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DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Rodney Jack Ball, B.S., M.A.

* * * * *

The Ohio State University

1974

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Dr. Desmond L. Cook
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## PUBLICATIONS

*Evaluation of the 1969-70 City-Wide Testing Program—Report II, Columbus Public Schools, Department of Evaluation and Research, Columbus, Ohio, 1970, Co-author.*

FIELDS OF STUDY

Major Field: Educational Development

Studies in R & D Management/Project Management.
Professor Desmond L. Cook

Studies in Statistics and Experimental Design.
Professors Robert J. Wherry and John J. Kennedy
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CHAPTER I

PROBLEM STATEMENT

An Overview of Project Management

The concept of project management is relatively new in this country having appeared in management literature mainly during the past twenty years. The emergence of the concept is primarily associated with the emergence of large, weapon system design, development and production efforts sponsored by the Department of Defense (e.g., Manhattan Project, Polaris, and Minuteman) and extended civilian efforts sponsored by the National Aeronautics and Space Administration (e.g., Mercury and Apollo).

Definition of Project Management

Project management refers to the process of managing projects. That is, it is concerned with the application of management philosophies and procedures to the management of efforts that meet the criteria or characteristics that define a project. To fully understand the concept of project management, it is necessary to operationally define the terms project and project management.
Current definitions of project focus upon the completion of an established set of tasks or achieving a goal within pre-specified time and cost dimensions. That is, a project is an effort designed to accomplish a goal having performance specifications that are often set before the effort begins. The effort is of a finite duration during which time a pre-specified cost is expected to be incurred.

In the writings of Gaddis, Baumgartner, Woodgate, and Marks, the following characteristics are generally used to define a project.

1. Is directed toward the attainment of a goal.
2. Has specifications for determining when the goal has been attained (performance specifications).
3. Has a pre-specified time limit.
4. Has a pre-specified cost limit.

---

These characteristics of a project define it as a goal oriented effort to be completed within time, cost, and performance standards. Cook, however, goes on to further characterize a project as being once-through, non-repetitive, or any one-of-a-kind activity that is complex in nature and involves a large number of tasks that relate only to that project.\(^5\)

The determination of what is complex in nature and what is a large number of tasks is primarily a matter of scale or degree. Cook states that specific criteria for such determination do not exist at this time.\(^6\)

Cleland and Kind support the points made by Cook when they write of the magnitude of project efforts, the interrelatedness of the tasks, and the unfamiliarity of the undertaking to the organization.\(^7\) They state that when an undertaking requires substantially more resources (people, money, equipment) than are normally available in the business, project techniques are clearly required. Further, another decisive criterion for establishing a project is the degree of interdependence existing between


\(^6\)Ibid.

the tasks of the effort. An undertaking is not a project unless it is something out of the ordinary and different from a normal, routine affair in the organization.

Summarizing the views expressed above, a project is defined as a unique, goal-oriented set of interrelated tasks often characterized by conditions of uncertainty but always conducted within time, cost, and performance specifications.

The concept of project is often made more clear when it is contrasted with the concept of program. Programs are on-going, repetitive efforts that usually are not characterized by the large amount of uncertainty usually associated with projects. Programs are more routine production type activities that repeat year after year.

An example of a program in the field of education is the mathematics program of an elementary school which continues year after year. The program may experience minor modification, but it still continues each year in much the same manner as the year before. In contrast, an effort to implement an almost totally new mathematics program would represent a project. The effort is complex and has a goal, finite life span, cost limit, and some uncertainty about the method of accomplishing its goal. The complexity is demonstrated in the fact that such ef-
forts usually involve staff at different levels in the organization from different buildings who must perform a variety of interrelated tasks. The goal would be the implementation of the new instructional materials and procedures into the on-going school curriculum. This implementation would be accomplished within a finite period of time, often one or two years, and within the bounds set by a fixed amount of money that has been budgeted for the effort. And finally, since the instructional materials and procedures are usually quite new to the staff, a considerable amount of uncertainty would exist regarding how the transition from the old way to the new way would be accomplished, and how successful the new program would be once it was implemented.

In summary, a project is a unique, goal-oriented set of interrelated tasks often characterized by conditions of uncertainty, but always conducted within time, cost, and performance specifications. A project is a finite, once-through endeavor; whereas, a program is an on-going, repetitive, routine endeavor involving considerably less uncertainty.

Project Management Process

The term project management process refers to the process of managing projects. In order to understand the process, it is first necessary to understand
the concept and functions of management.

**Management Functions.** Management can be defined as making decisions about allocating resources and directing the efforts of people so that desired ends are attained most efficiently. A manager accomplishes his task by performing several basic management functions. Authors often disagree regarding the number of the functions and the names given them. Four or five functions are, however, frequently cited.

Koontz and O'Donnell state that the most useful method of classifying managerial functions is to group them around the activities of planning, organizing, staffing, directing, and controlling.  

8 Newman and Summer divide the total task of management in terms of organizing, planning, leading, and controlling.  

Management is defined below in terms of the four basic functions of planning, organizing, directing, and controlling. Koontz and O'Donnell's function of "staffing" is subsumed under organizing. Newman and Summer's "leading" is termed directing.

---


Planning is defined by Koontz and O'Donnell as selecting objectives and the strategies, policies, programs, and procedures for achieving them. Newman and Summer define planning as clarifying objectives and setting goals, establishing policies and standard methods to guide those who do the work, and developing programs, strategies, and schedules to keep the work moving toward the objectives. Le Breton and Henning state that a plan is a predetermined course of action. In this document planning is defined as the making of a set of initial decisions regarding what goal or objective will be sought and how it will be achieved. It consists of the activities of setting goals or objectives, specifying tasks and work flow, determining schedule, and allocating resources.

Organizing is defined by Koontz and O'Donnell as . . . the establishment of an intentional structure of roles through determination and enumeration of the activities required to achieve the goals . . . , the grouping of these activities, the assignment of such groups of activities to a manager, the delegation of authority to carry them out, and provision for coordination of authority and informational relationships horizontally and vertically in the organization structure.

10 Koontz and O'Donnell, Principles of Management, p. 47.
They define staffing as manning and keeping manned the positions provided for by the organization structure. Newman and Summer state that organizing involves assigning various tasks to different people and coordinating their efforts.\(^{14}\) In this document, organizing is defined as selecting and arranging people in patterns of relationship relative to authority and responsibility in order to provide an effective and efficient structure for achieving desired goals. It involves such activities as selecting personnel, assigning them to tasks, and specifying their authority and responsibilities.

**Directing** is defined by Koontz and O'Donnell as guiding and leading subordinates.\(^{15}\) They further state that it involves clarifying assignments, guiding them (subordinates) toward improved performance, and motivating them to work with zeal and confidence. Newman and Summer, in discussing the function of leading, state that a manager strives to integrate the needs of people with the welfare of his company or department. This involves assisting subordinates to perform their duties, and helping them achieve their personal aspirations.\(^{16}\) Directing is defined in this document as motivating and guiding people in the

performance of their tasks. It frequently involves giving encouragement and rewards, clarifying tasks assignments, and providing guidance toward improved task performance.

Koontz and O'Donnell define controlling as "... measuring and correcting the activities of subordinates to assure that events conform to plans." Koontz and O’Donnell define controlling as "... measuring and correcting the activities of subordinates to assure that events conform to plans." Newman and Summer, in discussing the control function stress that a manager has to measure his progress in order to attain his objectives. And, when he discovers that operations are not proceeding according to plan, he takes corrective action to get back on course or, if this is not feasible, he readjusts his plans.

Controlling is defined in this document as the detection and correction of deviations between what was planned and what is actually happening. It involves measuring what is happening, comparing it with the plan and, when there is a discrepancy between the actual and the plan, specifying and implementing corrective action.

Management is the process of applying the four basic functions of planning, organizing, directing, and controlling to the operation of a program. That is, management is concerned with making decisions in order to accomplish the goals of a program through the execution of the general management

17 Koontz and O'Donnell, Principles of Management, p. 49.
functions of planning, organizing, directing, and controlling.

**Project Management Phases.** The project management process is concerned with the application of the general management functions of planning, organizing, directing, and controlling to the operation of a project. A project, as stated before, is basically different from a program in that it has a finite life span. It is created, it lives, and it terminates or dies. It is a temporary effort requiring a temporary management system. This is in direct contrast to programs or institutions which are on-going and, therefore, require a more permanent management structure or system.

The life span of a project can be divided into four periods—the planning, preparation, operation, and termination phases. Project management, then, involves the application of the four basic management functions of planning, organizing, directing, and controlling during each of the phases of a project. During each phase, however, certain functions are frequently emphasized more than others. These phases are pictured in Figure 1 and the management activities involved in each are outlined below.

The **project planning phase** is the first phase in the life of a project. It involves setting the goal and objectives for the project; specifying the work to be done;
Project Life Span

*Frequently the activities of a phase may continue as the next phase of the project begins.

Fig. 1. The four phases in the life of a project
describing the flow or sequence of work tasks; determining the time schedules, material, and manpower needs; and preparing a budget. These activities are primarily the same activities discussed previously under the basic management function of planning.

The project preparation phase is the second phase in the life of a project. It involves obtaining and organizing personnel, equipment, materials, and facilities, and developing a project information system so that the actual work or tasks of the project can begin on the specified project start-up date. These activities correspond primarily to the activities performed under the basic management function of organizing.

The third phase in the life span of a project is the operations phase. It usually begins at the project start-up date although preparation phase activities such as staff orientation may still be conducted. The operations phase involves the actual conduct of the activities specified in the project plan and the monitoring and control of those activities. The monitoring and control of activities involves detecting deviations from the project plan, analyzing the problem causing the deviation, con-

---


20) Ibid.
sidering alternative solutions, making decisions, and implementating those decisions in order to ensure the success of the project. These activities correspond to the activities performed under the basic management functions of directing and controlling.

The termination phase is the last phase in the life of a project and begins sometime toward the end of the project. It involves activities dealing with the ending of the project at or near the scheduled completion date. Some of these activities are: reporting about the project, transferring personnel and equipment, and storing records. These activities do not clearly correspond to any one of the four basic management functions since they are concerned with a primary characteristic that differentiates a project from a program—the fact that it terminates or ends. Project termination frequently involves activities from all four basic management functions in that the ending of a project must be planned, prepared for, and carried out.

The Project Manager and Project Placement. A project is characterized by having a single person responsible for its planning and execution. This person, who usually carries the title of project manager or director, is responsible for the accomplishment of the project goal within

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22 Ibid.
time, cost, and performance specifications. In an article discussing the role of the project manager, Gaddis states that his basic responsibility is to deliver the project end project "... (1) in accordance with performance requirements, (2) within the limitations of his budget, and (3) within the time schedule that his company or customer has specified."24

Projects, being temporary efforts, are usually found to be part of the operation of larger, more permanent structures or organizations. Examples of these structures, frequently termed the project parent organization, are private corporations, governmental departments, universities or colleges, and local school districts.

In summary, a project represents a temporary unit placed within a larger, more permanent organization. It is the responsibility of the project manager to plan, organize, direct, and control the project effort. He continually interacts with his project staff and the staff of the parent organization as the project moves through the phases of planning, preparation, operations, and termination.

23Ibid.
Emergence in Business and Industry

Although project management is basically not new to the world, it has emerged in industrialized countries more and more as the technological complexity of society has rapidly increased. Klohman states that

... there is little new or unique about project management. Much that has been achieved in human progress has come by dedicating and organizing human energies and physical resources to meet specific goals. Modern industrialized society has become dependent on this type of management to a higher degree than ever before.25

In the United States project management became an important management approach in business and industry during the last two decades. It first came into prominence through contract work for the government—namely the Department of Defense. Kast and Rosenzweig state that the adoption of the program (project) management concept has been influenced by rapid technological advancements, changing industrial complexes, the rise of an adverse power, and critical lead times.26

Writing in 1963 in regard to Department of Defense and National Aeronautics and Space Administration contract work with U.S. industry, Baumgartner stated the growth in


project activity from an almost negligible volume ten years ago is due directly to the tremendous pressures on time, cost, and performance resulting from rapidly changing technologies in an environment of continuing international tension. The increasing application of the project concept has proved to be the most effective way to meet these pressures.  

The Manhattan Project of World War II is frequently cited as the first major government/industry project in the country. The goal of the project was to produce a fission bomb meeting certain performance specifications within specified time and cost constraints. It wasn't until the late 1950's and 1960's though, that the project management approach became prevalent. Examples of important government/industry development efforts in the past two decades that have employed the project management approach include the Mercury, Minuteman, Polaris, and Apollo projects. Each of these was a unique, goal oriented effort conducted with uncertainty but within time, cost, and performance specifications. Each had a definable start and stop date, budget, and criteria of acceptable performance or project completion.

27Baumgartner, Project Management, p. 2.
28Ibid., p. 6.
29Ibid.
Examples of project efforts in industry directed toward the consumer include new product development efforts such as the Vega automobile. Development of the new car for the product year 1970 was a unique or once-through, goal oriented effort with start and completion dates, a budget, and performance requirements. A project manager was selected and he, in turn, selected his staff and planned and controlled the project from initiation to termination.

An example of the evolution of project management in the public sector is seen in the Los Angeles County Flood Control District, Los Angeles, California. Under the stimulus of having to produce a record volume of storm drains and flood control construction and new administrative goals, the Los Angeles Flood Control District adopted a project management scheme to manage the construction effort and achieve the new administrative goals.

Another example of project efforts in the public sector is the work of the Community Analysis Program in the city of Los Angeles. The purpose of the program was


to apply aerospace technology to identifying and countering physical, economic, environmental, and social deterioration in the city. The city selected a project team; obtained technical support, and planned, organized, and implemented a systems approach effort to counter current and future urban blight.\(^{32}\)

Indicative of the current prominence of project management in the U.S. was the formation of the Project Management Institute (PMI) in 1970. PMI is a professional, non-profit organization incorporated in the State of Pennsylvania. In its short life, PMI has become an international organization fostering professional development, research, and the sharing of knowledge within the area of project management. This is done primarily through an Annual Seminar/Symposium at which papers are presented and panel discussions held and through the publication of the PMI Quarterly. PMI members come from such fields and occupations as manufacturing, engineering and construction, education, government, electronics, and so forth.

Summarizing, during the past two decades project management has become a prominent management approach for achieving complex goals within specific time, cost, and

performance requirements. It first gained prominence in government contract work for the Department of Defense. It has since spread to nearly all business and industrial areas as the technological complexity of the nation has rapidly increased.

Emergence in Education

Although the practice of project management emerged first in the development of weapons systems for the Department of Defense in this country, it has since spread to education. Howard J. Hjelm stated that

the application of sophisticated project management techniques in the applied social sciences is a relatively recent phenomenon. And as management can be credited for the success in fields such as space exploration and industrial development, so too increasingly sophisticated management is required for large-scale programs of research, development, and demonstration in education. 33

During the past two decades, the emergence of project management in the field of education has been significant. An obvious stimulant has been the increased role of the federal government in education through programs and projects under such acts as the Cooperative Research Act of 1956, the National Defense Education Act of 1958, the Vocational Education Act of 1963, and the

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Elementary and Secondary Education Act of 1965. Cook states that the increased presence of projects has stemmed largely from the increased availability of funds to conduct such projects. He notes that the Cooperative Research Program of 1956 was probably the initial major act to provide funds for specific projects followed by the National Defense Education Act of 1958, the Vocational Education Act of 1963, and the Elementary and Secondary Education Act of 1965.\(^{34}\)

Typical of the project nature of the educational activities conducted in the schools of the country with funds provided by these legislative acts are the projects of the Elementary and Secondary Education Act (ESEA) Title III program named "Projects to Advance Creativity in Education (PACE)." The project nature of the activities funded under this program is seen in the following excerpt from the PACE manual.

1. Proposals for long-term projects should indicate methods for phasing out Federal support over a three-year period through gradual cost absorption by local and other funding.

2. The project period is the duration of time in which the applicant proposes to conduct all phases of the project activities. A project period may not exceed three years.\(^{35}\)

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\(^{34}\)Cook, *Educational Project Management*, p. v.

An "average" PACE project is a multi-district project, with seven or more (school) districts or serves a city of 10,000 or more; it provides services directly to pupils; it serves as a supplementary center; and its budget is between $50,000 and $100,000.\footnote{Office of Education, U.S. Department of Health, Education, and Welfare, Second National Study of PACE—The Views of 920 PACE Project Directors (Washington: U.S. Government Printing Office, 1968), p. 8.}

Another example of the project concept in education is the small project grants of the Regional Research Program which was established in 1966 and operated until 1972. The purpose of the program was to make funds available with minimal delay for the conduct of educational research projects. Small-scale meant maximum funding of $10,000 and not over eighteen months to complete.\footnote{Foster S. Buchtel, "U.S. Office of Education Regional Projects Research Program" (unpublished paper, Western Michigan University, 1971), p. 1.} The specific objectives of the program were:

1. To support significant, small-scale educational research projects.
2. To facilitate participation in educational research by a broad range of college and university personnel.
3. To encourage small colleges to undertake research programs so that students may benefit from having professors who are engaged in educational research activities.
4. To provide for direct and expeditious handling of proposals.\[^{38}\]

Grant awards were made across the country through ten regional offices which reviewed project proposals and monitored funded projects. Quite a number of educational research projects were funded each year under the program. For example, in the 1969 fiscal year, 984 proposals were received by the regional offices and 314 projects were funded at a total funding level of $2,542,142.\[^{39}\]

Although the Regional Research Program as such was terminated in 1972, a similar program is currently operating within the National Institute of Education.

