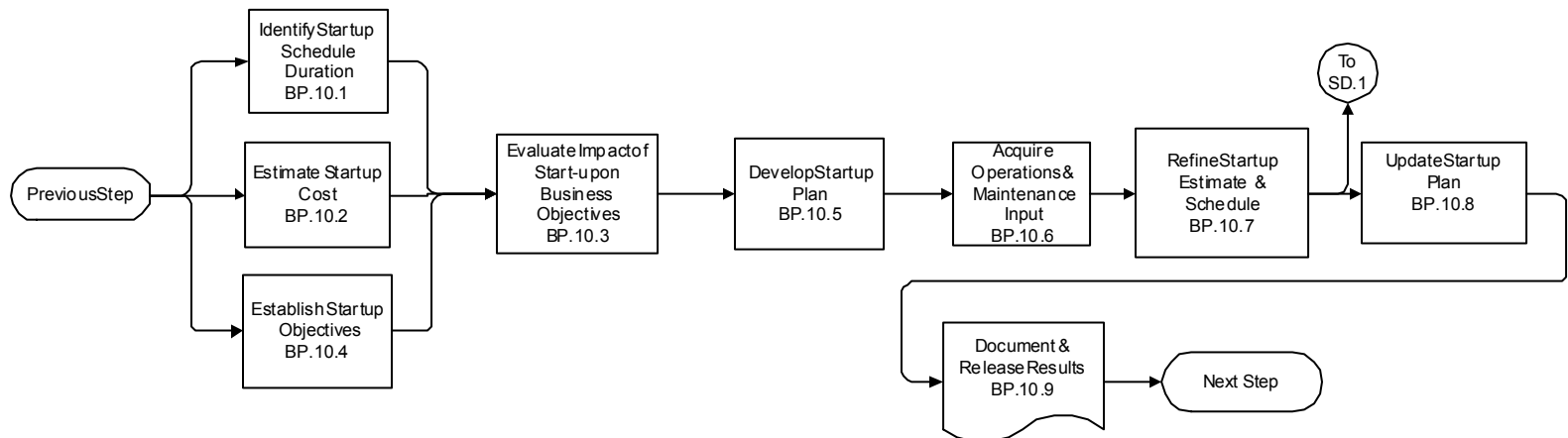
Any additional comments:

BP.10 Develop Startup Requirements

9-19-2005

The process of early definition and planning of plant start-up requirements to ensure smooth transition from the construction phase to plant operations.

365



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
BP.10.1	BP.2.6	Project Alternatives Report			
BP.10.1	SD.1.13	Conceptual Schedule & Estimate Document			
BP.10.1					Schedule Duration Data
BP.10.2	BP.10.1			Schedule Duration Data	
BP.10.2	BP.9.22	Labor Plan			
BP.10.2	BP.9.4			Plant Operations Requirement Data	
BP.10.2	BP.9.5			Staff Requirements	
BP.10.2			Estimated Startup Cost		
BP.10.3	BP.1.14	Business Objective Letter			
BP.10.3	BP.10.1			Schedule Duration Data	
BP.10.3	BP.10.2	Estimated Startup Cost			
BP.10.3					Business Objectives Evaluation
BP.10.4	BP.1.14	Business Objective Letter			
BP.10.4	BP.10.1			Schedule Duration Data	
BP.10.4	BP.10.2	Estimated Startup Cost			
BP.10.4	BP.10.3			Objectives Evaluation	
BP.10.4			Preliminary Startup Objectives		
BP.10.5	BP.10.1			Schedule Duration Data	
BP.10.5	BP.10.2	Estimated Startup Cost			
BP.10.5	BP.10.4	Preliminary Start-Up Objectives			
BP.10.5			Startup Plan		
BP.10.6	BP.10.5	Startup Plan			
BP.10.6	External			Plant Comments	
BP.10.6	External			Verbal Comments	
BP.10.6	External			Plant Information	
BP.10.6					Maintenance Input
BP.10.7	BP.10.1			Schedule Duration Data	
BP.10.7	BP.10.2	Estimated Startup Cost			
BP.10.7	BP.10.6			Maintenance Input	
BP.10.7					Modified Schedule Duration Data
BP.10.7			Modified Startup Cost Estimate		
BP.10.8	BP.10.5	Startup Plan			
BP.10.8	BP.10.6			Maintenance Input	

Activity: PP.05 – Address Quality and Safety Issues

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

Does the information listing (documents and data) adequately identify information?

