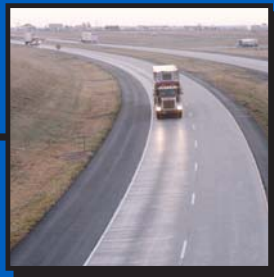


Project Delivery and Contract Strategy



P — D — C — S

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

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The University of Texas at Austin.

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1.0 Overview

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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.

1.0 Overview

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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.

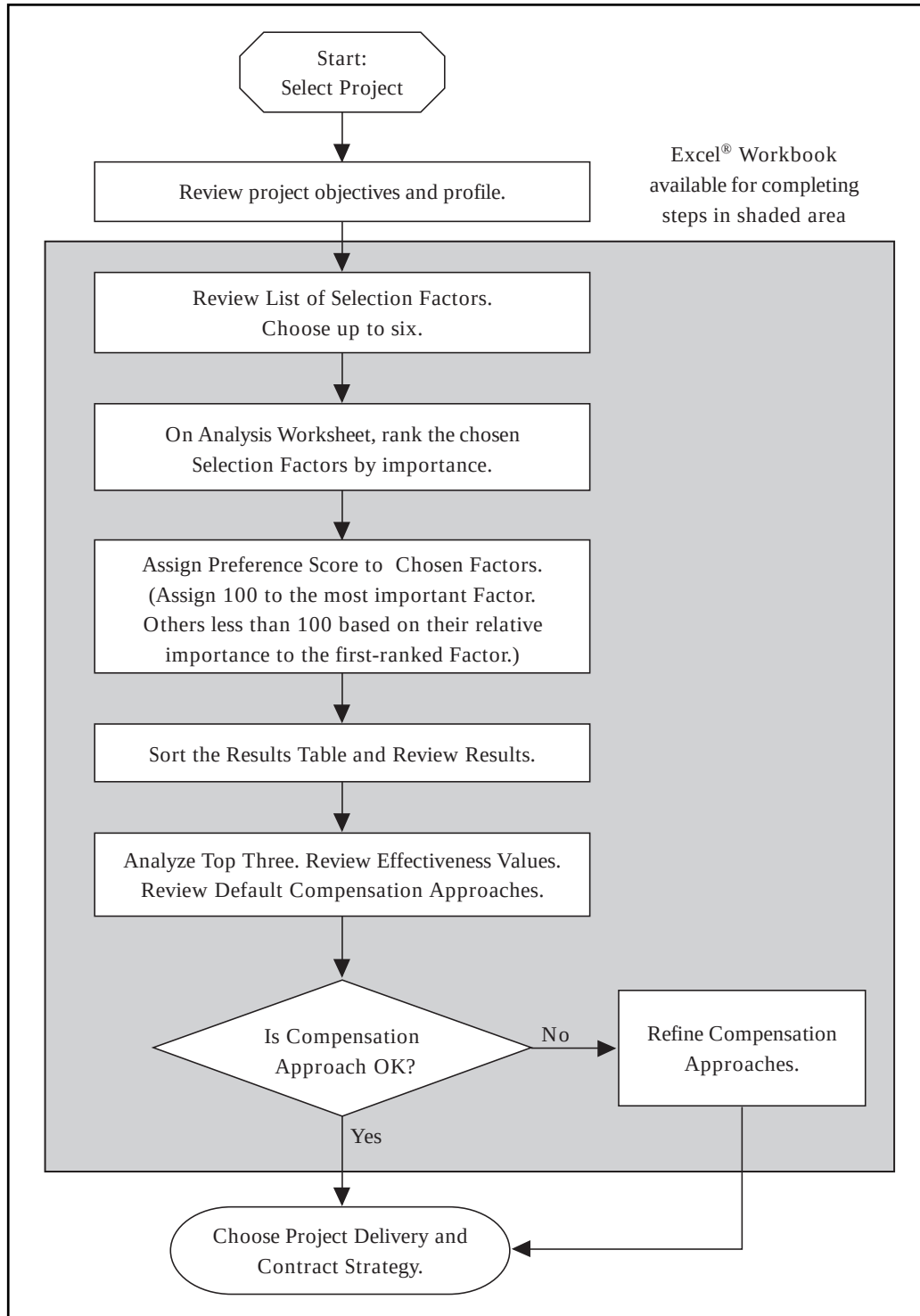


Figure 1.1. Process Flowchart

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.