Further indications of the emergence of project management into education are found in the literature. For example, Program Evaluation and Review Technique (PERT), a planning and control technique developed for the Navy Polaris project, has been adapted to educational projects in the monograph written by Cook entitled *PERT: Applications in Education*. This monograph is the product of a project, funded by the U.S. Office of Education, which pioneered the application of PERT in the field of education. Cook has followed this work with the recent publication of a book entitled *Educational Project Management*.


Management.

Research for Better Schools, Inc., a Regional Educational Laboratory at Philadelphia, and the Educational Program Management Center (under the direction of Cook) in the Faculty of Educational Development and Research at the Ohio State University have cooperatively developed and tested modules of the Educational Project Management Instructional System in several school districts across the country. These modules are designed to help districts develop and maintain their own capability to plan and operate educational projects.

Bennigson and Nixon, in a paper presented at the Project Management Institute's 1970/71 Annual Seminar/Symposium, discuss the application of project management concepts and techniques to the entire life cycle of an ESFA Title III project in a city public school district. In another paper presented at the same symposium, John R. Hanna describes the development of a project management capability in the Bellevue, Washington Public Schools. He concludes the paper by stating that "project management, even in its evolutionary stage, has been and will continue to be an important tool to be used by the Bellevue School.

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Summarizing, during the past two decades project management has become a prominent management approach in our nation's schools for achieving complex goals within time, cost, and performance specifications. The emergence of project management into the field of education has been stimulated by legislative acts of the federal government and aided by knowledge gained from the management of project efforts in government and industry.

Framework for the Study of Project Management

Dr. Desmond L. Cook, of The Ohio State University, recently conducted a research study which resulted in a conceptual framework to be used for the study of project management. The purpose of the effort was to develop a framework which could be used to integrate the results of past and current studies and to direct further research on project management. A schematic of this conceptual framework is presented as Figure 2. Project success represents a major component of the conceptualization. It

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Fig. 2. Conceptual framework for project management
includes the potential criteria defined below.

1. **Schedule** refers to meeting project milestone deadlines and the scheduled project termination date as established in the project contract. Success on this dimension means that the project was completed on or before the scheduled termination date and that all subsections or components of the project were completed as scheduled.

2. **Cost** refers to meeting the total dollar expenditure predicted for the entire life of the project. Success on this dimension means that the actual dollar cost of the project was less than or coincided with the predicted cost.

3. **Quality/Performance** refers to the achievement of the goals and objectives of the project. Success on this dimension means that the performance standards specified by the project objectives were met or exceeded.

4. **Customer/Client Satisfaction** refers to the degree to which the funding agency or user of the end product of the project is satisfied. This criterion is not necessarily concerned with the quality of the project as indicated by whether or not the original objectives and performance standards were met. It is concerned only with the satisfaction of the funding agency or customer.
with the project or its end product.

5. Spin-off refers to indirect benefits received by the parent institution, its faculty, and the project staff. Success on this dimension means, for example, that the project and/or the parent institution's faculty developed skills as a result of working with the project which can be applied to other areas of the institution's operations. Another important spin-off benefit is the recognition an institution often gains from a highly successful project.

6. Follow-on Work refers to additional contracts or follow-on work obtained as a result of the success of the original project and consequent enhancement of the reputation of the researcher. This criterion is not, however, concerned with additional work obtained as a logical or technical extension of the original project.

The relevance of such criteria in assessing project success is seen in the literature on project management.

Baumgartner states that the government or industrial customer wants to know just three important things during the life of a project:

1. Will deliveries be on time.
2. Will the final cost be within the amount contemplated.
3. Will the product meet the required performance and reliability standards.43

Marks states all projects have three basic elements, namely: technical objective, cost objective, and time objective. These objectives form the basis for project planning and control.44

Klohman emphasizes the importance of meeting time, cost, and performance criteria when he emphasizes the positive value of commitment throughout all organizations involved in a project to fulfilling objectives (quality/performance) within a set time (schedule) and specified resource (cost) limits.45

The importance of the criterion of customer satisfaction is seen in the fact that Baumgartner devotes an entire chapter to the project manager and the customer.46 Subsections within the chapter are entitled "Retaining Customer Confidence," "Knowing the Customer," and "Keeping the Customer Informed." Silverman stresses the importance of the customer when he states that the buyer is as much a part of a project as the project personnel and should be treated that way. He recommends that the project manager

43 Baumgartner, Project Management, p. 31.
44 Marks, Project Management of Industrial Contracts, pp. 11 and 12.
46 Baumgartner, Project Management, pp. 126-234.
keep the customer informed and use his inputs. Bennigson has stated that client satisfaction is an often neglected criterion of project success. He feels it is frequently ignored in favor of time, cost, and performance specifications. The importance of the criterion of customer satisfaction in education was emphasized by Francis E. Colgan of the State of Nebraska Department of Education in a letter to the Educational Program Management Center in the Faculty of Educational Development and Research at The Ohio State University. He stated that:

> It is possible that we educators might conduct a successful project and be in the throes of a conflict within the community simply because we do not first work with them to the extent that we will be aware of issues, conflicts, and problems they are experiencing.

The importance of the criterion of spin-off is noted by Bennigson when he states that project criteria have to be set in terms of potential internal spin-off. For example, projects are often undertaken for the purpose of allowing the parent organization to explore possible

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49 Francis E. Colgan, Letter to Educational Program Management Center, Faculty of Educational Development, The Ohio State University from State of Nebraska Department of Education, 17 March 1972.
new areas. Gaddis emphasizes the importance of spin-off benefits when he states that "the results of each project can expect to induce changes in the organization itself, and these changes should also be evaluated carefully."51

The importance of the criterion of follow-on work is emphasized by Bennigson. He states that projects are often intended to lead to larger projects or follow-on work and that criteria have to be established relevant to the needs of the larger project.52

In addition to identifying potential criteria for assessing project success, Cook's conceptual framework suggests that different persons may have different viewpoints on project success, and that these would be reflected in their ranking of the potential success criteria.53 For example, project managers may be most concerned with time, cost, and performance, whereas, parent organization representatives may be quite concerned about spin-off benefits, follow-on work, and customer or

funding agency satisfaction.

Project Success Criteria

The last two decades in American education have seen a dramatic increase in the number and magnitude of project type activities. Much of this increase is due to financial stimulation from sources external to the school districts such as the federal government. This increase in project activities has been accompanied by a concern for their evaluation. The concern for evaluation has been prompted by the realization by educational decision-makers of their need for evaluative information about new programs in their schools. Also, agencies such as the federal government who are providing the finances for many of the new programs and projects have frequently mandated the evaluation of projects.

A major problem in the evaluation of projects in education in recent years has been that of trying to specify appropriate and effective criteria for measuring project success. Various criteria have been employed in attempts to evaluate different projects. In discussing Title I of ESEA, Murphy states that elaborate criteria


for determining the success of programs or projects were not initially set up. The sole criterion of success was the actual fact of fund distribution to school districts. During the years 1967 to 1970, attempts were made by the Office of Education and the state departments of education to issue and enforce a set of criteria dealing with the success of projects in educational terms.

Two criteria most pressed for by the federal government were the establishment of parent advisory committees and the concentration of funds. The first criterion was designed to give the poor some control over their children's education and the second was designed to ensure that any one project was sufficiently funded.

Different states have employed various criteria in the evaluation of Title I projects. The Texas Education Agency, for example, presented three sets of criteria in their 1970 Annual Report of Title I. The criteria in the first set were concerned with compliance with the provisions of the Civil Rights Act of 1964. The criteria in the second set dealt with the conduct or management of the projects. The criteria in the final set, dealing with

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56 Ibid., p. 39.
57 Ibid., p. 48.
educational objectives and effectiveness, were:

1. To improve scores on standard tests.
2. To achieve cost-effectiveness.
3. To increase community involvement with education.
4. To increase parent involvement.\(^{58}\)

The Missouri State Department of Education discussed seventeen criteria by which to judge Title I projects in their 1970 Annual Evaluation Report. Many of the criteria were concerned with the management or conduct of educational projects. Others, concerned with educational outcomes, objectives, or effectiveness, were:

1. Achievement test scores should be improved.
2. Student health problems should be addressed.
3. Disadvantaged children's social skills should be improved.\(^{59}\)

The Michigan State Department of Education used ten criteria to evaluate Title I in 1970. Again, these criteria can be categorized as either being concerned with the management of the projects or the educational effectiveness or results of the projects. The criteria concerned with the educational effectiveness of projects


were:

1. That project quality be high.
2. That reading levels of disadvantaged children be raised.  

The Puerto Rican Department of Education used the following criteria of educational effectiveness in evaluating Title I projects.

1. To improve the physical, social, and emotional development of disadvantaged pupils.
2. To raise academic achievement.
3. To improve pre-school education.

Local school districts, like state departments of education, are concerned with educational effectiveness in the evaluation of their Title I projects. For example, in 1970 the Los Angeles Unified School District used the following objectives against which to evaluate the effectiveness of Title I projects.

1. To improve reading scores.
2. To improve mathematics scores.
3. To improve the English of Spanish-speaking children.
4. To improve the library skills of the children.

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5. To improve the verbal functioning behavior, self-image, and expectations of success of disadvantaged pre-schoolers and school children.

6. To increase inter-ethnic group contact and understanding.

7. To improve communications among home, school, and community; and to help parents understand the school.

8. To identify school children's health defects.

9. To understand the effects of poverty on children.

10. To help the handicapped.\(^6^2\)

In summary, a wide variety of criteria have been used by local school districts, state departments of education, and the U.S. Office of Education in evaluating the effectiveness of educational projects. Examples of these criteria are:

1. To improve reading scores.

2. To increase inter-ethnic group contact and understanding.

3. To improve the physical, social, and emotional development of disadvantaged pupils.

4. Student health problems should be addressed.

These criteria of success or effectiveness appear to be specific examples of criteria that would be classified under the heading of quality/performance in Cook's conceptual framework. Nowhere in the lists presented above do we see such criteria as:

1. The project will be completed on schedule.

2. The project will be completed within the budgeted resource limits.

3. The project will be followed by further projects in a similar area of concern.

4. The project staff will increase their competencies in a particular area of concern.

5. The students and parents will be satisfied with the project to the extent that they are willing to support further work in a particular area of concern.

It appears that the efforts to determine the success of projects in education have primarily employed the criterion of quality/performance to the exclusion of such criteria as schedule, cost, follow-on work, spin-off, and customer satisfaction.

The Problem

Cook's conceptual framework suggests six potential criteria for determining the success of a project. It appears that in education, however, only one criterion is commonly used in determining the success of projects—quality/performance. Cook's conceptual framework also suggests that different persons may view the success of a project differently. That is, a project rated high on quality/performance may not necessarily be rated high on customer satisfaction. Finally, Cook notes in his conceptual framework that, at present without the benefit of research, the six possible criteria of project success are
considered to be independent of each other and equally weighted.

The general purpose of this study was to explore two basic hypotheses or assumptions suggested by Cook's conceptual framework in regard to the criteria of project success. The general objectives of the study were:

1. To determine if schedule, cost, quality/performance, follow-on work, spin-off, and customer/client satisfaction are given a different order of importance by different persons associated with educational projects and what the order(s) of importance is(are).

2. To determine if a composite criterion of educational project success employing the criteria of schedule, cost, quality/performance, follow-on work, spin-off, and customer/client satisfaction could be established.

The relative importance of possible criteria of project success as viewed by different people would have implications for the many governmental and non-governmental organizations who must determine the ultimate success of the educational projects they fund, monitor, and/or plan to implement or institutionalize. That is, the determination of what constitutes a successful project is a necessary initial step in the evaluation of projects.
Once it is known what characterizes a successful project, research can be directed toward discovering which variables in the management of projects are critical in determining a successful project. If the composite criterion of project success resulting from this study is used as the dependent variable, research can be conducted on the relationship of selected independent variables of the framework in order to more firmly establish those management actions on a project that will make it successful.

Within the general purpose and specific objectives, the study proceeded with the following hypotheses.

Hypothesis 1: Project principal investigators (project managers), parent organization representatives, and government monitors will view the relative importance of the criteria differently.

Project principal investigators would most likely be concerned with the quality of their work, whereas, parent organization representatives would be expected to be quite concerned with spin-off benefits to their organization and the likelihood of obtaining follow-on contracts. The government project monitor would likely be concerned with whether or not the project is completed within time and cost constraints and if the customer is satisfied with the final product.
Hypothesis 2: Project principal investigators with previous project management experience will view the criteria differently than those without prior experience.

Principal investigators with previous experience would be expected to be concerned with obtaining follow-on work, benefiting others in their organization, and satisfying the customer. In contrast, the inexperienced principal investigator would likely be concerned with only the more direct or obvious criteria of meeting objectives (quality) and staying within the funding agency's time and cost constraints. He would probably have his "hands full" just meeting those criteria, and consequently have little time to be concerned with other criteria.

Hypothesis 3: Project principal investigators of sponsored projects (conducted under the supervision of a university faculty member) will view the criteria differently than those conducting other projects.

Graduate students conducting projects under the sponsorship of a major advisor as part of a degree program would be expected to be highly concerned with the quality of their work and the extent to which others are satisfied with it. It is not likely that they would be very concerned with spin-off benefits or follow-on contracts to the university.
Hypothesis 4: Project principal investigators and parent organization representatives at large colleges and universities will view the criteria differently than those from small colleges and universities.

Persons at large colleges and universities, where there is the influence of a research foundation and/or the conduct of many projects each year, would be expected to be concerned with spin-off benefits, follow-on work, and customer or funding agency satisfaction. In contrast, at small colleges, where the level of research activity is usually much lower, it is expected that principal investigators and parent organization representatives would be primarily concerned with quality, schedule, and cost.

Hypothesis 5: For project principal investigators and parent organization representatives the correlations of the project ratings on the six criteria with ratings of overall project success will be positively correlated with the rankings of the relative importance of the six criteria.

The question being explored here is whether or not the ranked relative importance of the criteria is reflected in the ratings given projects on the different criteria. For example, if quality were the most important criterion to a group of individuals, then their ratings of projects on quality should correlate positively with their ratings of the overall success of the projects. Likewise, if they
feel that cost is of little importance, then their ratings of projects on cost should show little or no correlation with their ratings of the overall success of the projects.

Hypothesis 6: The correlations of ratings of customer satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different when the government monitor is more familiar with the projects being rated than when the government monitor is less familiar with the projects.

Data regarding whether or not a project was completed on schedule and within cost is usually readily available to a government monitor. To some extent, the same is true regarding whether or not a project met its objectives. In contrast, information regarding customer satisfaction, follow-on work, and spin-off benefits can be much harder to obtain. Consequently, it is expected that a government monitor could only take these latter criteria into account in rating a project when the monitor was very familiar with the project.

Hypothesis 7: The correlations of the ratings of customer satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different for parent organization representatives who are more familiar with the project being rated than parent organization representatives who are less familiar with the project.

The rationale for this hypothesis is the same as
for the previous hypothesis. A similar hypothesis was not made for project principal investigators since it is not logical to think in terms of a project principal investigator not being quite familiar with his project.

Definition of Terms

Some important terms which appear frequently in this document are defined below for the convenience of the reader.

Project refers to a unique, goal-oriented set of interrelated tasks often characterized by conditions of uncertainty, but always conducted within time, cost, and performance specifications.

Small-grants program refers to a program which funded numerous small-scale ($10,000 limit) educational research projects through ten regional offices from 1966 until 1972. The projects included in this study were all funded under this program. Nearly all were conducted at a college or university.

Sponsored projects refers to projects of the small-grants program that were conducted under the supervision of a college or university faculty member. Usually the principal investigator was a graduate student and the sponsor a major adviser.
Project principal investigator refers to the one person responsible for the planning, preparation, operation, and termination of a project. This person is usually referred to as the project manager. With small-scale projects where the project manager often performs many or most of the project tasks, the label "principal investigator" is frequently used.

Parent organization representative refers to a person at a relatively high level in the organization housing a project who is not on the project staff. This person is in a position to view the project from the perspective of the larger, more permanent organization of which the project is a small part. For the small-grants projects, this person was frequently a department chairman or college dean.

Government project monitor refers to a person employed by the government funding agency to help ensure that funded projects are completed according to predetermined time, cost, and performance specifications. In this study, the government monitor was a single person in the regional office.

Schedule refers to meeting project milestone deadlines and the scheduled project termination date as established in the project contract. Success on this dimension means that the project was completed on or before
the scheduled termination date and that all subsections or components of the project were completed as scheduled.

**Cost** refers to meeting the total dollar expenditure predicted for the entire life of the project. Success on this dimension means that the actual dollar cost of the project was less than or coincided with the predicted cost.

**Quality/Performance** refers to the achievement of the goals and objectives of the project. Success on this dimension means that the performance standards specified by the project objectives were met or exceeded.

**Customer/Client Satisfaction** refers to the degree to which the funding agency or user of the end product of the project is satisfied. This criterion is not necessarily concerned with the quality of the project as indicated by whether or not the original objectives and performance standards were met. It is concerned only with the satisfaction of the funding agency or customer with the project or its end product.

**Spin-off** refers to indirect benefits received by the parent institution, its faculty, and the project staff. Success on this dimension means, for example, that the project and/or the parent institution's faculty developed skills as a result of working with the project which can
be applied to other areas of the institution's operations. Another important spin-off benefit is the recognition an institution often gains from a highly successful project.

**Follow-on Work** refers to additional contracts or follow-on work obtained as a result of the success of the original project and consequent enhancement of the reputation of the researcher. This criterion is not, however, concerned with additional work obtained as a logical or technical extension of the original project.