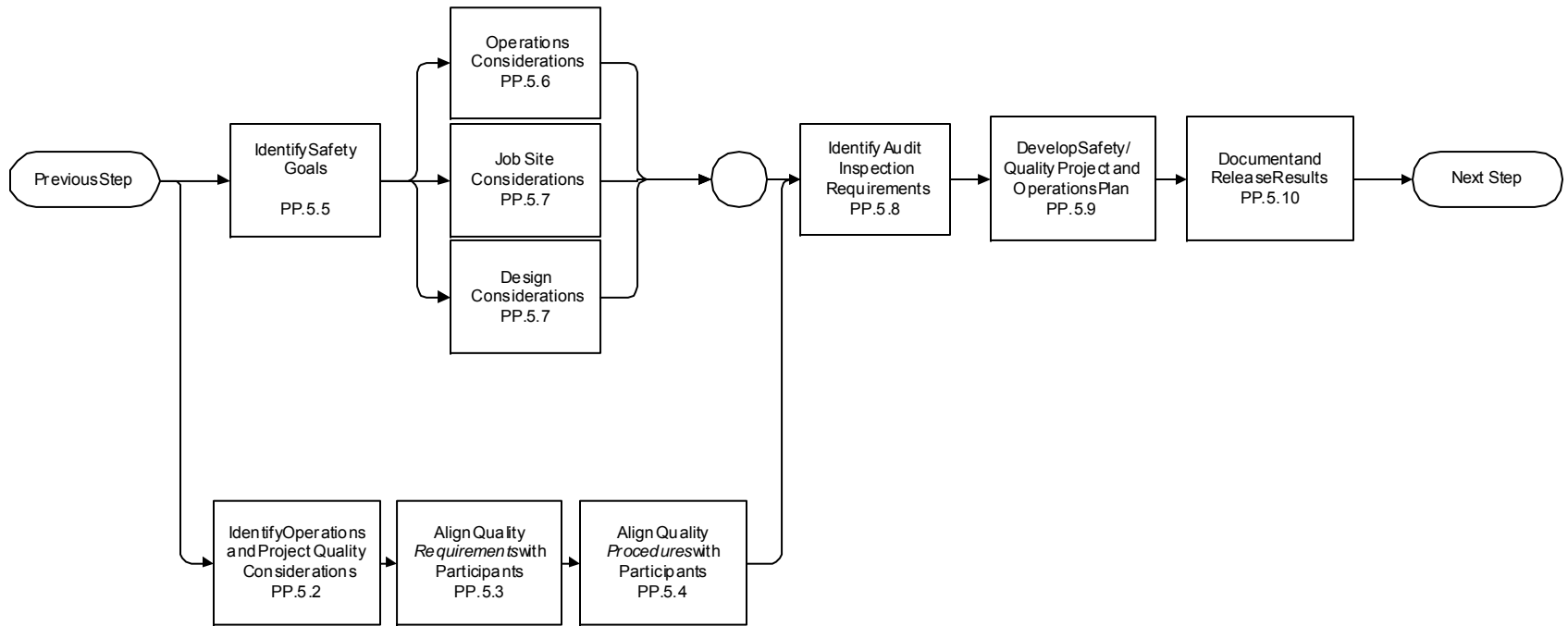
Yes No

Any additional comments:

PP.5 Address Quality and Safety Issues

7-19-05

Development of quality and safety management systems; development of procedures for quality and safety improvement processes.



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.5.2	BP.5.7	Final Project Objectives List			
PP.5.2	BP.6.12	List of Applicable Regulations			
PP.5.2	TP.2.10	Project Certification Needs & Test Plan			
PP.5.2		Corporate Quality Guidelines			
PP.5.2					Project Quality Considerations
PP.5.3	PP.5.2			Project Quality Considerations	
PP.5.3			Project Quality Requirements		
PP.5.4	PP.5.2			Project Quality Considerations	
PP.5.4	PP.5.3	Project Quality Requirements			
PP.5.4			Quality Procedures		
PP.5.5	BP.10.8	Start-up Plan			
PP.5.5	BP.11.8	Risk Management Plan			
PP.5.5	BP.5.7	Final Project Objectives List			
PP.5.5	BP.6.12	List of Applicable Regulations			
PP.5.5	BP.9.22	Labor Plan			
PP.5.5	CS.4.12	EPC Contract			
PP.5.5	PP.4.17	Resource Loaded Schedule			
PP.5.5	SD.4.23	Comprehensive Site Plan			
PP.5.5		Corporate Safety Guidelines			
PP.5.5			Safety Goals		
PP.5.6	BP.5.7	Final Project Objectives List			
PP.5.6	BP.6.12	List of Applicable Regulations			
PP.5.6	PP.5.5	Safety Goals			
PP.5.6					Operations Safety Considerations
PP.5.7a	BP.6.12	List of Applicable Regulations			
PP.5.7a	PP.5.5	Safety Goals			
PP.5.7a	SD.4.23	Comprehensive Site Plan			
PP.5.7a					Job Site Safety Considerations
PP.5.7b	BP.6.12	List of Applicable Regulations			
PP.5.7b	PP.1.25	Approved P&ID Document			
PP.5.7b	PP.5.5	Safety Goals			
PP.5.7b					Design Safety Considerations
PP.5.7b			Updated Design Drawings		
PP.5.8	BP.6.12	List of Applicable Regulations			

