



ASSESSMENT OF CONSTRUCTION INDUSTRY PROJECT MANAGEMENT PRACTICES AND PERFORMANCE

Bureau of Engineering Research
The University of Texas at Austin

April 1990

The purpose of this publication is to make available to industry the results of research conducted by the Construction Industry Institute (CII). The publication does not necessarily represent the views of CII member companies, but is offered as a contribution to the industry.

CII was founded in 1983 to improve the cost effectiveness of the nation's largest industry. The members, who represent a broad cross-section of owners and contractors, believe that many of the problems that limit cost effectiveness are common ones, and that real improvements can be best accomplished in a cooperative environment with the benefits being shared by the construction industry at large.

CII uses the acronym TOPICS to describe the research effort. TOPICS signifies the six research thrust areas: Technology, Organization, People, Information, Controls, and Sigma (meaning others). The task forces for each area are listed below.

Technology

- Advanced Technological Systems
- Computer Integrated Design & Construction
- Constructability
- Electronic Data Management
- EPC Flexibility
- Modularization
- Technology

Organization

- Constructability Implementation
- Partnering
- Project Organization
- Project Team Building
- Project Team Risk/Reward Allocation

People

- Construction Work Force
- Education and Training
- Employee Effectiveness
- Safety
- Zero Accidents

Information

- CICE Impact Evaluation
- Industry Data & Statistics
- International Construction
- Model Plant
- Owner Engineering Organization
- Project Management Assessment Survey

Controls

- ASCE Quality Manual
- Change Order Impacts
- Claims
- Contracting, Phase II
- Contracts
- Cost/Schedule Controls
- Design
- Materials Management
- Overtime
- Overtime Phase II
- Productivity Measurement
- Quality Management
- Quality Performance Measurement
- Total Quality Management

Sigma

- Construction 2000
- Insurance
- Retrofit Projects
- U.S. Navy Demonstration Project

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**Assessment of
Construction Industry
Project Management
Practices and Performance**

**Prepared by
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Strategic Planning Committee**

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SUMMARY

The mission of the Construction Industry Institute (CII) is to improve construction cost effectiveness. Through its research the industry has been exposed to key management principles and concepts which could have a great influence on achieving successful project performance. CII research also has confirmed many recommendations suggested in The Business Roundtable's Construction Industry Cost Effectiveness (CICE) Project.

This publication summarizes, contrasts, and compares study findings from three similar but separate volumes prepared for owners, architect/engineers (A/E's), and contractors (References 3, 4, and 5). It discusses an attempt to measure quantitatively the current level of utilization on projects of key principles and recommendations endorsed by CII/CICE. Current project performance is evaluated, and project characteristics influencing both utilization and performance are explored.

The results presented here reflect the perceptions of respondents from various owner, A/E, and contractor companies involved in the design and construction of facilities. Data was gathered during the last half of 1988. The database for the study consists of 1,902 respondents representing 428 different companies. Each respondent completed an in-depth questionnaire reflecting his/her experiences on recent projects. The questionnaires were tailored to capture the unique perspective of each participant group.

Responses indicate that the average level of perceived utilization on projects of CII/CICE principles and recommended practices is about 66 to 70 percent. About two-thirds of all projects meet or perform better than cost or schedule targets. Eighty percent achieve the technical/quality performance required. Approximately two-thirds to three-quarters of the A/E and contractor projects meet project profit objectives.

An analysis of both respondent and nonrespondent data characteristics suggests a bias in favor of the industry's best and most knowledgeable companies. Therefore, current utilization and performance levels presented may be better than for the industry as a whole.

Other major findings of the study include the following:

- Higher levels of utilization improve project performance.
- Higher levels of utilization increase project profits for A/E's and construction contractors.
- Maximum utilization could save up to \$15 billion annually in project cost.
- Level of utilization is strongly determined by project size, managerial qualities of project managers, and project responsibility level of project managers.
- Project managers lack strong management skills and experience.
- One of every three projects is over budget or behind schedule.
- Many economically attractive and proven practices are receiving only moderate utilization.
- Small projects may benefit most from increased utilization.

INTRODUCTION

The construction industry is the nation's largest industry. Since the early 1970s, construction productivity has declined markedly. Considerable effort has been put forth to identify critical areas where the construction industry can improve its cost effectiveness. The Business Roundtable's CICE Project offers 223 specific recommendations to improve project performance. As of July 1988, 51 percent of the industry was aware of the CICE Project.

The Construction Industry Institute has engaged in many studies compatible with CICE recommendations. CII has published its findings in over 70 different documents. Some of these documents contain specific recommendations, while others present principles and concepts associated with sound and cost-effective engineering, construction, and project management practices.

In mid-1987, CII performed a special study to evaluate change in the construction industry since the early 1980s (see Reference 1). Twelve key issues of concern were identified. Six owner and seven contractor organizations were interviewed about these issues. A larger subset of the 12 key issues of concern was formulated from the interview data. A questionnaire was developed to confirm 36 different areas of change. This questionnaire was distributed at the 1987 CII Annual Conference. A total of 220 responses was gathered. This total was comprised of 98 owners, 96 contractors, and 26 academics. A mean response was calculated for each question by each group (see Appendix A).