2.0 Process Steps

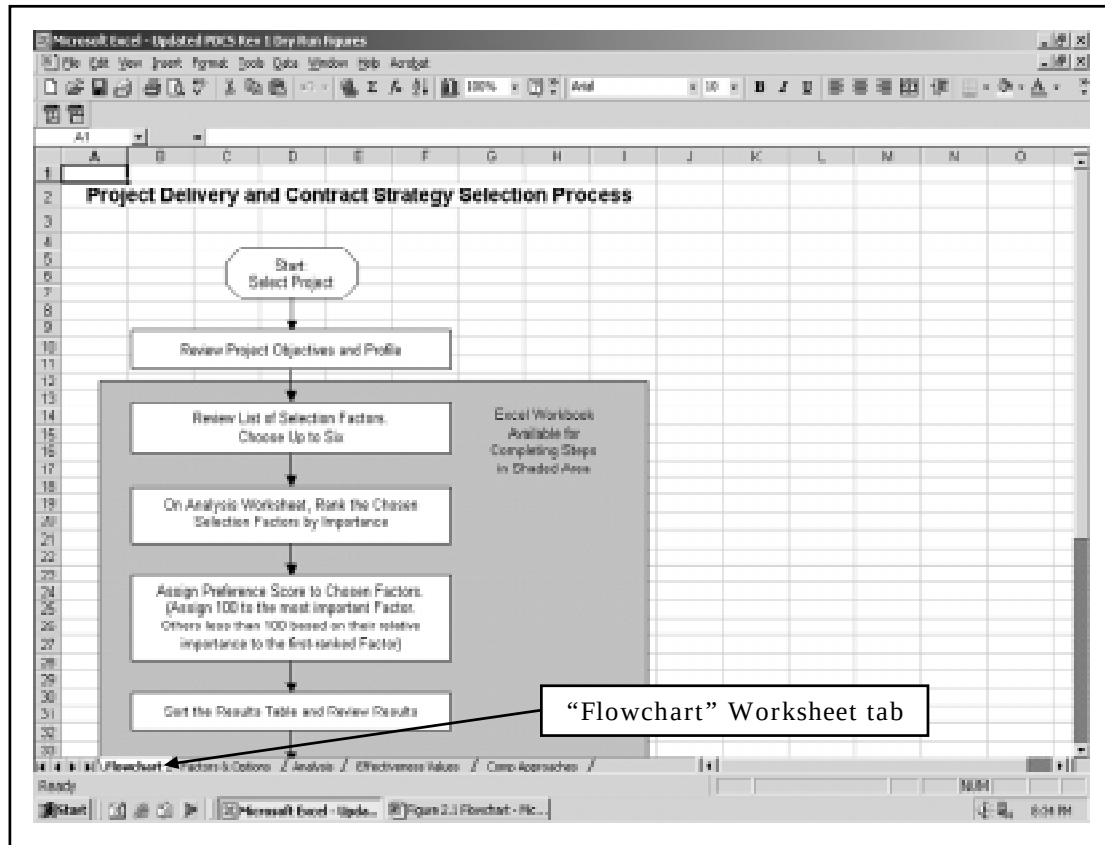


Figure 2.1. "Flowchart" Worksheet

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

2.0 Process Steps

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.