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.5.8	PP.5.3	Project Quality Requirements			
PP.5.8	PP.5.4	Quality Procedures			
PP.5.8	PP.5.6			Operations Safety Considerations	
PP.5.8	PP.5.7a			Job Site Safety Considerations	
PP.5.8	PP.5.7b			Design Safety Considerations	
PP.5.8	PP.7.6	Preliminary Project Scope			
PP.5.8			Audit Inspection Requirements		
PP.5.9	PP.5.3	Project Quality Requirements			
PP.5.9	PP.5.4	Quality Procedures			
PP.5.9	PP.5.6			Operations Safety Considerations	
PP.5.9	PP.5.7			Job Site Safety Considerations	
PP.5.9	PP.5.8			Design Safety Considerations	
PP.5.9	PP.5.8			Design Safety Considerations	
PP.5.9					Project Safety/Quality Plan Data
PP.5.10	PP.5.9			Project Safety/Quality Plan Data	
PP.5.10			Project Safety/Quality Plan		

Activity: PP.06 – Develop Preliminary Execution Plan

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

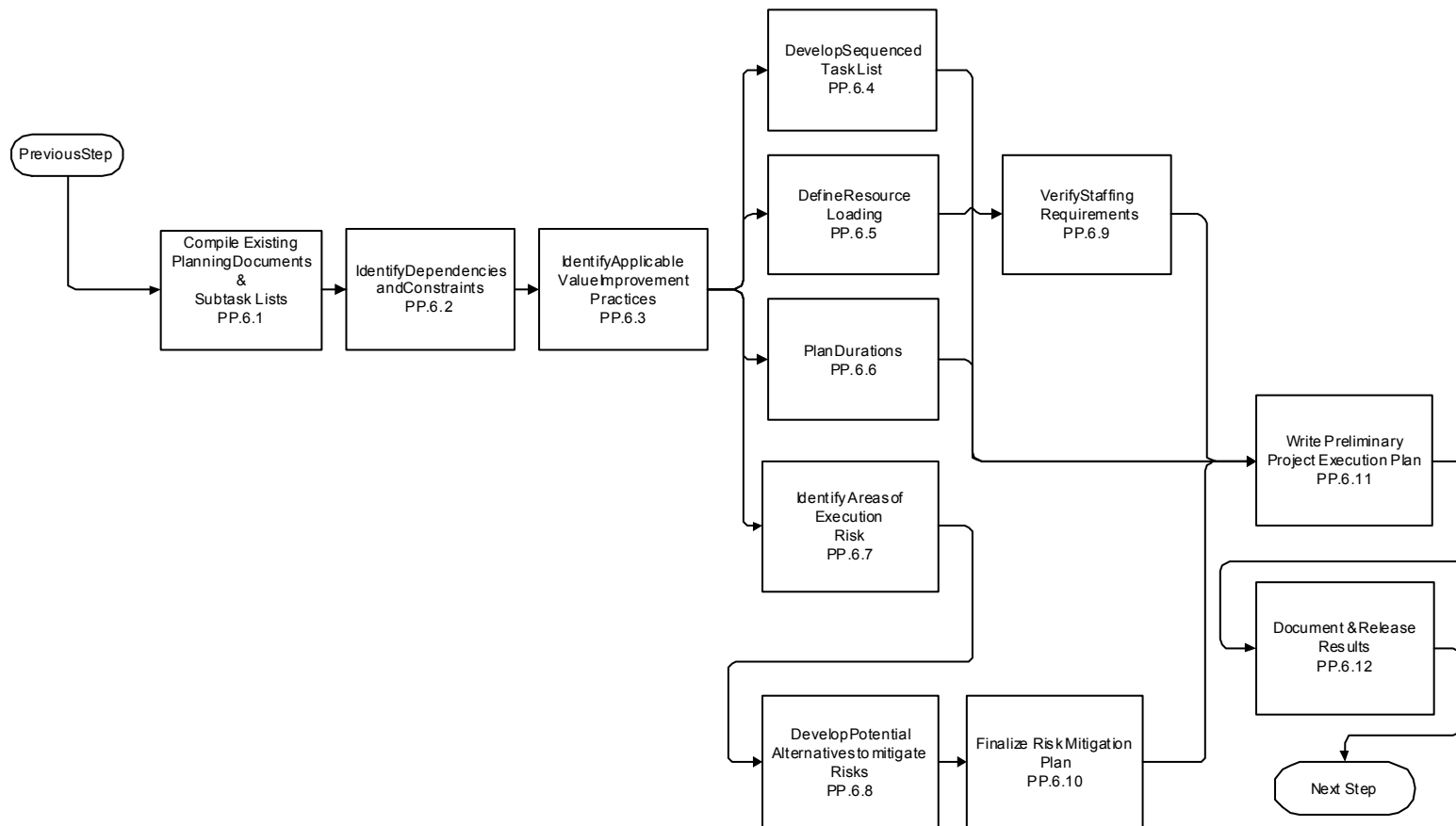
Does the information listing (documents and data) adequately identify information?