**Overall Success** refers to a general or overall evaluation of the project effort. Was it completed as scheduled? Were the objectives and performance standards met? Were all interested parties satisfied with the effort? Was the project conducted within the estimated cost? Did the project generate additional work? Did the parent institution and its staff benefit from the project? This criterion is not concerned with any one specific aspect or objective of the project. The concern is with making a general value statement indicating the degree to which the project was a success.

**Limitations**

Some limitations of the study which may affect the interpretation and generalizability of the findings are listed below.
1. The study was concerned with the determination of project success criteria in the field of education only.

2. Six specific criteria of project success were included in the study. No others were considered.

3. Participants were asked to accept the definitions given the six criteria. The results of the study are interpretable only in terms of these definitions.

4. Nearly all the projects in the study sample were conducted at institutions of higher learning.

5. All projects in the sample were relatively small as indicated by a maximum government funding contribution of $10,000.

6. Variability among projects on the criterion of cost was limited by the fact that the funding agency contribution was limited to $10,000.

7. All projects in the sample were conducted in a limited geographic region.
CHAPTER II

REVIEW OF RESEARCH

As was noted on page one, the concept of project management is relatively new in this country. Its emergence is usually associated with the conduct of large, weapon system development efforts sponsored by the Department of Defense and civilian efforts sponsored by the National Aeronautics and Space Administration. Project management evolved out of the pragmatic need of getting large, complex tasks completed within time, cost, and performance requirements. It did not evolve out of a prominent theory of management and/or extensive research. Cleland makes this point when he states that project management is an outgrowth of the need to develop and produce large projects in the shortest possible time. That is, it has been developed from a need with little theoretical formulation.¹

In view of the lack of a theoretical foundation for project management, conceptual frameworks such as Cook's, which can be used to integrate the results of past

¹Cleland and King, Systems Analysis and Project Management, p. 158.
and current studies and to direct further research, become quite important. Of particular importance are research studies that attempt to gather information and validate or modify aspects of such conceptual frameworks.

Only a limited amount of research has been done related to the criteria in the project success component of Cook's conceptual framework. This study is the first to examine project success criteria directly as defined in Cook's conceptual framework. Other studies relating to project success criteria can be categorized into two groups. First, there have been studies of various aspects of project management which have had to employ various measures of project success—often as the dependent variable. Important information can be gained from these attempts to define and measure project success. Second, a few studies have been conducted which involved a direct examination of what constitutes project success and how it might be measured. The review of research which follows is organized according to these two categories.

Criteria of Project Success in Project Management Research

During the late 1950's and early 1960's Peck and Scherer and others conducted a detailed study of twelve weapon system development projects in the United States. One aspect of the study was the determination of the
effectiveness of specific weapon development projects. This was first done by determining the variance of final project time, cost, and quality figures from original estimates of each made prior to the initiation of the project. Such a method results in what appear to be concrete, numerical measures of project effectiveness or success. The researchers discovered, however, three major problems in using such variance data. First, it is difficult to obtain reasonably useful and comparable data from different projects. For example, measures of project quality vary widely from project to project. Second, estimates of time, cost, and quality made prior to the start of a project are frequently unrealistic for various reasons associated with obtaining competitive contracts. Third, the product which emerges from a development effort is often quite different from what was originally visualized. Thus, calculations of time and cost overruns and deviations from original performance or quality specifications are frequently not the accurate measure of project success that they may at first seem to be.

A second method used in the study for determining project effectiveness was to look at the optimization of tradeoffs among conflicting time, cost, and quality

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variables. The formal criterion of an optimal tradeoff was that the quality-increasing features should be employed up to but not beyond the point where the cost of the last quality increment equals the additional expected value afforded by that increment. Although the researchers were able to apply the optimization criterion with some success, they do admit that the criterion is difficult to apply in practice.

A third method used in the study for determining project effectiveness was to obtain rankings of projects on the basis of a single criterion—overall effectiveness. A major difficulty in using this method is that project performance or effectiveness is presumably multidimensional. Obviously, from the previous discussion it can be concluded that project effectiveness has at least three interrelated dimensions—time, cost, and quality. The researchers noted that the test of whether a potentially multidimensional attribute can be ranked on a single ordinal scale is that transitivity must hold on pairs of ranked items. (If $A > B$ and $B > C$, then $A > C$). If transitivity does not hold, then the rankings of projects will show inconsistencies such as: $A > B$, $B > C$, and $C > A$.

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3 Ibid., p. 461.
4 Ibid., p. 472.
5 Ibid., p. 543.
6 Ibid., p. 544.
The researchers used a paired comparison approach in obtaining rankings of eight projects from people knowledgeable about them. This method made it possible to determine the degree of consistency exhibited by the participants in their rankings and to measure the amount of agreement among the different participants. They concluded that the overall effectiveness of development programs can successfully be ranked on an ordinal scale by individuals and that problems of multidimensionality appeared to have only a small effect on program rankings.

A. W. Marshall and W. H. Meckling presented a paper on predicting the time, cost, and success of development projects at a conference on research program effectiveness sponsored by the Office of Naval Research in Washington in 1965. Their paper was based upon the previous research of Eugene R. Brussell on the development of weapon systems in the U.S. They used the following four criteria in the measurement of development project success: 1) cost, 2) performance, 3) time of availability, and 4) utility. The first three criteria are the typical cost, quality, 

7Ibid., p. 545. 8Ibid., pp. 555 and 569.
10Ibid., p. 463.
and time criteria discussed previously. Marshall and Meckling defined utility as a qualitative measure of the usefulness of the product of a development effort. This criterion is quite similar to the criterion of customer satisfaction in Cook's conceptual framework discussed in Chapter I. The authors noted that there are many uncertainties in predicting the utility of a development effort, and then they concentrated on the prediction and measurement of the other three criteria of project success.

In 1967 Rubin and Seelig reported a study of the personal characteristics or role behaviors of project managers and how they affect project performance.\(^{11}\) The authors noted that it is impossible to compare the technical performance of different projects by any objective measure due to variances in the type of performance specifications. Therefore, they used expert judgment by fully informed individuals (the project manager and government technical monitor) as the measure of project performance.\(^{12}\) No attempt was made to measure project success or effectiveness on any other criteria such as time or cost.


\(^{12}\)Ibid., p. 132.
In 1969 Perry and others reported the results of a study of how accurately the military services have been able to predict the outcomes of weapon system development projects. The study concentrated on the prediction of three criteria of project success or outcomes—schedule, cost, and performance. For each criterion a factor number was obtained by dividing the actual results by the predicted results. This procedure is fairly straightforward for schedule and cost. A factor number greater than unity indicates a schedule or cost overrun. The authors stated that the performance characteristics of weapon systems cannot be compared as readily as can costs because performance is a combination of many parameters and is impossible to express in a single value. They attempted to circumvent this problem by subdividing the project performance criterion into six parameters and then generating factor numbers for each applicable parameter. But, since not all the parameters applied to all the projects, this method still left the comparison of different projects on the basis of performance in an ambiguous state.

In 1969 Souder reported the results of a study of the prediction of research and development project success.

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14 Ibid., p. 3.

15 Ibid., p. 15.
within a large U.S. corporation.\textsuperscript{16} The predictor variable used in the study was the estimate made by the project manager of the probability of the project successfully meeting all of its objectives.\textsuperscript{17} The criterion of ultimate project success was the opinion of top R and D management that the project was either a "success" or a "fail."\textsuperscript{18} This judgment was made when either a project met its objectives or was terminated. The authors admit that relying upon top management's classification of projects as successes or failures may be an inherent limitation of the study. What is important to note, though, is that project success was defined in terms of meeting the original objectives. This definition is the same as the criterion of "quality" in the project success component of Cook's conceptual framework.

\textbf{Research on Project Success Criteria}

In 1965 Marquis and Straight reported the results of a study of the effect of a number of management and organizational variables on the performance of large-scale

\begin{flushleft}
\textsuperscript{17} Ibid., p. 36.
\textsuperscript{18} Ibid., p. 40.
\end{flushleft}
research and development projects. Data was collected from thirty-seven projects that were conducted in thirty-two large corporations in the aerospace and electronics industries.

One of the objectives of the study was to determine what is considered success in the performance of R and D projects. The laboratory manager, project manager, government technical monitor, and government contract administrator associated with each project were asked to identify their criteria of project success and to rank them in order of importance. Technical performance was judged to be by far the most important criterion. It was ranked first by the majority of respondents. Meeting schedule was a poor second followed by meeting target cost, customer satisfaction, profit, follow-on business, company prestige, develop technical capability, and commercial applications.

The distinct similarity between these criteria and those in Cook's conceptual framework is illustrated in Figure 3. Note that profit is the only criterion suggested

19 Donald G. Marquis and David M. Straight, Jr., "Organizational Factors in Project Performance," Research Program Effectiveness—Proceedings of the Conference Sponsored by the Office of Naval Research (Washington, 1965), pp. 441-58. Note: This study is the larger research effort of which the work reported before by Rubin was a part.

20 Ibid., pp. 446-47.
<table>
<thead>
<tr>
<th>Marquis/Straight Study</th>
<th>Cook's Conceptual Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Performance</td>
<td>Quality/Performance</td>
</tr>
<tr>
<td>Meeting Schedule</td>
<td>Schedule</td>
</tr>
<tr>
<td>Meeting Target Cost</td>
<td>Cost</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>Customer/Client Satisfaction</td>
</tr>
<tr>
<td>Profit</td>
<td></td>
</tr>
<tr>
<td>Follow-on Business</td>
<td>Follow-on Work</td>
</tr>
<tr>
<td>Company Prestige</td>
<td></td>
</tr>
<tr>
<td>Develop Technical Capability</td>
<td></td>
</tr>
<tr>
<td>Commercial Applications</td>
<td>Spin-off</td>
</tr>
</tbody>
</table>

Fig. 3. Comparison of Criteria of Project Success discovered in the Marquis/Straight Study with those in Cook's conceptual framework.

by the respondents in the Marquis and Straight study that is not clearly represented in Cook's conceptual framework. This seems logical since Cook's framework is primarily concerned with project management in education; a field in which most organizations are non-profit.

In exploring the relationships between project organizational variables and project success, Marquis and Straight used measures of cost overrun, schedule overrun, and technical performance as indicators of project success. They noted that performance toward schedule and cost targets is more easily measured than technical performance.
and is also directly comparable across projects. As noted earlier in the discussion of the Rubin study, Marquis and Straight used expert judgments by fully informed individuals as the measure of project technical performance.

In 1973 Baker and others reported the results of a comprehensive study designed to specify the relationships among situational, organizational, and project management process variables as they relate to project success. Data were gathered by questionnaire from 646 persons involved in project management in various roles within business and industry and government. The factor analysis of the questionnaire responses resulted in the identification of a factor that was subsequently used as a measure of overall project success. The factor was comprised of questionnaire items relating to client, parent organization, project team, and end user satisfaction with the outcome of the project; the technical adequacy of the project end result; and a statement that all things considered, the project was a success. Note that the factor

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21 Ibid., p. 448.


23 Ibid., p. 8.
includes the criteria of customer/client satisfaction and quality/performance found in Cook's conceptual framework. One important limitation in the methodology of the Baker study is that it is not possible for criteria to appear in the project success factor that were not included in the questionnaire items written by the researchers. Consequently, it is quite possible that important aspects in the determination of project success were not included in the data gathered from the respondents.

In 1968 the views of 920 educational project directors on various aspects of project management including criteria for determining project success were collected. Each project director was asked to rate twelve factors with respect to first, second, or third order of importance in evaluating the overall effectiveness of their project. These factors are presented below in order of importance based upon their weighted rating across all the project directors.

1. Constructive change
2. Meeting objectives
3. Innovative and creative


25 Ibid., p. 20.
4. Development of interest
5. Meeting area needs
6. Producing results
7. Development of skills
8. Demonstration
9. Dissemination
10. Local funding
11. Planning and evaluation
12. Serving a sizeable number

Many of these criteria such as "constructive change" and "demonstration" are quite vague. It is interesting to note, however, that the rather specific criterion "meeting objectives," which corresponds to "quality/performance" in Cook's conceptual framework, was ranked second in importance. The other criteria identified in the study do not appear to match clearly with any of the other criteria in the conceptual framework. Many of these criteria appear to be quite specific to the type of projects operated under the PACE program and, consequently, reflect the intention of the program regarding the purpose and operation of individual projects. That is, the criteria reflect the specific U.S. Office of Education guidelines regarding the intended purpose and operational procedures for projects funded by the PACE program. Hence, the criteria are probably not generalizable to the deter-
mination of the success of other educational projects.

In 1972 the results of an intensive study of twenty projects spanning the areas of educational research, development, diffusion, and evaluation were reported.\textsuperscript{26} Data were gathered by interview from 134 project staff associated with the twenty projects. Part of the study was concerned with gathering statements from the interviewees regarding the standards they used in judging the outputs or end products of their projects and the standards they used in judging the processes involved in the production of those outputs. For the five research projects studied, the five categories of standards or criteria identified most frequently for judging outputs were:

1. goal attainment
2. acceptance by others (in project)
3. completeness of content
4. personal satisfaction or feeling
5. functions as planned\textsuperscript{27}

For the seven development projects studied, the five categories of criteria identified most frequently for judging outputs were:


\textsuperscript{27}Ibid., p. 123.
1. acceptance by others (in project)
2. goal attainment
3. completeness of content
4. utility or value
5. personal satisfaction or feeling

The criterion of "goal attainment" appears to watch with the criterion of "quality/performance" in Cook's conceptual framework. The only other criterion that may be related to one of the criteria in the conceptual framework is "utility or value," which may be similar to "customer/client satisfaction."

In judging the process of producing project outputs, the following five categories of criteria were most frequently identified for research projects.

1. external enthusiasm evident
2. deadlines are met
3. personnel cooperative
4. acceptable level of output
5. an expected activity occurs

In judging process for development projects, the following five categories of criteria were most frequently identified.

1. deadlines are met
2. work conducted within budget

\(^{28}\)Ibid.
\(^{29}\)Ibid., p. 126.
3. acceptable level of output
4. employment criteria met
5. no felt deficiencies

The criteria of "deadlines are met" and "work conducted within budget" appear to correspond to the criteria of "schedule" and "cost" in Cook's conceptual framework. "External enthusiasm evident" may be similar to "customer/client satisfaction" and "acceptable level of output" may be similar to "quality/performance."

The authors concluded that project personnel working on different types of projects such as research and development apply approximately the same criteria or standards to the outputs of their work. This is true to a lesser extent for the judgment of project process.

From the data presented in this study, one can only make a crude estimate of the relative importance of different criteria for determining project success based upon the frequency with which the criteria were mentioned by the group of interviewees. Also, it is not known whether the criteria identified are important only to project directors, project staff, or to both groups.

**Summary and Implications**

Research studies in the area of project management and project success have identified numerous criteria

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30 Ibid.
31 Ibid., p. 128.
employed in the measurement or determination of project success. Studies concerned with project success in business and industry and government have resulted in the identification of the following criteria.

1. time
2. cost
3. technical performance/meeting objectives
4. overall effectiveness
5. customer satisfaction
6. profit
7. follow-on work
8. company prestige
9. develop technical capability
10. commercial applications
11. parent organization satisfaction
12. project team satisfaction
13. utility

Studies concerned with project success in education have resulted in the identification of the following criteria.

1. constructive change
2. meeting objectives
3. innovative and creative
4. development of interest
5. meeting area needs
6. producing results
7. development of skills
8. demonstration
9. dissemination
10. local funding
11. planning and evaluation
12. serving a sizeable number
13. meeting deadlines
14. within budget
15. acceptable level of output
16. no felt deficiencies
17. employment criteria met
18. external enthusiasm
19. personnel cooperative
20. acceptance by others
21. utility
22. personal satisfaction

Although numerous criteria for determining project success have been identified, many are vaguely defined, if defined at all. Several others, especially in the field of education, are closely tied to funding agency requirements regarding how the project is to be conducted. Many of these, such as "employment criteria met" and "serving a sizeable number" really don't appear to be measures of project success. Rather, they appear to be
indicators of whether or not the funds were spent according to funding agency regulations.

The six criteria of schedule, cost, quality/performance, follow-on work, spin-off, and customer/client satisfaction included in Cook's conceptual framework appear to cover the concerns expressed by the criteria listed above after the vaguely defined criteria and funding agency regulations are omitted from the lists. The only exception appears to be "profit" which, of course, does not generally apply to the field of education.

The appearance of the criteria of customer satisfaction, parent organization satisfaction, and project team satisfaction points to the possibility that these three groups may view the success of a given project differently.

The measurement of the success of projects using the various criteria listed above has resulted in the following conclusions:

1. It is difficult and often inaccurate to measure project success on schedule, cost, and quality/performance by comparing original estimates along these criteria with final project results.

2. Informed individuals are capable of ranking the effectiveness of different projects
without making an excessive number of errors of consistency.

3. Although many criteria of project success have been identified in the field of education, little is known regarding their relative importance.

This study was designed to answer the questions listed below that were left unanswered by previous research.

1. Do persons associated with educational research and development projects in different roles view the success of projects differently? That is, do they emphasize different criteria when assessing the success of a project?

2. What is the relative importance of the various criteria employed for determining the success of research and development projects in education?

3. Can a criterion which represents a composite of various important criteria be developed for the determination of the success of research and development projects in education?
CHAPTER III
PROCEDURES

A sample of educational projects was first selected and then the personnel associated with the conduct and monitoring of the projects were identified. These persons represented the primary source of data for the study. In this chapter the instruments used in the collection of data, the sample and data collection procedures, and the data analysis procedures are described.

Instruments

The two instruments developed for the collection of data, labeled Criteria Ranking Form and Project Rating Form, are described below. A Definitions Sheet defining the several criteria of project success was developed to accompany these forms. Background information relating to the project environment and project director was also gathered.