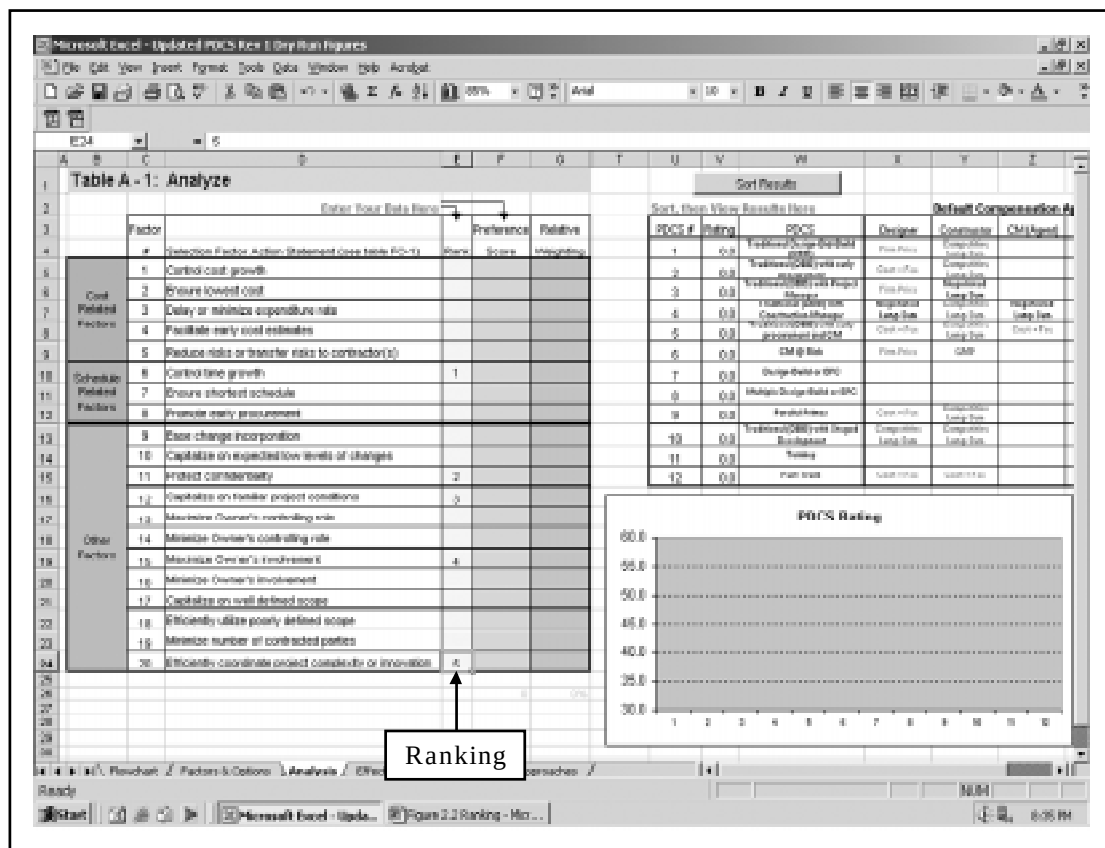


Figure 2.2. Ranking Relevant Selection Factors in “Analysis” Worksheet

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.