Yes No

Any additional comments:

PP.6 Develop Preliminary Execution Plan

The dependencies and constraints are identified from the task lists, standard logic diagram, and deliverables to produce a sequenced task list replicating a logic diagram. Includes preliminary resource loading to define internal and external staffing and other -resource requirements to accomplish individual or groups of tasks. Also includes an estimated duration for completing the task consistent with the resources applied. A key project management tool enabling the project manager to delineate, in as much detail as required, the plan for executing a project and by this means advise all concerned departments and individuals in the company of the requirements, responsibilities and assignments for carrying out the task. An integrated and coordinated program for completing all project activities.



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.6.1	BP.1.14	Business Objective Letter			
PP.6.1	BP.10.8	Start-up Plan			
PP.6.1	BP.11.8	Risk Management Plan			
PP.6.1	BP.5.7	Final Project Objectives List			
PP.6.1	BP.6.12	List of Applicable Regulations			
PP.6.1	BP.7.3	Funding Estimate			
PP.6.1	BP.8.9	Final Evaluation of Feed Stock Suppliers			
PP.6.1	BP.9.22	Labor Plan			
PP.6.1	CS.4.12	EPC Contract			
PP.6.1	PP.2.10	Project Org Chart			
PP.6.1	PP.3.15	Project Budget			
PP.6.1	PP.3.17	Preliminary Estimate			
PP.6.1	PP.4.17	Resource Loaded Schedule			
PP.6.1	PP.5.10	Project Safety/Quality Plan			
PP.6.1	PP.7.6	Preliminary Project Scope			
PP.6.1	PP.PP.1.25	Design Drawings			
PP.6.1	SD.4.23	Comprehensive Site Plan			
PP.6.1	SD.5.5	Work Breakdown Structure			
PP.6.1					Execution Plan Data
PP.6.2	PP.6.1			Execution Plan Data	
PP.6.2					Dependencies & Constraints
PP.6.3	PP.6.1			Execution Plan Data	
PP.6.3	PP.6.2			Dependencies & Constraints	
PP.6.3					Value Improvement Practices
PP.6.4	PP.4.17	Resource Loaded Schedule			
PP.6.4	PP.6.1			Execution Plan Data	
PP.6.4	PP.6.3			Value Improvement Practices	
PP.6.4	SD.5.5	Work Breakdown Structure			
PP.6.4			Sequenced Task List		
PP.6.5	PP.2.10	Project Org Chart			
PP.6.5	PP.4.17	Resource Loaded Schedule			
PP.6.5	PP.6.1			Execution Plan Data	
PP.6.5	PP.6.3			Value Improvement Practices	
PP.6.5			Resource Loading		
PP.6.6	BP.10.8	Start-up Plan			

Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
PP.6.6	PP.4.17	Resource Loaded Schedule			
PP.6.6	PP.6.1			Execution Plan Data	
PP.6.6	PP.6.3			Value Improvement Practices	
PP.6.6	PP.6.4	Sequenced Task List			
PP.6.6	PP.6.5	Resource Loading			
PP.6.6			Durations		
PP.6.7	BP.11.8	Risk Management Plan			
PP.6.7	PP.6.1			Execution Plan Data	
PP.6.7					Execution Risks
PP.6.8	PP.6.7			Execution Risks	
PP.6.8					Risk Mitigation Alternates
PP.6.9	PP.6.1			Execution Plan Data	
PP.6.9	PP.6.5	Resource Loading			
PP.6.9			Verified Staffing Requirements		
PP.6.10	BP.11.8	Risk Management Plan			
PP.6.10	PP.6.8			Risk Mitigation Alternates	
PP.6.10			Final Risk Management Plan		
PP.6.11	PP.6.1			Execution Plan Data	
PP.6.11	PP.6.10	Risk Mitigation Plan			
PP.6.11	PP.6.4	Sequenced Task List		Execution Plan Data	
PP.6.11	PP.6.6	Durations			
PP.6.11	PP.6.9	Verified Staffing Requirements			
PP.6.11					Project Execution Plan Data
PP.6.12	PP.6.11			Project Execution Plan Data	
PP.6.12			Project Execution Plan		

Activity: SD.02 – Develop Utilities and Offsite Scope

Are the tasks on the diagrams comprehensive of the steps need to execute this activity?