Criteria Ranking Form

As stated previously, the purpose of this study was to explore two basic hypotheses suggested by Cook's conceptual framework regarding the relative importance
of six possible criteria of educational project success. Specifically, the first general objective of the study was to determine if schedule, cost, quality/performance, follow-on work, spin-off, and customer/client satisfaction are given a different order of importance by different persons associated with educational projects and what the order(s) of importance is (are).

Rankings of the importance of these criteria relative to each other could have been obtained by simply asking each person in the study sample to put the criteria in rank order (1 to 6). Such a procedure, however, assumes that there is a measurable difference between the importance of the different criteria and that the respondent can express this difference on a linear scale. Kendall makes this point clear by way of example.

... we may ask an observer to rank a number of districts according to his preference for living in them; but his preferences will depend on a number of factors such as cost, availability of transport, height above sea level, or nearness to shopping centres, and it by no means follows that he is capable of expressing a final preference on a linear scale. If we insist on his carrying out a ranking, and even if he complies under the impression that he is doing something within his powers, we may be forcing the data, so to speak, into an over-narrow framework which will distort the true situation.¹

Kendall then recommends the method of "paired

comparisons" in order to overcome such difficulties in ranking. He notes that if a respondent prefers A to B, B to C, and C to A, then the triad ABC is circular or inconsistent. The paired comparison approach permits one to examine the triads completed by the respondent for inconsistency. Kendall further states that it is a necessary and sufficient condition for the possibility of expressing preferences as a ranking that no circular triads be present, and that the more circular triads there are, the further we depart from the ranking situation.

In the Peck and Scherer study, the researchers used the paired comparison approach in obtaining rankings of eight projects on four criteria. They used this approach since it made it possible to determine the degree of consistency exhibited by individual participants in their choices and to establish an ordinal ranking of the eight programs.

A most important benefit of using the paired comparison approach, however, is that a procedure exists which enables one to obtain interval scale values in addition to ordinal ranks. As a result, information is obtained re-

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2Ibid., p. 123.  
3Ibid.  
5The procedure, which is based upon Thurstone's Law of Comparative Judgment, is described in detail in Chapter
garding the relative magnitude of the items that are ranked.

In view of the points discussed above, the ranking of the six possible criteria of educational project success was obtained using the paired comparison approach. The paired comparison approach, when used to obtain an "average" scale for a population, requires that each of the stimuli (criteria) be placed in a pair with each of the other stimuli, and that one stimuli be selected from each pair by each of the respondents independently. Torgerson makes the following important point in regard to the presentation of stimuli to the respondent.

No explicit provision is made for time or space errors in the law of comparative judgment. Nor is there provision for changes in performance due to fatigue or practice effects, or for judgments based in part on factors other than the relative magnitudes of the discriminant processes. Consequently it is necessary to control experimentally the conditions that might introduce these biasing effects.

He goes on to say that control by the randomization of the relative positions and orders of the stimuli is often an adequate procedure, but not the most efficient method.

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7 of J. P. Guilford's Psychometric Methods and Chapter 9 of W. S. Torgerson's Theory and Methods of Scaling. Further reference to the procedure will be made in the Analysis of Data section.


7Ibid., pp. 167 and 168. 8Ibid., p. 168.
Ross notes that the suggestion of ordering pairs of stimuli by randomization, originally suggested by Fechner in 1871, leaves the series liable to undesirable features such as space and time errors and not maintaining the greatest possible spacing between pairs involving any given member of the stimulus group. He then presents a method for directly obtaining the optimum order for the presentation of pairs of stimuli when there are an odd number of stimuli and an indirect method when there are an even number of stimuli. The method for an even number involves determining the order for the one larger odd number and then eliminating all pairs involving the extra member in the group.

Wherry notes that although the Ross method produced lists of pairs that agreed with empirically derived lists for groups of 5, 7, and 15 that were recognized as being the most desirable so far invented, the method does not always produce the optimum list. By trial-and-error Wherry empirically derived a list for a group of seven stimuli that contained the same number of time errors as

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10 Ibid., p. 376.

the Ross list but only half as many space errors (two instead of four).\textsuperscript{12}

In view of the discussion above, the order for the presentation of pairs of the six criteria on the ranking form was determined by taking the Wherry list for seven stimuli and apply the Ross procedure of eliminating the extra member. The list that resulted was: 4-2, 3-1, 2-5, 1-6, 5-3, 4-1, 6-3, 1-2, 3-4, 5-6, 2-3, 4-6, 1-5, 6-2, and 5-4. While this list may not be the optimal list, it is decidedly better than any list likely to result from random assignment. A copy of the Criteria Ranking Form appears in Appendix A.

Project Rating Form

As stated previously, the second general objective of the study was to determine if a composite criterion of educational project success employing the criteria of schedule, cost, quality, follow-on work, spin-off, and customer/client satisfaction could be established. In order to achieve this objective, ratings of completed projects on each of these six criteria and overall project success had to be obtained. A Project Rating Form employing an equal-interval scale was developed for this purpose.

In the Rubin and Seelig study discussed previously,

\textsuperscript{12} Ibid., p. 653.
ratings of the technical performance of projects were obtained by means of a nine-point equal-interval scale. The authors note, however, that all except one of the scores or ratings fell in the range of five to nine. The ratings were, in effect, distributed on a five-point scale.

Moore and Baker present a detailed treatment regarding the design of a scoring model for application to research and development project selection. For the rating of projects on various criteria, they recommend the use of equal-interval scales with interval width equal to one-half the estimated standard deviation of the distribution function. They further suggest the initial use of a nine-point interval scale. They do add, though, that the number of intervals or points may be reduced if there is doubt regarding the ability to obtain data sufficiently precise to permit meaningful use of the nine-point interval scale.

In view of the discussion above, the Project Rating Form was developed using a seven-point, equal-interval scale for rating the sample projects on each of the seven

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14 Ibid., p. 95.  
15 Ibid., p. 97.
criteria (including overall success). The direction of the scales from positive to negative was reversed for each successive scale on the form. A copy of the Project Rating Form appears in Appendix B.

Definitions Sheet

The Definitions Sheet was developed to provide the respondents with a common set of definitions for use in ranking the relative importance of the criteria and rating projects with the criteria. Since the purpose of the study was to explore hypotheses suggested by Cook's conceptual framework in regard to criteria of project success, the definitions of the criteria were taken from that framework. The Definitions Sheet also included instructions for completing the Criteria Ranking Form and Project Rating Form. A copy of the Definitions Sheet appears in Appendix C.

The development of these instruments included the important step of review by others to ensure clarity of directions and wording, correctness of definitions, and appropriateness of design. Professors Cook, Kennedy, and Wherry and Dean Anderson of The Ohio State University reviewed draft copies of the instruments and made suggestions for improvement.
Background Information

The specific hypotheses of the study required that what might be called "background information" be collected. This refers to information regarding (a) the size of the parent organizations housing the projects in the sample, (b) the previous project management experience of the project principal investigators, (c) whether or not each project in the sample was a sponsored (under the supervision of a university faculty member) or non-sponsored project, and (d) the degree of familiarity that the respondent had with the project being rated. The collection of this information is described below.

Size. Nearly all the projects in the sample were conducted at a college or university. The total degree credit enrollment in the Fall of 1969 was used as the measure of parent organization size. The majority of the projects were in operation within a year of that time.

Experience. Each principal investigator was asked to indicate on the Criteria Ranking Form the number of projects he had managed or directed prior to the project specified in the sample. This number was used as a measure of previous project management experience. In a previous

17 What represents the size of an organization is a difficult question with many possible answers. For educational institutions, however, student enrollment is the commonly used measure, as crude as it may be.
study by Rubin this same figure was used as a measure of previous project management experience.\textsuperscript{18}

**Sponsorship.** Information regarding whether a project was sponsored or not was obtained from the records of the regional office of the Regional Research Program of the National Center for Educational Research and Development, United States Office of Education from which the sample projects were selected.

**Familiarity.** Each respondent was asked to indicate on the project rating form the degree to which he was familiar with the project he had just rated. A seven-point, equal-interval scale appearing on the Project Rating Form was used for this purpose. In the Peck and Scherer study previously discussed, respondents were also asked to indicate their familiarity with the projects being rated. They did so on only a four-point scale.\textsuperscript{19}

**Sample and Data Collection**

A sample of educational projects was first selected and then the personnel associated with the actual conduct and Office of Education monitoring of the projects were identified. Data were then obtained from these persons by


mailing the Criteria Ranking and Project Rating Forms described previously. The sample and data collection procedures are described below.

Sample

Reference was made in Chapter I to the Regional Research Program of the National Center for Educational Research and Development, U.S. Office of Education. The program provided support for numerous small-scale educational research projects from 1966 until 1972. Grant awards were made across the country through ten regional offices which were responsible for reviewing project proposals and monitoring funded projects. One of these regions was the source of projects for the study sample.

The study hypotheses and intended data analysis procedures required that a rather large sample of projects be drawn (at least 100) that met the following criteria. First, for each project a principal investigator, parent organization representative, and government monitor had to be clearly identifiable. Second, it was necessary for the projects to have been recently terminated if ratings of project success were to be obtained. The representativeness of the sample relative to the universe of projects in education was not a concern since no explicit generalization of results to the larger population was intended. The study was of an exploratory nature.
The projects funded and monitored under each of the regions of the Regional Research Program were found to fit these criteria. The single region that was selected was chosen because of the regional office staff's interest in the study and willingness to help. The access to project information provided by the regional office made the conduct of this study possible.

A total of 196 projects funded and monitored by the regional office and completed or terminated from 1967 through 1970 were included in the study sample. The regional office provided the project number, title, and the name and address of the principal investigator(s) of each of these projects. In addition, the name and address of the sponsor for those projects that were sponsored (conducted under the supervision of a college or university faculty member) was also provided. One government monitor was identified for the entire sample of projects.

As indicated by the hypotheses, it was necessary to obtain data from the principal investigator (project manager), parent organization representative, and government monitor associated with each project in the sample. These people represent what may be described as "well-informed individuals" capable of rating the project with which they were associated on the seven criteria appearing on the project rating form.\(^\text{20}\) In the study by Marquis

\(^\text{20}\text{Ibid., pp. 554 and 555.}\)
and Straight similar data were gathered from five sources: the laboratory manager, the project manager, the government technical monitor, the government contract administrator, and the company contract administrator. 21

The projects in the sample chosen for this study generally did not have a laboratory manager and the roles of government technical monitor and government contract administrator were served by one government monitor. Since nearly all the projects were conducted at a college or university, a few university project contract administrators were contacted by phone in order to explore the possibility of their responding to the rating form. It became immediately clear that they were not nearly familiar enough with the projects to provide useful data. Consequently, it was decided to ask each principal investigator to identify (by name, title, and address) someone who would be both representative of the views of the parent organization that housed the project and knowledgeable of the project in question. It was suggested that a major advisor, department chairman, college dean, or superintendent of schools might be such a person. The project sponsor served this role when identified in the records of the regional office.

21 Marquis and Straight, Organizational Factors in Project Performance, p. 444.
In summary, data were to be collected from three sources associated with each of the 196 projects: the principal investigator (project manager), the parent organization representative (major advisor, sponsor, department chairman, dean, etc.), and the government monitor.

Data Collection

The data were collected by means of six initial mailings and a follow-up mailing to all non-respondents for whom correct mailing addresses could be assumed. The procedures associated with these mailings are described below and then the summarization of the results of the data collection is presented.

In the Spring of 1972 one criteria ranking form and 200 project rating forms were mailed to the assistant government monitor in the regional office responsible for the monitoring of all the projects in the study sample. The sudden death of the government monitor\(^2\) necessitated the mailing of the forms to the assistant monitor who graciously completed many of the forms. The assistant monitor, however, was not as familiar with many of the projects and, therefore, could not provide usable data on all 196 projects.

The second through sixth mailings took place during the Fall of 1972. The second mailing went to the

\(^2\)Joseph J. Murnin.
principal investigators of projects for which no sponsor was identified in the regional office records. Each person was sent a cover letter, definition of terms page, Criteria Ranking Form, and Project Rating Form. Each was asked to identify a parent organization representative for his/her project. A copy of the cover letter and Criteria Ranking Form appears in Appendix D. There were minor differences in the Criteria Ranking Form sent with each mailing due to differences in the background information being sought from different groups of respondents.

The third mailing went to the project sponsors (parent organization representatives) identified in the regional office records. Each person was sent a cover letter, definition of terms page, criteria ranking form, and project rating form. Each was asked to provide an up-to-date mailing address for the project principal investigator if possible. A copy of the Criteria Ranking Form appears in Appendix E.

The fourth mailing went to the parent organization representatives identified by the respondents to the second mailing. Each was sent a cover letter, definition of terms page, Criteria Ranking Form, and project rating form. A copy of the Criteria Ranking Form appears in Appendix F.

The fifth mailing went to the principal investigators of projects for which a sponsor was listed in the regional office records. Each was sent the same basic
materials as the other mailings. A copy of the Criteria Ranking Form appears in Appendix G.

During the period in which 196 selected projects were conducted, the regional office also funded six consortia which, in turn, funded small-scale educational research efforts. The sixth mailing consisted of a letter to each of the six consortium directors requesting the project number and title and project director's name, title, and address for each of the projects they funded under their consortium. A copy of this mailing appears in Appendix H.

All six consortium directors responded, several providing rather detailed information regarding the nature of the various projects funded. Based upon the information obtained, the projects funded by the consortia were not added to the study sample. The reasons for this decision are listed below.

1. The majority of the projects did not appear to fit the commonly accepted definition of a project (A unique, goal-oriented set of interrelated tasks often conducted with uncertainty, but always within time, cost, and performance specifications.).

2. The projects were not monitored directly by the Regional Research Program regional office.
In many cases it appeared difficult to identify the person who did monitor specific projects.

3. The consortium projects appeared to represent a different concept in many ways than the typical project funded directly by the regional office. The purpose of some was to foster a research relationship between several institutions and others were designed to foster creativity and research in the classroom. They possibly represent a different sort of "animal" worthy of study in its own right.

4. Additional projects and respondents were not needed to achieve the objectives of the study.

A follow-up mailing was sent to each non-respondent to the second through fifth mailings for whom a correct mailing address could be assumed. A few mailings were returned by the postal service marked "no known address." In such cases no further attempt was made to obtain data. The follow-up mailing, which consisted of a cover letter, definition of terms page, Criteria Ranking Form, and Project Rating Form, was sent approximately six weeks after the corresponding initial mailing was sent. A copy of the cover letter appears in Appendix I.
The results of the data collection efforts are summarized in Table 1. It is important to note that 65 percent of the project principal investigators and 65 percent of the parent organization representatives responded to the mailing by completing the data collection instruments. Fifty-five percent responded to the initial mailing and 10 percent responded to the follow-up mailing. Ninety-five percent of the Criteria Banking Forms received were usable, and 93 percent of the Project Rating Forms were usable. These figures are particularly high in view of the fact that 11 percent of the persons in the study sample did not receive the mailings because of the lack of a forwarding address. It is concluded that the majority of the persons in the study sample responded to the request for data, and all but a few were able to complete the data collection instruments without error.

Data Analysis

The procedures used in analyzing the data collected in the study are described in this section. The results of the data analysis as they related to the objectives and hypotheses of the study are presented in Chapter IV.

Two basic types of data were collected in the study—rankings of six possible criteria of project success according to perceived relative importance by different persons associated with a sample of educational
<table>
<thead>
<tr>
<th>Group of Study Participants</th>
<th>Number in Group Sample</th>
<th>Number and Percent That Received Mailing</th>
<th>Number and Percent That Responded to First Mailing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Monitor</td>
<td>1</td>
<td>1 100%</td>
<td>1 100%</td>
</tr>
<tr>
<td>Principal Investigator</td>
<td>53</td>
<td>40 75%</td>
<td>27 51%</td>
</tr>
<tr>
<td>(Sponsored Project)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principal Investigator</td>
<td>165</td>
<td>144 87%</td>
<td>98 59%</td>
</tr>
<tr>
<td>(Non-sponsored Project)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principal Investigator</td>
<td>218</td>
<td>184 84%</td>
<td>125 57%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Organization</td>
<td>121</td>
<td>117 97%</td>
<td>61 50%</td>
</tr>
<tr>
<td>Representative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total All Groups (1 + 4 + 5)</td>
<td>340</td>
<td>302 89%</td>
<td>187 55%</td>
</tr>
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</table>
TABLE 1—Continued

<table>
<thead>
<tr>
<th>Group of Study Participants</th>
<th>Number and Percent That Responded to Follow-up</th>
<th>Total Number and Percent That Responded</th>
<th>Number and Percent of Criteria Ranking Forms Usable</th>
<th>Number and Percent of Project Rating Forms Usable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Monitor</td>
<td></td>
<td>1</td>
<td>1</td>
<td>51 26%</td>
</tr>
<tr>
<td>Principal Investigator (Sponsored Project)</td>
<td>5 9%</td>
<td>32 60%</td>
<td>30 94%</td>
<td>30 94%</td>
</tr>
<tr>
<td>Principal Investigator (Non-sponsored Project)</td>
<td>13 8%</td>
<td>111 67%</td>
<td>106 95%</td>
<td>103 93%</td>
</tr>
<tr>
<td>Principal Investigator Total</td>
<td>18 8%</td>
<td>143 65%</td>
<td>136 95%</td>
<td>133 93%</td>
</tr>
<tr>
<td>Parent Organization Representative</td>
<td>18 15%</td>
<td>79 65%</td>
<td>75 95%</td>
<td>72 91%</td>
</tr>
<tr>
<td>Total All Groups (1 + 4 + 5)</td>
<td>36 10%</td>
<td>223 65% b</td>
<td>212 95%</td>
<td>205 a 93%</td>
</tr>
</tbody>
</table>

a Government monitor returns excluded from this figure.

b Of those believed to have received the mailing, 73% (220 302) responded.