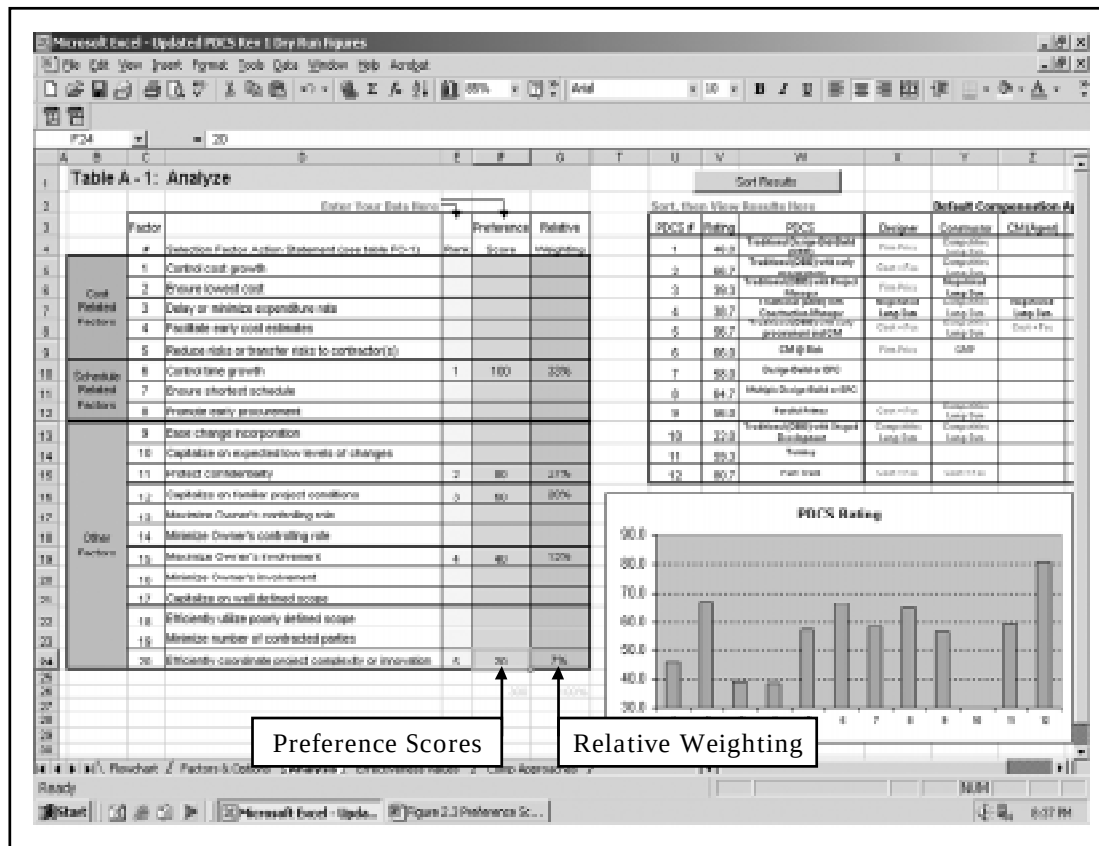


Figure 2.3. Assigning Preference Score and Calculating Relative Weighting in “Analysis” Worksheet

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

			PDCS OPTION	Selection Factor			Aggregate Score
				1	5	6	
Selection Factor	Preference Weight	Normalized Preference Weight		Normalized Preference Weight			
				0.35	0.38	0.27	
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

- 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.

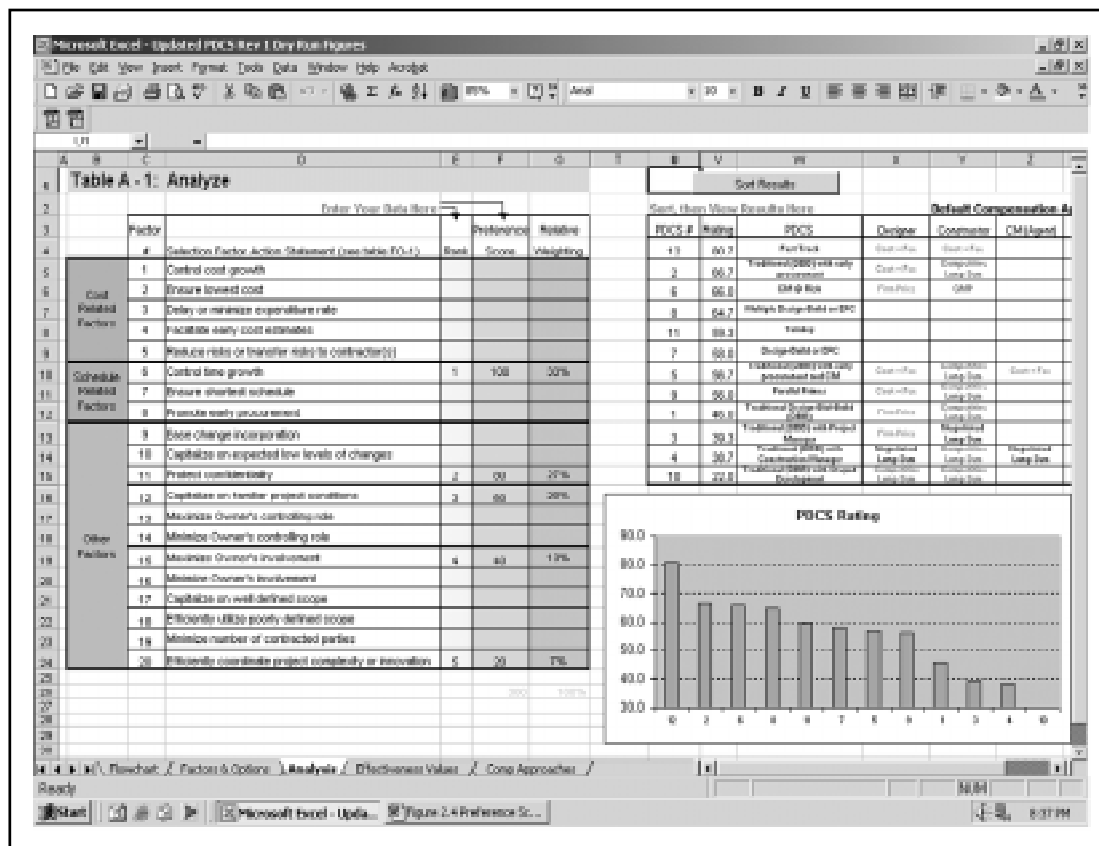


Figure 2.4. PDCS Ratings Histogram in Descending Order in “Analysis” Worksheet

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.

