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IMPROVEMENT OF THE MANAGEMENT OF EVENTS PRECEDING
FACILITY START-UP.

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THE UNIVERSITY OF OKLAHOMA

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IMPROVEMENT OF THE MANAGEMENT OF EVENTS

PRECEDING FACILITY START-UP

A DISSERTATION

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BY

NORRIS ALDREDGE GRIFFITH

Norman, Oklahoma

1978

IMPROVEMENT OF THE MANAGEMENT OF EVENTS

PRECEDING FACILITY START-UP

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IMPROVEMENT OF THE MANAGEMENT OF EVENTS

PRECEDING FACILITY START-UP

CHAPTER I

INTRODUCTION

Public sector organizations (government) and private sector organizations (industrial) often are faced with the necessity of having a new facility constructed to satisfy production goals, to meet competition, to respond to obsolescence of products or production equipment, for consolidation, or for other reasons. Once a favorable decision toward construction of the new facility is made, including some designation of funds, the pre-start-up period addressed by this study has begun. Its end is signalled by initial production of the planned product and/or services within the new facility. All such organizations during the pre-start-up period then face a management task of horrendous size and scope, extending usually over a period of some years. Broad new facility production or service objectives have been defined and the old organization which is the parent of the new must begin to consider what sub-goals are involved in meeting the objectives. Questions must be answered as to who will perform them and under what constraints of money, men, material, and time they will be performed. Even the decisions as to what architectural

design and plant surroundings are acceptable can be an early and primary consideration. Wild's reference on architectural designs by type of industry with pictorial illustrations is an example.¹ The management of events preceding start-up of the facility can have a prolonged effect upon investment pay-back, flexibility of the facility and its resources to meet changing objectives, and even the power to meet the original objectives which set its attainment in motion. In trying to assure the best possible finished facility, regarding post-start-up operating conditions and with least possible cost and time over-runs during construction, parent organizations may assign a cadre from their current employees to it even before original designs are firm. These may include some top to middle managers to perform the management functions of planning, organizing, staffing, directing, and controlling activities or events preceding actual start-up of the facility. Paraphrasing Koontz and O'Donnell,² these functions are:

PLANNING--The selecting of objectives and the policies, programs, and procedures for achieving them.

ORGANIZING--Determination and enumeration of the activities required to achieve the objectives of the enterprise, the grouping of these activities, the assignment of such groups to a manager, the delegation of authority to carry them out, and provision for coordination of authority relationships horizontally and vertically in the organization structure.

¹Friedmann Wild, Design and Planning Factories (New York: Van Nostrand Reinhold Co., 1972).

²Harold Koontz and Cyril O'Donnell, Principles of Management (New York: McGraw-Hill Book Company, 1972), pp. 39 - 41.

STAFFING—Manning and keeping manned the positions provided for by the organization structure.

DIRECTING—Involves guiding and supervising subordinates.

CONTROLLING—Compels events to conform to plans.

Purpose of This Study

Organizations having needs for new facilities may have well developed procedures to aid managers assigned to the new facility in performing these supportive management functions. A partial one for example, covering only maintenance requirements, has been used by the U. S. Postal Service.³ Others may attempt the start-up preparations without defined procedures of any kind, or may rely upon others, outside their organization, to provide guidance at each point toward start-up. Differences may exist in application of the management functions by organization members.

The desire of the author is to find any problems with pursuing the five management functions as they are associated with pre-start-up events, with a view toward how improvement can be made, or to note items which would be worthy of review for solution by others. The study is justified in that much money and time are currently expended which may be better spent if the spirit of the five management functions is applied to management of facility pre-start-up events.

Is there difference in application in public and private sectors of the five management functions as asked in the research questions below? The author is interested in knowing wherein management of the events

³United States Postal Service, Milestone Actions Associated with Start-up of Maintenance Operations at New Postal Facilities (Norman, Oklahoma, Maintenance Technical Support Center, 1970).

preceding facility start-up may be improved. The study then turns to recommendations for future attention in this field.

Definition of Terms

So as to assure understanding of special terms used herein, the following are defined:

Facility--A new building, plant, or construction in which future production or service is planned by an organization of the private or public sectors. A reference⁴ definition states: "Facility--some--thing that makes an action easy." Included would be water treatment plants for cities, dams for state and federal application, parking lots, and any other structure making possible a product or service, but not including rearrangements in existing structures or sites.

Public Sector--Agencies or organizations of federal, state, or city governments in the United States.

Private Sector--Business organizations operating in the United States. In this study, these are limited to data asked from businesses not subsidiary to others; this does not prevent response data from subordinate organizations or firms.

Pre-Start-Up--The period before actual production or services are available from the new facility.

⁴ _____, The World Book Encyclopedia Dictionary (Chicago: Field Enterprise Educational Corporation, 1963), p. 705.