Yes No

Does the table correctly depict the flow of information through this activity?

Yes No

Does the information listing (documents and data) adequately identify information?

Yes No

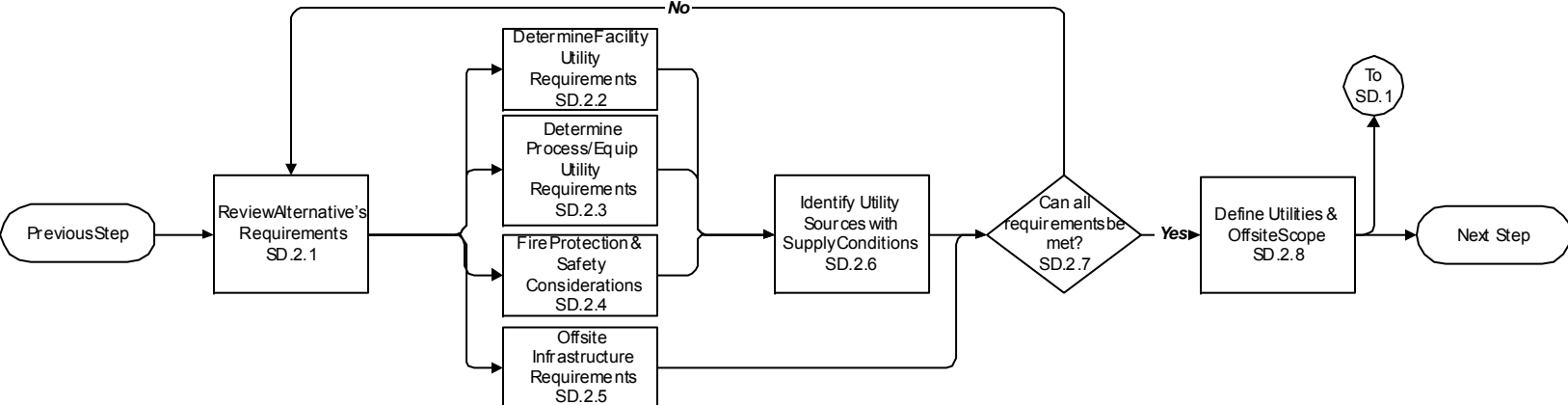
Any additional comments:

SD.2 Develop Utilities and Offsite Scope

Determine the requirements for power, water, sewer and other utilities and/or infrastructure, as well as other support facilities not part of the immediate location.

9-20-05

376



Task Number	Ref	Document Used	Document Produced	Data Used	Data Produced
SD.2.1	SD.2.1	Capacity Evaluation			
SD.2.1					Requirements Data
SD.2.2	SD.1.2	Capacity Evaluation			
SD.2.2					Facility Utility Requirements Data
SD.2.3	SD.1.2	Capacity Evaluation			
SD.2.3					Process/Equipment Utility Requirements Data
SD.2.4	SD.1.2	Capacity Evaluation			
SD.2.4					Fire Protection & Safety Data
SD.2.5	SD.1.2	Capacity Evaluation			
SD.2.5					Offsite Infrastructure Data
SD.2.6	BP.5.7	Final Project Objectives List			
SD.2.6					Utility Sources and Supply Data
SD.2.7	SD.2.2			Facility Utility Requirements Data	
SD.2.7	SD.2.3			Process/Equipment Utility Requirements Data	
SD.2.7	SD.2.4			Fire Protection & Safety Data	
SD.2.7	SD.2.5			Offsite Infrastructure Data	
SD.2.7	SD.2.6			Utility Sources and Supply Data	
SD.2.7					Decision
SD.2.8	SD.2.5			Offsite Infrastructure Data	
SD.2.8	SD.2.6			Utility Sources and Supply Data	
SD.2.8	SD.2.7			Decision	
SD.2.8			Utilities and Offsite Scope Document		

