Topic: **Reservoir Committee Agenda Item 1-6 2017 Dec 21**

Subject: **Joint Authority/Reservoir Committee workshop on Phase 2 Work Plan and Procurement Packages.**

Requested Action:

1. Discussion and possible direction to staff regarding the development of a common set of values to be used as the basis for developing an overarching procurement strategy and plan (refer to attachments).

   Prior to the meeting, please become familiar with the attachments - especially the PDCS Excel Workbook's tab: Analysis, which lists a series of owner's values that when ranked and scored can aid in the identification of potential contracting methods best suited to your values. While intended for construction, the potential delivery options will be factored into the structure of the Phase 2 procurements. At the meeting, we will attempt to reach consensus on the top 4 to 6 factors.

2. Discussion and possible direction to staff regarding the scheduling of a joint Authority/Reservoir Committee workshop to discuss the Phase 2 Work Plan and potential procurement packages.

Detailed Description/Background:

Sites program staff is recommending the scheduling and facilitation of a joint Authority/Reservoir Committee workshop to discuss planning for the Phase 2 Work Plan, review of future phases of the project, and to discuss potential contract and procurement strategies for the identified work activities.

The Joint Workshop is tentatively planned to coincide with the next Reservoir Committee meeting (January 18 or 19), which will be held in Maxwell.

Prior Reservoir Committee Action:

None.

Fiscal Impact/Funding Source:

None.

Staff Contact:

Jim Watson

Attachments:

Attachment 1-6a: Owner's Tool for Project Delivery and Contract Strategy (PDCS) Selection - User's Guide, prepared by the Construction Industry Institute.

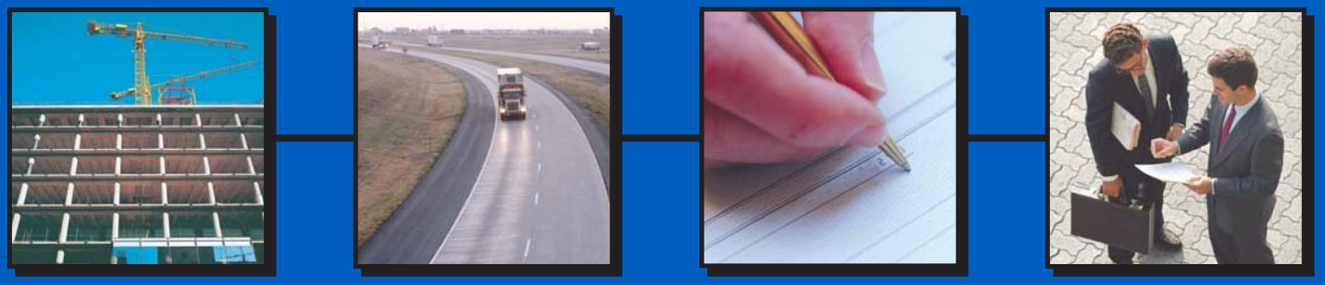
Attachment 1-6b: PDSC Excel Workbook, prepared by the Construction Industry Institute.

A Tool for Owners

CII Implementation Resource 165-2

Second Edition

Project Delivery and Contract Strategy



P — D — C — S

Construction Industry Institute®

Owner's Tool for Project Delivery and Contract Strategy Selection

User's Guide

Prepared by the

Construction Industry Institute

Project Delivery and Contract Strategy Research Team

Implementation Resource 165-2

Second Edition

October 2003

Printed in the United States of America.

Contents

1.0 Overview

The procedure described in this publication for selecting an integrated project delivery and contract strategy (PDCS) for capital projects should be used on a project-by-project basis. The central component of the procedure is a decision support tool that consists of Excel® spreadsheets for selecting integrated PDCS alternatives. Compensation approach charts also are provided for reviewing and selecting the compensation approach for each owner-contractor relationship for any given project.

The purpose of the procedure is to facilitate maximum achievement of the owner's project objectives. Therefore, for a project under consideration, the selection criteria should be based on the owner's objectives for that project. Other factors that may influence successful project execution also should be considered in the selection process. The integrated PDCS alternatives are presented in Appendix 1. Industry-wide selection factors are presented in Appendix 2.

Each of the 12 integrated PDCS alternatives includes default compensation approaches, as shown in Appendix 1. Once an integrated PDCS is selected using the Excel® spreadsheet, default compensation approaches are obtained for all the contractual relationships defined for that PDCS alternative. The user may choose to use the default compensation approaches or select more suitable approaches using the compensation approach charts.

The procedure consists of a four-part process. First, ratings for all the PDCS alternatives are obtained from the PDCS spreadsheet tool, based on selection factors derived from project objectives and project conditions. The three PDCS alternatives with the highest ratings are selected. Second, the strengths and weaknesses of the highest rated PDCS alternatives are analyzed. Third, the default compensation approaches that are associated with each of the three PDCS alternatives are reviewed for suitability, using the compensation approach charts. The default compensation approach would be replaced if an approach that is more suitable to the project under consideration is obtained from the compensation approach charts. The fourth part involves the final decision-making step. In this step, special factors that are peculiar to the owner, if any, are considered and one of the three PDCS alternatives is selected for the subject project.

A flowchart illustrating the procedure for selecting an integrated PDCS for a capital project is presented in Figure 1.1. Process steps with descriptions on how to use the Excel® Workbook are presented in Section 2.0.

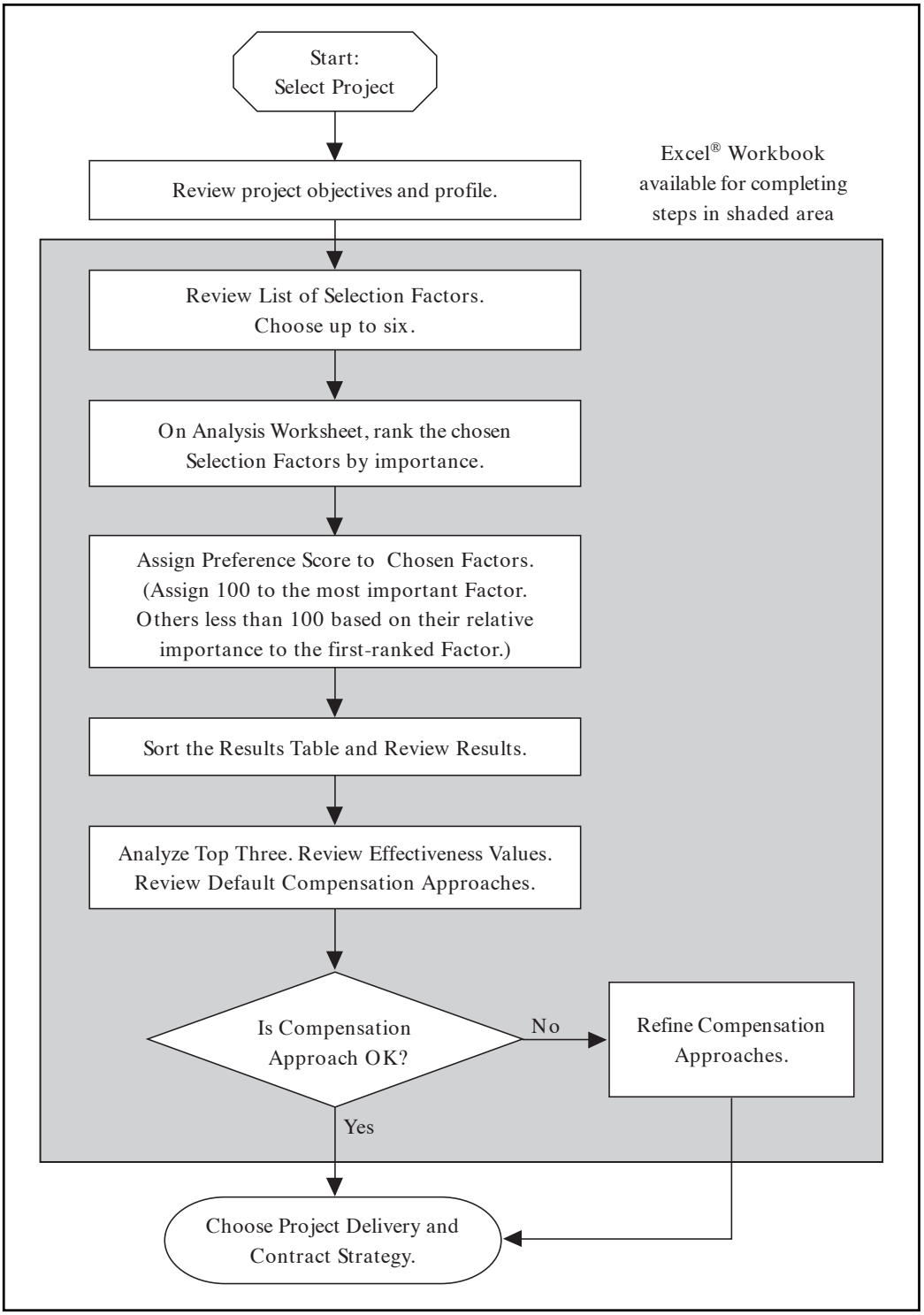


Figure 1.1. Process Flowchart

2.0 Process Steps

2.1 Review Project Objectives and Project Conditions

For a given project, review the project objectives and identify those objectives that may influence the choice of project delivery and contract strategy (cost, schedule, quality, and business). This step encourages the user to focus on the critical success factors of the project under consideration. If documented project objectives have not been established for the project under consideration, this should be done. (Guidelines for project objectives setting are included in CII Research Summary 12-1 and Implementation Resource 113-3.)

In addition, there may be other key project requirements that influence the selection of a PDCS. These other requirements may result from project complexity, location, or from certain strategic policies that the owner has for project development and execution.

2.2 Launch Excel® Workbook

1. Insert the disk that comes with this document into the user's computer. Copy the Excel® file to the user's hard drive (PDCS2.xls). Open the Excel® file, click on "Enable Macros," and save with a new file name (e.g., relate to a specific project). The Excel® Workbook consists of the following five worksheets:
   - Flowchart
   - Factors & Options
   - Analysis
   - Effectiveness Values
   - Comp Approaches
2. The Excel® spreadsheet automatically opens to the "Flowchart" Worksheet, as shown in Figure 2.1. PDCS process steps should be reviewed.

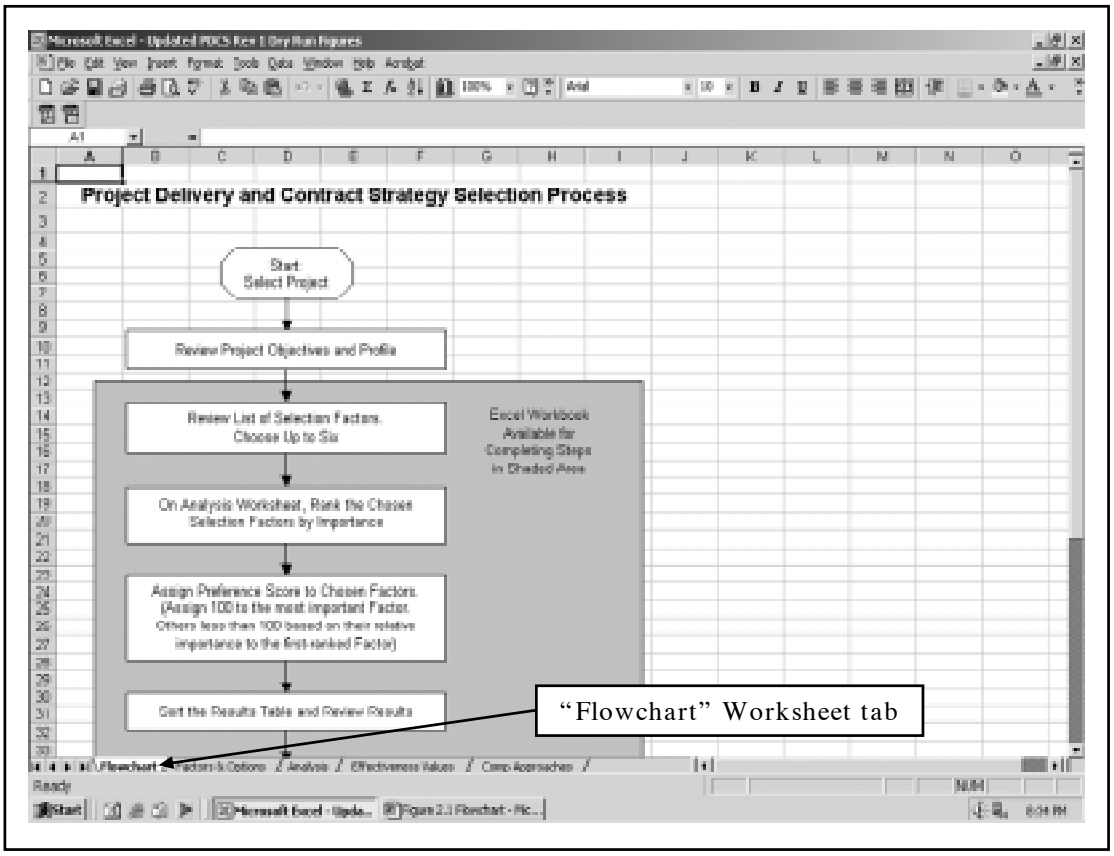


Figure 2.1. "Flowchart" Worksheet

Comment:

> This flowchart is the same as that shown in Figure 1.1 and is reproduced in the Excel® Workbook for completeness. Similarly, the PDCS Alternatives and Selection Factors that are provided in Appendices 1 and 2 are also provided in the Excel® Workbook. A summary of Relative Effectiveness Values for each Selection Factor is provided in Appendix 3. The Excel® Workbook is designed to be used without any need to reference another document, except this Implementation Resource.

All the steps in this procedure (the shaded area in Figure 1.1) are implemented in the Excel® file.

2.3 Review List of Selection Factors

1. Go to Worksheet "Factors & Options" and review the list of selection factors. (The list of selection factors is also presented in Appendix 2.)

   - Identify the factors that may be relevant to the selection of a PDCS for the project under consideration. The selection factors should be derived from the project objectives and project execution environment (see comments on selection factors in Appendix 2).
   - Pay close attention to the Factor Action Statements.
   - Avoid factor interaction (see Appendix 2).
   - Choose up to six selection factors, but no fewer than four (note which ones).

2. Go to Worksheet "Analysis" and Table A-1: Analyze.

   Comment:

   This is the first of two critical inputs that the user will make in the analysis. Identifying the relevant selection factors for a project will be based on the judgement of the user. Examples 3.1 and 3.2 in Chapter 3, Case Study Examples, show how this step was performed for the example projects. Also scenario-based associations of selection factors with project objectives and project types are presented in Appendix 4. These are expected to provide some guidance in performing this step in the selection analysis for any project. However, this step has to be performed on a project-by-project basis.

2.4 Rank Selection Factors

1. Based on the decision analysis theory behind the PDCS tool, a maximum of six factors should be identified. However, best results can be achieved by using between four and six selection factors. The selection factors should then be ranked according to their importance to the project from one to six, with one being the highest ranked selection factor. The ranking for each selection factor is entered in

the appropriate column on Table A-1 under the "Analysis" Worksheet, as shown in Figure 2.2. This ranking would reflect the priority of the project objectives and the impact other project characteristics or project execution issues would have on the success of the project. Previous experience would likely contribute to the proposed ranking.