Note: Project ratings were received on 146 projects of the sample of 196. That is, ratings were received from one or more persons on 74% of the original sample of projects.
projects and ratings of the success of these projects by the same persons relative to the six possible criteria and overall project success. The first general objective of the study was concerned with the ranking of the relative importance of the six criteria. The second general objective was concerned with the quantification of a composite criterion of project success based upon the ratings of numerous projects on the six criteria and overall success. Consequently, the first step of the data analysis was to analyze the criteria ranking data in order to meet the first general objective. The second step was to analyze the project rating data in order to meet the second general objective. The third step of the data analysis was concerned with answering the questions raised by each of the seven hypotheses of the study. The data analysis procedures are described below according to these three steps.

Criteria Ranking

As previously discussed, the respondents to the criteria ranking form indicated the relative importance of the criteria by means of a paired comparison format. This format permits the computation of interval scale values for each of the criteria and enables the researcher to obtain a measure of the consistency of individual respondents in ranking the several criteria and a measure of the amount of agreement among groups of respondents in the rankings they
make. All of these aspects of the data analysis are described below.

The analysis of the paired comparison (criteria ranking) data was based upon Thurstone's law of comparative judgment. It is presented in some length in Torgerson and Guilford. The presentation here is not intended as a detailed treatment of the subject, but rather it is intended as an explanation of the basic principle and procedures of the data analysis employed in the study.

The law of comparative judgment is a set of equations relating the proportion of times any given stimulus is judged greater on a given attribute than any other stimulus to the scale values and discriminant dispersions (standard deviations of the distributions associated with each of the stimuli) of the two stimuli on a psychological continuum. The complete form of the law is expressed by the following equation.

$$R_j - R_k = \frac{2_{jk}}{\sqrt{\sigma_j^2 + \sigma_k^2} - 2R_{jk} \sigma_j \sigma_k}$$

23 Torgerson, Theory and Methods of Scaling, pp. 155-204.
25 Torgerson, Theory and Methods of Scaling, p. 159.
26 Guilford, Psychometric Methods, p. 155.
where

\[ R_j - R_k \]

denotes the difference between the mean scale values associated with two stimuli

\[ \delta_{jk} \]

denotes the standard-measure distance or deviate from the mean of a unit normal distribution

\[ \sigma_j \] and \[ \sigma_k \] denote the standard deviations of the distributions of \( R_{hj} \) and \( R_{hk} \) respectively

\[ \gamma_{jk} \]

denotes the coefficient of correlation between \( R_{hj} \) and \( R_{hk} \)

Thurstone identified five "cases" regarding the application of the law. The first two are not solvable. The third case, which was used in this study, involves the assumption that \( r_{jk} = 0 \). That is, it was assumed that there was no correlation between responses to any pair of stimuli (criteria). If the intercorrelations of the criteria were substantially different from 0, then the respondents would have committed errors of inconsistency in comparing the criteria. As mentioned previously, samples of individual respondent criteria ranking forms were checked for internal consistency.

The fourth and fifth cases as described by Thurstone require additional constraints upon the data. Since additional constraints were not necessary, the conditions of Thurstone's third case were assumed.

Under case three, the last term in equation (1)

\(^{27}\)Ibid.
drops out, leaving the following equation:

$$R_j - R_k = s_{jk} \sqrt{\sigma_j^2 + \sigma_k^2}$$  \hspace{1cm} (2)

$s_{jk}$ is determined from the proportion of times one stimulus (criterion) is chosen over another by the group of respondents. And, since methods exist for estimating $\sigma_j$ and $\sigma_k$, the equation becomes solvable.\(^{28}\)

In order to obtain scale values for the six criteria of project success, the paired comparison data were run on the PCMP computer program of the Psychology Department of The Ohio State University. The program follows the assumptions of the Thurstone case three and the computational procedures specified by Guilford.\(^{29}\) The program output consists of the mean, standard deviation, and scale value for each criterion.\(^{30}\)

As mentioned previously, a sample of individual respondent criteria ranking forms were checked for internal consistency by determining the frequency of circular triads completed. In the study by Peck and Scherer, this same procedure of computing the number of circular triads completed by respondents was employed as a measure of in-

\(^{28}\)Ibid.

\(^{29}\)Ibid., pp. 154-68.

\(^{30}\)Robert J. Wherry and Jerry Olivero, The Ohio State University—Computer Programs for Psychology (Columbus, Ohio: The Ohio State University, 1971), p. 41.
ternal consistency.\(^{31}\)

Kendall presents a formula for determining the maximum possible number of circular triads that a respondent can make when comparing any given number of items by the paired comparison technique and a procedure for determining how many circular triads a respondent has made.\(^{32}\)

When \(n\) is even, the formula is:

\[
C_{\text{max}} = \frac{n^3 - 4n}{24}
\]  

(3)

In this study, the respondents were comparing a total of six criteria. Thus, the maximum number of circular triads that any respondent could have completed was eight. A frequency distribution for the number of circular triads made by the respondents samples was generated.

As mentioned before, the paired comparison procedures permits one to obtain a measure of the agreement among groups of respondents in the rankings they make. This is done by computation of the coefficient of agreement, \(\kappa\), which is given by the following formula.\(^{33}\)

\[
\kappa = \frac{8 \sum}{m (m-1)n(n-1)} - 1
\]

---


\(^{33}\)Ibid., p. 126.
The symbol \( m \) represents the number of persons making the rankings, \( n \) represents the number of objects being ranked, and \( \sum \) represents \( \sum (y) \) where \( y \) is the number in row \( X \) and column \( Y \) of a table of the frequencies of the choice of each object over every other object made by a group of respondents. After the value of \( u \) is computed for a group, a chi-square test of its significance can be made.\(^{34}\) This gives one a level of confidence in stating that the agreement of a group in ranking objects is not the result of chance, but does, in fact, indicate that there is some agreement among the members of the group.

In this study the two main groups of respondents were the project principal investigators and the parent organization representatives. The coefficient of agreement and its significance was determined for each group.

**Project Rating**

As previously discussed, the respondents to the project rating form indicated their rating of a project with which they were familiar on each of six criteria and overall success using a seven-point, equal-interval scale for each criterion. The second general objective of the study was to determine if a composite criterion of project success employing these six criteria could be established. This was accomplished by means of multiple-regression

\(^{34}\)Ibid., p. 130.
analysis with overall success as the criterion variable and to the six specific criteria as predictors. The multiple-prediction or multiple-regression model and analysis procedures employed are discussed below. The discussion is not meant as a detailed treatment of the subject of multiple-regression, but rather it is intended as an explanation of the basic principle and procedures of the data analysis employed in the study.

The model of linear, multiple-prediction for the prediction of a single criterion (dependent variable) $X_0$ from a linear combination of $m$ predictors (independent variables) $X_1, X_2, \ldots, X_m$ is given by the equation below.\(^{35}\)

$$X_0 = A + b_1X_1 + b_2X_2 + \ldots + b_mX_m$$ (5)

The symbol $\hat{X}_0$ represents the predicted value of the criterion as contrasted with $X_0$, the value actually observed. The symbols $A$, $b_1$, $b_2$, $\ldots$, $b_m$ represent weights or constants that are derived from empirical data.

An important concept in multiple-prediction is the multiple correlation coefficient usually designated by $R$. It represents the correlation of a set of predicted criterion "scores," $\hat{X}_0$, with the set of actually obtained "scores," $X_0$. The important point is that the square of

the multiple correlation coefficient, $R^2$, gives the proportion of total variance that is predicted by the predictor variables in predicting values of the criterion variable.\textsuperscript{36} Hence, if an $R$ of 0.60 is obtained, then 36 percent of the variance in the criterion variable is predicted or "accounted for" by the predictor variables.

Frequently in prediction situations many of the predictor variables measure roughly the same thing, and, consequently, they are found to be correlated. The result in the prediction of the criterion variable is that many of the predictors are accounting for the same variance in the criterion. Therefore, four or five predictors may do just as well as many more in predicting the criterion variable unless the new predictor(s) is quite different in content and process from its predecessors.\textsuperscript{37} That is, a point of "diminishing returns" may set in rather early in a typical prediction situation.

The logical solution to this problem of "diminishing returns" in multiple-prediction is to determine whether or not the addition of each new predictor variable results in a significant increase in the multiple correlation coefficient, and consequently, the predicted or "accounted for" variance in the criterion variable. A variance-

\textsuperscript{36}Ibid., p. 57. \hspace{1cm} \textsuperscript{37}Ibid., p. 54.
ratio or F-test is normally used for this purpose.\textsuperscript{38}

In this study the ratings of the various projects were run on the Wherry Test Selection Program of the Psychology Department of The Ohio State University with overall success as the single criterion variable and the six specific criteria as predictor variables. The program is a regression analysis program which selects, in order of decreasing importance, those variables contributing significant variance to the prediction of the criterion. The first predictor chosen is the one which correlates highest with the criterion. Thereafter, predictors are chosen on the basis of contributing the most unique variance to the prediction of the criterion. The output of the program includes among other things the multiple R, shrunken R (multiple R corrected for capitalizing on chance in deriving the multiple R value), F and degrees of freedom for adding new predictors, b weights, and A weight.\textsuperscript{39} With this information, a composite criterion of overall project success was quantified.

Hypotheses

In order to answer the questions raised by each of the seven hypotheses of the study, certain data analysis

\textsuperscript{38}Ibid., p. 57.

\textsuperscript{39}Wherry and Olivero, \textit{Computer Programs for Psychology}, pp. 56-60.
was needed in addition to the analysis described above. The particular data analysis procedures associated with each of the seven hypotheses are described below.

The first hypothesis stated that project principal investigators, parent organization representatives, and government monitors will view the relative importance of the six possible criteria of project success differently. First, the data were partitioned according to the three groups identified in the hypothesis. Then the scale values of the criteria were computed for the principal investigator and parent organization representative groups. Since there was only one government monitor, the rank order of the criteria was determined directly from the monitor's criteria ranking form.

In order to obtain a measure of the agreement between the principal investigators and parent organization representatives, a procedure based upon analysis of variance was used. Since the rankings of the criteria were in the form of values on an interval scale, the procedure was applicable and more advantageous than non-parametric measures of association such as Kendall's coefficient of concordance $W$.

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Specifically, the procedure involves the computation of an estimate of the reliability of sets of scores. The formula for this computation is given below.\(^41\)

\[ r = \frac{M_x - M}{M_x + (k - 1)M} \]  \hspace{1cm} (6)

The symbol \( M \) represents the mean square for error, \( M_x \) represents the mean square for persons, and \( k \) represents the number of sources (or raters) of scores. The reliability figure, \( r \), represents the degree of agreement of sources, judges, or raters in the scores they have generated. A coefficient of 1.00 represents complete agreement.

A principal advantage of this method of measuring agreement is that the "between-raters" variance can be included or removed from the error term depending upon the nature of the problem situation.\(^42\) The result is a more precise estimate of agreement or reliability.

A description of the precision of the reliability estimate obtained is useful in judging the confidence which can be placed in the obtained estimate. Ebel presents a method for estimating how much greater or lesser one should believe the obtained reliability estimate to be, at any selected level of confidence.\(^43\)

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\(^{41}\) Ibid., p. 410.

\(^{42}\) Ibid., p. 420.

\(^{43}\) Ibid., pp. 413 and 414.
In this study, then, the agreement between the scale values given to the six criteria by the two groups, principal investigators and parent organization representatives, was computed using the formula (6). Since the scale values were not affected by general level of rating, the "between-raters" variance was removed from the error term. Ebel notes that where differences from rater to rater in general level of rating do not lead to corresponding differences in the ultimate grades, classifications, or selections, the between-raters variance should be removed from the error term.45

For each agreement or reliability estimate, upper and lower estimates were computed for the 5 percent level of confidence following the procedures specified by Ebel.46

In comparing the ranking of the six criteria made by the government monitor to the principal investigators and parent organization representatives, a different procedure was required since the rankings of the government monitor were ordinal data, not interval. In this case, the scale values given the criteria by the two groups were converted to ordinal ranks, and then Kendall's coefficient of concordance, W, was computed as a measure of the agree-

44 They were based upon mean 3 values derived from the proportion of times criteria are selected over other criteria. (See Guilford, pp. 161, 162).


46 Ibid., pp. 413 and 414.
ment or associated between the three sources in ranking the criteria. Siegel notes that $W$ is particularly useful in studies of interjudge reliability when there are more than two sets of rankings of particular objects or individuals.\(^47\) The computation followed the procedures specified by Siegel.\(^48\) Values of $W$ range from 0 to 1, with 1 representing complete agreement.

The second hypothesis of the study stated that project principal investigators with previous project management experience will view the criteria differently than those without prior experience. In the study by Rubin cited earlier, project management experience was treated as a dichotomy resulting in two groups of approximately equal size—one with high previous project management experience and one with low previous experience.\(^49\) It is difficult to argue that the number of projects previously directed represents the measurement of project management experience on an interval or ordinal scale. It does seem logical, however, that there is a measurable difference in project management experience between a man who has previously directed one or more projects and one who has never


\(^{48}\) Ibid., p. 231.

\(^{49}\) Rubin, *Project Management and the Role of the Project Manager*, p. 9.
directed a project. Therefore, the data were partitioned into two groups—principal investigators who had indicated that they had been the director or principal investigator of one or more projects prior to the one identified in the study sample and principal investigators who indicate not having previously been a project director or principal investigator. As was done for the first hypothesis, the procedure described by Ebel was used in computing a measure of agreement between the two groups in the ranking of the six possible criteria of project success.

The third hypothesis stated that principal investigators of sponsored projects will view the criteria differently than those conducting non-sponsored projects. The data were first partitioned according to whether or not the principal investigator was the director of a sponsored project. That is, a project that, according to the regional office records, was conducted under the supervision of a university or college faculty member. Again, the Ebel procedure was followed in computing a measure of the agreement between the two groups in their ranking of the six criteria.

The fourth hypothesis stated that project principal investigators and parent organization representatives from large institutions will view the criteria differently than those from small institutions. In order to test this hypothesis, the data had to first be partitioned into
groups representing persons at large and small institutions. What represents a large or small educational institution is arbitrary. Some organizations such as the U.S. Office of Education do, however, classify educational institutions on the basis of size for different purposes. Since most of the projects in the study sample were conducted at universities or colleges, the U.S. office of Education, Division of Educational Statistics was contacted by phone in an effort to determine if they had a standard size classification scheme for universities and/or colleges. Although they indicated no standard classification scheme, they did report an unpublished classification based upon total degree credit enrollment at colleges and universities. The classification included ten groups beginning with enrollment below 200 and ending with those universities with enrollment over 30,000. If such a classification scheme were used in this study, it would likely serve only to hide any trend that may exist in the data. Therefore, it was decided to divide the size distribution of the project parent institutions into four groups of roughly equal size. This distribution and classification of parent organizations appears in Figure 4. The lowest enrollment group was labeled small and the highest enrollment group was labeled large.

Principal investigators and parent organization
![Number of Projects](attachment:image.png)

### Table: Number of Projects Classification Enrollment in Thousands

<table>
<thead>
<tr>
<th>Number of Projects</th>
<th>Classification</th>
<th>Enrollment in Thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>Small</td>
<td>0 - 10</td>
</tr>
<tr>
<td>29</td>
<td>Medium</td>
<td>11 - 22</td>
</tr>
<tr>
<td>31</td>
<td>Medium/Large</td>
<td>23 - 34</td>
</tr>
<tr>
<td>35</td>
<td>Large</td>
<td>35 and Over</td>
</tr>
</tbody>
</table>

### Figure 4. Relationship between project parent organization size distribution and number of projects
representatives were then categorized on the basis of the enrollment of the institution at which the project they were associated was conducted. Persons associated with the few projects conducted at small research organizations and public school districts were not included in the data partition groups because it would be inappropriate to use the same classification scheme on such institutions.

Again, the Ebel procedure was used in computing a measure of the agreement between principal investigators and parent organization representatives from large and small organizations.

The fifth hypothesis stated that for principal investigators and parent organization representatives the correlations of the project ratings on the six criteria with ratings of overall project success will be positively correlated with the rankings of the relative importance of the six criteria. First, the data were partitioned into the two groups of principal investigators and parent organization representatives. Then, the correlations of their ratings of projects on the six criteria with their ratings of project overall success were determined using a Pearson r. This was accomplished as one of the first steps in the analysis of the project rating data by use of the Wherry Test Selection Program described before. Since correlation coefficients do not represent figures on an interval
scale, the correlations were then transformed by means of
the Fisher $r$ transformation. Next, the Pearson $r$ cor-
relation coefficient between the transformed correlations
and the interval scale values of the rankings of the cri-
teria was computed for each group. Finally, the signifi-
cance of the obtained correlations was determined.

The sixth hypothesis stated that the correlations
of ratings of customer/client satisfaction, follow-on
work, and spin-off benefits with ratings of overall pro-
ject success are different when the government monitor is
more familiar with the projects being rated than when the
government monitor is less familiar with the projects. First,
the project rating data gathered from the government monitor
were partitioned into two approximately equal groups based
upon the monitor's rating of familiarity with the project
being rated. The more familiar group consisted of those
ratings associated with those projects given a familiarity
rating of 5, 6, or 7 on the seven-point scale. The point
5 was labeled "quite familiar" and the point 7 was labeled
"extremely familiar" on the scale. The less familiar group
consisted of those ratings associated with projects given a
familiarity rating of 4 or less.