REFERENCES

- “Achieving an Integrated Data Environment: A Strategic Initiative.” February (1993). *Publication 20-3*, Construction Industry Institute, Austin, TX.
- “An Introduction to Integrated Database Systems.” February (1993). *Publication 20-2*, Construction Industry Institute, Austin, TX.
- Back, Edward, & Karen Moreau. “Information Management Strategies for Project Management.” Project Management Journal March, (2001): 10-19.
- Barker, Brent. “Power of Information Technology.” EDIR Journal. V. 15, N. 2, March (1990): 16-27.
- Barua, Anitesh, Suryanarayanan Ravindran, & Andrew B. Whinston. “Effective Intra-Organizational Information Exchange.” Journal of Information Science. V. 23, N. 3, (1997): 239-248
- Bjork, Bo-Christer. “Electronic Document Management in Construction.” ITcon May, (2003): 105-117.
- Bolisani, Ettore, & Enrico Scarso. “Information Technology Management: A Knowledge-Based Perspective.” Technovation. V. 19, N. 4, (1999): 209-217.
- “Breaking the Information Barriers.” Petroleum Review. July (2003).
- Breuer, James, & Martin Fischer. “Managerial Aspects on Information-Technology Strategies for A/E/C Firms.” Journal of Management in Engineering July/August, (1994): 52-59.
- Cho, C. S., & Gibson, G. E., “Building Project Scope Definition Using Project Definition Rating Index.” Journal of Architectural Engineering. V. 7, N. 4, December (2001): 115-125.
- Cleland, David I., & Lewis R. Ireland. Project Management: Strategic Design and Implementation. New York, NY: McGraw-Hill, 2002.
- “CII Best Practices.” [Online]
Available <http://www.construction-institute.org/scriptcontent/bp.cfm?section=Orders>. February 14, 2007.
- Corso, Mariano, & Emilio Paolucci. “Fostering Innovation and Knowledge Transfer in Product Development Through Information Technology.” Int. J. Technology Management Vol. 22, Nos. 1/2/3, (2001): 126-147.

- “Cost and Schedule Impacts of Information Management.” May (1998). *Publication 125-1*, Construction Industry Institute, Austin TX.
- Cottrell, Donald R. (CFI Inc) “Electronic Component Information Exchange (ECIX).” Proceedings – Design Automation Conference, (1997): 559-563.
- Damodaran, Leela, & Wendy Olphert. “Barriers and Facilitators to the use of Knowledge Management Systems.” Behavior & Information Technology. V. 19, N. 6, (2000): 405-413.
- “Determining the Impact of Information Management on Project Schedule and Cost.” June (1998). *Publication 125-11*, Construction Industry Institute, Austin TX.
- “Development of the Project Definition Rating Index (PDRI) for Building Projects.” (1999). *Publication 155-11*, Construction Industry Institute, Austin TX.
- Drabble, Brian. “Modern Planning and Scheduling Technologies.” Computing & Control Engineering Journal. V. 9, N. 3, June (1998): 123-126.
- Dumont, P., Gibson, G., Jr., and Fish, J.. “Scope Management Using the Project Definition Rating Index.” Journal of Management in Engineering. V. 13, N. 5, (1997): 54-60.
- “EDI: Concepts and Applications.” (1993). *Publication 20-1*, Construction Industry Institute, Austin TX.
- Gaonkar, Roshan, & N. Viswanadham. “Collaboration and Information Sharing in Global Contract Manufacturing Networks.” IEEE/ASME Transaction on Mechatronics. V. 6, N. 4, December, (2001): 366-376.
- Garber, Richard B. “Front-End Planning for Successful Project Outcomes.” Construction Specifier. February, (2004): 55-61.
- Gardiner, P. D., & J. M. Ritchie. “Project Planning in a Virtual World: Information Management Metamorphosis or Technology Going Too Far?” International Journal of Information Management. 19 (1999): 485-494.
- Gelle, Esther, & Katja Karhu. “Information Quality for Strategic Technology Planning.” Industrial Management and Data Systems. V. 103, N. 8-9, (2003): 633-643.
- “Get Ready for SQL Server 2005.” [Online] Available <http://www.microsoft.com/sql/default.msp> March 7, 2005.