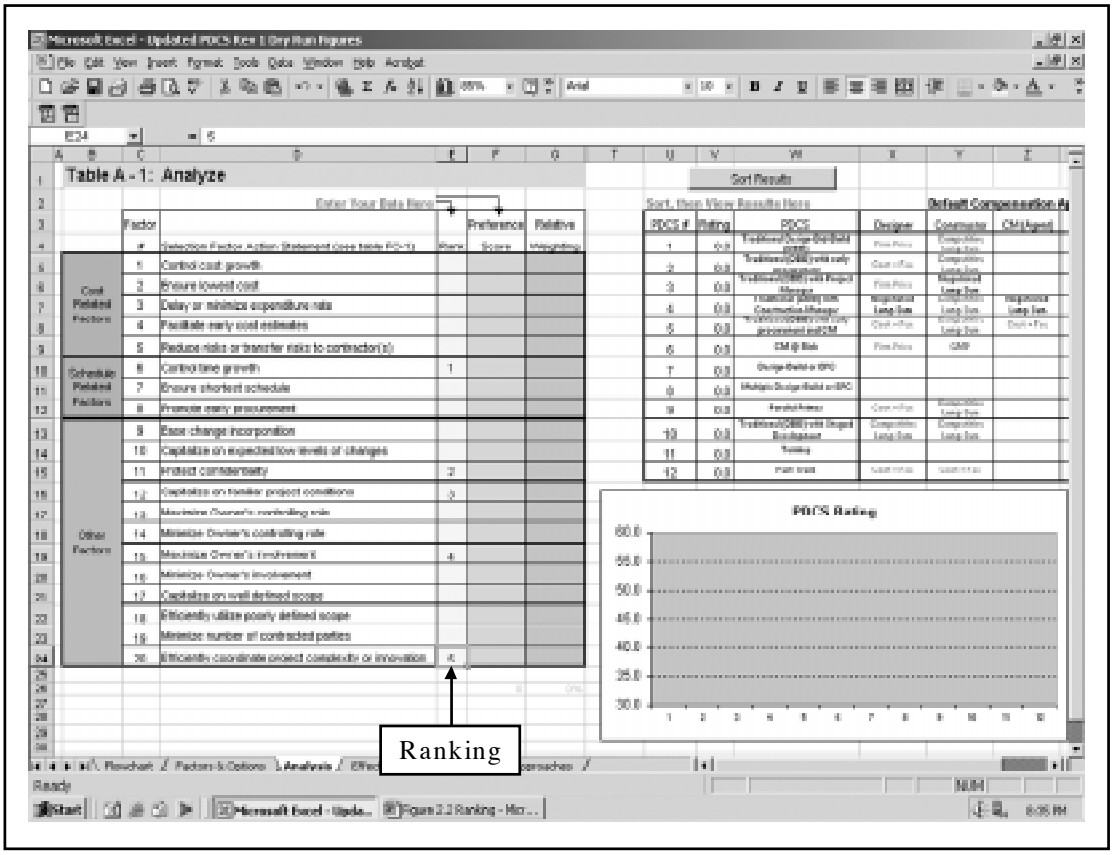


Figure 2.2. Ranking Relevant Selection Factors in "Analysis" Worksheet

2.5 Assign Preference Scores

1. The rankings must be converted to a "Preference Score." This score reflects the relative importance of one selection factor in relation to the others. The top ranked factor (i.e., 1) is the benchmark from which all other preference scores for the other selection factors are determined. Thus, the top ranked factor **is assigned a 100**. The remaining factors are assigned a score less than 100 to reflect their relative importance to the top ranked selection factor and the other selection factors. This step is delineated on Figure 2.3. It is recommended that increments of five or 10 be used for individual preference scores.

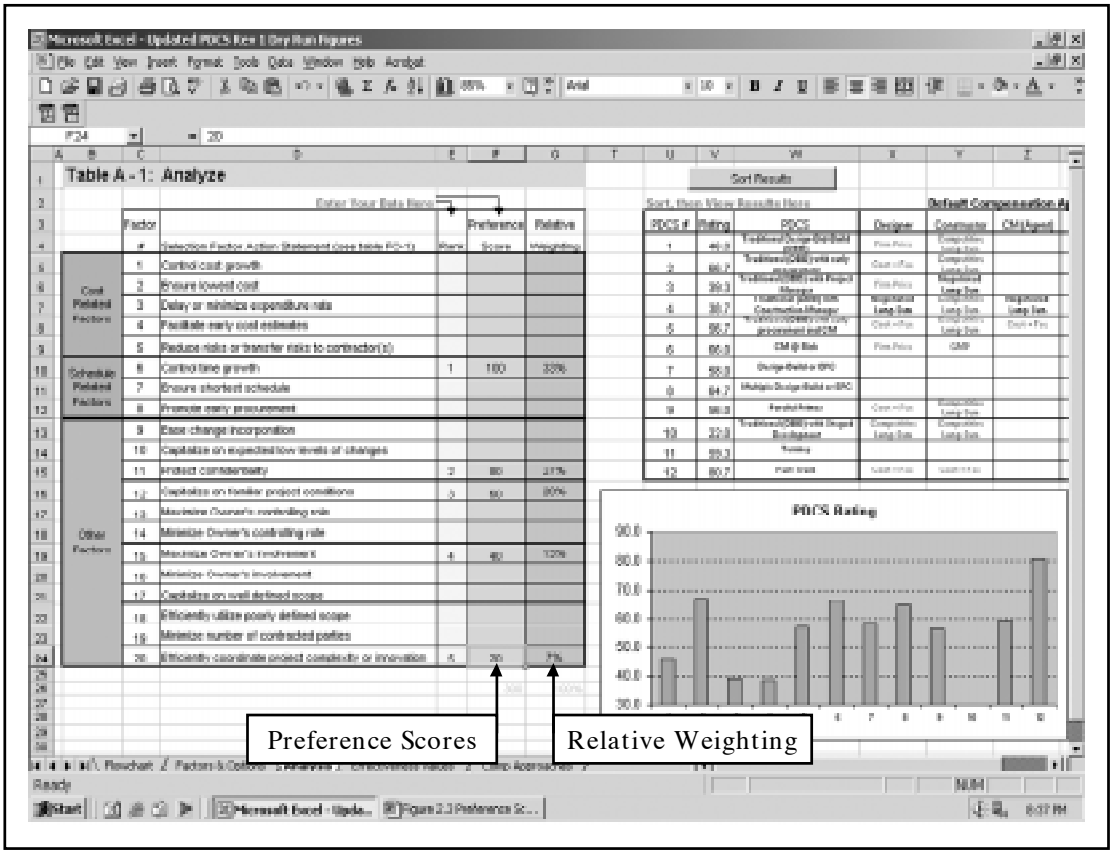


Figure 2.3. Assigning Preference Score and Calculating Relative Weighting in "Analysis" Worksheet

Comment:

Project objectives and their priorities should be used as a guide. Knowledge of other issues that might influence the selection of a PDCS alternative will also help in establishing the rank order and assigning preference scores for each selection factor. Ultimately, the **experience** of the project manager and his or her key team members is required to make the final determination of each preference score. Finally, there is no quantitative methodology to assign the rank and preference scores.

2. As the Preference Scores are entered, the Relative Weighting is automatically computed by the spreadsheet (see Figure 2.3). Summing the preference scores then dividing the preference score for each factor by the total makes this calculation. For example, the relative weighting for the factor action statement "Control Time Growth" would be 100/300 or 0.33.

As the Preference Score is entered and the Relative Weighting is calculated for each Selection Factor, the PDCS Rating histogram is automatically computed by the spreadsheet for each of the 12 PDCS alternatives (see Figure 2.3). The sample calculation of the PDCS Rating based on three selection factors is shown in Table 1.

Table 1. Sample Calculation of PDCS Rating

Selection Factor	Preference Weight	Normalized Preference Weight	PDCS OPTION	Selection Factor 1 / Normalized Preference Weight 0.35	Selection Factor 5 / Normalized Preference Weight 0.38	Selection Factor 6 / Normalized Preference Weight 0.27	Aggregate Score
1	90	0.35	PDCS 1	80	80	20	63.8
5	100	0.38	PDCS 2	50	50	50	50.0
6	70	0.27	PDCS 3	80	60	20	56.2
	260	1.00					

2.6 Sort Results and Review

1. Once all Preference Scores have been assigned to each factor, click on the "Sort Results" button. The spreadsheet automatically sorts the PDCS Ratings in descending order, as depicted in Figure 2.4. Review the top three PDCS alternatives. Switching to the "Factors & Options" Worksheet and scrolling to the right to view the 12 PDCS alternatives can help accomplish this. Magnify the worksheet to 200 percent and review the descriptions of the top three alternatives. The 11 by 17 foldout in the jacket of IR165-2 can also be used to review the PDCS alternatives.

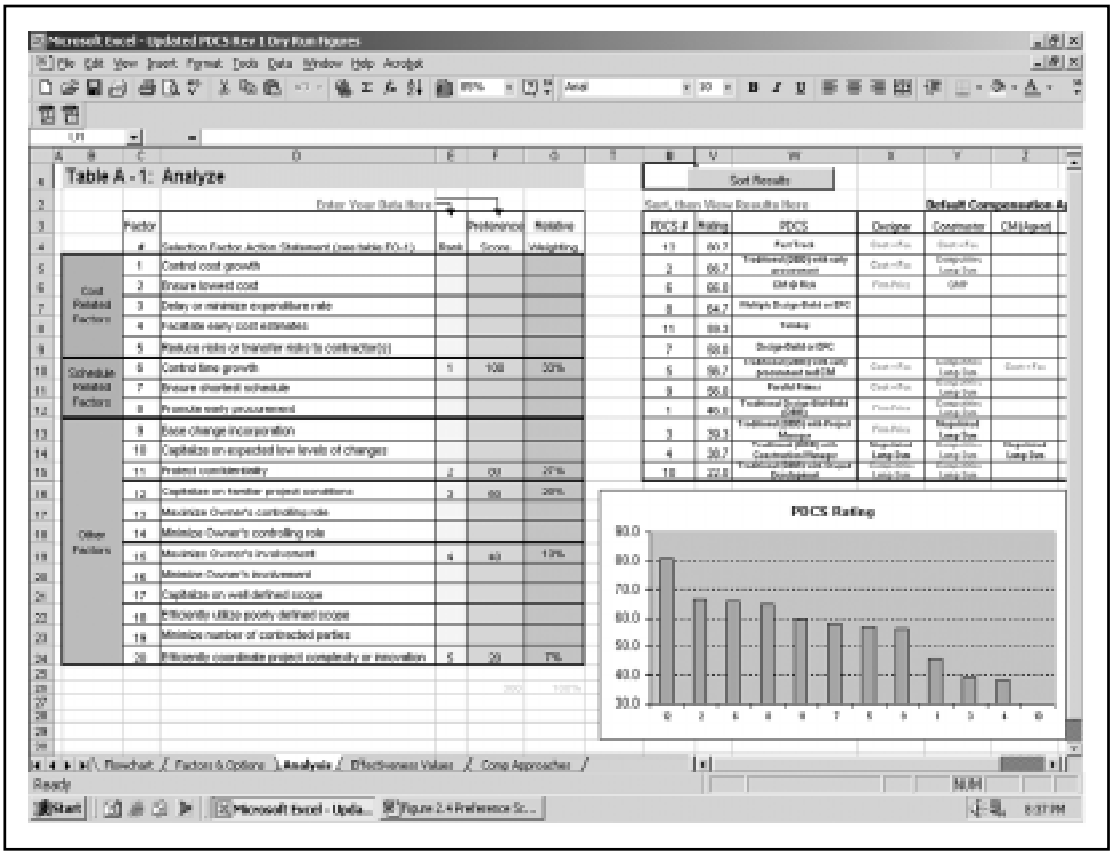


Figure 2.4. PDCS Ratings Histogram in Descending Order in "Analysis" Worksheet

2.7 Analyze Top Three PDCS Ratings

1. Review histogram in Figure 2.4 to identify the top three PDCS alternatives.

   Comment:

   For the factors chosen in the analysis and the preference weightings assigned to them by the user, the ratings represent the overall suitability of each PDCS alternative to the project under consideration. The higher the rating, the more suitable the PDCS alternative. It is recommended that the three alternatives with the highest ratings should be selected for consideration in the final decision-making step.

   In some cases, the "turnkey" project delivery and contract strategy (PDCS 11) would be in the top three for a project where commissioning and start-up are not considered in PDCS selection. In such cases, the turnkey PDCS should be overlooked in selecting the top three alternatives. Similarly, when PDCS 3 and PDCS 4 both have ratings in the top three for a particular project, only one of these needs to be included in the final three PDCS alternatives considered.

   In Figure 2.4, the top ratings were PDCS 12 (80.7), PDCS 2 (66.7), and PDCS 6 (66.0). These three alternatives will be considered in the following steps leading to the final decision.

2. The effectiveness values associated with each Selection Factor for the top three PDCS alternatives should be reviewed. Clicking on the "Effectiveness Values" tab opens the Worksheet with Table EV-1, Effectiveness Values of PDCS Alternatives With Respect To Selection Factors. As shown in Figure 2.5, only those effectiveness values for the factors used in the analysis are provided. The PDCS alternatives are sorted by descending ratings. The top three PDCS alternatives and the effectiveness values for the selection factors are highlighted. The intent of reviewing the

effectiveness values for the PDCS alternatives is to identify potential strengths and weaknesses in implementing each PDCS. For example, in Figure 2.5, PDCS 2 performs well on providing confidentiality (Factor 11) for the owner (effectiveness value of 90) while allowing the owner to maximize the owner's involvement (Factor 15) in the project (effectiveness value of 90). Alternatively, PDCS 2 does not provide the best alternative in Controlling Time Growth, Factor 6, and Capitalizing on Familiar Site Conditions. Both Factors 6 and 12 have effectiveness values of 50.

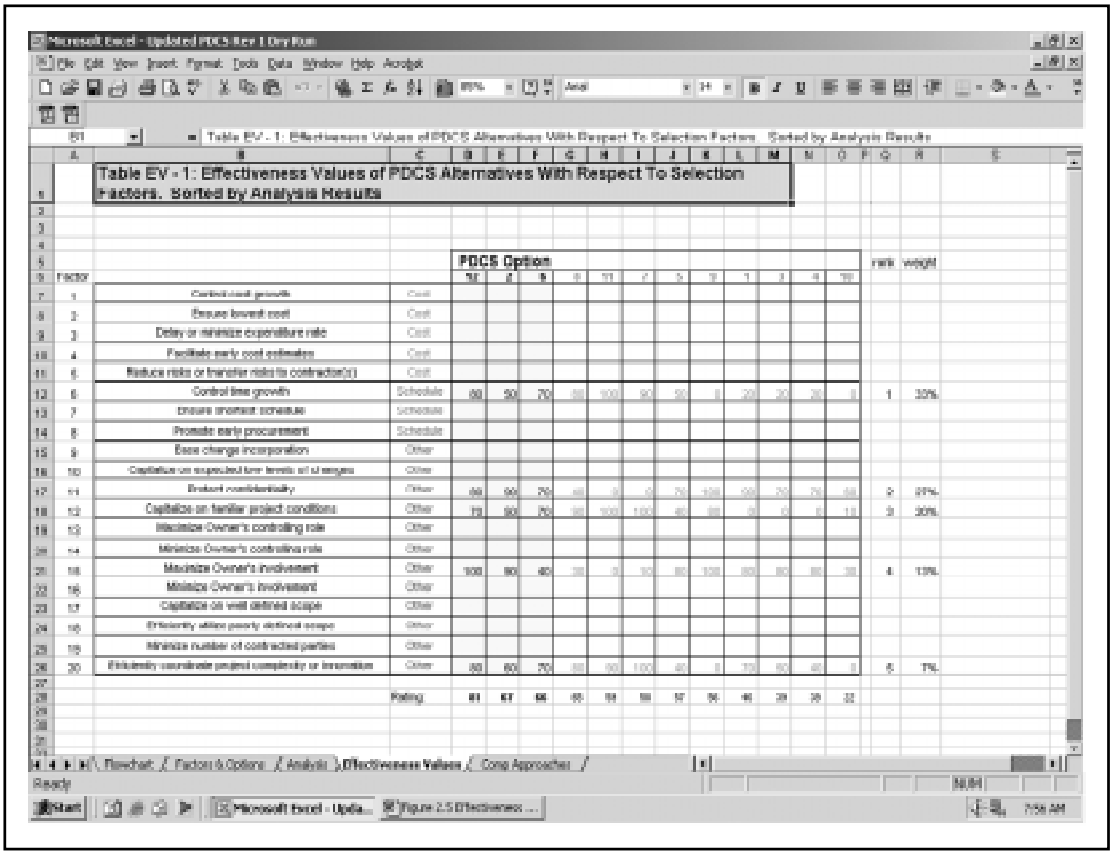


Figure 2.5. Effectiveness Values for the Top Three PDCS Alternatives in "Effectiveness Values" Worksheet

2.8 Review/Refine Compensation Approaches

Comment:

Each PDCS alternative involves several owner-contractor relationships, as shown in the Project Team relationships in Appendix 1. Each contractual relationship is based on a compensation approach; default compensation approaches have been defined for every contractual relationship. The default compensation approaches are shown under "Compensation Approaches" in the definition of the PDCS alternatives in Appendix 1.

For each PDCS alternative, the default compensation approaches represent the most common approach adopted for the contractual relationships involved in that project delivery and contract strategy. However, depending on the particular circumstances of a project, alternatives to the default approaches may be more suitable. This step shows how the Compensation Approach charts shown in Worksheet "Comp Approaches" in the Excel® file and in Appendix 6 may be used to analyze the default compensation approaches that come with the PDCS alternatives selected in 2.7 above, and determine the most suitable approaches for the project under consideration. Appendix 5 provides key definitions, including each compensation approach.