Factor	PDCS Option	1	2	3	4	5	6	7	8	9	10	FWR weight
1. Control cost growth	Cost	100	90	80	70	60	50	40	30	20	10	1
2. Ensure lowest cost	Cost	100	90	80	70	60	50	40	30	20	10	1
3. Delay or minimize expenditure rate	Cost	100	90	80	70	60	50	40	30	20	10	1
4. Provide early cost estimates	Cost	100	90	80	70	60	50	40	30	20	10	1
5. Reduce risks or transfer risks to contractor(s)	Cost	100	90	80	70	60	50	40	30	20	10	1
6. Control time growth	Schedule	50	50	70	80	90	100	90	80	70	60	2
7. Ensure prompt schedule	Schedule	50	50	70	80	90	100	90	80	70	60	2
8. Promote early procurement	Schedule	50	50	70	80	90	100	90	80	70	60	2
9. Ease change incorporation	Other	50	50	70	80	90	100	90	80	70	60	2
10. Capitalize on requested low levels of change	Other	50	50	70	80	90	100	90	80	70	60	2
11. Protect confidentiality	Other	90	90	70	60	50	40	30	20	10	0	3
12. Capitalize on familiar project conditions	Other	70	80	70	60	50	40	30	20	10	0	3
13. Maximize Owner's controlling role	Other	70	80	70	60	50	40	30	20	10	0	3
14. Minimize Owner's controlling role	Other	70	80	70	60	50	40	30	20	10	0	3
15. Maximize Owner's involvement	Other	90	90	70	60	50	40	30	20	10	0	4
16. Minimize Owner's involvement	Other	90	90	70	60	50	40	30	20	10	0	4
17. Capitalize on well defined scope	Other	50	50	70	80	90	100	90	80	70	60	5
18. Efficiently utilize poorly defined scope	Other	50	50	70	80	90	100	90	80	70	60	5
19. Minimize number of contracted parties	Other	50	50	70	80	90	100	90	80	70	60	5
20. Efficiently coordinate project complexity or transition	Other	50	50	70	80	90	100	90	80	70	60	5
Rating		81	87	68	60	59	58	57	56	49	39	32

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.

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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

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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.

3.0 Case Study Examples

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.