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50 George A. Ferguson, *Statistical Analysis in
Psychology and Education* (New York: McGraw-Hill Book

51 Ibid., p. 413.
Then, the correlations of the ratings of projects on the three criteria with ratings of overall project success were determined using a Pearson $r$. This was accomplished, as before, using the Wherry Test Selection Program. Next, these correlations were transformed using the Fischer $Z$ transformation. Finally, the significance of the difference between the three pairs of correlation coefficients was determined.\(^{52}\)

The seventh hypothesis stated that the correlations of the ratings of customer/client satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different for parent organization representatives who are more familiar with the project being rated than parent organization representatives who are less familiar with the project. First, the project rating data gathered from the parent organization representatives were partitioned into two approximately equal groups based upon the respondents' rating of familiarity with the project being rated. The more familiar group consisted of those respondents giving a familiarity rating of 7, "extremely familiar." The less familiar group consisted of those respondents giving a familiarity rating of 6 or less.

The correlations of the ratings of projects on the three criteria with ratings of overall success were deter-

\(^{52}\)Ibid., p. 188.
mined as described above. Then the significance of the difference between the three pairs of correlation coefficients was determined using the Fischer transformation as before.
CHAPTER IV

FINDINGS AND INTERPRETATIONS

The findings and interpretations resulting from the analysis of data are presented in four sections within this chapter. The first section is concerned with the results of the ranking of the project success criteria, the second with the results of the project ratings, and the third with the results related to each of the seven hypotheses. The fourth section presents a brief summary of the findings.

Criteria Ranking

The first general objective of the study was to determine if the criteria of schedule, cost, quality, follow-on work, spin-off, and customer/client satisfaction are given a different order of importance by different persons associated with educational projects. This was accomplished by having different persons associated with a sample of educational projects rank the importance of the criteria using a paired comparison format. The scale values for the ranking of the criteria by each of the partition groups identified in the study hypotheses.
are presented in Table 2. The number of persons in each group for whom usable data were available is also given in the table.

From the scale values given the criteria by principal investigators (second column) and parent organization representatives (third column), it can be seen that, as groups, they view the relative importance of the criteria much the same. The criteria in order of relative importance are:

1. Quality/Performance
2. Customer/Client Satisfaction
3. Spin-off Benefits
4. Follow-on Work
5. Cost
6. Schedule

From the magnitude of the scale values in Table 2, it can be seen that quality/performance is by far the most important criterion with customer/client satisfaction a poor second. Spin-off benefits and follow-on work follow and are very close in relative importance. Cost and schedule are at the very bottom of the list in importance.

The relative positions of the criteria are the same in the ranking of the criteria by the single government monitor (first column) with the exception of customer/client satisfaction appearing in the fourth position instead
### TABLE 2

**SCALES VALUES FOR RANKING OF PROJECT SUCCESS CRITERIA MADE BY DIFFERENT GROUPS OF PERSONS ASSOCIATED WITH A SAMPLE OF EDUCATIONAL PROJECTS**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Criteria</th>
<th>Government Monitor</th>
<th>Principal Investigator</th>
<th>Parent Organization Representative</th>
<th>Experienced Principal Investigators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number in Group</td>
<td>1</td>
<td>136</td>
<td>72</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.97</td>
<td>2.81</td>
<td>2.82</td>
</tr>
<tr>
<td></td>
<td>Customer Satisfaction</td>
<td>4</td>
<td>1.87</td>
<td>1.61</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>Spin-off</td>
<td>2</td>
<td>1.61</td>
<td>0.99</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>Follow-on Work</td>
<td>3</td>
<td>1.25</td>
<td>0.89</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
<td>5</td>
<td>0.00</td>
<td>0.32</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
<td>6</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<sup>a</sup> Values for government monitor are rank order numbers, not scale values. One implies first in importance, two implies second in importance; and so forth.
<table>
<thead>
<tr>
<th>Groups</th>
<th>Inexperienced Principal Investigators</th>
<th>Principal Investigators Sponsored Projects</th>
<th>Principal Investigators Non-sponsored Projects</th>
<th>Principal Investigators and Parent Organization Representatives Large Institutions</th>
<th>Principal Investigators and Parent Organization Representatives Small Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number in Group</td>
<td>62</td>
<td>30</td>
<td>103</td>
<td>50</td>
<td>54</td>
</tr>
<tr>
<td>Quality</td>
<td>2.81</td>
<td>2.42</td>
<td>3.00</td>
<td>2.82</td>
<td>2.37</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>1.81</td>
<td>1.56</td>
<td>1.90</td>
<td>1.62</td>
<td>1.53</td>
</tr>
<tr>
<td>Spin-off</td>
<td>1.61</td>
<td>1.27</td>
<td>1.66</td>
<td>1.21</td>
<td>1.12</td>
</tr>
<tr>
<td>Follow-on Work</td>
<td>0.96</td>
<td>1.03</td>
<td>1.30</td>
<td>1.11</td>
<td>0.61</td>
</tr>
<tr>
<td>Cost</td>
<td>0.12</td>
<td>0.10</td>
<td>0.00</td>
<td>0.40</td>
<td>0.21</td>
</tr>
<tr>
<td>Schedule</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
of the second. Since only one government monitor participated in the study, no particular significance can be attached to this difference.

A random sample of fifty criteria ranking forms complete by principal investigators and parent organization representatives was selected to check the internal consistency of respondents in performing the paired comparison task. The number of circular triads completed by each respondent was determined. A frequency distribution of the number of circular triads completed by the sample of respondents appears as Figure 5. The maximum number of circular triads that can be completed when comparing six items is eight. Thirty-three or 66 percent of the sampled respondents did not complete a circular triad; that is, make an error of consistency. Forty-three or 86 percent made only one or no circular triads. Since each of these respondents could have completed eight circular triads, the group of forty-three could have completed 344 circular triads. They completed a total of only ten circular triads. Expressed as a percent, they completed circular triads at a rate of 2.9 percent. In the Peck and Scherer study discussed earlier, the total group of respondents completed circular triads at a rate of approximately 2 1/2 percent. They felt that the incidence of circular triads in their study was extremely low.1 It is concluded, then, that the large

Fig. 5. Frequency distribution of circular triads completed by a random sample of respondents.
majority of respondents sampled in this study showed little or no incidence of inconsistency in their completion of the criteria ranking form.

Some individuals, however, did show problems of consistency. One respondent in the sample completed four circular triads (50 percent of all possible) and three completed three each (37.5 percent of all possible). These four respondents (8 percent of the sample) completed 45 percent of the circular triads completed by the sample of fifty respondents. Thus, only a few respondents accounted for nearly half of the errors in consistency of response.

The paired comparison approach to ranking permits one to obtain a measure of the agreement among a group of respondents in the rankings they make. A coefficient of agreement, \( \mu \), was computed for the two main groups of respondents in the study—principal investigators and parent organization representatives. The value obtained for the 136 principal investigators was 0.373 where 1.000 represents complete agreement. The chi-square test for the significance of this value resulted in a chi-square equal to 781.5 with approximately 15.3 degrees of freedom. Since a chi-square value of 39.29 is needed for significance at the .001 level with sixteen degrees of freedom, the obtained chi-square value is significant. It is interpreted that the scale values of rankings of the six criteria of project
success made by the project principal investigators are not the result of random assignments, but they do, in fact, represent a level of agreement among the group.

The value of $u$ obtained for the seventy-two parent organization representatives was 0.415. The chi-square test for significance resulted a chi-square equal to 488.5 with approximately 15.6 degrees of freedom. Since a chi-square value of 39.29 is needed for significance at the .001 level with sixteen degrees of freedom, the obtained chi-square value is significant. It is concluded that the scale values of rankings of the six criteria of project success made by the parent organization representatives are not the result of random assignments, but they, in fact, do represent a level of agreement among the group.

**Project Rating**

The second general objective of the study was to determine if a composite criterion of educational project success employing the criteria of schedule, cost, quality, follow-on work, spin-off, and customer/client satisfaction could be established. This was accomplished by having different persons associated with a sample of educational projects rate those projects using the six criteria and the criterion of overall project success. A composite criterion of overall project success was generated for project principal investigators, parent organization repre-
sentatives, both groups taken together, and the government
monitor. The composite criterion for each of the groups is
presented below in the form of a prediction equation de­
erived by means of the multiple-regression procedure de­
scribed before. In each case, the criterion variable is
the overall project success rating and the predictor vari­
ables are selected from the set of six possible criteria
of project success.

The means and standard deviations of the project
ratings made on each of the seven criteria by the group of
133 project principal investigators for whom there was usable
data are illustrated in Figure 6.

The prediction equation for the principal investi­
gators is given below.

\[ X_0 = -0.495 + 0.413X_1 + 0.409X_2 + 0.126X_3 + 0.156X_4 + \\
0.078X_5 \]

where \( X_0 \) is overall success, \( X_1 \) is quality, \( X_2 \) is
customer satisfaction, \( X_3 \) is spin-off, \( X_4 \) is cost, and \( X_5 \)
is schedule.

In Table 5 the variables in the equation are defined,
their correlations with overall project success are listed,
the F value associated with the addition of each variable to
the prediction equation is given, and the resultant multiple
R and shrunken R are stated.

The means and standard deviations of the project
ratings made on each of the seven criteria by the group of
seventy-two parent organization representatives for whom
Fig. 6. Mean project ratings and plus one and minus one standard deviation on project success criteria made by project principal investigators.
### Table 3

**Summary of Regression Analysis for Project Principal Investigators**

<table>
<thead>
<tr>
<th>Variable Symbol</th>
<th>Variable Name</th>
<th>Correlation With Overall Success</th>
<th>F For Increase</th>
<th>Multiple R</th>
<th>Shrunken R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_0$</td>
<td>Overall Success</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>$X_1$</td>
<td>Quality</td>
<td>0.589</td>
<td>69.53</td>
<td>0.589</td>
<td>0.585</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Customer/Client Satisfaction</td>
<td>0.575</td>
<td>38.41</td>
<td>0.704</td>
<td>0.699</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Spin-off</td>
<td>0.347</td>
<td>7.47</td>
<td>0.723</td>
<td>0.716</td>
</tr>
<tr>
<td>$X_4$</td>
<td>Cost</td>
<td>0.010</td>
<td>4.16</td>
<td>0.734</td>
<td>0.724</td>
</tr>
<tr>
<td>$X_5$</td>
<td>Schedule</td>
<td>0.152</td>
<td>1.22</td>
<td>0.737</td>
<td>0.724</td>
</tr>
</tbody>
</table>
there was usable data are illustrated in Figure 7.

The prediction equation for the parent organization representatives is given below.

\[ X_0 = 0.777 + 0.611X_1 + 0.172X_2 + 0.255X_3, \]

where \( X_0 \) is overall success, \( X_1 \) is quality, \( X_2 \) is spin-off, and \( X_3 \) is customer satisfaction. In Table 4 the variables in the equation are identified, their correlations with overall project success are listed, the F value associated with the addition of each variable to the prediction equation is given, and the resultant multiple R and shrunken R are stated.

The means and standard deviations of the project ratings made on each of the seven criteria by the group of 205 principal investigators and parent organization representatives taken together are illustrated in Figure 8.

The prediction equation for the principal investigators and parent organization representatives is given below.

\[ X_0 = -0.184 + 0.455X_1 + 0.371X_2 + 0.142X_3 + 0.134X_4, \]

where \( X_0 \) is overall success, \( X_1 \) is quality, \( X_2 \) is customer satisfaction, \( X_3 \) is spin-off, and \( X_4 \) is cost. In Table 5 the variables are identified, their correlations with overall project success are listed, and the F value associated with the addition of each variable to the prediction equation, the resultant multiple R, and the shrunken R are given.
Fig. 7. Mean project ratings and plus one and minus one standard deviation on project success criteria made by parent organization representatives.
### TABLE 4
SUMMARY OF REGRESSION ANALYSIS FOR PARENT ORGANIZATION REPRESENTATIVES

<table>
<thead>
<tr>
<th>Variable Symbol</th>
<th>Variable Name</th>
<th>Correlation With Overall Success</th>
<th>F For Increase</th>
<th>Multiple R</th>
<th>Shrunken R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_0$</td>
<td>Overall Success</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>$X_1$</td>
<td>Quality</td>
<td>0.660</td>
<td>53.99</td>
<td>0.660</td>
<td>0.654</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Spin-off</td>
<td>0.475</td>
<td>10.66</td>
<td>0.715</td>
<td>0.705</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Customer/Client Satisfaction</td>
<td>0.573</td>
<td>5.93</td>
<td>0.742</td>
<td>0.728</td>
</tr>
</tbody>
</table>
Fig. 8. Mean project ratings and plus one and minus one standard deviation on project success criteria, made by principal investigators and parent organization representatives.
### TABLE 5

**SUMMARY OF REGRESSION ANALYSIS FOR PRINCIPAL INVESTIGATORS AND PARENT ORGANIZATION REPRESENTATIVES**

<table>
<thead>
<tr>
<th>Variable Symbol</th>
<th>Variable Name</th>
<th>Correlation With Overall Success</th>
<th>F For Increase</th>
<th>Multiple R</th>
<th>Shrunken R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_0$</td>
<td>Overall Success</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>$X_1$</td>
<td>Quality</td>
<td>0.609</td>
<td>119.8</td>
<td>0.609</td>
<td>0.607</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Customer/Client Satisfaction</td>
<td>0.576</td>
<td>48.8</td>
<td>0.703</td>
<td>0.699</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Spin-off</td>
<td>0.392</td>
<td>16.5</td>
<td>0.729</td>
<td>0.725</td>
</tr>
<tr>
<td>$X_4$</td>
<td>Cost</td>
<td>0.003</td>
<td>3.3</td>
<td>0.735</td>
<td>0.728</td>
</tr>
</tbody>
</table>
The means and standard deviations of the project ratings made on each of the seven criteria by the government monitor in rating fifty-one projects are illustrated in Figure 9. The prediction equation for the government monitor is given below.

\[
X_0 = -2.846 + 0.283X_1 + 0.279X_2 + 1.051X_3 + 0.338X_4 - 0.221X_5,
\]

where \(X_0\) is overall success, \(X_1\) is spin-off, \(X_2\) is quality, \(X_3\) is cost, \(X_4\) is customer satisfaction, and \(X_5\) is schedule. In Table 6 the variables are identified, their correlations with overall project success are listed, and the F value associated with the addition of each variable to the prediction equation, the resultant multiple R, and the shrunken R are given.

The second general objective was concerned with whether or not a composite criterion of educational project success employing the criteria of schedule, cost, quality, follow-on work, spin-off, and customer/client satisfaction could be established. A composite criterion of overall project success was generated for project principal investigators, parent organization representatives, both groups taken together, and the government monitor. In Tables 3, 4, 5, and 6, it can be seen that the value of the multiple R or shrunken R for the composite criteria
Fig. 9. Mean project ratings and plus one and minus one standard deviation on project success criteria made by government monitor.
<table>
<thead>
<tr>
<th>Variable Symbol</th>
<th>Variable Name</th>
<th>Correlation With Overall Success</th>
<th>F For Increase</th>
<th>Multiple R</th>
<th>Shrunken R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_0$</td>
<td>Overall Success</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_1$</td>
<td>Spin-off</td>
<td>0.749</td>
<td>62.58</td>
<td>0.749</td>
<td>0.743</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Quality</td>
<td>0.646</td>
<td>6.76</td>
<td>0.784</td>
<td>0.774</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Cost</td>
<td>0.215</td>
<td>5.82</td>
<td>0.811</td>
<td>0.797</td>
</tr>
<tr>
<td>$X_4$</td>
<td>Customer/Client Satisfaction</td>
<td>0.473</td>
<td>5.70</td>
<td>0.834</td>
<td>0.818</td>
</tr>
<tr>
<td>$X_5$</td>
<td>Schedule</td>
<td>-0.125</td>
<td>7.10</td>
<td>0.858</td>
<td>0.841</td>
</tr>
</tbody>
</table>
associated with these groups changes very little after two or three variables are included in the prediction equation. These variables are quality/performance, customer/client satisfaction, and spin-off. The maximum shrunken $R$ obtained in each case was a little over 0.700, which indicates that the predictor variables or criteria are accounting for approximately 50 percent of the variance in the criterion variable, overall project success. It is concluded that the criteria of quality/performance, customer/client satisfaction, and spin-off benefits are important factors in the determination of overall project success, accounting for approximately half the variance in overall project success ratings.

Although it is interesting that the composite criterion of overall project success for the government monitor appears quite similar to the composite criterion for the principal investigators and parent organization representatives, no particular significance can be attached since the prediction equation was derived from the rating of only fifty-one projects. With six predictors and one criterion variable at least twice as many projects probably should have been rated.

**Hypothesis**

Hypothesis 1—The first hypothesis stated that project principal investigators, parent organization repre-
sentatives, and government monitors will view the relative importance of the six possible criteria of project success differently. The rankings of the criteria by principal investigators and parent organization representatives were expressed in terms of scale values. These scale values were then compared by means of a coefficient of judge reliability or agreement. The obtained coefficient of 0.9559 indicates a high degree of agreement between these two groups in their ranking of the relative importance of the six criteria. Figure 10 illustrates this agreement.

The upper and lower estimates of the obtained value of the coefficient were computed for the 5 percent level of confidence. These values were 0.9910 and 0.7950.

The government monitor's ranking of the criteria was compared to the rankings made by the other two groups by first converting their scale values to ranks and then computing the coefficient of concordance, W. The obtained W of 0.90 indicates a high level of agreement between the government monitor and the two groups in the ranking of the importance of the criteria. This value was found to be significant at the .01 level.²

These findings indicate that project principal investigators, parent organization representatives, and representatives, and government monitors will view the relative importance of the six possible criteria of project success differently. The rankings of the criteria by principal investigators and parent organization representatives were expressed in terms of scale values. These scale values were then compared by means of a coefficient of judge reliability or agreement. The obtained coefficient of 0.9559 indicates a high degree of agreement between these two groups in their ranking of the relative importance of the six criteria. Figure 10 illustrates this agreement.