1. In the Excel® file, go to Table A-1 found under the "Analysis" Worksheet. Scroll to the right until the Default Compensation Approach Table is shown in its entirety. This table shows all the PDCS alternatives with their default compensation approaches. The same information can be found by going to Figure FO-1 in the "Factors & Options" Worksheet. For improved legibility, use the "Zoom" command in the Excel® toolbar to magnify the view of Figure FO-1 to 200 percent. The 11 by 17 foldout in the jacket of IR 165-2 can also be used to review the default compensation approaches for each PDCS alternative.

- For each PDCS chosen in 2.7, identify the default compensation approaches that have been defined for each of the contracted parties in that PDCS. For example, for PDCS 2 selected in 2.7 above, the default compensation approaches are:

Default Compensation Approaches for PDCS 2:

Designer:	Cost reimbursable + Fee
Constructor:	Competitive Lump Sum
Supplier:	Competitive Lump Sum

2. Go to worksheet "Comp Approaches" in the Excel® file. Use the "Zoom" command in the Excel® toolbar to magnify the view. This worksheet contains all the compensation approach charts as shown in Appendix 6.

- Select the compensation approach chart for a contractual relationship defined in the PDCS alternative.
- Determine the level of information available at award of contract and the levels of owner's control effort and budget risk associated with the default compensation approach.
- Decide whether or not these levels of the parameters are suitable for the project under consideration.
- If suitable, adopt the default compensation approach for the subject relationship.
- If required levels of the parameters associated with the default compensation approach are not suitable for the project under consideration, determine the desired levels that are suitable and select the compensation approach that is associated with those levels.
- In some cases, a compensation approach may be selected to enhance the effectiveness of a PDCS alternative with respect to some selection factors. Care must be taken when changing compensation approaches. For example, changing from lump sum to cost reimbursable increases the owner's ability to change the design, but this could reduce the ability to control cost.
- Repeat the process for every contractual relationship defined in the PDCS alternative and note the results for the final decision-making step.

Comment:

For example, consider the owner-designer relationship for PDCS 2 shown in 2.8.1. The default compensation approach for this relationship is "Cost Reimbursable plus Fee." From the compensation approach charts for owner-designer relationships in Worksheet "Comp Approaches" in the Excel® file (and also in Appendix 6), Cost Reimbursable plus Fee contract requires:

- Low level of available information at award of design contract.
- High level of owner's design contract budget risk.
- High level of owner's design contract control effort.

If these parameter levels are satisfactory to the user, then the default compensation approach should be adopted. However, if the user desires a low level of design contract control effort, the choices are limited to lump sum or firm price, or guaranteed maximum price (GMP) contract types. Each of these is associated with different levels of available information required at award of design contract. If the user projects a *high level* of available information at award, then the suitable compensation approach is GMP. If the user projects a *very high level* of available information at award, the most suitable choice is a lump sum, firm price contract type. Meanwhile, it should be noted that it would be uncommon to use a GMP contract for design services. Therefore, the user may be better served in this case by using a firm price contract or a unit price contract (the unit price contract would require a high level of information at award and involve medium levels of owner's control effort and budget risk).

3. When this process is completed, the most suitable compensation approaches will be defined for all the contractual relationships in each of the three PDCS alternatives selected in 2.7 for final decision making.

This concludes the operations in the Excel® file.

2.9 Choose Project Delivery and Contract Strategy

Comment:

At this point the user will have the three highest scoring PDCS alternatives, with refined compensation approaches to select from, for the project under consideration. The project delivery and contract strategy with the highest rating would theoretically be the most suitable for the project. However, the final decision on the PDCS approach to select rests with the user. This decision may be influenced by other factors such as corporate culture, statutory limitations, or level of knowledge (familiarity) with some approaches. These special factors are not consistently rated in all situations in which they are applied. For example, where familiarity with a PDCS influences the selection decision, different owners will have different levels of familiarity with different PDCS alternatives. In such cases, industry-wide effectiveness values cannot be developed for the factor. As such, those factors could not be included in this tool. **Consideration of such factors is left to the individual user.**

1. The results of the PDCS analysis should be documented. This document could be an executive summary covering the following topics:
   - Project Objectives
   - Key Selection Factors
   - Relative Weighting Results
   - Post Analysis
   - Communication of Decision

Appendix 7 provides a more complete discussion of the six topics. A template is provided as a Microsoft Word® file (Template Exec Sum.doc) and is included on the disk.

3.0 Case Study Illustrations

In this section, two examples will be used to demonstrate how this procedure can be applied to select a project delivery and contract strategy for a capital project.

3.1 Gulf Coast Cogeneration Plant

The Gulf Coast Cogeneration Plant Project is an industrial (electrical power generating) project. The project cost approximately $32 million, with project duration targeted at about 18 months from conceptual engineering to mechanical completion.

The project is designed to provide 35 MW of electrical power, 330,000 pounds per hour of process steam at various pressure levels, and 335 gpm of high pressure boiler feedwater to the owner's refinery. The project site is centrally located within the existing refinery and includes a 35 MW gas turbine generator (GTG), a heat recovery steam generator (HRSG), and a water treatment plant to provide 50 percent of the boiler feedwater. The HRSG and GTG equipment requires particularly long-lead procurement times.

Electrical equipment and facilities include a 40 MVA power transformer, a 69 kV substation, and a building that houses the switchgear and motor control centers. The plant employs state-of-the-art control and instrumentation. The gas turbine would be controlled by the GTG manufacturer's control system and would be harmonized with the combined control system for the other equipment. All control systems would be located in the cogeneration plant control room, next to the switchgear building. An extensive piping system and pipe rack would be provided to permit tying in the steam, water, fuel gas, and utility lines with the existing refinery piping system. The schematics and site layout are presented in Figures 3.1 and 3.2, respectively.

The 3D schematic in Figure 3.1 shows equipment layout, the pipe racks and piping on the pipe racks. The two major pieces of equipment are the gas turbine generator (GTG) and the heat recovery steam generator (HRSG) with a stack. Both are located in the lower lefthand corner of the figure. A dominant feature of this type of facility is the long lead fabrication and delivery of the GTG and HRSG.

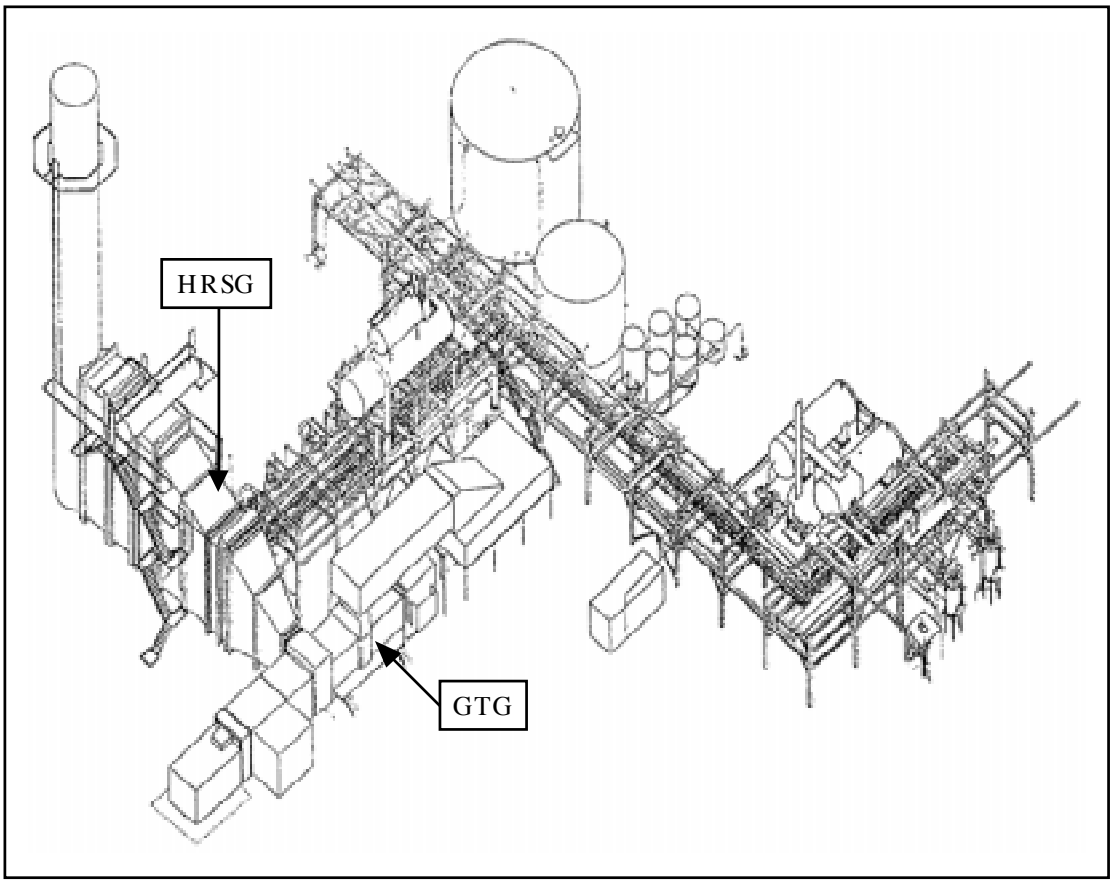


Figure 3.1. Schematic Drawing of Gulf Coast Cogeneration Project

The existing refinery has several old gas-fired heaters that currently produce steam for the refinery. Emissions from these are causing air quality concerns. There is pressure to eliminate this problem by having an alternate source of steam as soon as possible.

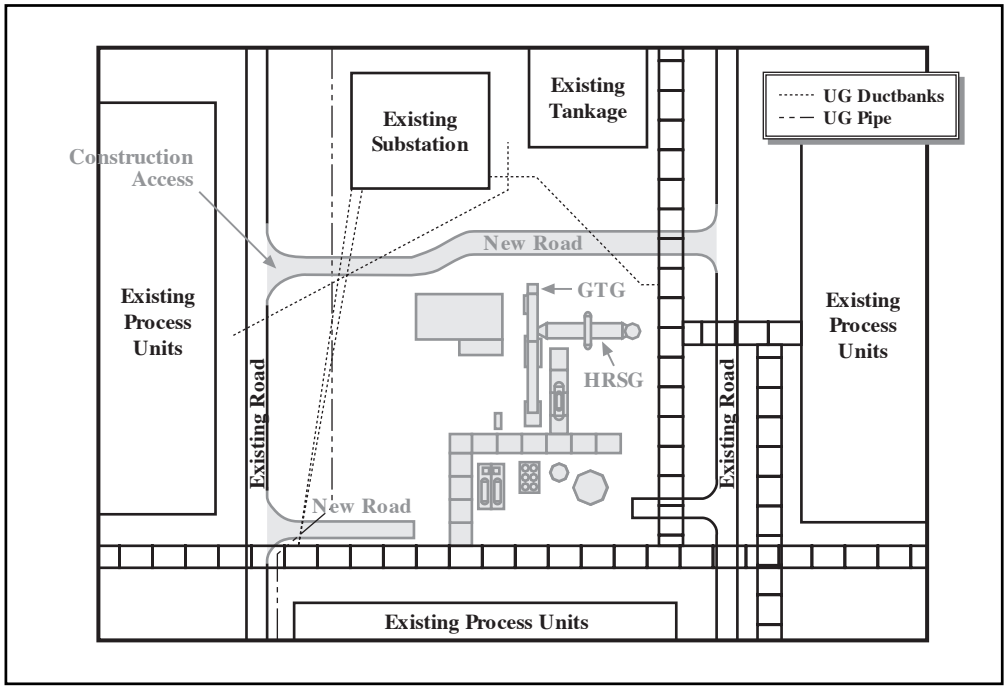


Figure 3.2. Site Layout for Example Gulf Coast Cogeneration Project

Step 1: Review Project Objectives and Profile.

The owner's project objectives are listed as follows, in order of priority:

1. Complete construction with zero accidents.
2. Complete construction and achieve mechanical completion in less than 18 months.
3. Meet operational requirements of 35 MW electricity and 330,000 pounds per hour of steam.
4. Complete project within allocated projected cost of $32 million.
5. Minimize design and construction rework to less than 3 percent of design work-hours and field labor work-hours.
6. Maximize project participants' satisfaction through incentives.

Some of these objectives would not influence the selection of the project delivery and contract strategy alternative. For example, each of the 12 PDCS alternatives will perform equally well at achieving the safety objective. The same is true of the last objective involving incentives. Those objectives that can have an impact on PDCS selection are as follows:

Complete construction and achieve mechanical completion in less than 18 months	Schedule-related
Meet operational requirements of 35 MW electricity and 330,000 pounds per hour of steam	Quality-related
Complete project within allocated project cost of $32 million	Cost-related
Minimize design and construction rework to less than 3 percent of design work-hours and field labor work-hours	Quality-related

In addition to these objectives it is worth noting that the project will be constructed in a confined space within an operating refinery (see Figure 3.2). As such, interaction with existing operations and the owner's involvement in project execution could be significant. This is also the owner's first cogeneration project. With the objectives and project execution environment in mind, factors relevant in this case will be identified.

Step 2: Launch Excel® Workbook and Review List of Selection Factors.

The Excel® file is opened and the selection factors in the Worksheet "Factors & Options" are considered.

Given the objectives and project execution environment, the selection factors that are regarded as most appropriate for consideration in this case are:

Factor 1:	Completion within original budget	(Control cost growth)
Factor 7:	Early completion is critical	(Ensure shortest schedule)
Factor 8:	Early procurement of equipment	(Promote early procurement)
Factor 9:	Above-normal level of changes	(Ease of change incorporation)
Factor 13:	Owner desires high degree of control	(Maximize owner's controlling role)

Comments on Selection Factors and Project Objectives:

- Since early procurement is required to ensure the shortest schedule, including both Factors 7 and 8 in the analysis would amount to double counting. Factor 8, "Promote early procurement," will be dropped from the analysis.
- Given that the project was to be constructed in an area surrounded by existing operating facilities with numerous underground installations and tie-ins to existing facilities, it was anticipated that a significant number of changes would be required in the course of project execution. This led to the inclusion of Factor 9 in the analysis.
- A new facility type for the owner, need to control tie-ins to existing facilities, and achievement of the quality-related objectives (customer satisfaction) all point to the inclusion of Factor 13, "Maximize owner's controlling role," in the analysis.
- Factors 1 and 7 are included in the analysis to address the related project objectives. Factor 7 is selected in this case because the proposed schedule for the project is tight and it is only by focusing on the shortest schedule that the objective of completion in less than 18 months can be met. Factor 1 is selected because the owner has $32 million budgeted for this project and no more money is available.

Step 3: Rank Selection Factors

The Worksheet "Analysis" is opened and the chosen factors are entered in the rank column, as shown in Figure 3.3. Factor 7 is the first ranked factor because it will help achieve the highest priority objective, completing construction in less than 18 months. Factor 1 is ranked second because the budget of $32 million is very tight. Since the owner wants to be able to make design modifications as design develops, Factor 9 is included and ranked third to insure that the technical and quality objectives are achieved. Finally, because of tie-ins to the existing operating facility, the owner wants a major controlling role. However, this is not as important as the other three selection factors. Thus, Factor 13 is ranked fourth. Figure 3.3 illustrates this input.