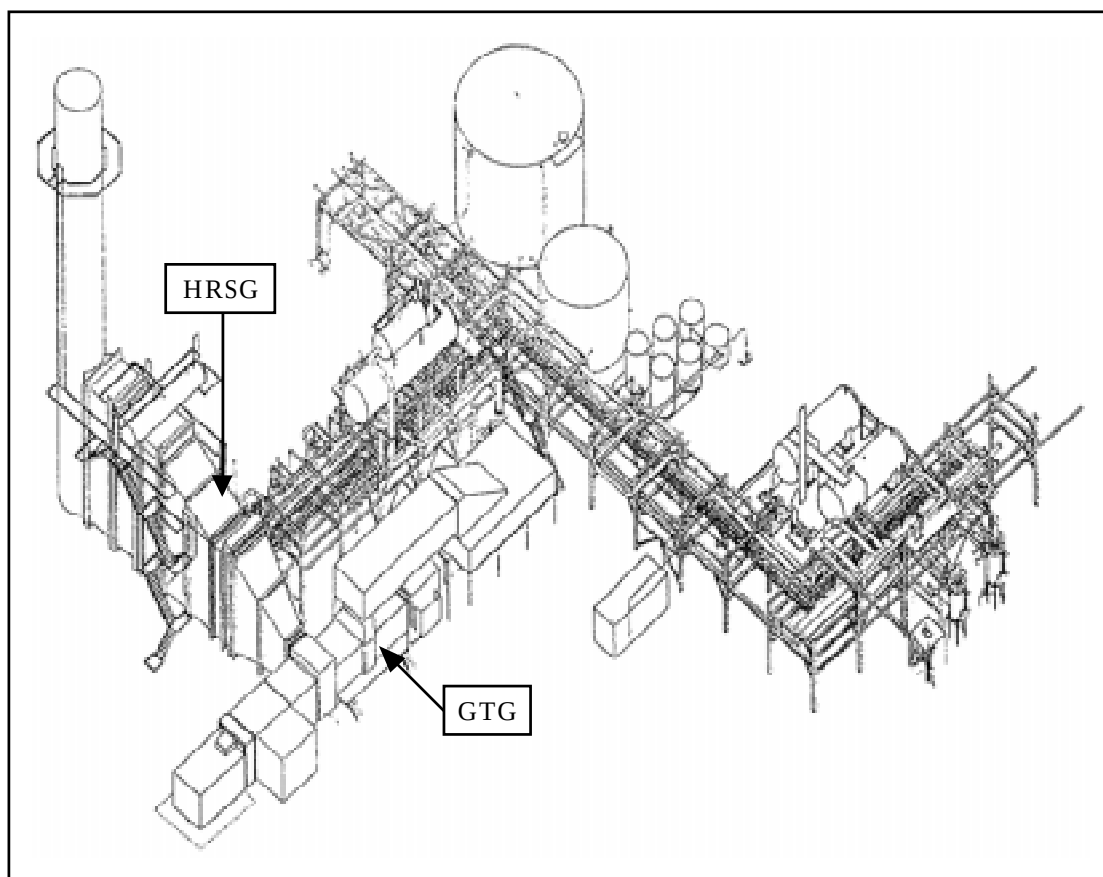


Figure 3.1. Schematic Drawing of Gulf Coast Cogeneration Project

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.

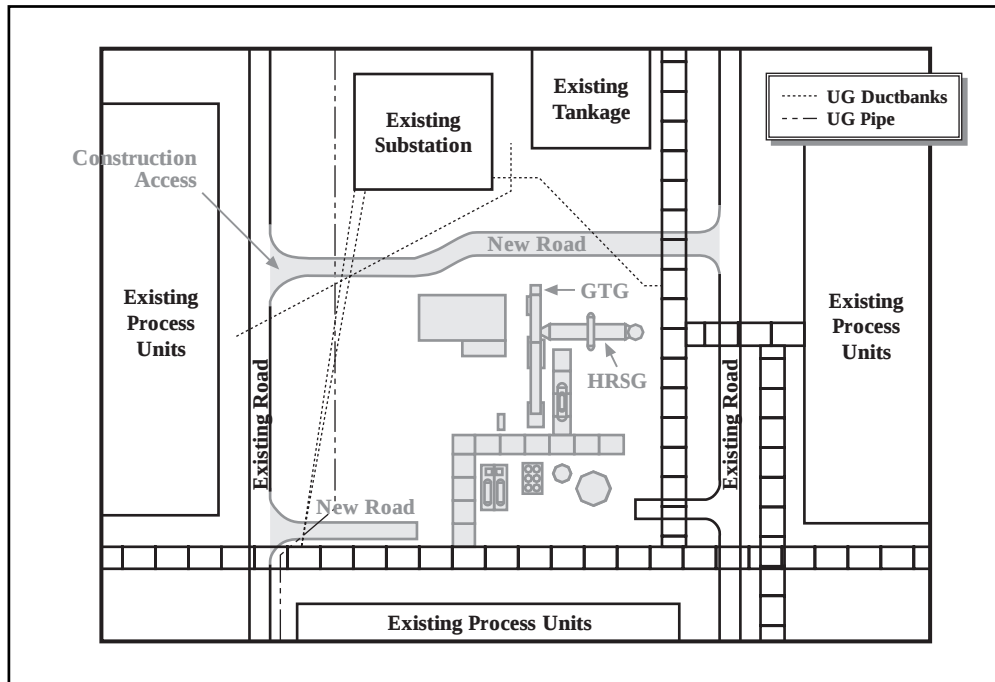


Figure 3.2. Site Layout for Example Gulf Coast Cogeneration Project

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.

3.0 Case Study Examples

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.