Research Questions

Pertinent to the text development, findings, analysis, conclusions, and recommendations are these research questions:

1. What are the proportions of organizations and/or firms showing new facility start-ups versus those which have not done so.
2. What are the proportions of new facility start-up costs of \$10 million or more, and of less than \$10 million?
3. What proportion of new facilities have been obtained by the private sector versus the public sector?
4. What design performance range exists: in-house, contract, or other?
5. What proportions and ranges of contingency funds provision exists in construction and installation of new facilities?
6. What proportion of firms/organizations providing new facilities used a formal management information system to assist in management of pre-start-up events?
7. What proportion of new employees who would be involved in start-up of the new facility received skills-training in advance of start-up?
8. What range of size by number of employees in the new facility concerned are included in the study?
9. What freedom of access by firm/organization employees was experienced prior to start-up?
10. What are some key factors which may be important in having an efficient pre-start-up phase for a new facility?

11. What are some variables from outside the organization which affect the pre-start-up phase for a new facility?
12. Is there any difference in terms of the five management functions of planning, organizing, staffing, directing, and controlling when comparing management in pre-start-up of facilities which differ in cost, or in the management functions as implemented for private versus public sector pre-start-up?

Narrative Hypotheses

In order to deal with research question 12, the null form of narrative hypotheses will be tested as follows:

1. There is no difference in management approach between respondents as groups having start-up costs of \$10 million or more and those having costs less than \$10 million in terms of:
 - 1.1 Planning
 - 1.2 Organizing
 - 1.3 Staffing
 - 1.4 Directing
 - 1.5 Controlling
 - 1.6 A consensus of these when taken together.
2. There is no difference in management approach between public and private respondent groups in terms of:
 - 2.1 Planning
 - 2.2 Organizing
 - 2.3 Staffing

- 2.4 Directing
 - 2.5 Controlling
 - 2.6 A consensus of these when taken together.
- 3. There is no difference in management approach between public and private respondent groups whose start-up costs are under \$10 million in terms of:
 - 3.1 Planning
 - 3.2 Organizing
 - 3.3 Staffing
 - 3.4 Directing
 - 3.5 Controlling
 - 3.6 A consensus of these when taken together.
- 4. There is no difference in management approach between public and private respondent groups whose start-up costs are \$10 million or more in terms of:
 - 4.1 Planning
 - 4.2 Organizing
 - 4.3 Staffing
 - 4.4 Directing
 - 4.5 Controlling
 - 4.6 A consensus of these when taken together.

Each sub-entry under the four main statements numbered .1, .2, .3, .4, and .5, identifies a hypothesis. Consensus in each statement numbered .6 will be obtained by majority demonstrating or rejecting the null in each management functional category applying to the five main statements, .1, .2, .3, .4, and .5.

Population of the Study

The data of the study are from the populations of the following:

1. Government organizations' employees which may have had experience with management of the events preceding new facility start-up. These are employees of cities of the United States, of states of the United States, and of executive agencies and offices of the executive branch of the United States (federal).
2. Business firms' employees which may have had such experience. These are employees of firms not subsidiary to other firms as originally addressed; however, some data may have been supplied by employees of subsidiary firms of those initially contacted, wherein referrals were made by employees of superior firms.

Sampling of this population; coding of intended respondents; pre-test, general mailing, and follow-up activities associated with use of a questionnaire to gather data are discussed in Appendix 1.

Data Gathering: The Questionnaire

The questionnaire is organized into four sections. These are:

1. Instructions and Definitions, to inform the prospective respondent of its purpose, of its methodology in completion, of special terms used, and to offer a copy of the results of the study.
2. Part I, consisting of questions asking for a variety of demographic data to be used in connection with Research Questions 1 through 9 and 12, for general aid in analysis,

and to enable testing of narrative hypotheses when combined with data of Part II.

3. Part II, consisting of fifteen questions for responses on a five point scale to test attitudes associated with the management functions of planning, organizing, staffing, directing, and controlling, having three questions for each function, and forming the data base for dealing with the narrative hypotheses.
4. Part III, of three open-ended questions supporting Research Questions 10 and 11 and also to be used for general aid in analysis, conclusions, and recommendations.

In developing the 15 questions of Part II, the author attempted to pick three typical questions for each of the five functions. There could have been many others. Correspondence of question numbers to function is:

<u>Questions</u>		<u>Management Function</u>
1-3	-	Planning
4-6	-	Organizing
7-9	-	Staffing
10-12	-	Directing
13-15	-	Controlling

The content of the questions is based upon comments of managers at new plants/facilities when contacted in advance of the finalization of the questionnaire.

The questionnaire, shown below, is relatively unchanged in its final form from that used in the pre-test. Cover letters and follow-up telephone calls and personal notes are contained and discussed in Appendix 2.

A Questionnaire Concerning Events Preceding Facility Start-UpInstructions and Definitions

Please complete the entire form by placing check marks in appropriate blocks on Part I and Part II, then supply any information which you think may be helpful in the three items of Part III. It is very important that each statement or question of Parts I and II be completed, because some of the analysis of Part II data will depend upon your doing so. Your voluntary statements in Part III can well help in identifying factors and remedies associated with events common to others' problems and their solution in the future.

A facility may include buildings and structures, the site and any improvements made on it, and installed equipment for providing products or services of the organization or firm which will use it. The facility can include hardstands, out-buildings, added rail spurs and trucking accommodations, or any other thing added to the site. In this study the facility is intended only to mean new sites and improvements; please do not report on relocation or rearrangements in existing plants or facilities.