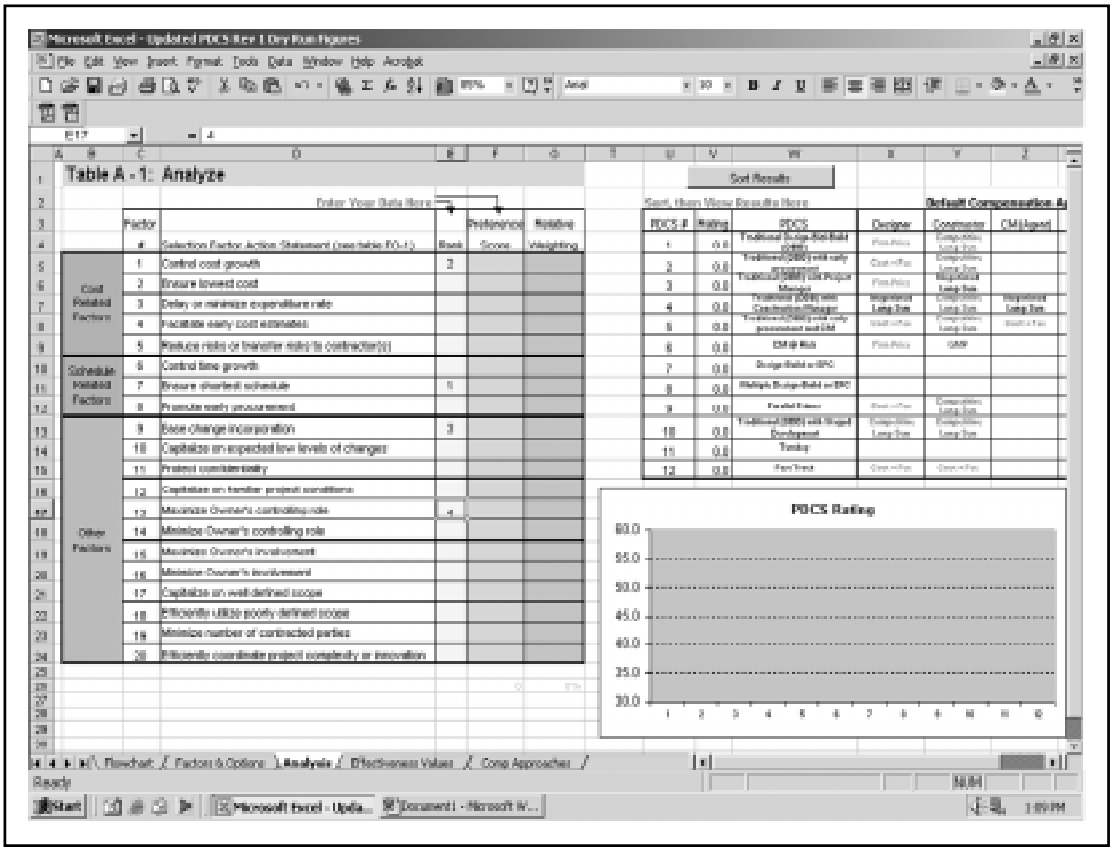


Figure 3.3. Ranking Selection Factors for Cogeneration Project

Step 4: Assign Preference Score

On the "Analysis" Worksheet, enter the Preference Score in the appropriate column. According to the procedure, the first ranked selection factor, Factor 7, "Ensure shortest schedule," is given a 100. Since staying within the budget is ranked second but not quite as critical as schedule completion, a Preference Score of 85 is assigned to Factor 1. The owner wants to influence the design so Factor 9, "Ease of change incorporation," is important to insure the project technical requirements are met, especially steam production. This factor is slightly less important than Controlling Cost Growth. Thus, a Preference Score of 75 is assigned. Factor 1 and 9 work hand-in-hand so care has to be taken to avoid scope creep that would impact cost. Maximizing Owner's Controlling Role is important to insure a smooth interface with existing refinery operations but not as critical as Factors 1, 7, and 9. On this basis, Factor 13 is assigned a Preference Score of 50. Figure 3.4 illustrates this input.

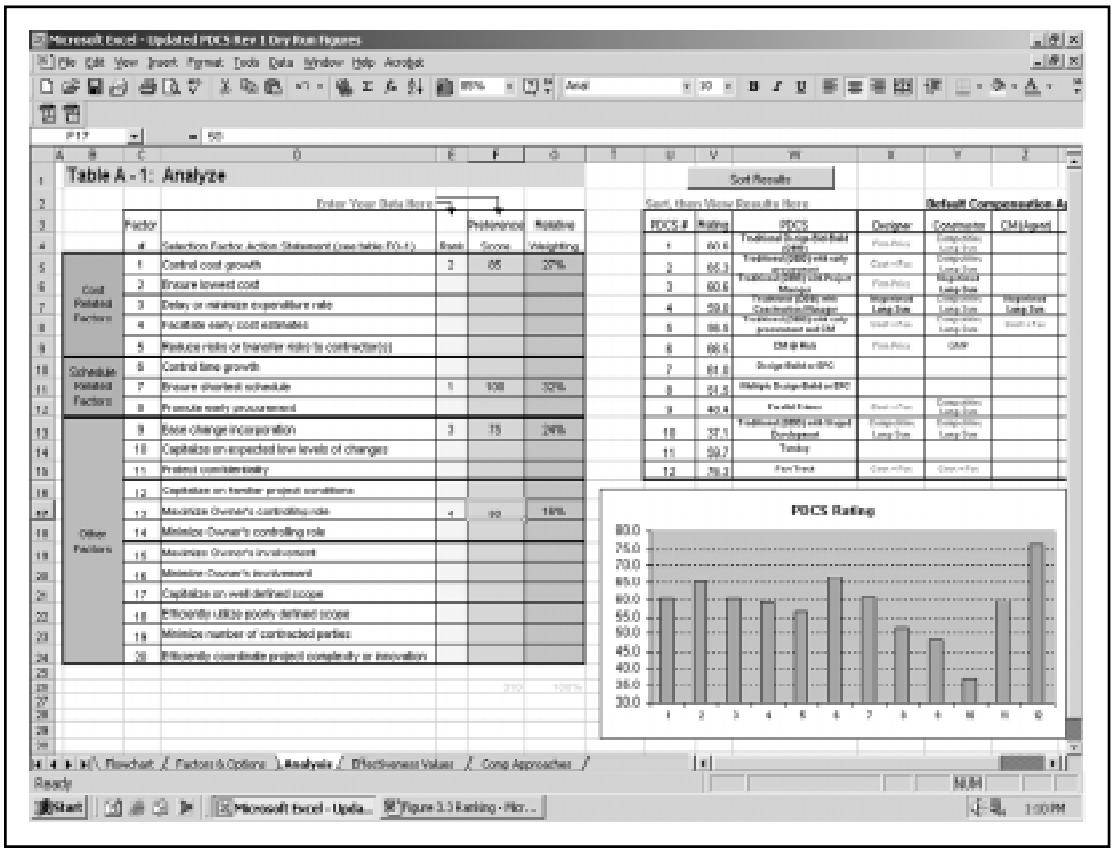


Figure 3.4. Preference Scores for Cogeneration Project

Step 5: Sort and Review Results

The sort button on the "Analysis" Worksheet is selected. Clicking on this button sorts the PDCS alternatives by their respective ratings from the highest rating to the lowest. The histogram shown in Figure 3.5 shows these results based on the four selection factors and their relative weightings. The top six ranked PDCS alternatives are:

PDCS 12 Fast Track

PDCS 6 CM @ Risk

PDCS 2 Traditional with Early Procurement

PDCS 7 Design Build

PDCS 3 Traditional with Project Manager (Agent)

PDCS 1 Traditional Design-Bid-Build

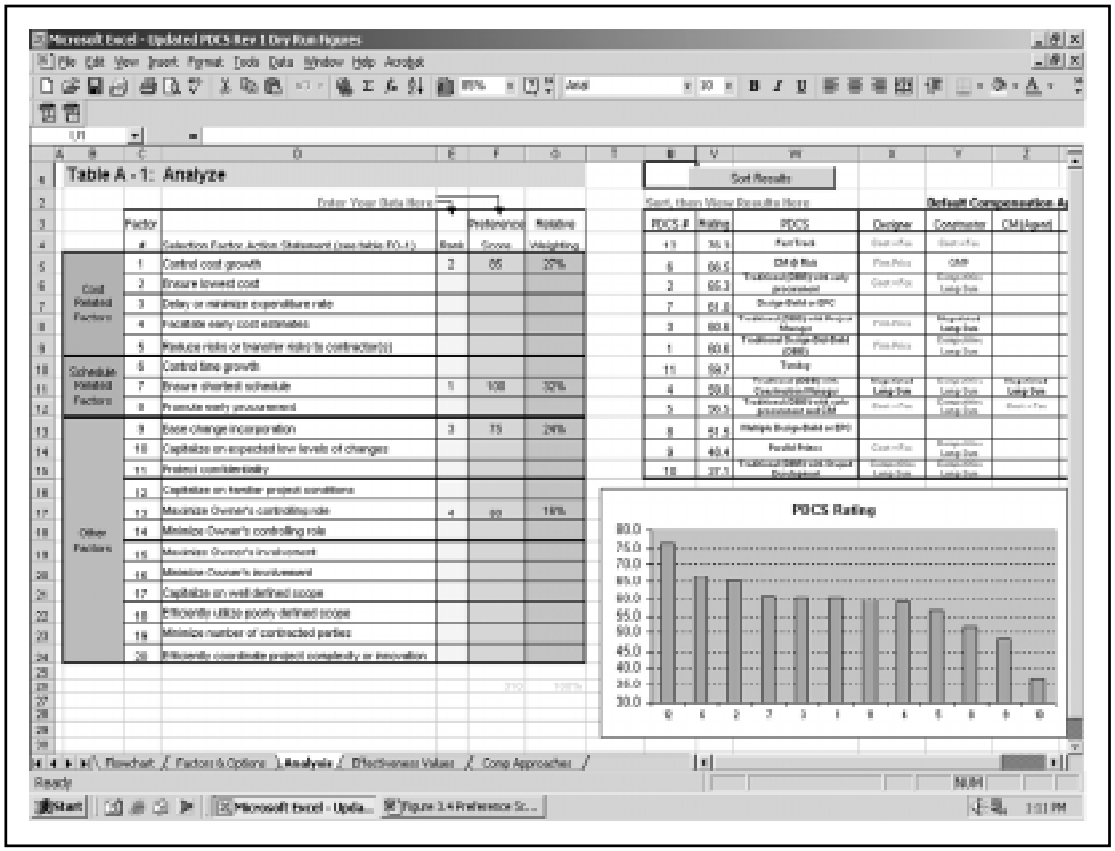


Figure 3.5. Sort Results for Cogeneration Project

Step 6: Analyze Top Three PDCS Alternatives

Based on the review of the histogram in Figure 3.5, the top three highest scoring alternatives that will be analyzed in more detail are:

PDCS 12 (Fast Track)	76.3
PDCS 6 (CM @ Risk)	66.5
PDCS 2 (Traditional with Early Procurement)	65.3

The strengths and weaknesses of each of these PDCS alternatives can be analyzed by reviewing the effectiveness values for each selection factor. Table EV-1 found under the "Effectiveness Values" Worksheet should be reviewed. As presented in Figure 3.6, the effectiveness values for PDCS 12 show that this alternative is strongest on shortest

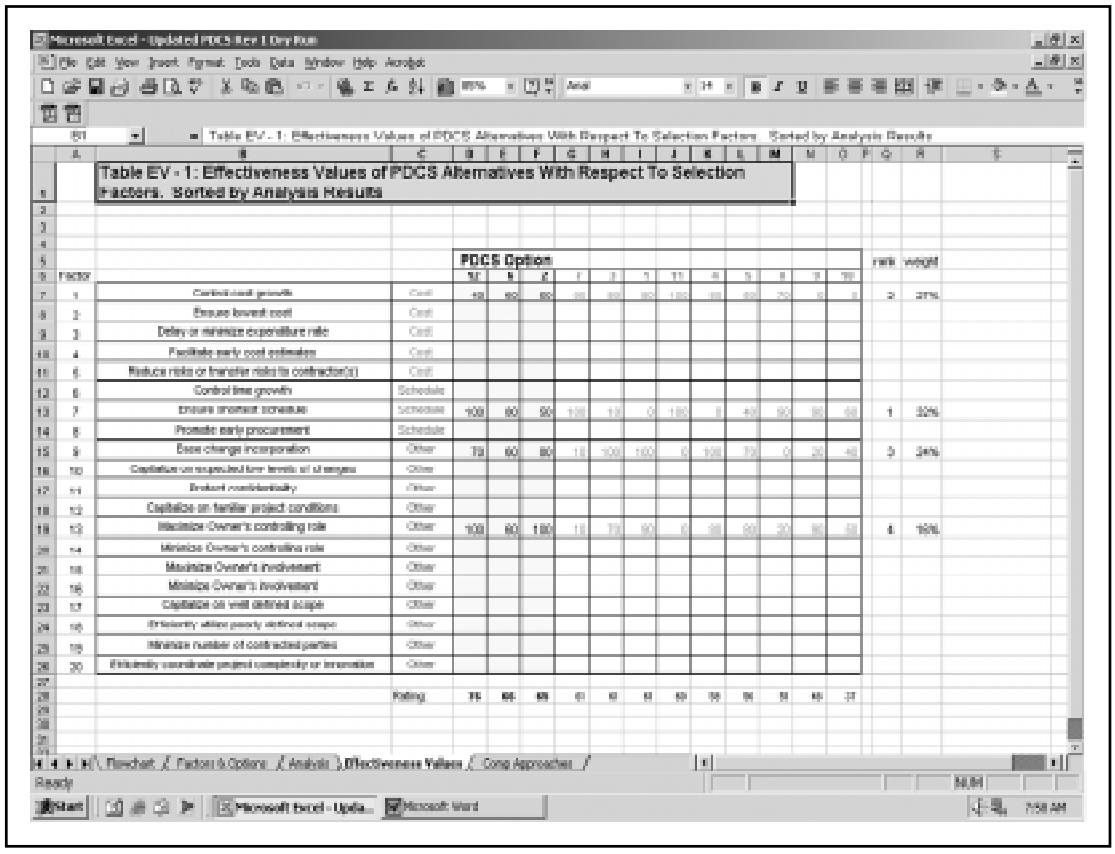


Figure 3.6. Effectiveness Values for Cogeneration Project

schedule and can maximize owner's controlling role (both 100). However, PDCS 12 is not strong on controlling cost growth so care has to be taken when managing the budget. PDCS 12 is better than average for ensuring change incorporation. PDCS 6 is not very strong on any of the four selection factors except for Shortest Schedule. In this case, PDCS 6 is better than average (80), but is not the best performing PDCS on schedule. PDCS 2 is only average in terms of performance on schedule and cost factors (50). However, this PDCS is better than average on change incorporation and maximizing the owner's controlling role. Based on this analysis, PDCS 12 appears to be the best alternative. However, the compensation approaches for each alternative are reviewed before making the final decision.

Step 7: Review/Refine Default Compensation Approaches.

The default compensation approaches are as follows:

PDCS 12 Default Compensation Approaches:

Designer:	Cost Reimbursable + Fee
Constructor:	Cost Reimbursable + Fee

PDCS 6 Default Compensation Approaches:

Designer:	Firm Price
CM @ Risk (Constructor):	GMP

PDCS 2 Default Compensation Approaches:

Designer:	Cost Reimbursable + Fee
Constructor:	Competitive Lump Sum
Supplier:	Competitive Lump Sum

The user should view the Compensation Approach Charts provided in the "Factors & Options" Worksheet or in the 11 by 17 foldout in the jacket of IR165-2 when reviewing the default compensation approaches.

Design Contract

As shown in the Compensation Approach Charts, a firm price contract would require that design contract information be defined to a relatively high level before awarding the design contract. This would require more time in developing the conceptual designs before the detailed design contract could be awarded, while at the same time the owner's design control effort and design budget risk would have to be minimized.

On the other hand, a cost reimbursable + fee contract would allow an early award of the design contract and thus, a quick commencement of design work. Although this imposes a significant amount of risk with respect to the budget for design services on the owner, the design contract would typically represent a small portion of the overall project cost. The risk associated with the design contract would therefore be small compared to the overall project budget. Similarly, the effort required of the owner in controlling the design contract, in the context of the overall project, would be relatively small. Since time is of the essence on this project, the preferred compensation approach for the design contract would be cost reimbursable + fee.

Construction Contract

A negotiated cost reimbursable + fee contract would provide the fastest way to contract for construction services for this project. This approach would eliminate the lengthy bid process and extensive design development required for a competitive lump sum contract as shown in the Compensation Approach charts. The Compensation Approach charts, however, show that the cost reimbursable + fee contract would place a high level of construction control effort and construction budget risk on the owner. A large portion of the construction cost, however, would go to procurement of large pieces of equipment (the HRSG and the GTG), which would be determined early in the project cycle, and thus control effort and risks become substantially lower. The cost reimbursable compensation approach would also facilitate the owner's controlling role during construction when tie-ins to existing facilities are required.

Based on the foregoing, the preferred compensation approach for the construction contract would be cost reimbursable + fee. It should be noted that the GMP compensation approach (PDCS 6) typically consists of a cost reimbursable + fee approach with the addition of a maximum price that the constructor/CM @ Risk guarantees to the owner so as to limit the owner's budget risk. Therefore, the construction contract could be awarded quickly as a cost reimbursable + fee contract and a GMP could be established during execution of the project.

Supplier Contract

Supplier contracts are usually based on firm price quotations. The competitive lump sum contract provided would be preferred for the supply contract for this project, if required.

Step 8: Choose Project Delivery and Contract Strategy

No special factors are involved in this project and the final decision would be a straightforward selection of one of the three top scoring alternatives. Of the three alternatives, PDCS 2 is least able to address the need for speedy execution of the project, while PDCS 6 least addresses the requirement for owner involvement and change incorporation. PDCS 12 has the best overall effectiveness values for the four selection factors as well as the highest rating.

Therefore, the final decision is to use PDCS 12 (Fast Track) with cost reimbursable + fee compensation approaches for both design and construction contracts.