The major findings of the 1987 Construction Industry Status study are presented in Figures 1 through 4 (see page 2). Indications of antagonistic relationships between owners and contractors are apparent in the results presented. Mistrust is evident between owners and contractors. Litigation and claim activity are rising. Owners are viewed as short-sighted. Also, owners are perceived to be shifting the risks to contractors without considering the ramifications of such policies. A general loss of expertise has occurred in the industry, thereby impacting project management capabilities at different levels of project execution. Project managers are handling a greater number of projects. Foreign competition for construction work in the U.S. will increase.

One solution to these problems is to promote a cooperative project management environment. This can be accomplished by the increased use of cost-effective project management practices by all participants in the design-construct process. The opportunity for large savings is extremely attractive. The nonresidential construction industry is an approximately \$240 billion-a-year enterprise. The distribution of this annual volume is shown in Table 1 (see page 3). If the industry can improve its performance and reduce costs by 10 percent, a savings of \$24 billion annually can be achieved. Of this savings, a potential

	Owner	Contractor	Academics
• Loss of Expertise	1.8	2.1	2.4
• Shift Toward Lump Sum Contracting	2.2	1.8	2.1
• Significant Level of Litigation	2.3	1.8	1.5
• Increased Contract Claim Activity	2.2	1.9	1.5
• Significant Increase in Foreign Competition	2.1	2.0	1.8
• Tighter Bidding with Cost Recovered Through Scope changes	2.2	2.1	1.9
• Mistrust Between Contractors and Owners	2.3	2.1	2.4
• Owners Moving Toward Decentralization of Central Engineering	2.6	2.3	2.2

Figure 1. Construction Industry Status Findings—General Agreement

	Owner	Contractor	Academics
• Owners Shifting Risks to Contractors Without Considering Ramifications	2.8	1.6	1.8
• Bidders Increasing While Quality of Bidders is Decreasing	2.7	1.8	2.2
• Owners Have Become Short Sighted in Project Execution and Management	3.2	2.2	2.3

Figure 2. Construction Industry Status Findings—Major Disagreements

	Owner	Contractor	Academics
• Increased Information Sharing Between Owner and Contractor	1.5	1.7	1.4
• Increased Emphasis on Preconstruction Planning	1.5	1.3	1.5
• Find Ways to Improve Performance in All Areas	1.3	1.4	1.4

Figure 3. Construction Industry Status Findings—High Needs

Survey Scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree

- Shift toward more generalists and fewer specialists
- Operating units (plant) have lost required expertise to execute projects
- Project managers handle greater number of projects
- Average project size is smaller
- Larger owners/contractors having difficulty adjusting to small project execution
- Total number of projects increasing
- Loss of U. S. manufacturing capacity
- U. S. manufacturers not keeping up with technology changes
- Industry losing young professionals due to desire to be less mobile

Figure 4. Construction Industry Status—Other Interview Findings

Table 1
Adjusted Construction Industry Volume
(Excluding Residential Construction)

INDUSTRY SECTOR	Base 1986* \$ Billions	CII Adjustment Factor	Revised Base 1986 \$ Billions	% Sector (Less Residential)	FUNDING—1986	
					Private \$ Billions	Public \$ Billions
Building	100.4	1.18**	100.4	41.6	79.8	20.6
Industrial						
Utility	37.9		44.8		44.8	
Process, Manufacturing, Etc.	15.3		48.6		47.0	1.6
Subtotal	53.2		93.4	38.8	91.8	1.6
Heavy Engineering	47.3	3.18**	47.3	19.6		47.3
Total	200.9		241.1	100.0	171.6	69.5
Percent					71.2	28.8

NOTES: * Developed from data in "Construction Review," Nathan Rubinstein, Editor, U.S. Department of Commerce, Vol. 33, No. 5, September/October, 1987.

 ** Developed from data in "How Big Is The Construction Industry," by Jack C. Phillips, *Construction Industry Institute News*, Volume 1, No. 4, Fall 1988.

of \$15 billion could be attributed to maximizing the use of good project management practices.

In mid-1987, CII embarked upon the Project Management Practice Assessment Survey to evaluate industry utilization of the principles and recommendations of CII/CICE. The general purpose was fourfold: 1) to select, categorize, and measure key project management practices; 2) to relate the level of utilization on projects of these principles and recommended practices to other project characteristics; 3) to capture current level of project performance as measured in terms of meeting project cost, schedule, technical, quality, safety, and profit objectives; and 4) to relate level of utilization to project performance.

Eight management categories were examined: Strategic Project Organizing, Contracting Practices, Design Effectiveness, Project Controls, Management of Quality, Materials Management, Human Resource Management, and Safety. Each category is described by a brief scope statement as delineated in Table 2 (see page 5).

This publication summarizes the results of the survey and captures the extent of utilization on projects of key project management principles and recommended practices articulated by CII/CICE. The effort here focuses on determining appropriate correlations between project characteristics, utilization, and performance. The primary characteristics hypothesized to have an association with the level of utilization include project size, project manager attributes, knowledge of cost-effective management principles and concepts, project type, and organizational location of project execution.