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These findings indicate that project principal investigators, parent organization representatives, and representatives, and

²Siegel, Non-Parametric Statistics, p. 286.
Fig. 10: Comparison of scale values given to criteria of project success by principal investigators and parent organization representatives.
government monitors pretty much agree in their rankings of the importance of the criteria with the order being: (1) quality/performance, (2) customer/client satisfaction, (3) spin-off, (4) follow-on work, (5) cost, and (6) schedule. The hypothesis is rejected.

Hypothesis 2—The second hypothesis of the study stated that project principal investigators with previous project management experience will view the relative importance of the criteria differently than those without prior experience. The obtained coefficient of agreement of 0.9771 indicates a high degree of agreement between these two groups in their ranking of the relative importance of the six criteria. Figure 11 illustrates this agreement. The upper and lower estimates of the obtained value of the coefficient were 0.9954 and 0.8898.

The findings indicate that project principal investigators with previous project management experience and those without prior experience pretty much agree in their rankings of the relative importance of the criteria with the order being: (1) quality/performance, (2) customer/client satisfaction, (3) spin-off, (4) follow-on work, (5) cost, and (6) schedule. The hypothesis is rejected.

Hypothesis 3—The third hypothesis stated that principal investigators of sponsored projects will view
Fig. 11. Comparison of scale values given to criteria of project success by experienced and inexperienced project principal investigators.
the relative importance of the criteria differently than those conducting non-sponsored projects. The obtained coefficient of agreement of 0.9703 indicates a high degree of agreement between these two groups in their ranking of the relative importance of the six criteria. Figure 12 illustrates this agreement. The upper and lower estimates of the obtained value of the coefficient were 0.9940 and 0.8586.

The findings indicate that principal investigators of sponsored projects and those conducting non-sponsored projects pretty much agree in their ranking of the relative importance of the criteria with the order being: (1) quality/performance, (2) customer/client satisfaction, (3) spin-off, (4) follow-on work, (5) cost, and (6) schedule. The hypothesis is rejected.

Hypothesis 4—The fourth hypothesis stated that project principal investigators and parent organization representatives at large colleges and universities (institutions) will view the criteria differently than those at small institutions. The obtained coefficient of agreement of 0.9241 indicates a high degree of agreement between these two groups in their ranking of the relative importance of the six criteria. Figure 13 illustrates this agreement. The upper and lower estimates of the obtained value of the coefficient were 0.9845 and 0.6677.
Fig. 12. Comparison of scale values given to criteria of project success by principal investigators of sponsored and non-sponsored projects.
Fig. 13. Comparison of scale values given to criteria of project success by principal investigators and parent organization representatives from large and small institutions.
The findings indicate that project principal investigators and parent organization representatives from large and small colleges and universities pretty much agree in their rankings of the relative importance of the criteria with the order being: (1) quality/performance, (2) customer/client satisfaction, (3) spin-off, (4) follow-on work, (5) cost, and (6) schedule. The hypothesis is rejected.

**Hypothesis 5**—The fifth hypothesis stated that for principal investigators and parent organization representatives the correlations of the project ratings on the six criteria with ratings of overall project success will be positively correlated with the rankings of the relative importance of the six criteria. The correlations of project ratings with ratings of overall success were transformed using the Fischer z transformation and correlated with the interval scale rankings of the six criteria. The correlation coefficient for the group of 133 principal investigators was 0.933. A one-tailed test of the significance of the obtained value showed it significant at the .005 level. The correlation coefficient for the group of seventy-two parent organization representatives was 0.907. This value was found to be significant at the .01 level.

This hypothesis dealt with the question of whether or not the correlations of the project ratings on the six criteria with ratings of overall project success are posi-
tively correlated with the rankings of the relative importance of the six criteria. It was predicted that for a criterion that was ranked high in relative importance, the correlation of ratings with overall project success ratings would be high. In the same manner, for a criterion that was ranked low in relative importance, the correlation of ratings with overall project success ratings would also be low. The findings indicate that this is the case—the hypothesis is accepted.

**Hypothesis 6**—The sixth hypothesis stated that the correlations of ratings of customer/client satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different when the government monitor is more familiar with the projects being rated than when the government monitor is less familiar with the projects. The correlations of the ratings on the three criteria with overall success are given in Table 7.

The significance of the difference between the three pairs of correlation coefficients was determined using the Fischer Z transformation method. The only pair of correlations to show a significant difference were the correlations for the customer/client satisfaction criterion. The obtained Z value of 3.03 indicates significance beyond the .01 level. The correlation coefficient of 0.619 for more familiar projects is itself significant at the .01 level, and the corre-
The findings indicate that the correlations were significantly different on only one of the criteria—customer/client satisfaction. Ratings on this criterion were correlated with overall project success ratings when the government monitor was more familiar with the projects being rated and not when the monitor was less familiar with the projects. The hypothesis is rejected.

**Hypothesis 7**—The seventh hypothesis stated that the correlations of the ratings of customer/client satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different for parent organization representatives who are more familiar with the

<table>
<thead>
<tr>
<th>Criterion</th>
<th>More Familiar (N=25)</th>
<th>Less Familiar (N=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer/Client Satisfaction</td>
<td>0.619</td>
<td>-0.179</td>
</tr>
<tr>
<td>Follow-on Work</td>
<td>0.536</td>
<td>0.442</td>
</tr>
<tr>
<td>Spin-off</td>
<td>0.723</td>
<td>0.602</td>
</tr>
</tbody>
</table>
project being rated than parent organization representatives who are less familiar with the project. The correlations of the ratings on the three criteria with overall success are given for both groups in Table 8.

**TABLE 8**

RELATIONS FOR PARENT ORGANIZATION REPRESENTATIVE RATINGS OF PROJECTS ON THREE CRITERIA WITH RATINGS OF OVERALL SUCCESS FOR THOSE MORE OR LESS FAMILIAR WITH THE PROJECT RATED

<table>
<thead>
<tr>
<th>Criterion</th>
<th>More Familiar N=35</th>
<th>Less Familiar N=37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer/Client Satisfaction</td>
<td>0.747</td>
<td>0.417</td>
</tr>
<tr>
<td>Follow-on Work</td>
<td>0.322</td>
<td>0.489</td>
</tr>
<tr>
<td>Spin-off</td>
<td>0.284</td>
<td>0.667</td>
</tr>
</tbody>
</table>

The significance of the difference between the three pairs of correlation coefficients was determined using the Fischer z transformation. Significant difference between the correlation coefficients was found for the criteria of customer/client satisfaction and spin-off benefits. The obtained z values of 2.11 and 2.08 respectively indicate significance at the .05 level.

The correlation coefficients of 0.747 and 0.417 are both significant themselves (.01 and .02 levels respectively) indicating that customer/client satisfaction ratings are
correlated with overall project success ratings regardless of whether or not the parent organization representatives are more or less familiar with the projects being rated. There does seem to be a trend, however, that the more familiar the representative is with the project being rated, the higher the correlation of the rating on customer/client satisfaction with the rating on overall success.

The correlation coefficient of 0.284 is not significant and the correlation coefficient of 0.667 is significant at the .01 level. Consequently, it appears that ratings on spin-off benefits only correlate with ratings of overall success when the parent organization representative is less familiar with the project being rated.

The findings indicate that the correlations were significantly different on two of the criteria—customer/client satisfaction and spin-off benefits. Ratings on customer/client satisfaction were more highly correlated with overall project success ratings when the parent organization representative was more familiar with the project being rated than when less familiar. Ratings on spin-off benefits were correlated with ratings of overall success only when the parent organization representative was less familiar with the project being rated. This finding is contrary with what one would rationally expect. Just what it means is hard to say. The hypothesis is rejected.
Summary of Findings

From the analysis of the criteria ranking data, it was found that, as groups, project principal investigators and parent organization representatives view the relative importance of the criteria of project success much the same. The coefficient of agreement for these two groups in their ranking of the criteria was 0.9559. The criteria in order of relative importance are:

1. Quality/Performance
2. Customer/Client Satisfaction
3. Spin-off Benefits
4. Follow-on Work
5. Cost
6. Schedule

The data were also partitioned according to whether or not the principal investigator was experienced, the principal investigator conducted the project under the supervision of a sponsor such as a college or university faculty member, and whether or not the principal investigator and parent organization representative were from a large or small college or university. These groups also expressed a high degree of agreement in their ranking of the importance of the criteria with all agreement coefficients well over 0.900.

Using the ratings of many projects on each of the
above criteria, a composite criterion of overall project success was generated for project principal investigators, parent organization representatives, both groups taken together, and the government monitor. In each case, a shrunken multiple R of over 0.700 resulted after the inclusion of the variables/criteria of quality/performance, customer/client satisfaction, and spin-off benefits in the prediction equation.

It was also found that the correlations of the project ratings on the six criteria with ratings of overall project success were positively correlated with the rankings of the relative importance of the six criteria. That is, project ratings on criteria that were ranked high in relative importance showed higher correlations with ratings of overall project success than did ratings on the other criteria.

The government monitor and parent organization representatives were sometimes quite familiar and sometimes less familiar with the project they were requested to rate the success of. The analysis of ratings of projects on the criteria of customer/client satisfaction, follow-on work, and spin-off benefits resulted in the following findings:

1. For the government monitor project ratings on the criterion of customer/client satis-
faction were correlated with overall project success ratings when the monitor was more familiar with the projects being rated and not when the monitor was less familiar with the projects.

2. For the parent organization representatives, project ratings on the criterion of customer/client satisfaction were more highly correlated with overall project success ratings when the representatives were more familiar with the project being rated than when less familiar with the project. Also, ratings on spin-off benefits were correlated with ratings of overall success only when the representatives were less familiar with the project being rated.
CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

Background

The determination of the final success or failure of research and development projects is an important problem for those concerned with project management in almost all fields of endeavor. One immediate problem encountered in determining project success is defining what is meant by "success." Previous research at Harvard University\(^1\) and the Massachusetts Institute of Technology\(^2\) has indicated that several criteria are considered when the success of various weapons systems oriented projects are rated.

Cook\(^3\) recently conducted a research study which

\(^1\)Peck and Scherer, The Weapons Acquisition Process.

\(^2\)Marquis and Straight, "Organizational Factors in Project Performance."

resulted in a conceptual framework to be used for the study of project management. The purpose of this effort was to develop a framework which could be used to integrate the results of past and current studies and to direct further research on project management. Project success, which represents a major component of the conceptualization, includes such potential criteria as meeting schedule dates, remaining within cost constraints, meeting quality specifications (objectives), satisfying the customer, obtaining spin-off benefits, and securing support for additional or follow-on work.

The conceptual framework suggests that different persons may have different viewpoints on project success, and that these would be reflected in their ranking of the potential success criteria. For example, project managers may be most concerned with time, cost, and performance, whereas, parent organization representatives may be quite concerned about spin-off benefits, follow-on work, and customer or funding agency satisfaction.

Purpose

The general purpose of the study was to explore two basic hypotheses suggested by Cook's conceptual framework in regard to the criteria of project success. The general objectives of the study were:

1. To determine if schedule, cost, quality/performance, follow-on work, spin-off,
and customer/client satisfaction are given a different order of importance by different persons associated with educational projects and what the order(s) of importance is (are).

2. To determine if a composite criterion of educational project success employing the criteria of schedule, cost, quality/performance, follow-on work, spin-off, and customer/client satisfaction could be established.

The relative importance of possible criteria of project success as viewed by different people would have implications for the many governmental and non-governmental organizations that must determine or judge the ultimate success of the educational projects they fund, monitor, and/or plan to implement or institutionalize. Once it is known what constitutes a successful project, research can be directed toward discovering which variables in the management of projects are critical in determining a successful project. If the composite criterion of project success resulting from this study is used as the dependent variable, research can be conducted on the relationship of selected independent variables of the conceptual framework in order to more firmly establish those management actions on a project that will make it successful.

Within the framework of the general purpose, the study proceeded with the following hypotheses:
1. Project principal investigators (project managers), parent organization representatives, and government monitors will view the relative importance of the criteria differently.

2. Project principal investigators with previous project management experience will view the criteria differently than those without prior experience.

3. Project principal investigators of sponsored projects (conducted under the supervision of a university faculty member) will view the criteria differently than those conducting other projects.

4. Project principal investigators and parent organization representatives from large colleges and universities will view the criteria differently than those from small colleges and universities.

5. For project principal investigators and parent organization representatives, the correlations of the project ratings on the six criteria with ratings of overall project success will be positively correlated with the rankings of the relative importance of the six criteria.

6. The correlations of ratings of customer satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different when the government monitor is more familiar with the projects being rated than when the government monitor is less familiar with the projects.

7. The correlations of the ratings of customer satisfaction, follow-on work, and spin-off benefits with ratings of overall project success are different for parent organization representatives who are more familiar with the project being rated than parent organization representatives who are less familiar with the project.
Procedures

A sample of educational projects was first selected and then the personnel associated with the conduct and monitoring of the projects were identified. These people represent the source of data for the study. The instruments used in the collection of data, the sample and data collection procedures, and the data analysis procedures are briefly described below.

Instruments

A Criteria Ranking Form using a paired comparison format was developed to obtain rankings of the relative importance of the potential criteria of project success. A Project Rating Form using a seven-point, equal-interval scale was developed to obtain ratings of projects on the potential criteria and overall success. A Definitions Sheet was developed to provide the respondents with a common set of definitions for use in ranking the criteria and rating the projects.

The specific hypotheses of the study required that what might be called "background information" be collected. This refers to information regarding (a) the size of the parent organization housing the projects in the sample, (b) the previous project management experience of the principal investigator, and (c) whether or not each project in the sample was a sponsored (under the supervision of a
university faculty member) or non-sponsored project, and (d) the degree of familiarity that the respondent had with the project being rated.

**Size**—Nearly all the projects in the sample were conducted at a college or university. The total degree credit enrollment in Fall 1969 was used as the measure of parent organization size.

**Experience**—Each principal investigator was asked to indicate the number of projects he had managed or directed prior to the project specified in the sample. This number was used as a measure of previous project management experience.

**Sponsorship**—Information regarding whether a project was sponsored or not was obtained from the records of a regional office of the Regional Research Program that funded and monitored the project.

**Familiarity**—Each respondent was asked to indicate on the Project Rating Form the degree to which he was familiar with the project he had just rated. A seven-point, equal-interval scale was used for this purpose.

**Sample and Data Collection**

The data for the study were obtained from the project manager, parent organization representative, and government
project monitor associated with each project in a sample of 146 terminated projects funded in one of the several Regions under the Regional Research Program of the National Center for Educational Research and Development, United States Office of Education. The projects were all operated and terminated during the period from September 1967 to January 1972; had a maximum government support of $10,000, and were usually conducted or managed by a single "principal investigator."

The data were collected in 1972 by means of six initial mailings and a follow-up mailing to all non-respondents for whom correct mailing addresses could be assumed. Sixty-five percent of the project principal investigators and parent organization representatives responded to the mailing by completing the data collection instruments. Ninety-five percent of the Criteria Ranking Forms received were usable, and 93 percent of the Project Rating Forms were usable. The one government monitor associated with the entire sample of projects responded by completing the Criteria Ranking Form and numerous Project Rating Forms.

Data Analysis

In order to obtain a ranking of the six criteria of project success, the paired comparison data were run on the POMP computer program of the Psychology Department of The Ohio State University. This program follows the
assumptions of the Thurstone Case III model and computes a scale value for each criterion.

In order to measure the agreement of the different groups of respondents in their rankings of the relative importance of the criteria, an analysis of variance procedure was used in estimating the reliability of scale values given the criteria by the groups. This represents the degree of agreement of the groups or judges in the scale values they have given the criteria.

In order to obtain a composite criterion of project success, the ratings of projects on the six criteria plus overall success made by the respondents were run on the Wherry Test Selection Program of the Psychology Department of The Ohio State University. The program is a regression analysis program which selects, in order of decreasing importance, the variables contributing significant variance to the prediction of the criterion variable (overall success).

Conclusions

It was found that, in general, different groups of persons associated with educational projects view the relative importance of the six possible criteria of project success much the same. There may be differences between individuals, but as a group project principal investigators and parent organization representatives view the criteria.
in the following order of importance.

1. Quality/Performance
2. Customer/Client Satisfaction
3. Spin-off Benefits
4. Follow-on Work
5. Cost
6. Schedule

The single government monitor placed the criteria in the same relative order with the exception of customer/client satisfaction appearing in the fourth position instead of the second.

A composite criterion of overall project success was generated for project principal investigators, parent organization representatives, both groups taken together, and the government monitor. It was found that the shrunken multiple R changed very little after two or three variables were included in the prediction equation. These variables were quality/performance, customer/client satisfaction, and spin-off benefits. The maximum shrunken multiple R obtained in each case was a little over 0.700, which indicates that the three criteria are accounting for approximately 50 percent of the variance in the criterion variable, overall project success.

On the basis of the results of the data analysis, all the hypotheses of the study with the exception of number five were rejected. Consequently, the following
conclusions were drawn.

1. Persons associated with educational projects demonstrate a high degree of agreement in their rankings of the relative importance of the six criteria of project success regardless of the following factors:
   a. whether or not the person is a project principal investigator or parent organization representative;
   b. whether or not a project principal investigator has had previous project management experience;
   c. whether or not a project principal investigator has recently conducted a project under the sponsorship and supervision of a university faculty member;
   d. whether or not the project principal investigator or parent organization representative is from a large or small college or university.