Comment:

> The same firm could be the designer and constructor if the owner desires a single contract. In this case, PDCS 12 is similar to PDCS 7, Design-Build, except a single cost reimbursable compensation approach would be used.

Documentation of the results from the PDCS selection process is extremely important. Figure 3.7 provides an Executive Summary of the PDCS results for the Gulf Coast Cogeneration Project using the template found in Appendix 7.

Project Delivery and Contract Strategy Selection Analysis
Gulf Coast Cogeneration Project
Executive Summary

Project Objectives

The key project objectives that influenced the PDCS selection are summarized below in order of priority:

1. Complete construction and achieve mechanical completion in less than 18 months.
2. Meet operational requirements of 35 MW electricity and 330,000 pounds per hour of steam.
3. Complete project within allocated project cost of $32 million.
4. Minimize design and construction rework to less than 3 percent of design work-hours and field labor work-hours.

Other criteria that influence PDCS selection include procurement of long lead equipment requirements for the GTG and HRSG, the new Cogeneration facility is surrounded by existing facilities, piping tie-ins to existing operating facilities are required, and project is new type for owner.

Key Selection Factors

The following table summarizes the Selection Factors identified and why these factors were chosen:

Factor Number	Factor Action Statement	Rationale for Factor	Supporting Objective or Other Criteria
7	Ensure shortest schedule	Critical to completing project as early as possible to maximize benefits and mitigate air quality problem.	Complete construction and achieve mechanical completion in less than 18 months
1	Control cost growth	Only have $32 million to spend and no more.	Complete within the allocated project cost of $32 million.
9	Ease change incorporation	Modify scope and design as design develops, also potential impact of underground utilities is uncertain.	Meet technical requirements related to capacity and control rework.
13	Maximize owner's controlling role	Control tie-ins to operating facility.	New facility type and surrounded by existing operations

Figure 3.7. Executive Summary for Gulf Coast Cogeneration Project PDCS Selection

Relative Weighting

The Preference Scores for each Selection Factor are:

Factor 7 – 100 because top priority objective

Factor 1 – 85 because budget is fixed but not quite as important as project schedule

Factor 9 – 75 because of ability to modify scope and possibly avoid scope creep, therefore, weight slightly less than Factor 1

Factor 13 – 50 because tie-ins are required and control is important but not as important as Factors 7, 1, and 9

Results

The top three PDCS alternatives are:

PDCS 12: Fast Track with Cost Reimbursable plus Fee with Designer and Constructor

PDCS 6: CM @ Risk with Firm Price for Designer and GMP for the Constructor

PDCS 2: Traditional with Early Procurement with Cost Reimbursable plus Fee for Designer, Competitive Lump Sum for the Constructor, and Competitive Lump Sum for the Supplier.

PDCS 12 is best fit in supporting the primary objective of completing in less than 18 months. This PDCS is also the best fit for maximizing the owner's controlling role. This alternative is better than average for allowing changes during design. However, it is least effective in controlling cost growth. Because the level of information available at time of contract award will likely be low, the cost reimbursable compensation approach appears to be the best suited approach for both design and construction. This approach also insures that the owner can be involved in critical aspects of design and construction. The owner will have to be careful in managing costs. Neither PDCS 6 nor PDCS 2 are strong on shortest schedule when compared to PDCS 12. PDCS 2 tends to be stronger on allowing change and maximizing the owner's role. These are lower priority Selection Factors. PDCS 6 is only slightly above average on the other factors.

Post-Analysis

Since this is the owner's first Cogeneration facility, owner management will want to be involved in a controlling role during design and construction execution. Otherwise, no other major external factors influence the decision.

Recommendation

PDCS 12: Fast Track with Cost Reimbursable plus Fee is the best suited PDCS for this project. Consider using incentives to insure that the budget is met.

Figure 3.7. Executive Summary for Gulf Coast Cogeneration Project PDCS Selection (continued)

3.2 Federal Courthouse

A Federal Courthouse project under the auspices of the U.S. General Services Administration (GSA) consists of construction of a new 205,000 square feet facility on a previously developed site. As a government agency, GSA would normally award a contract to the lowest bidder and seek to complete the project within the budgeted cost. Typically, GSA retains the services of construction managers (agents) to supplement in-house resources in managing such capital projects and in performing constructability reviews.

Step 1: Review Project Objectives and Profile.

GSA's project objectives are listed as follows, in order of priority:

1. Complete project within budgeted cost.
2. Conform to space allocation.
3. Appearance of building must project appropriate image.
4. Accommodate special security requirements.
5. Provide capability for future facility expansion.

These objectives can be categorized as follows:

Complete project within budgeted cost	Cost
Conform to space allocation	Quality
Appearance of building must project appropriate image	Quality
Accommodate special security requirements	Quality
Provide capability for future facility expansion	Quality

With these objectives in mind, factors relevant in this case are identified.

Step 2: Launch Excel® Workbook and Review List of Selection Factors.

The Excel® file is opened and the selection factors in the Worksheet "Factors & Options" are considered. The selection factors that are regarded as most appropriate for consideration in this case are:

Factor 1:	Completion within original budget	(Control cost growth)
Factor 3:	Owner's cash flow for project is constrained	(Delay or minimize expenditure rate)
Factor 13:	Owner desires a high degree of control/influence	(Maximize owner's controlling role)
Factor 20:	Project is complex/innovative	(Efficiently coordinate complexity)
Factor 19:	Owner prefers minimal number of parties	(Minimize # of contracted parties)

Comments on Selection Factors and Project Objectives:

- Factor 1 is an obvious inclusion since it directly addresses the owner's preference for completing the project within budget.
- GSA operates in an environment where the process for appropriating funds for projects constrains when money for design and construction is authorized. This situation will be reflected in the selection analysis by the inclusion of Factor 3.
- The second through fifth objectives that the owner specified are categorized as quality-related objectives. In the context of delivery systems and contract strategies, quality is synonymous with customer satisfaction. Assurance of customer satisfaction depends on the extent of the owner's controlling role in the project. Therefore, Factor 13 is included to address customer satisfaction issues.
- The intricate requirements on the project, including providing for special security features, capability for future expansion, and projected image, qualify the project as complex from the owner's perspective. Factor 20 is included to address these issues.
- Typically, GSA prefers to deal with a minimal number of parties on projects due to limited staffing levels. Therefore, Factor 19 is included in the set of selection factors for this project.

Step 3: Rank Selection Factors

The Worksheet "Analysis" is opened and the chosen factors are entered, as shown in Figure 3.8. Factor 1, Control Cost Growth, is ranked first because it will help achieve the highest priority objective, completing the project within budgeted cost. Factor 3, Delay or Minimize Expenditure Rate, is ranked second. Federally funded projects receive funds through Congressional appropriation. This appropriation typically occurs in phases related to design and construction. A PDCS alterative that requires sequential design and construction best fits this funding limitation. Because quality, and particularly aesthetics, is extremely important for Federal Courthouses, emphasis on GSA's involvement in design is critical. Thus, Factor 13, Maximize Owner Involvement, is ranked third. Federal Courthouses have unique features. In this case, future expansion is critical as well. These issues create complexity in design and construction and require innovation from the

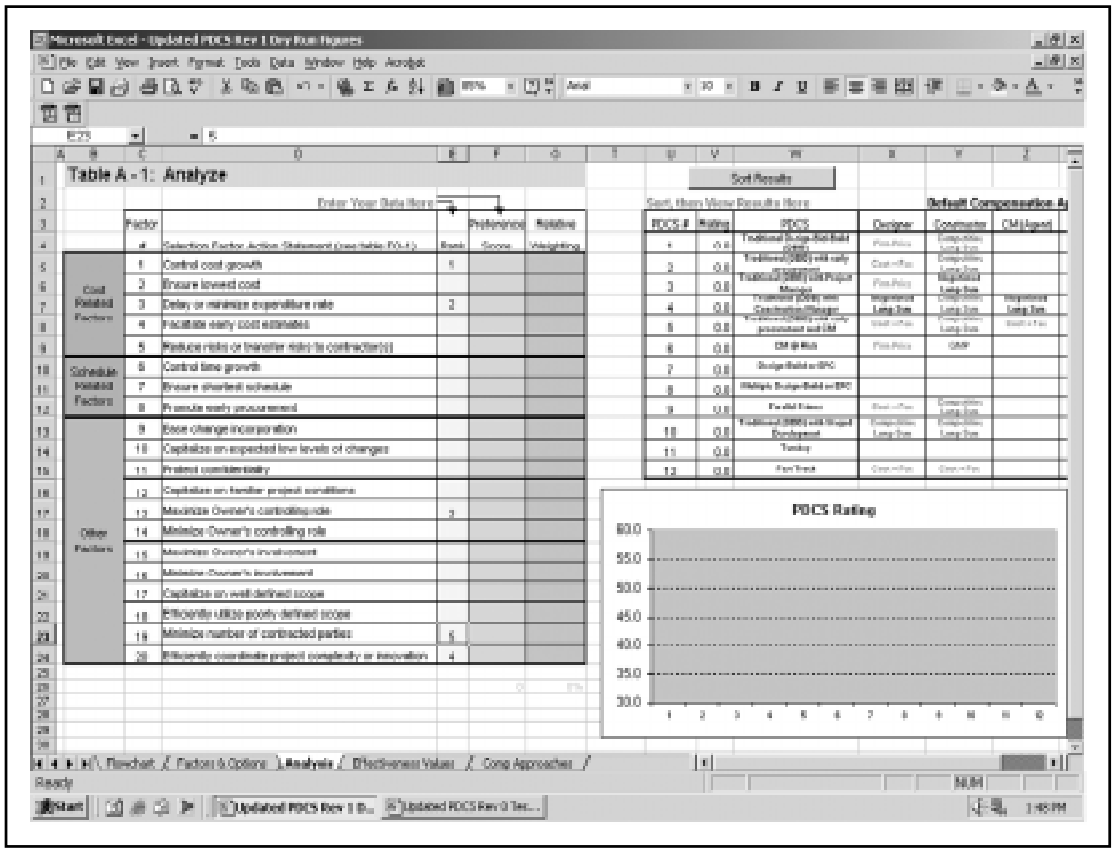


Figure 3.8. Ranking Selection Factors for Courthouse

designer. Constructability could be an issue. Thus, Factor 20, Efficiently Coordinate Complexity, is ranked fourth. Minimizing the number of contracted parties was the fifth rank factor. This factor is not as important in this project as compared to the other factors.

Step 4: Assign Preference Score

On the "Analysis" Worksheet, enter the Preference Score in the appropriate column (see Figure 3.9). According to the procedure, the first ranked selection factor, Factor 1, Control Cost Growth, is given a 100. This is by far the most important selection factor as Congress only appropriates specified amounts. Factor 3 is important and is considered critical to insure Federal funding procedures are followed. This factor is given a weight of 60. Factor 1 and 3 are by far the most important in terms of weighting. The remaining

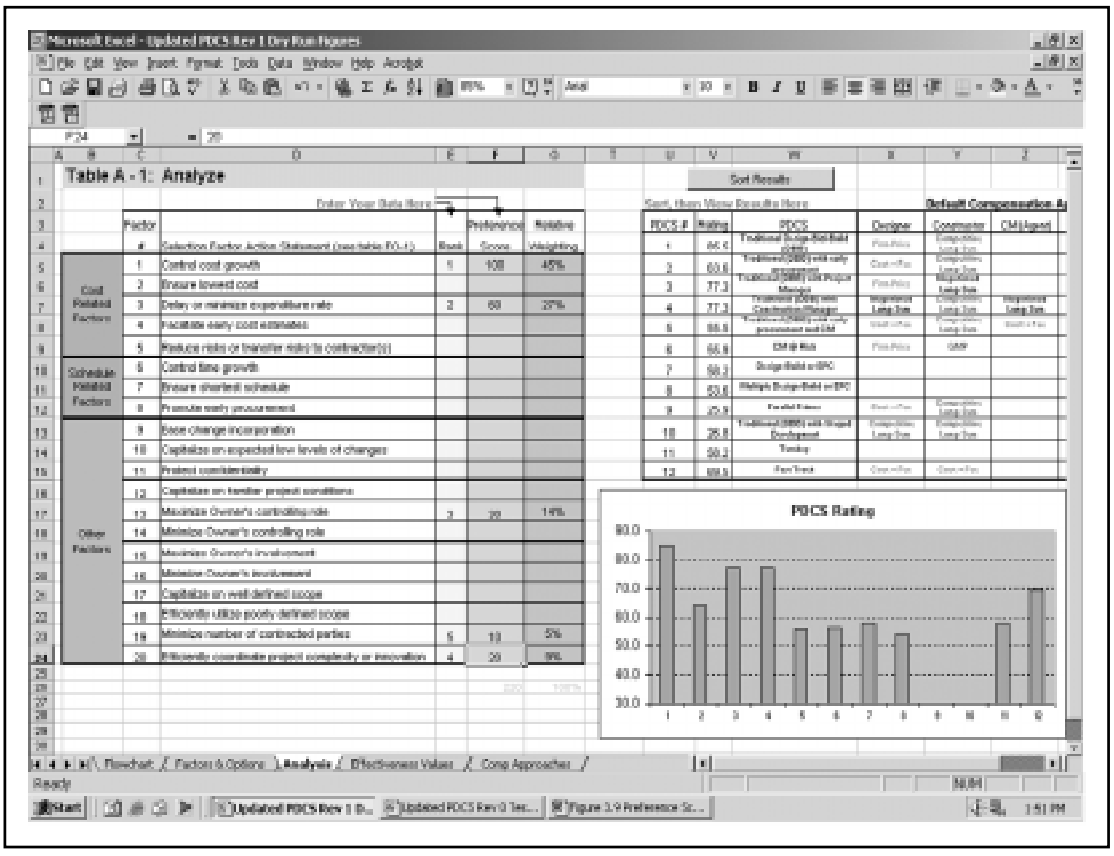


Figure 3.9. Preference Scores for Courthouse

factors are given a much lower weight. Factor 13 is assigned a 30. While GSA wants to exert a controlling role, it has to be careful not to allow scope creep as this could impact cost. GSA wants to insure that the design basis achieves the quality objectives, but does not want to be involved in the details of the design. Both complexity and minimizing the number of contracted parties (Factors 20 and 19 respectively) have a much lower priority in terms of weight, as shown in Figure 3.9.

Step 5: Sort and Review Results

The sort button on the "Analysis" Worksheet is selected. Clicking on this button sorts the PDCS alternatives by their respective ratings from the highest rating to the lowest. The histogram shown in Figure 3.10 displays these results based on the five selection factors and their relative weightings.

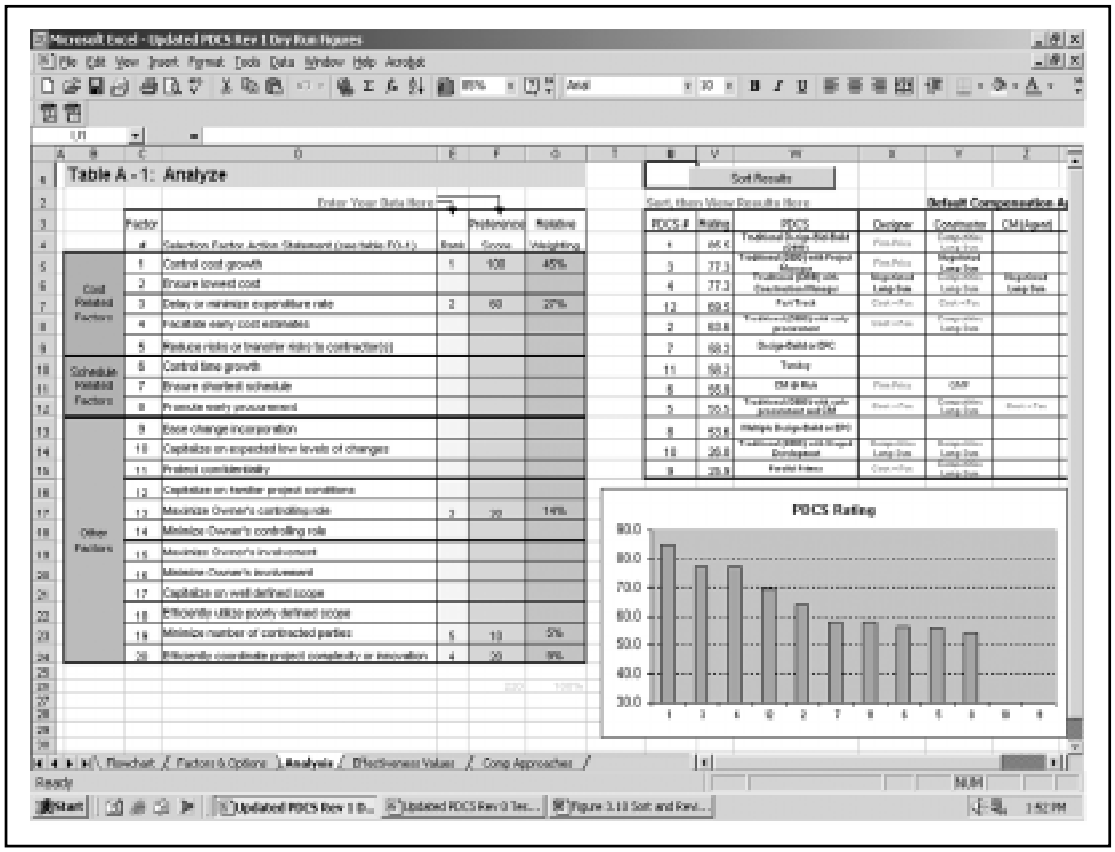


Figure 3.10. Sort and Review for Courthouse

The top six ranked PDCS alternatives are:

PDCS 1	Traditional Design-Bid-Build
PDCS 3	Traditional with PM (Agent)
PDCS 4	Traditional with CM (Agent)
PDCS 12	Fast Track
PDCS 2	Traditional with Early Procurement
PDCS 7	Design Build

Note that PDCS 10 and 9 do not show on the histogram because their rating is less than 30, the cut off rating for the histogram. However, the ratings for these two PDCS alternatives are shown in the table above the histogram in Figure 3.10 as 26.8 and 25.9, respectively.