- Gibson Jr., G. Edward, Irons, Kyle T, & Ray, Michael P.. Proceedings of the 2006 Architectural Engineering National Conference, Omaha, NE, 2006. "Front End Planning for Buildings." American Society of Engineers, 2006.
- Gibson Jr., G. Edward, & Gebken II, Richard J., "Design Quality in Pre-Project Planning: Applications of the Project Definition Rating Index." Building Research and Information. N. 5, September/October (2003): 346-356.
- Gibson Jr., G. Edward, & Gebken II, Richard J., Proceedings of the Architectural Engineering 2003 Conference, Austin, Texas, 2003. "Planning Charrattes Using the Project Definition Rating Index." American Society of Engineers, 2003.
- Gibson, G. E. Jr., & Hamilton, M. R.. "Benchmarking Preproject Planning Effort." Journal of Management in Engineering. V. 12, N. 2, March-April (1996): 25-33.
- Gibson, G. E. Jr., & Hamilton, M. R.. Proceedings of the 1995 Construction Congress, San Diego, CA, 1995. Construction Industry Institute (CII), University of Texas, TX, 1995.
- Gibson, G.E. Jr., J. H. Kaczmarowski, & H. E. Lore Jr. "Modelling Pre-Project Planning for Construction of Capital Facilities.": *Source Document 94*, Construction Industry Institute (CII), University of Texas, Austin, TX.
- Gibson, G.E. Jr., J. H. Kaczmarowski, & H. E. Lore Jr. "Preproject-Planning Process for Capital Facilities." Journal of Construction Engineering and Management. September, (1995): 312-318.
- Gibson, G.E. Jr., & Lansford Bell. "Electronic Data Interchange in Construction." Journal of Construction Engineering and Management. V. 116, N. 4, December (1990): 727-737.
- Gibson, G.E. Jr., Wang, Y, Cho, C-S., & Pappas, M. P.. "What is Preproject Planning Anyways." Journal of Management in Engineering. V. 22, N. 1, January (2006): 35-42.
- Gillard, Sharlett, & Jane Johansen. "Project Management Communication: A Systems Approach." Journal of Information Science. 30 (1) (2004): 23-29.
- Griffith, A. F., & Gibson, G. E. Jr., "Alignment During Preproject Planning." Journal of Management in Engineering. V. 17, N. 2, April (2001): 69-76.

- Griffith, A. F., Gibson, G. E. Jr., Hamilton, M. R., Tortora, A. L., & Wilson, C. T., "Project Success Index for Capital Facility Construction Projects." Journal of Performance of Constructed Facilities. V. 12, N. 1, February (1999): 39-45.
- Hamilton, M. and Gibson, G.. "Benchmarking Preproject Planning Effort." ASCE Journal of Management in Engineering. 12 (2) (1996): 25-33.
- Hardwick, Martin, David L. Spooner, Tom Rando, & K. C. Morris. "Sharing Manufacturing Information in Virtual Enterprises." Communications of the ACM. V. 39, N. 2, February (1996): 45-54.
- Hartman, Francis, & Ashrafi, Rafi. "Development of the SMART™ Project Planning Framework." International Journal of Project Management. 22 (2004): 499-510.
- Herschel, Richard T., & Hamid R. Nemati. "CKOS and Knowledge Management: Exploring Opportunities for Using Information Exchange Protocols." Proceedings of the ACM SIGCPR Conference, (1999): 42-50.
- "Information." Merriam-Webster Online. Available <http://www.webster.com/info/copyright.htm> September 12, 2006.
- "Information Management." Answers.com. Available <http://www.answers.com> October 19, 2006.
- Kaefer, Frederick, & Elliot Bendoly. "The Adoption of Electronic Data Interchange: A Model and Practical Tool for Managers." Decision Support Systems. V. 30, N. 1, December (2000): 23-32.
- Kazi, Abdul S., & Chotchai Charoenngam. "Facilitating Inter-Enterprise Information Exchange in One-Of-A-Kind Settings." ITcon. 8 (2003): 319-339.
- Krings, Lothar, & Rauli Hantikainen. "Re-Think, Re-Engineer, Close the Gaps: New Cement Information Management Solutions." IEEE Cement Industry Technical Conference (Paper). (1996): 351-361.
- Lai, Vincent S., & Radha K. Mahapatra. "Exploring the Research in Information Technology Implementation." Information & Management. (1997): 187-201.
- Lefebvre, Elizabeth, Louis-A. Lefebvre, & Lise Prefontaine. "Relating Technology Management Capabilities to the Use of Information Technology." Proceeding of the Hawaii International Conference on System Sciences. V. 3 (1994): 460-468.