Findings and conclusions are drawn from the perspectives of 1,902 respondents representing 428 different owner, A/E, and contractor companies from all three major industry sectors. Table 3 (see page 6) summarizes survey distribution and receipt for each participant group. Within each industry sector, small to large companies are included in addition to a broad range of different project sizes. Between 50 and 100 principles and recommendations are tested and used in the data analysis depending on the participant group being studied (see References 3, 4, and 5).

Table 2
Project Management Categories of CII/CICE Principles and Recommended Practices

Management Category	Scope Statement
Strategic Project Organizing	This category focuses on principles/recommendations related to project organization, establishing objectives, scope definition control, establishing communications/information processes, and constructability planning.
Contracting Practices	This category focuses on those principles/recommendations related to contracting strategy (planning, packaging, etc.) and the utilization of specific contract provisions and/or clauses for contracts controlled by the initiating party.
Design Effectiveness	This category covers principles/recommendations relevant to the evaluation of the design effort, incorporating constructability concepts into design, and control of design activities.
Project Controls	This category focuses on principles/recommendations related to control integration, decision making, scope control, control techniques, and estimating practices.
Management of Quality	This category is concerned with principles/recommendations related to the implementation of quality assurance/quality control and the documentation of quality effectiveness.
Materials Management	This category focuses on principles/recommendations related to planning and utilization of materials management on projects.
Human Resource Management	This category is concerned with principles/recommendations related to the quality of site supervision, field work force motivation, training, and site labor practices (substance abuse, overtime, etc.)
Safety	This category covers principles/recommendations related to safety communications, specific practices, and management attitude toward safety.

Table 3
Survey Distribution and Receipt

PARTICIPANTS	SENT OUT		RETURNED		% Companies Responding	% Surveys Returned
	Companies	Surveys	Companies	Surveys		
Owners	220	2204	105	773	47.7	35.1
Arch/Engineers	630*	3230	113	465	17.9	14.4
Contractors	1450*	7306	210	664	13.7	9.1
Total	2300	12740	428	1902	18.6	14.9

*NOTE: Some duplication exists because several of these companies provide engineering and construction services. They completed both the A/E and contractor questionnaires.

COST BENEFITS OF IMPROVED PROJECT MANAGEMENT EFFECTIVENESS

In an industry as large and complex as construction, many different factors influence the facility acquisition process. These factors will determine, to some extent, the cost effectiveness of construction projects. Any effort to improve the industry's cost effectiveness, therefore, lies first in the identification of these significant factors.

Three major areas are considered crucial to improving cost effectiveness in construction. They are referenced here as: 1) technology enhancements; 2) managing the design-construct interface; and 3) utilizing sound project management practices. The third area is the main thrust of this report.

Quantifying the potential savings as a direct consequence of using good project management practices is difficult. In an actual project situation, cost benefit analyses of different alternatives are not always based on hard facts. Often, subjective assessments are made from past experiences. Assumptions are crucial and frequently subjective in themselves. It is believed that providing an assessment of the dollar savings from the application of CII/CICE principles and recommended practices is worthwhile even if such an assessment is basically subjective.

A cost benefit analysis was conducted using a three-phased approach. First, literature was reviewed and cost data extracted. Second, cost benefits discussed in CII research findings and cost savings presented in the CICE reports were compiled. Finally, the subjective assessment of knowledgeable industry experts was tapped. This database was comprised of 35 industry experts who provided their assessment of the potential gross savings in total project cost and the associated benefit-to-cost ratio of implementing the principles and recommendations of CII/CICE. The form used to collect the information is shown in Appendix B. The data was analyzed with appropriate statistical methods.

Table 4 (see page 8) presents a composite of all information collected. As depicted, cost benefit conclusions are summarized by the eight project management categories. In deriving the values shown, the greatest weight was given to the assessment of industry experts. This data was then modified by comparable data extracted from CICE, CII research, and the literature.

The combined results presented in Table 4 are rounded so as not to imply precision. A range of gross savings for maximum utilization also is shown, since the potential savings are likely to vary depending on project type and size.

Table 4
Cost Benefit of Maximum Utilization of CII/CICE Principles and Recommended Practices

Management Category	Potential Gross Savings for Maximum Utilization¹ (%)	Range of Gross Savings for Maximum Utilization (%)	Benefit to Cost Ratio
Strategic Project Organizing	15	10 to 20	20:1
Design Effectiveness	10	5 to 20	15:1
Human Resource Management	10	5 to 20	15:1
Project Controls	10	5 to 15	10:1
Management of Quality	8	5 to 10	10:1
Materials Management	5	3 to 8	10:1
Contracting Practices	5	3 to 10	10:1
Safety	5	2 to 8	10:1
Integrated Effect ²	25	15 to 30	15:1

Note: ¹ Gross savings of total project cost

²The integrated effect does not reflect a summation of the savings for all eight management categories. It represents a composite of the subjective assessments of all respondents (adjusted for other data sources). Each respondent had their own weighting process to derive the percent savings for the combined maximum utilization of all categories.