Step 6: Analyze Top Three PDCS Alternatives

Based on the review of the histogram in Figure 3.10, the top three highest scoring alternatives that will be analyzed in more detail are:

PDCS 1	Traditional Design-Bid-Build	85.5
PDCS 4	Traditional with CM (Agent)	77.3
PDCS 12	Fast Track	69.6

In this case, PDCS 3, Traditional with PM (Agent) was dropped from consideration. This PDCS alternative provides the same result as PDCS 4. However, since it does increase the number of contracted parties and GSA prefers to use the Construction Manager approach, PDCS 4 is included in lieu of PDCS 3.

The strengths and weaknesses of each of these PDCS alternatives can be analyzed by reviewing the effectiveness values for each selection factor. Table EV-1 found under the "Effectiveness Values" Worksheet should be reviewed. As presented in Figure 3.11, the effectiveness values for PDCS 1 and 4 perform above average on Controlling Cost

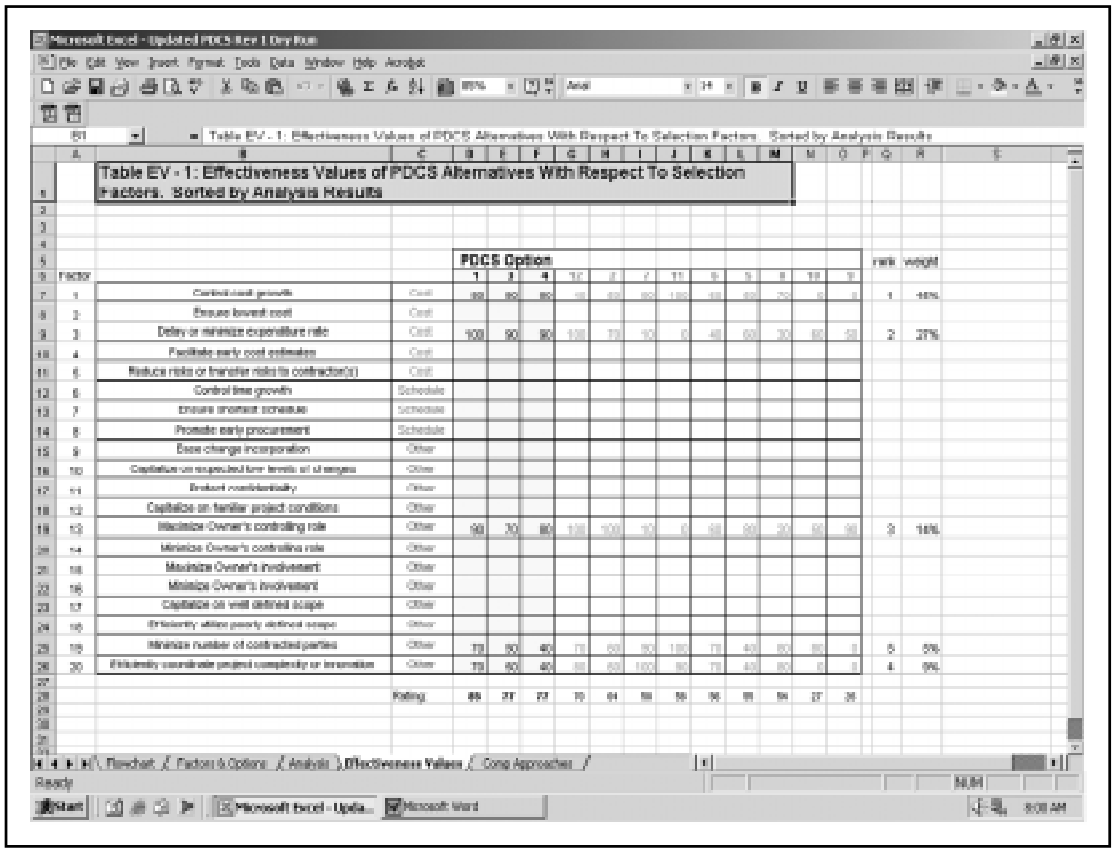


Figure 3.11. Effectiveness Values for Courthouse

Growth, although these two PDCS alternatives are not the best performing alternatives. PDCS 12 performs below average on controlling cost growth. All three alternatives perform very high on controlling cash flow (Factor 3). This factor is the second highest weighted selection factor. Likewise, all three perform above average on maximizing the GSA's controlling role. This is important to insure quality objectives are met. PDCS 1 and 12 perform above average on Factors 19 and 20, while PDCS 4, CM Agent performs below average against these two factors. However, the weights are very low on Factors 19 and 20 so their impact on meeting the project objectives may not be as great.

Step 7: Review/Refine Default Compensation Approaches.

The default compensation approaches are as follows:

PDCS 1 (Traditional) Default Compensation Approaches:

Designer: Firm Price

Constructor: Competitive Lump Sum

PDCS 4 (Traditional with CM) Default Compensation Approaches:

Designer:	Negotiated Lump Sum
Construction Manager (Agent):	Negotiated Lump Sum
Constructor:	Competitive Lump Sum

PDCS 12 (Fast Track) Default Compensation Approaches:

Designer: Cost Reimbursable plus Fee

Constructor: Cost Reimbursable plus Fee

Design Contract

Design contracts in public agencies typically are firm price, requiring the highest level of conceptual design definition. Because speed is less important than cost performance in this case, taking the necessary time during the conceptual design stage for proper definition would align with the overall project objectives. Thus, the firm price contract would be more suitable. In the event that PDCS 4 or PDCS 12 is selected, a firm price contract would be used for the owner-designer relationship.

CM (Agent) Contract

Project managers and construction managers usually are selected because of their expertise. Although the lump sum/firm price contract requires the highest level of scope definition before award, the project information required to attain such a level of scope definition for agency contracts is usually limited. Cost or schedule risks usually are excluded from the agent's scope. Also, experience gleaned from previous projects provides a good basis for setting firm price contracts for agency services with less information than would be required for similar compensation approaches for the main contract. One advantage of using a CM is allowing the CM to provide constructabilty input on the design

earlier in the design process. Also, the CM can provide more realistic construction budgets and schedules for the owner. Thus, the CM can help the owner control cost growth. This requires contracting for CM services prior to having a complete design package. A firm price compensation approach would be acceptable as the CM services are typically a small percent of construction cost and the owner has experience with this approach. Therefore, a firm price contract would be suitable for the CM (Agent) contract.

Constructor Contract

As a public agency, GSA would award the construction contract on a lump sum basis after competitive bidding. The competitive lump sum contract would require completion of design before award of the construction contract. The competitive lump sum contract also would minimize the owner's construction contract control effort and budget risk. Typically, public agency projects place more emphasis on cost considerations rather than speedy execution. A competitive lump sum contract for construction, therefore, would be most suitable on this project.

Step 8: Choose Project Delivery and Contract Strategy

Documentation of the results from the PDCS selection process is extremely important. Figure 3.12 (next page) provides an Executive Summary of the PDCS results for the Federal Courthouse project using the template found in Appendix 7.

GSA has had success in the past on similar projects using the traditional design-bid-build approach with an agency construction manager (PDCS 4). This approach came in a close second to the traditional design-bid-build approach (PDCS 1). With a firm price contract for the designer and CM (Agent) and a competitive lump sum contract for the constructor, the only difference between these two alternatives is the inclusion of a CM (Agent) in PDCS 4.

The supplemental services offered by the CM (Agent) would complement in-house efforts and contribute to project success. Also, considering the previous successes recorded with PDCS 4 and GSA's familiarity with this approach, it was decided that PDCS 4, Traditional Design-Bid-Build with agency Construction Manager would be used for this project. Firm price contracts would be used for the design and CM (Agent) services, while a competitive lump sum contract would be used for the construction services.

Project Delivery and Contract Strategy Selection Analysis
Federal Courthouse Project
Executive Summary

Project Objectives

The key project objectives that influenced the PDCS selection are summarized below in order of priority:

1. Complete project within budgeted cost.
2. Conform to space allocation.
3. Appearance of building must project appropriate image.
4. Accommodate special security requirements.
5. Provide capability for future facility expansion.

Another criterion that influences PDCS selection includes the fact that GSA is a public agency and must follow Federal procurement laws.

Key Selection Factors

The following table summarizes the Selection Factors identified and why these factors were chosen:

Factor Number	Factor Action Statement	Rationale for Factor	Supporting Objective or Other Criteria
1	Control Cost Growth	Congress appropriates a given sum of money for the project; this sum cannot be exceeded.	Complete project within the budgeted cost.
3	Delay or Minimize Expenditure Rate	The project cash flow must be consistent with funds appropriation by project phase.	Meet Federal requirements for allocating funds to capital projects.
13	Maximize Owner's Controlling Role	GSA wants to insure that customer is satisfied.	Meet all technical requirements and other special features.
20	Efficiently Coordinate Project Complexity or Innovation	Project has special security features and other design requirements that require innovation from the designer.	Meet all technical requirements and other special features.
19	Minimize Number of Contracted Parties	Generally, this is a GSA preference for capital project work.	Limited resources to manage project; therefore, minimize parties involved.

Figure 3.12. Executive Summary for Federal Courthouse Project PDCS Selection

Relative Weighting

The Preference Scores for each Selection Factor are:

Factor 1 – 100 because top priority objective

Factor 3 – 60 because must be consistent with timing of funds appropriation

Factor 13 – 30 because of ability to modify scope early in design and possibly avoid scope creep; also, owner can be more involved in contract administration during construction

Factor 20 – 20 because some innovation is required from designer (historically this is not a major concern)

Factor 19 – 10 because not a major concern on this project and GSA has experience working with multiple parties

Results

The top three PDCS alternatives are:

PDCS 1: Traditional Design-Bid-Build with Firm Price with Designer and Competitive Lump Sum with Constructor.

PDCS 4: CM (Agent) with Negotiated Lump Sum for Designer and CM and Competitive Lump Sum for Constructor.

PDCS 12: Fast Track with Cost Reimbursable plus Fee for Designer and the Constructor.

GSA has had success in the past on similar projects using the traditional design-bid-build with a CM agent. While this is not the top rated PDCS, this alternative meets the three top objectives of controlling cost growth, controlling cash flow, and maximizing GSA's controlling role when necessary. This approach does provide the opportunity for constructability analysis if the CM is under contract early in the design phase. The CM can also aid GSA in controlling cost through the development of realistic budgets. The compensation approach for design and CM services can be changed to Firm Price to be consistent with traditional design-bid-build contracting practices.

Post-Analysis

No other major external factors influence the decision.

Recommendation

PDCS 4: CM (Agent) with Firm Price for Designer and CM and Competitive Lump Sum for Constructor. CM Agent is a typical GSA approach for this type of project.

Figure 3.12. Executive Summary for Federal Courthouse Project PDCS Selection (continued)

4.0 Conclusions

An integrated project delivery and contract strategy provides the framework for executing capital projects. Owners find it desirable to select the framework that facilitates efficient execution of capital projects. The selection procedure and tool are proven aids for decision-makers in selecting the appropriate PDCS for capital projects.

The benefits of using this PDCS selection procedure and decision support tool include:

- Consideration of a larger set of relevant alternatives in the PDCS selection process.
- Consideration of well-defined selection factors that relate to the owner's project objectives and other critical project requirements.
- Provision of a defensible rationale for PDCS selection based on quantification of alternatives.
- Improvement over current practices of non-systematic, holistic assessment of alternatives.
- Enhancement of insight into PDCS selection through systematic consideration of many important decision variables.
- Encourage decision-makers to identify and focus on project objectives and other critical success factors early in project development.

The PDCS selection procedure and tool should be used as a standard. The procedure and tool are easy to use and ultimately align owner project objectives with the PDCS selected for capital projects.

In cases where higher scoring alternatives differ from those allowed by law, or are preferred because of familiarity or corporate culture, the ratings would give the difference between that which is allowed/preferred and that which is most suitable. Examining effectiveness values for each PDCS alternative would also help provide a basis for understanding strengths and weaknesses between the preferred and most suitable PDCS. Appropriate actions can then be identified to ensure success of the most suitable PDCS. Such quantification may be useful in convincing policy makers of the need to allow flexibility in the choice of project delivery and contract strategies.

An iterative process may be used in the Excel® file to identify the set of preference scores/weights that would lead to a desired project delivery and contract strategy (i.e., highest rating). This approach is not recommended. The user is encouraged to provide the best estimate of the preference scores for each factor. Sensitivity analyses can then be performed by adjusting a preference score for a single factor while holding the others constant. The user may obtain quantitative insight from this type of sensitivity analysis into the emphasis placed on different factors in order for the tool to select the desired PDCS alternative.

Appendix 1: Project Delivery and Contract Strategies

Project Delivery and Contract Strategy Alternatives
(with default compensation approaches)

Please refer to large-format diagrams in the binder pockets.

Project Delivery and Contract Strategy Descriptions

PDCS Number	PDCS Name	Description
PDCS 1	Traditional D-B-B	Serial sequence of design and construction phases; procurement begins with construction; owner contracts separately with designer and constructor.
PDCS 2	Traditional with early procurement	Serial sequence of design and construction phases; procurement begins during design; owner contracts separately with designer, constructor, and supplier.
PDCS 3	Traditional with PM	Serial sequence of design and construction phases; procurement begins with construction; owner contracts separately with designer and constructor; PM (Agent) assists owner in managing project.
PDCS 4	Traditional with CM	Serial sequence of design and construction phases; procurement begins with construction; owner contracts separately with designer and constructor; CM (Agent) assists owner in managing project.
PDCS 5	Traditional with early procurement and CM	Serial sequence of design and construction phases; procurement begins during design; owner contracts separately with designer, constructor and supplier; CM Agent assists owner in managing project.
PDCS 6	CM @ Risk	Overlapped sequence of design and construction phases; procurement begins during design; owner contracts separately with designer and CM @ Risk (constructor).
PDCS 7	Design-Build (or EPC)	Overlapped sequence of design and construction phases; procurement begins during design; owner contracts with Design-Build (or EPC) contractor.
PDCS 8	Multiple Design-Build	Overlapped sequence of design and construction phases; procurement begins during design; owner contracts with two Design-Build (or EPC) contractors, one for process and one for facilities.
PDCS 9	Parallel Primes	Overlapped sequence of design and construction phases; procurement begins during design; owner coordinates separate contracts with designer and multiple constructors (or D-B contractor(s)).
PDCS 10	Traditional with Staged Development	Multi-stage, serial sequence of design and construction phases; separate contracts for each stage; procurement begins with construction; Project Manager (Agent) assists owner with project management.
PDCS 11	Turnkey	Overlapped sequence of design and construction phases; procurement begins during design; owner contracts with Turnkey contractor.
PDCS 12	Fast Track	Overlapped sequence of design and construction phases; procurement begins during design; owner contracts separately with designer and constructor.