- Lowes, Nick, Van Driel, & Jan Paul. "Too Much of a Good Thing?" Petroleum Review. June, (2004): 28-30.
- Matthews, Mark. "Networking and Information Management: Its Use by the Project Planning Function." Networking and Information Management. 10 (1986): 1-9.
- Mervi, Lehto, & Himanen Veli. "Multidisciplinary Information Management in Construction Industry, Example of Facilities Management." ITcon. Vol. 7 (2002): 213-244.
- Moenaert, R.K., A. De Meyer, W.E. Souder, & D. Deschoolmeester. "R&D/Marketing Communication during the Fuzzy Front-End." IEEE Transactions on Engineering Management. August: 243-258.
- Moreau, Karen Anne. The Development of a Methodology to Quantify the Impacts of Information Management Strategies on EPC Projects. Texas: Texas A&M, 1997.
- Ng, Jimmy J.M., K.X. Li. "Implications of ICT for Knowledge Management in Globalization." Information Management and Computer Security. V. 11, N. 4, (2003): 167-174.
- O'Mahony, Donal, & Neil Weldon. "X.500 Directory Services Support for Electronic Data Interchange (EDI)." Computer Networks and ISDN Systems. V. 27, N. 5, March (1995): 691-701.
- "PDRI: Project Definition Rating Index, Building Projects." (1999). *Publication 155-2*, Construction Industry Institute, Austin TX.
- Pena-Mora, Feniosky, Sanjeev Vadhavkar, Eric Perkins, & Thomas Weber. "Information Technology Planning Framework for Large-Scale Projects." Journal of Computing in Civil Engineering. V. 13, N. 4, October (1999): 226-237.
- Pinkerton, J. M. M., "The Advance of Information Technology." ICL Technical Journal (International Computers Limited). V. 3, N 2, November (1982): 119-136.
- "Pre-Project Planning: Beginning a Project the Right Way." (1994). *Publication 39-1*, Construction Industry Institute, Austin TX.
- "Pre-Project Planning Handbook." April (1995). *Publication 39-2*, Construction Industry Institute, Austin TX.

- “Pre-Project Planning Tools: PDRI & Alignment.” (1997). *Publication 113-1*, Construction Industry Institute, Austin TX.
- Pritchard, Carl. The Project Management Communications Toolkit. Norwood, MA: Artech House, Inc., 2004.
- “Project Management Software.” [Online] <http://www.project-management-software.org/project/html> March 7, 2005.
- Qingrui, Xu, Liu Jingjiang, & Chen Jin. “Knowledge Strategy: Toward to Dynamically Integrating Technological Innovation with Knowledge Management.” IEEE International Engineering Management Conference. V. 2, (2002): 719-723.
- Ramamurthy, K., & G. Premkumar. “Determinants and Outcomes of Electronic Data Interchange Diffusion.” IEEE Transactions on Engineering Management. V. 42, N. 4, November (1995): 332-351.
- Schloz, Michael. “Project Cost Management During Conceptual Engineering.” Transactions of the American Association of Costs Engineers. June, (1977): 167-172.
- Smith, Brian L., John S. Miller, Brian M. Revels, & Kevin W. Smith. “Planning for Civil Engineering Applications of Information Technology.” Journal of Management in Engineering. April (2001): 95-104.
- Smith, C.C. “Improved Project Definition Ensures Value-Added Performance – Part 1.” Hydrocarbon Processing. August, (2000): 4.
- “Softalot Team Manager.” [Online] <http://www.softalot.com/default.htm> March 7, 2005.
- Sriprasert, Eknarin, & Nashwan Dawood. “Multi-Constraint Information Management and Visualisation for Collaborative Planning and Control in Construction.” ITcon. Vol. 8 (2003): 341-366.
- Sulankivi, Kristiina. “Benefits of Centralized Digital Information Management in Multipartner Projects.” ITcon. Vol. 9 (2004): 35-63.
- Sullivan, John J, Ted C Kennedy, Merle W Hauser, & George Watcher. “Critical Issues in Planning and Implementing Capital Projects.” Engineering Conference, Proceedings of the Technical Association of the Pulp and Paper Industry. (1985): 481.

- Tserng, H. Ping & Yu-Cheng Lin, "Developing an Activity-Based Knowledge Management System for Contractors." Automation in Construction. (2004): Vol 13, 781-802.
- Wang, Y.. Applying PDRI in Project Risk Management. Texas: Univ. of Texas, Austin, 2002.
- Weaver, Alfred C.. "Survey of Industrial Information Technology." IECON Proceeding (Industrial Electronics Conference). V. 1, (2001): 2056-2061.
- Webster, Jeffery. "Project Planning: Getting it Right the First Time." 2004 IEEE Aerospace Conference Proceedings. (2004): 3924-3930.
- "When to use Fisher's Exact Test." [Online]
http://www.asq.org/pub/sixsigma/past/vol2_issue4/ssfmv2i4bower.pdf July 27, 2006.
- Young, R.I.M., G. Espinosa, D. Gunendran, & S. Liu, "Information and Knowledge Sharing in Design Decision Support." CE: The Vision for the Future Generation in Research and Applications. (2003): 147-153.
- Zhang, Yanping (Paul) & Chun (Chick) Zhang, "An Internet Based STEP Data Exchange Framework for Virtual Enterprises." Computer in Industry. Jan, (2000): 51-63.
- Zipf, Peter. "Technology-Enhanced Project Management." Journal of Management in Engineering. January/February (2000): 34-39.