2. When rating the overall success of a project, principal investigators and parent organization representatives appear to give more emphasis to criteria that they rank as being more important than to criteria they rank lower in relative importance.

3. Customer/client satisfaction appears to be more of a factor in the rating of the success of a project when the parent organization representative is more familiar with the project.

4. Spin-off appears to be a factor in the rating of the success of a project when the parent organization representative is less familiar with the project.

Implications

The findings and conclusions of this study have some specific implications for the management and evalua-
tion of educational projects. These implications are discussed below.

The most important criterion in determining the success of a project is quality/performance. This criterion was also found to be important in the study by Baker and others which was conducted independent of this study. To have a successful project then, the project manager should concentrate on the achievement of the goal and objectives of the project. Management decisions are said to usually involve trade-offs between time, cost, and performance. Since time or schedule and cost were ranking the lowest among the six criteria of project success considered and were the least correlated criteria with ratings of overall project success, the project manager should try to maximize quality/performance when faced with decisions involving trade-offs among time, cost, and performance factors.

The parallel implication for project monitors, contract administrators, and evaluators is not to attach high importance to meeting project time and cost constraints. Although completing a project on schedule and within budget may appear to be important, achieving the goal and objectives of a project is far more important. Consequently,

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4 Bruce N. Baker, Dalmar Fisher, and David O. Murphy, "Factors Affecting Success of Project Management," p. 4.
time and cost factors should not be unnecessarily con-
strained to the detriment of project performance.

Although much writing in project management litera-
ture stresses the importance of time, cost, and performance
factors to the project manager, there are other very impor-
tant factors that deserve consideration. Among these are
customer/client satisfaction, spin-off benefits, and follow-
on work. These factors may appear to be external to the
project and of secondary importance, but the findings indi-
cate that they are of substantial importance in judging the
success of a project. The project manager, then, needs to
concern himself with the likely effects of his decisions
upon the satisfaction of the funding agency and ultimate
client or user with the end product of the project. He
should also be concerned with the indirect benefits the
project may have for the parent organization, its staff,
and the project staff. Finally, he should be concerned
with the implications that project success has on obtain-
ing other additional or follow-on projects for himself and/
or his parent organization following the termination of the
project.

The parallel implication for project monitors and
evaluators is to give consideration to these factors when
determining the success of a project. Since it was found
that the familiarity of parent organization representatives
with a project has a relationship with the consideration
they give to customer/client satisfaction and spin-off benefits in rating the overall success of the project, project monitors and evaluators are probably wise to learn as much about a project before trying to judge its success.

In summary, the major implication or recommendation for the educational project manager is to achieve the project goal and objectives even if one has to overrun the schedule and budget. Relative to other criteria, time and cost are not very important. And, while one is striving to achieve the objectives of the project, try to ensure that the customer or user will, in the end, be satisfied. Also, try to maximize spin-off benefits such as the development of skills in the project staff and new capabilities in the parent organization. Finally, don't overlook the importance of trying to obtain future projects for the parent organization.

Recommendations

Based upon the limitations and findings and conclusions of this study, the following recommendations for future research related to determining the success of educational projects are made.

1. Quality/performance is considered to be by far the most important criterion of educational project success. Measurement on the criterion is most often achieved by obtaining the opinion or judgment of knowledgeable individuals. Consequently, the reliability
and validity of the evaluation of projects on this criterion is often open to question. Research directed toward improving the reliability and validity of measurement on this important criterion is needed.

2. This study dealt with projects of a limited size or scale from a limit geographic region that were nearly all conducted in a college or university setting. Research is needed to determine if the results hold for larger, more complex projects conducted in different educational institutions across the country. For example, future studies might include large, state or federally funded projects in large, city public school districts in their sample.

3. The variability of the projects included in the study on the criterion of cost was limited by the fact that the contracts were all of the fixed price type. It is quite possible that the importance of the criterion of cost may vary with the type of contract issued. Future studies should include projects operated under a variety of contract types.

4. Studies directed at discovering which variables in the management of educational projects are critical in determining a successful project, should use a composite criterion as the dependent variable which includes the factors of quality/performance, spin-off benefits, and customer/client satisfaction.
APPENDIX A

CRITERIA RANKING FORM
Success Criteria Ranking

Listed below in pairs are the criteria of educational project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project by placing an "X" before the more important criterion in each pair. After you have finished, turn the page and continue. Be sure that all items are marked.

1. customer/client satisfaction
   ___ cost
   ___ schedule

2. quality/performance
   ___ schedule
   ___ spin-off

3. cost
   ___ schedule
   ___ spin-off

4. ___ schedule
   ___ follow-on work

5. spin-off
   ___ quality/performance

6. customer/client satisfaction
   ___ schedule

7. ___ follow-on work
   ___ quality/performance

8. ___ schedule
   ___ cost

9. ___ quality/performance
   ___ customer/client satisfaction

10. ___ spin-off
    ___ follow-on work

11. ___ cost
    ___ quality/performance

12. ___ customer/client satisfaction
    ___ follow-on work

13. ___ schedule
    ___ spin-off

14. ___ follow-on work
    ___ cost

15. ___ spin-off
    ___ customer/client satisfaction

Check the box at the right if you would like to receive a copy of the results of this study of educational project success criteria.
APPENDIX B

PROJECT RATING FORM
### Project Success Rating Scale

**PROJECT NUMBER**

**PROJECT PRINCIPAL INVESTIGATOR**

**PROJECT TITLE**

The several criteria of project success defined before appear below in a rating scale format. Rate the project identified above on each of these criteria. Cross out the number on each scale that best approximates your rating of the project on that criterion. At the bottom of the page indicate your familiarity with the project.

<table>
<thead>
<tr>
<th>Schedule</th>
<th>far behind schedule</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>far ahead of schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>far under</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>far over</td>
</tr>
<tr>
<td>Quality/Performance</td>
<td>standards far from met</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>standards greatly exceeded</td>
</tr>
<tr>
<td>Customer/Client</td>
<td>extremely satisfied</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>unsatisfied</td>
</tr>
<tr>
<td>Spin-off</td>
<td>no spin-off</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>substantial spin-off</td>
</tr>
<tr>
<td>Follow-on Work</td>
<td>substantial follow-on</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>no follow-on</td>
</tr>
<tr>
<td>Overall Success</td>
<td>unsuccessful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>extremely successful</td>
</tr>
</tbody>
</table>

Your familiarity with project:

- extremely familiar
- quite familiar
- somewhat familiar
- unfamiliar
APPENDIX C

DEFINITIONS SHEET
Definitions

On the following pages you will be asked to rank the importance of several possible criteria of educational project success. You will also be asked to rate the success of a project using these same criteria. Although you may not agree with the definitions of the criteria provided below, please accept and use them for the purpose of this study. After you have studied the definitions, turn the page and continue.

Schedule refers to meeting project milestone deadlines and the scheduled project termination date as established in the project contract. Success on this dimension means that the project was completed on or before the scheduled termination date and that all subsections or components of the project were completed as scheduled.

Cost refers to meeting the total dollar expenditure predicted for the entire life of the project. Success on this dimension means that the actual dollar cost of the project was less than or coincided with the predicted cost.

Quality/Performance refers to the achievement of the goals and objectives of the project. Success on this dimension means that the performance standards specified by the project objectives were met or exceeded.

Follow-on Work refers to additional contracts or follow-on work obtained as a result of the success of the original project and consequent enhancement of the reputation of the researcher. This criterion is not, however, concerned with additional work obtained as a logical or technical extension of the original project. It is concerned only with whether or not additional work is obtained as a result of the success of the original project.

Spin-off refers to indirect benefits received by the parent institution, its faculty, and the project staff. Success on this dimension means, for example, that the project and/or the parent institution's faculty developed skills as a result of working with the project which can be applied to other areas of the institution's operations. Another important spin-off benefit is the recognition an institution often gains from a highly successful project.

Customer/Clien Satisfaction refers to the degree to which the funding agency or user of the end product of the project is satisfied. This criterion is not necessarily concerned with the quality of the project as indicated by whether or not the original objectives and performance standards were met. It is concerned only with the satisfaction of the funding agency or customer with the project or its end product.

Overall Success refers to a general or overall evaluation of the project effort. Was it completed as scheduled? Were the objectives and performance standards met? Were all interested parties satisfied with the effort? Was the project conducted within the estimated cost? Did the project generate additional work? Did the parent institution and its staff benefit from the project? This criterion is not concerned with any one specific aspect or objective of the project. The concern is with making a general value statement indicating the degree to which the project was a success.
APPENDIX D

SECOND MAILING
Dear Dr.

Dr.

Department of

Southern Illinois University

Carbondale, Illinois 62903

In recent years, there has been an increase in the magnitude of research and development activities in most all fields of inquiry. There has also been a corresponding increase in the concern for the effective management of research and development projects. This concern is exemplified by a recent research study conducted at The Ohio State University by the Educational Program Management Center which resulted in a conceptual framework for the study of project management in education. Further, a series of studies is being undertaken to determine the validity of this conceptual framework.

One study in this series is designed to ascertain the feasibility of determining the relationships among the variables in the project success component of the conceptual framework. Specifically, the objectives of this study are to determine the relative importance of several possible criteria of project success and to generate a composite criterion of educational project success. The ranking of such criteria could have many implications for the governmental and nongovernmental agencies that must determine the success of the educational projects they fund and/or monitor.

In order to accomplish these objectives, a sample of projects funded under Region V of the U. S. Office of Education Regional Research Program has been selected. According to the records of the Region V office, you were the principal investigator of one of these projects. Your cooperation in completing the enclosed instruments and returning them will be greatly appreciated. It should take you approximately 15 minutes to complete the instruments and enclose them in the self-addressed, stamped return-envelope provided. Your responses will be kept strictly confidential.

Thank you for your assistance.

Sincerely,

R. A. Ball

Research Associate

RJb; 4/71

Enc.
Project Background Information

Please answer the following items which make reference to the Region V funded project numbered ______ and titled ____________________________

1. Assuming that a project is a once-through research or development effort funded by an institution, foundation, or governmental unit and is to be completed within specified time, cost, and performance dimensions, indicate the number of projects prior to the one identified above for which you were the principal investigator or director.

Number ______

2. Print the name, title, and address of a person representative of the institution where you conducted the project identified above who would be familiar with the project. Such a person might be a major advisor, department chairman, college dean, or superintendent of schools.

Name ____________________________

Title ____________________________

Address ____________________________

Check the box at the right if you would like to receive a copy of the results of this study of educational project success criteria.

Success Criteria Ranking

Listed below in pairs are the criteria of educational project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project by placing an "x" before the more important criterion in each pair. After you have finished, turn the page and continue. Be sure that all items are marked.

1. ___ customer/client satisfaction ___ cost
   Quality/performance

2. ___ quality/performance ___ schedule
   Cost

3. ___ cost ___ spin-off
   Schedule

4. ___ schedule ___ follow-on work
   Cost

5. ___ spin-off ___ quality/performance
   Customer/client satisfaction

6. ___ customer/client satisfaction ___ schedule
   Quality/performance

7. ___ follow-on work ___ quality/performance
   Customer/client satisfaction

8. ___ schedule ___ cost
   Customer/client satisfaction

9. ___ quality/performance ___ customer/client satisfaction
   Customer/client satisfaction

10. ___ spin-off ___ follow-on work
    Quality/performance

11. ___ cost ___ quality/performance
    Customer/client satisfaction

12. ___ customer/client satisfaction ___ follow-on work
    Schedule

13. ___ schedule ___ spin-off
    Cost

14. ___ follow-on work ___ cost
    Customer/client satisfaction

15. ___ spin-off ___ customer/client satisfaction
APPENDIX E

THIRD MAILING
Mailing Information

In order to complete this study, important information must be obtained from [name] who was the principal investigator of a Region V funded project. Please print his current title and address on the following lines.

Title ________________________________________
Address ________________________________________
_________________________________________ ZIP

Check the box at the right if you would like to receive a copy of the results of this study of educational project success criteria.

Success Criteria Ranking

Listed below in pairs are the criteria of educational project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project by placing an "x" before the more important criterion in each pair. After you have finished, turn the page and continue. Be sure that all items are marked.

1. customer/client satisfaction
   ___ cost
   ___ schedule
2. quality/performance
   ___ schedule
   ___ cost
3. ___ spin-off
   ___ follow-on work
4. ___ schedule
   ___ follow-on work
5. ___ spin-off
   ___ quality/performance
6. ___ customer/client satisfaction
   ___ schedule
7. ___ follow-on work
   ___ quality/performance
8. ___ schedule
   ___ cost
9. ___ quality/performance
   ___ customer/client satisfaction
10. ___ spin-off
    ___ follow-on work
11. ___ cost
    ___ quality/performance
12. ___ customer/client satisfaction
    ___ follow-on work
13. ___ schedule
    ___ spin-off
14. ___ follow-on work
    ___ cost
15. ___ spin-off
    ___ customer/client satisfaction
APPENDIX F

FOURTH MAILING
Success Criteria Ranking

Listed below in pairs are the criteria of educational project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project by placing an "x" before the more important criterion in each pair. After you have finished, turn the page and continue. Be sure that all items are marked.

1. customer/client satisfaction  
   __________cost
2. quality/performance  
   __________schedule
3. __________cost  
   __________spin-off
4. __________schedule  
   __________follow-on work
5. __________spin-off  
   __________quality/performance
6. customer/client satisfaction  
   __________schedule
7. __________follow-on work  
   __________quality/performance
8. __________schedule  
   __________cost
9. __________quality/performance  
   __________customer/client satisfaction
10. __________spin-off  
    __________follow-on work
11. __________cost  
    __________quality/performance
12. __________customer/client satisfaction  
    __________follow-on work
13. __________schedule  
    __________spin-off
14. __________follow-on work  
    __________cost
15. __________spin-off  
    __________customer/client satisfaction

Check the box at the right if you would like to receive a copy of the results of this study of educational project success criteria. □
APPENDIX G

FIFTH MAILING
Project Background Information

Please answer the following item which makes reference to the Region V funded project numbered ________ and titled ________________________

Assuming that a project is a once-through research or development effort funded by an institution, foundation, or governmental unit and is to be completed within specified time, cost, and performance dimensions, indicate the number of projects prior to the one identified above for which you were the principal investigator or director.

Number ________

Check the box at the right if you would like to receive a copy of the results of this study of educational project success criteria. [ ]

Success Criteria Ranking

Listed below in pairs are the criteria of educational project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project by placing an "X" before the more important criterion in each pair. After you have finished, turn the page and continue. Be sure that all items are marked.

1. customer/client satisfaction
   ________cost
   ________quality/performance

2. quality/performance
   ________schedule
   ________spin-off

3. cost
   ________spin-off
   ________quality/performance

4. schedule
   ________follow-on work
   ________customer/client satisfaction

5. spin-off
   ________quality/performance
   ________customer/client satisfaction

6. customer/client satisfaction
   ________schedule
   ________follow-on work

7. follow-on work
   ________quality/performance
   ________customer/client satisfaction

8. schedule
   ________cost
   ________spin-off
APPENDIX H

SIXTH MAILING
Dr.

Dear Dr.,

In recent years, there has been an increase in the magnitude of research and development activities in most all fields of inquiry. There has also been a corresponding increase in the concern for the effective management of research and development projects. This concern is exemplified by a recent research study conducted at Ohio State University by the Educational Program Management Center which resulted in a conceptual framework for the study of project management in education. A series of studies is being undertaken to determine the validity of this conceptual framework.

One study in this series is designed to ascertain the feasibility of determining the relationships among the variables in the project success component of the conceptual framework. Specifically, the objectives of this study are to determine the relative importance of several possible criteria of project success and to generate a composite criterion of educational project success. The ranking of such criteria could have many implications for the governmental and non-governmental agencies that must determine the success of the educational projects they fund and/or monitor. A composite criterion of project success is necessary to further research within the conceptual framework.

In order to accomplish these objectives, a sample of projects funded by the U.S. Office of Educational Regional Research Program has been selected to serve as a database. According to the records of the Region office, you were the director of the CORD project number .

In order to complete this study, important information must be obtained from the principal investigator or director of each project funded under your CORD project. You can help by specifying the name and address of each of these persons together with their project title and number. Your cooperation in providing this information on the enclosed forms and returning them in the enclosed, self-addressed, stamped envelope will be greatly appreciated. A copy of a project list that you have already prepared would be just as helpful. Any information provided will be used strictly for mailing instruments created for this study.

Thank you for your assistance.

Sincerely,

Rodney J. Ball
Educational Program Management Center
### CORD Funded Projects and Project Directors

On the lines below please provide the project title and number for each of the projects funded under your CORD project. Also, for each project specify the name, title, and address of the person who was the project principal investigator or director.

<table>
<thead>
<tr>
<th>Project</th>
<th>Number</th>
<th>Title</th>
<th>Director</th>
<th>Name</th>
<th>Title</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

FOLLOW-UP MAILING COVER LETTER
Dear

Your help is needed!

A study is being conducted at the Educational Program Management Center of Ohio State University to determine the relative importance of several possible criteria of educational project success and to develop a composite criterion of project success. As part of a select sample of persons associated with projects funded under Region V of the U.S. Office of Education Regional Research Program, you were mailed two data collection forms a few weeks ago. Due to the nature of the study design and sample, your response is critical.

If you have already completed and returned the forms, please accept our thanks and we apologize for contacting you again. If you have not returned the forms, please take a few minutes to complete the forms enclosed and return them in the self-addressed, stamped return-envelope provided.

Thank you for your assistance.

Sincerely,

Rodney J. Bell
Educational Program Management Center
The Ohio State University
BIBLIOGRAPHY


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