Appendix 2: Selection Factors

Selection Factors for Project Delivery and Contract Strategy

Factor Number	Selection Factor	Factor Description for Comparing PDCS	Factor Action Statement
Cost-related factors			
1	Completion within original budget is critical to project success.	Project delivery and contract strategy facilitate control of cost growth.	Control cost growth.
2	Minimal cost is critical to project success.	Project delivery and contract strategy ensure lowest reasonable cost.	Ensure lowest cost.
3	Owner's cash flow for the project is constrained.	Project delivery and contract strategy delay or minimize rate of expenditures.	Delay or minimize expenditure rate.
4	Owner critically requires early (and reliable) cost figures to facilitate financial planning and business decisions.	Project delivery and contract strategy facilitate accurate early cost estimates.	Facilitate early cost estimates.
5	Owner assumes minimal financial risk on the project.	Project delivery and contract strategy reduce risks or transfer a high level of cost and schedule risks to the contractor(s).	Reduce risks or transfer risks to contractor(s).
Schedule-related factors			
6	Completion within schedule is highly critical to project success.	Project delivery and contract strategy facilitate control of time growth.	Control time growth.
7	Early completion is critical to project success.	Project delivery and contract strategy ensure shortest reasonable schedule.	Ensure shortest schedule.
8	Early procurement of long-lead equipment and/or materials is critical to project success.	Project delivery and contract strategy promote early design and purchase of long-lead equipment or materials.	Promote early procurement.

Selection Factors for Project Delivery and Contract Strategy

Factor Number	Selection Factor	Factor Description for Comparing PDCS	Factor Action Statement
Other factors			
9	An above-normal level of changes is anticipated in the execution of the project.	Project delivery and contract strategy promote ease of incorporating changes to the project scope during detailed design and construction.	Ease change incorporation.
10	A below-normal level of changes is anticipated in the execution of the project.	Project delivery and contract strategy capitalize on expected low levels of changes.	Capitalize on expected low levels of changes.
11	Confidentiality of business/ engineering details of the project is critical to project success.	Project delivery and contract strategy protect secrecy of business objectives and proprietary technology.	Protect confidentiality.
12	Local conditions at project site are favorable to project execution.	Project delivery and contract strategy capitalize on familiar project conditions.	Capitalize on familiar project conditions.
13	Owner desires a high degree of control/influence over project execution.	Project delivery and contract strategy increase owner's role in managing design and construction.	Maximize owner's controlling role.
14	Owner desires a minimal level of control/influence over project execution.	Project delivery and contract strategy minimize owner's role in managing design and construction.	Minimize owner's controlling role.
15	Owner desires a substantial use of own resources in the execution of the project.	Project delivery and contract strategy promote greater owner involvement in detailed design and construction.	Maximize owner's involvement.
16	Owner desires a minimal use of own resources in the execution of the project.	Project delivery and contract strategy minimize owner involvement in detailed design and construction.	Minimize owner's involvement.
17	Project features are well-defined at award of the design and/or construction contract.	Project delivery and contract strategy capitalize on well-defined project scope prior to award of design and/or construction.	Capitalize on well-defined scope.

Selection Factors for Project Delivery and Contract Strategy

Factor Number	Selection Factor	Factor Description for Comparing PDCS	Factor Action Statement
Other factors (continued)			
18	Project features are not well-defined at award of design and/or construction contract.	Project delivery and contract strategy efficiently utilize poorly defined project scope prior to award of design and/ or construction.	Efficiently utilize poorly defined scope.
19	Owner prefers minimal number of parties to be accountable for project performance.	Project delivery and contract strategy minimize the number of parties under contract directly with the owner.	Minimize number of contracted parties.
20	Project design/engineering or construction is complex, innovative, or non-standard.	Project delivery and contract strategy facilitate efficient coordination and management of non-standard project design/engineering and/or construction.	Efficiently coordinate project complexity or innovation.

Factor Explanation

The following tables provide comments on each selection factor. These comments give the user insights into the intent of each selection factor in terms of its key focus in achieving the factor action statement.

Factor Number	Factor Action Statement	Comment
Cost-related factors		
1	Control cost growth	Your project must be completed for the budget appropriated. You have committed to upper management that it can be done. There is no going back for additional funds. The well is dry. Your career is on the line. You must effectively manage project scope growth and the resulting budget creep.
2	Ensure lowest cost	The return on investment for the project is at the minimum for it to proceed. You must ensure the lowest possible cost to insure adequate return on the investment.
3	Delay or minimize expenditure rate	The issue here is not the total cost of the project, but the amount of funds available over a certain period of time. You must optimize cost efficiencies with schedule to balance the funds available by delaying or minimizing their expenditure rate.
4	Facilitate early cost estimates	Go/no-go decisions must be made early based on reliable cost estimates before significant time and money is expended.
5	Reduce risks or transfer risks to contractor	Owner assumes minimal financial risk on the project. Even though project cost will likely be higher, it may be of more value to the owner to know the maximum exposure the owner may face.

Factor Number	Factor Action Statement	Comment
Schedule-related factors		
6	Control time growth	Completion within schedule is highly critical to project success. The owner must meet product delivery commitments. Failure to meet promised deliveries will have an adverse effect on future sales. Schedule growth must be managed.
7	Ensure shortest schedule	A new product must be first to market for competitive advantage. Demand for the product results in a higher margin and increased profits. The shortest schedule must be achieved.
8	Promote early procurement	It is important to lock in pricing on expensive equipment. Equipment delivery is critical to construction sequencing and overall schedule.
Other factors		
9	Ease change incorporation	The project may interface with an existing facility. Design may not be finalized. Product sales forecasts may be fluctuating.
10	Capitalize on expected low levels of changes.	Site conditions are known. No surprises are expected. Design is not complex, and production capacities are known. This is a "cookie cutter" type project.
11	Protect confidentiality	Owner's intellectual property could be a huge competitive advantage. The value of this intellectual property could be much more valuable to the owner than the cost of capital.
12	Capitalize on familiar project conditions	Adequate supply of skilled labor is available. No adverse weather conditions are expected. Site conditions, including the subsurface soil, are good.
13	Maximize owner's controlling role	Owner has extensive experience in design and construction. The owner knows what the owner wants and how to get it. The project may closely interface with existing facilities and plant operations.
14	Minimize owner's controlling role	The owner is inexperienced in design and construction. The owner's product and production knowledge and capabilities are the owner's expertise.

Factor Number	Factor Action Statement	Comment
Other factors (continued)		
15	Maximize owner's involvement.	The owner has experienced resources available to devote to the project. It is cost effective to use these resources in terms of both project costs and production overhead.
16	Minimize owner's involvement.	Owner has no resources to commit to project. The owner must rely on outside resources.
17	Capitalize on well-defined scope.	Site conditions are known. There are no surprises expected. Production processes and capabilities are locked-in.
18	Efficiently utilize poorly defined scope.	Site conditions are not totally known. Sales forecasts and product demand are fluctuating. New production process technologies are not yet proven.
19	Minimize number of contracted parties.	Owner wants to deal with one entity. Project and/ or process confidentiality may be an issue.
20	Efficiently coordinate project complexity or innovation.	Owner needs proven designers and constructors. The owner desires outside-the-box thinking. There is no "cookie-cutter" approach here.

Elimination of Redundant Factors

Some initial factors that were considered the same were merged. Other factors that would not impact PDCS selection were dropped, while those that could not be generalized were defined as extraneous factors that should be considered separately for projects for which they apply in the final decision-making step. After this exercise, the initial set of 30 factors was reduced to the 20 factors that are presented in the table above. The factors that were merged/eliminated are presented below. A discussion of the merging/elimination of the factors is presented in CII Research Report 165-12.

- "Local conditions at project site are not favorable to project execution" and "Site conditions may drive design and/or construction changes" were subsumed in Factor 9, "An above normal level of changes is anticipated in the execution of the project."

- "Project location is reasonably near owner's resources" was subsumed in Factor 15, "Owner desires a substantial use of its own resources in the execution of the project."
- "Project location is remote from owner's resources" was subsumed in Factor 16, "Owner desires a minimal use of its own resources in the execution of the project."
- "Project scope and/or dollar amounts are large" was subsumed in Factor 5, "Owner assumes minimal financial risk on the project."
- "Project scope and/or dollar amounts are small" was dropped.
- "High safety performance is critical to project success" was dropped.
- "Innovative non-standard design and/or construction methods are required to meet the project objectives," "Project design/engineering is complex," and "Project construction is complex" were all merged and defined as Factor 20, "Project design/engineering or construction is complex, innovative, or non-standard."
- "Familiarity with delivery approach/contractor" would be treated as an extraneous factor and considered in the final decision-making step for any project to which it applies.

Factor Interaction

In selecting the factors to include in the analysis for a project, care must be taken to avoid factor interaction. Factor interaction (double counting) would occur and ultimately bias the result of the selection analysis if two factors that are close in attributes are included in the analysis for a project. For example, Factor 13, "Owner desires a high degree of control/influence over project execution," and Factor 15, "Owner desires a substantial use of its own resources in the execution of the project," may or may not be addressing the same underlying issue. When "Owner's level of involvement" is synonymous with "Owner's level of control," then Factors 13 and 15 address the same issue and should not be included together in the same selection analysis. However, if an owner has some resources that the owner wants to use in a project in a non-controlling role, then Factors 13 and 15 (or 14 and 16) are sufficiently different to be included together in an analysis without double counting. Similarly, Factors 9 and 18 (or Factors 10 and 17) have to be significantly differentiated before being included together in the analysis for a project.

Care also should be taken before considering Factor 8 (Early procurement) in the analysis for a project. Close examination shows that Factor 8 may be related to Factor 1 (Control cost growth) if the underlying reason for procuring materials early is to fix prices on some critical equipment or materials. On the other hand, Factor 8 may be related to Factor 6 (completion within schedule) if the underlying reason for early procurement is tied to the construction schedule, or related to Factor 7 (shortest schedule) if the underlying reason for early procurement is related to minimizing overall project duration.

Included in the list of factors in Table 2.2 are some counterposed pairs of factors, such as Factor 9, "An above normal level of changes is anticipated in the execution of the project," and Factor 10, "A below normal level of changes is anticipated in the execution of the project." Such factors represent opposing perspectives that cannot exist together on a project. In this situation, the owner should include the factor that best represents the owner's viewpoint. Counterposed pairs should not be included in the selection analysis for the same project. Other counterposed pairs are Factors 13 and 14, Factors 15 and 16, and Factors 17 and 18.

Careful consideration should be given to these issues on factor interaction before including factors that appear to be related in the same analysis.

Summary Table of Relative Effectiveness Values, Factors 1–8

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
	Control cost growth	Ensure lowest cost	Delay or minimize expenditure rate	Facilitate early cost estimates	Reduce or transfer risks to contractor(s)	Control time growth	Ensure shortest schedule	Promote early procurement
PDCS 1	80	90	100	0	80	20	0	0
PDCS 2	50	100	70	20	50	50	50	90
PDCS 3	80	70	90	10	60	20	10	0
PDCS 4	80	70	90	10	60	20	0	0
PDCS 5	50	60	60	20	20	50	40	90
PDCS 6	60	40	40	70	70	70	80	100
PDCS 7	90	80	10	90	90	90	100	100
PDCS 8	70	80	30	80	80	80	90	100
PDCS 9	0	0	50	20	10	0	90	80
PDCS 10	0	0	60	0	0	0	60	50
PDCS 11	100	80	0	100	100	100	100	100
PDCS 12	40	40	100	60	0	80	100	100

Summary Table of Relative Effectiveness Values, Factors 9–14

	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14
	Ease change incorporation	Capitalize on expected low levels of change	Protect confidentiality	Capitalize on familiar project conditions	Maximize owner's controlling role	Minimize owner's controlling role
PDCS 1	100	0	90	0	90	10
PDCS 2	80	20	90	50	100	0
PDCS 3	100	0	70	0	70	30
PDCS 4	100	0	70	0	80	20
PDCS 5	70	30	70	40	80	20
PDCS 6	60	40	70	70	60	40
PDCS 7	10	90	0	100	10	90
PDCS 8	0	100	40	90	20	80
PDCS 9	20	80	100	80	90	10
PDCS 10	40	60	60	10	50	50
PDCS 11	0	100	0	100	0	100
PDCS 12	70	30	80	70	100	0

Summary Table of Relative Effectiveness Values, Factors 15–20

	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
	Maximize owner's involvement	Minimize owner's involvement	Capitalize on well-defined scope	Efficiently utilize poorly defined scope	Minimize number of contracted parties	Efficiently coordinate project complexity or innovation
PDCS 1	80	20	0	100	70	70
PDCS 2	90	10	20	80	60	60
PDCS 3	80	20	0	100	50	50
PDCS 4	80	20	0	100	40	40
PDCS 5	80	20	30	70	40	40
PDCS 6	40	60	40	60	70	70
PDCS 7	10	90	100	0	90	100
PDCS 8	30	70	90	10	80	80
PDCS 9	100	0	80	20	0	0
PDCS 10	30	70	60	40	80	0
PDCS 11	0	100	100	0	100	90
PDCS 12	100	0	60	40	70	80

Relative Effectiveness Values with Supporting Comments

Factor 1:

Completion within original budget is critical to project success.	PDCS facilitates control of cost growth.	Control cost growth.

Relative Effectiveness Values for Factor 1:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
80	50	80	80	50	60	90	70	0	0	100	40

Comments:

- Good scope definition and accurate estimates aid cost control.
- Single-point coordination of design, procurement, and construction aid cost control.

Factor 2:

Minimal cost is critical to project success.	PDCS ensures lowest reasonable cost.	Ensure lowest cost.

Relative Effectiveness Values for Factor 2:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
90	100	70	70	60	40	80	80	0	0	80	40

Comments:

- Serial phasing provides more time to find lowest cost, though slow implementation may engender cost escalation — minimal cost at the sacrifice of overall completion schedule.
- Arrangements involving a sole contractor with responsibility for design and construction, coupled with competitive bidding work well for minimizing cost — minimal cost at the sacrifice of owner's control over finished project.

Factor 3:

Owner's cash flow for the project is constrained.	PDCS delays or minimizes rate of expenditures.	Delay or minimize expenditure rate.

Relative Effectiveness Values for Factor 3:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
100	70	90	90	60	40	10	30	50	60	0	100

Comments:

- Cash flow manipulation is possible with any project delivery and contract strategy. The important difference is the ease of cash flow manipulation under each project delivery and contract strategy to achieve a delayed or minimal expenditure rate.
- Higher execution speed generally translates to a higher expenditure rate.
- Early procurement increases early expenditure.

Factor 4:

Owner critically requires early (and reliable) cost figures to facilitate financial planning and business decisions.	PDCS facilitates accurate early cost estimates.	Facilitate early cost estimates.

Relative Effectiveness Values for Factor 4:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	20	10	10	20	70	90	80	20	0	100	60

Comments:

- Reliable cost estimates are synonymous with a contractor's quotations/bid prices. With serial sequence of design and construction phases, it takes more time before reliable estimates can be obtained (only after design completion).

Factor 5:

Owner assumes minimal financial risk on the project.	PDCS reduces risks or transfers a high level of cost and schedule risks to the contractor(s).	Reduce risks or transfer risks to contractor(s).

Relative Effectiveness Values for Factor 5:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
80	50	60	60	20	70	90	80	10	0	100	0

Comments:

- Contractors carry more responsibilities and risks for schedule and cost performance in single-source project delivery and contract strategies.

Factor 6:

Completion within schedule is highly critical to project success.	PDCS facilitates control of time growth.	Control time growth.

Relative Effectiveness Values for Factor 6:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
20	50	20	20	50	70	90	80	0	0	100	80

Comments:

- Single-source responsibility for total schedule performance leads to improved control of time growth.
- Agents (CM or PM) not at risk do not have responsibility for performance.

Factor 7:

Early completion is critical to project success.	PDCS ensures shortest reasonable schedule.	Ensure shortest schedule.

Relative Effectiveness Values for Factor 7:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	50	10	0	40	80	100	90	90	60	100	100

Comments:

- Arrangements with overlapped sequence of design, procurement, and construction phases are better for minimizing overall project schedule.
- Elimination of protracted bidding processes contributes to minimizing project schedule.

Factor 8:

Early procurement of long-lead equipment and/or materials is critical to project success.	PDCS promotes early design and purchase of long lead equipment or materials.	Promote early procurement.

Relative Effectiveness Values for Factor 8:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	90	0	0	90	100	100	100	80	50	100	100

Comments:

- Level of design completion at which procurement may start.

Factor 9:

An above-normal level of changes is anticipated in the execution of the project.	PDCS promotes ease of incorporating changes to the project scope during detailed design and construction.	Ease change incorporation.

Relative Effectiveness Values for Factor 9:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
100	80	100	100	70	60	10	0	20	40	0	70

Comments:

- Serial phasing allows more time for firming up scope and taking care of changes before procurement and construction.
- Change incorporation as a coordination issue: multiple contractors are more difficult to coordinate for change incorporation than single contractor.
- Change incorporation as a control issue: single source systems limit ability of owner to request changes without claims of major impact on project.

Factor 10:

A below-normal level of changes is anticipated in execution of the project.	PDCS capitalizes on expected low levels of changes.	Capitalize on expected low levels of changes.

Relative Effectiveness Values for Factor 10:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	20	0	0	30	40	90	100	80	60	100	30

Comments:

- If few changes were expected, what is known would be reliable. The basis for comparison then is the capability of project delivery and contract strategy to capitalize on a low risk environment.

Factor 11:

Confidentiality of business/engineering details of the project is critical to project success.	PDCS protects secrecy of business objectives and proprietary technology.	Protect confidentiality.

Relative Effectiveness Values for Factor 11:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
90	90	70	70	70	70	0	40	100	60	0	80

Comments:

- The object of confidentiality is process technology that may be leaked during project execution, not the finished product of a completed and operating production.
- For confidentiality, it works best to minimize the number of project participants who see all documents. Secrecy may be achieved by breaking up critical aspects of the work to many parties, ensuring that no single entity sees the whole picture.
- Competitive lump sum bidding requires all bidders to see all documents. Project delivery and contract strategies based on competitive bidding would poorly facilitate confidentiality.
- Single-source project delivery and contract strategies would require all potential contractors to have access to all information, which may lead to poor confidentiality.

Factor 12:

Local conditions at project site are favorable to project execution.	PDCS capitalizes on familiar project conditions.	Capitalize on familiar project conditions.

Relative Effectiveness Values for Factor 12:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	50	0	0	40	70	100	90	80	10	100	70

Comments:

- If conditions (labor, site) were familiar, unknowns would be few. The basis for comparison then is the capability of project delivery and contract strategy to capitalize on a well-known project environment.

Factor 13:

Owner desires a high degree of control/ influence over project execution.	PDCS increases owner's role in managing design and construction.	Maximize owner's controlling role.

Relative Effectiveness Values for Factor 13:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
90	100	70	80	80	60	10	20	90	50	0	100

Comments:

- Single-source project delivery and contract strategies minimize owner's role.
- Owner's agents (PM or CM) reduce owner's role.
- Project delivery and contract strategies in which owner directly takes on some major procurement activities would lead to increased owner's role.

Factor 14:

Owner desires a minimal level of control/ influence over project execution.	PDCS minimizes owner's role in managing design and construction.	Minimize owner's controlling role.

Relative Effectiveness Values for Factor 14:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
10	0	30	20	20	40	90	80	10	50	100	0

Comments:

- Single-source project delivery and contract strategies minimize owner's role.
- Owner's agents (PM or CM) reduce owner's role.
- Project delivery and contract strategies in which owner directly takes on some major procurement activities would lead to increased owner's role.

Factor 15:

Owner desires a substantial use of its own resources in the execution of the project.	PDCS promotes greater owner involvement in detailed design and construction.	Maximize owner's involvement.

Relative Effectiveness Values for Factor 15:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
80	90	80	80	80	40	0	30	100	30	0	100

Comments:

- Procurement during design phase by owner would increase owner's involvement.
- Single-source project delivery and contract strategies reduce the opportunities for using owner's resources.

Factor 16:

Owner desires a minimal use of its own resources in the execution of the project.	PDCS minimizes owner involvement in detailed design and construction.	Minimize owner's involvement.

Relative Effectiveness Values for Factor 16:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
20	10	20	20	20	60	90	70	0	70	100	0

Comments:

- Procurement during design phase by owner would increase owner's involvement.
- Single-source project delivery and contract strategies reduce the opportunities for using owner's resources.

Factor 17:

Project features are well defined at the award of the design and/or construction contract.	PDCS capitalizes on well defined project scope prior to award of design and/or construction.	Capitalize on well defined scope.

Relative Effectiveness Values for Factor 17:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
0	20	0	0	30	40	100	90	80	60	100	60

Comments:

- If project scope were well-defined, unknowns would decrease. The basis for comparison then is capability of project delivery and contract strategy to capitalize on a well-defined project scope.
- The basis for comparison here is similar to those for Factors 10 and 12. However, well-defined scope or project features do not necessarily mean that low levels of changes would be expected or that project conditions are familiar. It is possible to have a well-defined scope yet still to expect many changes or to have unfamiliar project conditions. For example, with several possible execution scenarios, a most likely scenario may be assumed and project features and scope for that scenario may be well-defined. However, the possibility of the execution scenario ultimately being different from the most expected may lead to an expectation of high levels of changes.

Factor 18:

Project features are not well defined at the award of the design and/or construction contract.	PDCS efficiently utilizes poorly defined project scope prior to award of design and/or construction.	Efficiently utilize poorly defined scope.

Relative Effectiveness Values for Factor 18:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
100	80	100	100	70	60	0	10	20	40	0	40

Comments:

- If project scope were poorly defined, the basis for comparison is capability of project delivery and contract strategy to efficiently utilize poorly defined project scope.

Factor 19:

Owner prefers minimal number of parties to be accountable for project performance.	PDCS minimizes the number of parties under contract directly with the owner.	Minimize number of contracted parties.

Relative Effectiveness Values for Factor 19

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
70	60	50	40	40	70	90	80	0	80	100	70

Comments:

- The basis for comparison here is the number of parties in direct contract with owner (contractual relationships) in a project delivery and contract strategy since each contract involves accountability for some aspects of the project. The number of contractual relationships is the number of accountable parties. The number of functional relationships in a PDCS counts to a lesser extent because functional relationships relate to coordination effort only.

Factor 20:

Project design/engineering or construction is complex, innovative or non-standard.	PDCS facilitates efficient coordination and management of non-standard project design/engineering and/ or construction.	Efficiently coordinate project complexity or innovation.

Relative Effectiveness Values for Factor 20:

PDCS 01	PDCS 02	PDCS 03	PDCS 04	PDCS 05	PDCS 06	PDCS 07	PDCS 08	PDCS 09	PDCS 10	PDCS 11	PDCS 12
70	60	50	40	40	70	100	80	0	0	90	80

Comments:

- Single-source coordination of design, procurement, and construction facilitates complex, innovative, or non-standard work. Where specialized/proprietary technology is involved, this technology may be obtained as a package and coordinated by a single-source contractor.
- With a single-source project delivery and contract strategy, arrangements where commissioning involves using the owner's in-house resources or third parties would rate higher than commissioning with the single-source contractor's resources.

Appendix 4: Project Scenarios and Associated Selection Factors

Project Scenarios and Associated Selection Factors

The following information may be used as a starting point in identifying selection factors that may be considered in the analysis for a project. For a given project, the user will identify any one of four scenarios that match the project type and the dominant project objectives. The selection factors that are associated with the scenario that matches the project would then represent selection factors from which the user may identify those to be considered in the analysis for the project under consideration.

In several cases, not all of the factors that need to be considered in an analysis are included in the scenario. For example, for an analysis that is based on six selection factors, it is possible that not more than three out of the six factors will be identified from the scenario of factors. The other three factors in the analysis would in this case be identified from the complete list of factors in Appendix 2.

Project Scenario 1: Industrial projects driven by cost-, schedule-, or business-related objectives.

- Factor 6 / Factor 7: Control time growth/ ensure shortest schedule
- Factor 1 / Factor 2: Control cost growth/ ensure lowest cost
- Factor 20: Efficiently coordinate project complexity or innovation
- Factor 5: Reduce risks or transfer risks to contractor(s)
- Factor 13: Maximize owner's controlling role
- Factor 4: Facilitate early cost estimates
- Factor 8: Promote early procurement
- Factor 17: Capitalize on well-defined scope

Project Scenario 2: Building projects driven by cost- or schedule-related objectives.

- Factor 6 / Factor 7: Control time growth/ensure shortest schedule
- Factor 1 / Factor 2: Control cost growth/ ensure lowest cost
- Factor 4: Facilitate early cost estimates
- Factor 20: Efficiently coordinate project complexity or innovation
- Factor 17: Capitalize on well-defined scope
- Factor 19: Minimize number of contracted parties
- Factor 16: Minimize owner's involvement
- Factor 3: Delay or minimize expenditure rate

Project Scenario 3: Industrial projects driven by quality-related objectives.

- Factor 6 / Factor 7: Control time growth/ensure shortest schedule
- Factor 13: Maximize owner's controlling role
- Factor 1 / Factor 2: Control cost growth/ensure lowest cost
- Factor 20: Efficiently coordinate project complexity or innovation
- Factor 17: Capitalize on well-defined scope
- Factor 9: Ease change incorporation
- Factor 16: Minimize owner's involvement
- Factor 8: Promote early procurement

Project Scenario 4: Building projects driven by quality/customer satisfaction-related objectives.

- Factor 9: Ease change incorporation
- Factor 1 / Factor 2: Control cost growth/ensure lowest cost
- Factor 13: Maximize owner's controlling role
- Factor 20: Efficiently coordinate project complexity or innovation
- Factor 17: Capitalize on well-defined scope
- Factor 6 / Factor 7: Control time growth/ensure shortest schedule
- Factor 16: Minimize owner's involvement
- Factor 18: Efficiently utilize poorly defined scope

Appendix 5: Key Definitions

Key Definitions

Some terms used in the configuration of the project delivery and contract strategy alternatives are defined as follows:

- CM (Agent): Individual who performs an administrative role throughout the entire project, acting primarily as an agent to the owner. This includes construction management services performed as a professional service for a fee.
- CM (@ Risk): Project delivery and contract strategy where owner contracts separately with designer and "constructor." "Constructor" performs construction management services and is at risk for all construction work in accordance with plans and specifications. "Constructor" usually has significant input in the design process.
- Competitive Lump Sum: Compensation contract based on a fixed-price, lump sum award to lowest bid from multiple bidders.
- Construct: The process associated with physical construction, starting with construction mobilization and ending with project completion, excluding commissioning and start-up.
- Cost Reimbursable + Fee: Compensation contract based on reimbursement of actual costs plus a fixed or variable fee.
- Design: Architectural and/or engineering services occurring after project authorization to prepare plans and specifications for construction of permanent facilities. Services provided prior to project authorization are considered part of the pre-project planning process.
- Design-Build: Contractual arrangement where owner contracts with a single entity to perform both design and construction under a single design-build contract. Portions of the design or construction may be subcontracted by the single design-build entity to other companies.
- Firm Price: Compensation contract for design or management services based on a pre-determined, fixed amount or a pre-determined, fixed percentage of total estimated facility cost.
- Guaranteed Maximum Price (GMP): Compensation contract based on cost reimbursable + fee, up to a maximum price. The fee could be fixed or variable.

- Negotiated Lump Sum: Compensation contract based on negotiations for a fixed-price, lump sum amount.
- Procure: The process associated with specifying, acquiring, and transporting engineered equipment and bulk materials (e.g., concrete, steel, pipe) to the work site.
- Project Manager (Agent): Individual who acts as a surrogate owner. Provides specialized services as owner's agent. May provide services from early feasibility services to post-construction facilities management.
- Time and Materials (T&M): Compensation approach that is based on specific rates, usually hourly or daily, and the rates are comprehensive of direct labor, overheads, and profit, plus direct material expenses at cost or with an administrative surcharge. Since profit is within the multiplier or rate, it is not treated separately.
- Unit Price: Compensation contract based on a fixed price for units for work or material.

Appendix 6: Compensation Approach Charts

Please refer to large-format diagrams in the binder pockets.

Appendix 7: Template for Developing an Executive Summary

(Two Pages Maximum)

Project Objectives

List the project objectives and show the priority of each objective. Identify other criteria that influenced the PDCS decision. This criterion may be related to the project situation, characteristics, or other related information.

Key Selection Factors

Identify the selection factors and more importantly document why these selection factors were chosen. Include a link to the project objectives and other relevant criteria.

Relative Weighting

Document the preference scores used and provide a rationale for these preference scores. Include the link to the priority of the project objectives and other relevant criteria.

Results

Document the top three PDCS alternatives as given by the selection tool. Show the default compensation approach. Document justification for each of the alternatives. If the compensation approach was changed explain the basis for the changes made. Review the effectiveness values for each PDCS alternative and consider the impact of low effectiveness values on the likely success of the PDCS alternative. If a sensitivity analysis is performed, describe the changes made and the impact this has on the top three PDCS alternatives.

Post Analysis

After preparing the results, consider other factors that led to the final decision among the top three PDCS alternatives. Document what these factors are and how they influence the final decision.

Recommendation

Provide a final recommendation of the PDCS alternative selected for the project.

References

1. Bowers, D. D., and Anderson, S. D., "Characteristics of Integrated Project Delivery and Contract Strategies," A Report to the Construction Industry Institute, CII Research Report 165-11, CII, Austin, TX (2003)

2. Oyetunji, A. A., and Anderson, S. D., "Project Delivery and Contract Strategy Selection," A Report to the Construction Industry Institute, CII Research Report 165-12, CII, Austin, TX (2002)

3. *Owner's Tool for Project Delivery and Contract Strategy Selection*, CII Research Summary 165-1, Construction Industry Institute, Austin TX (2001)

4. *Pre-Project Planning Handbook*, Special Publication 39-2, Construction Industry Institute, Austin, TX (1995)

5. *Setting Project Objectives*, Research Summary 12-1, Second Edition, Construction Industry Institute, Austin, TX (2003)

6. *Alignment During Pre-Project Planning*, Implementation Resource 113-3, Construction Industry Institute, Austin, TX (1998)

7. Howard, W. E., and Bell, L. C., "Innovative Strategies for Contractor Compensation," A Report to the Construction Industry Institute, CII Research Report 114-11, Austin, TX (1998)

8. Sanvido V. E., and Konchar M. D., "Project Delivery Systems: CM @ Risk, Design-Build, Design-Bid-Build," A Report to the Construction Industry Institute, CII Research Report 133-11, Austin, TX (1998)

CII Member Companies

3M
Abbott Laboratories
Air Products and Chemicals
Amgen
Anheuser-Busch Companies
Aramco Services Company
BP America
CITGO Petroleum Corporation
Cargill
Celanese
ChevronTexaco Corporation
Colectric Partners
ConocoPhillips
Dofasco
The Dow Chemical Company
DuPont
Eastman Chemical Company
ExxonMobil Corporation
General Motors Corporation
GlaxoSmithKline
Intel Corporation
International Paper
Eli Lilly and Company
NASA
Naval Facilities Engineering Command
Ontario Power Generation
PSEG Power
Petrobras
Pfizer
Praxair
The Procter & Gamble Company
Rohm and Haas Company
Shell Oil Company
Smithsonian Institution
Solutia
Southern Company Services
Sunoco
Tennessee Valley Authority
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of State
U.S. General Services Administration
U.S. Steel
Weyerhaeuser Company

ABB Lummus Global
ALSTOM Power
AMEC
AZCO
BE&K
BMW Constructors
Baker Concrete Construction
Bechtel Group
Black & Veatch
Bovis Lend Lease
Burns & McDonnell
Butler Manufacturing Company
CB&I
CDI Engineering Solutions
CH2M HILL Constructors/IDC
CSA Group
Day & Zimmermann International
Dick Corporation
Emerson Process Management
Fluor Corporation
Foster Wheeler USA Corporation
Fru-Con Construction Corporation
Hatch
Hilti Corporation
Honeywell International
Jacobs
Johnson Controls
Kellogg Brown & Root
Kier/CCC USA
Kiewit Construction Group
Kværner
Lockwood Greene
M. A. Mortenson Company
Parsons E&C
Perot Systems Corporation
Primavera Systems
Rust Constructors
S&B Engineers and Constructors
The Shaw Group
Siemens Westinghouse Power
Stevens Painton Corporation
Technip USA Corporation
Turner Construction Company
Victaulic Company of America
Walbridge Aldinger Company
Washington Group International
Williams Group International
Zachry Construction Corporation
Zurich North America

Project Delivery and Contract Strategy Research Team

*Stuart D. Anderson, Texas A&M University

Stanley F. Berger, 3M Company

G. Wayne Burchette, Eastman Chemical Company, Chairman

James R. Greene, Abbott Laboratories

Robert P. Kehoe, NASA Johnson Space Center

Larry Kruse, Murphy Company

Ade Oyetunji, Texas A&M University

Tim Thury, General Services Administration

Gary Vandiver, Solutia Inc.

Paul Wicker, General Motors Company

Past Members:

Darrick D. Bowers, Texas A&M University

David Combs, John Gray

Richard De Leon, Jr., The University of Texas System

Jerry Kirk, Florida Power & Light

John Phillips, U.S. Steel, Chairman

Janice White, The University of Texas System

John Wrockloff, U.S. Air Force

*Principal Author

Editor: Rusty Haggard

Construction Industry Institute
The University of Texas at Austin
3925 W. Braker Lane (R4500)
Austin, TX 78759-5316