Pre-start-up events are those, whether planned or not, which precede actual production or commencement of services to be rendered at a new facility, which relate either to private or public sectors of the United States.

Public facilities are defined as those provided by and for a City, a State of the United States, or by and for an agency or organization of the federal government of the United States. This study covers the public sector exclusive of counties, in other words.

Private facilities are defined as industrial firm owned or operated, whether the firm (company) is independent or is affiliated with another. These organizations as a class make up the private sector.

Check here if you want a copy of the results of this study mailed to you. ()

PART I

(1) Has your firm effected a facility start-up: (Select one choice only from the most current range.)

() Prior to 1965? () 1965 through 1969? () 1970 to present? () None of these.

Note: If you must check "None of these", go no further, but check it so and then mail the uncompleted questionnaire in the stamped, addressed envelope.

(2) Was the facility cost:

Greater than or equal to 10 million dollars? (If so show approximate amount. _____)

Less than 10 million dollars?

Note: Cost here means all fund outlays after decision to build a new facility including internal and external expenditures up to the point of start-up.

(3) Your organization, which managed events preceding start-up of the facility, is of the:

Public sector. Private sector.

(4) Design of the new facility was mainly performed by:

Our firm or management. A firm or organization under contract. Other. Please specify: _____.

(5) Construction and installation funds included contingency amounts of:

50% or greater. 25% or greater but less than 50%.

10% or greater but less than 25%. Less than 10% but more than 0%. None. Please explain why not. _____.

(6) My firm or organization had a formal management information system in use during pre-start-up concerning the new facility, specially designed to assist our pre-start-up management functions.

Yes No Do Not Know

(7) Training programs were available for most new employees who would operate the new facility to provide skills in advance of start up.

Yes. No. Do Not Know. Not applicable.

(8) The facility reported in this survey had in its employment at start-up:

- () Less than 100 employees. () 100 to 499 employees.
 () 500 to 999 employees. () 1,000 or more employees.

(9) Did your employees have access to the facility prior to start-up?

- () Yes. () No. () Do Not Know.

(10) Approximately how many employees are in your total organization?

_____ (Show Number)

PART II

In the following express your attitude or feeling as best you can on each of the 15 items by placing a check mark in the appropriate column, but only one check per item.

- (1) Few modifications of production equipment were necessary after start-up.
- (2) Location of the facility in the selection site was decided by our management based on consideration of organized labor in the vicinity.
- (3) Written objectives and policy statements affecting our pre-start-up managers were available ahead of start-up.
- (4) Our intended organization structure for the new facility was firm ahead of start-up.

	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
(1) Few modifications of production equipment were necessary after start-up.					
(2) Location of the facility in the selection site was decided by our management based on consideration of organized labor in the vicinity.					
(3) Written objectives and policy statements affecting our pre-start-up managers were available ahead of start-up.					
(4) Our intended organization structure for the new facility was firm ahead of start-up.					

- (5) There was a statement of functions for personnel available to the on-site pre-start-up management.
- (6) Expected interrelationships between working elements of our pre-start-up organization were furnished to us by our management.
- (7) Before start-up we knew how we would fill future vacancies caused by promotions or losses.
- (8) A job classification and wage program was used in ranking or grading the various positions in the new facility's organization structure.
- (9) We were able to meet hiring goals in the pre-start-up period for production-type employees as planned.
- (10) Organizations or personnel from which we could get assistance for solving pre-start-up problems were known to us.
- (11) It was clear to those assigned as pre-start-up managers what their responsibilities were to be after start-up.
- (12) An important directed effort prior to start-up was checkout or test of equipment in the new facility by some of our own employees who would later maintain or operate them.

	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
(5) There was a statement of functions for personnel available to the on-site pre-start-up management.					
(6) Expected interrelationships between working elements of our pre-start-up organization were furnished to us by our management.					
(7) Before start-up we knew how we would fill future vacancies caused by promotions or losses.					
(8) A job classification and wage program was used in ranking or grading the various positions in the new facility's organization structure.					
(9) We were able to meet hiring goals in the pre-start-up period for production-type employees as planned.					
(10) Organizations or personnel from which we could get assistance for solving pre-start-up problems were known to us.					
(11) It was clear to those assigned as pre-start-up managers what their responsibilities were to be after start-up.					
(12) An important directed effort prior to start-up was checkout or test of equipment in the new facility by some of our own employees who would later maintain or operate them.					

- (13) Status of tools and equipment availability were determined in the pre-start-up period.
- (14) An outside firm or organization acted as overall facility construction or installation contracting officer/controller.
- (15) Access to the facility caused interference with the contractor prior to start-up.

	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
(13) Status of tools and equipment availability were determined in the pre-start-up period.					
(14) An outside firm or organization acted as overall facility construction or installation contracting officer/controller.					
(15) Access to the facility caused interference with the contractor prior to start-up.					

PART III

For the following three items please comment as you think it may be helpful to understanding your viewpoint.

- (1) If you feel that you have had a successful facility start-up, what do you think were the key factors which contributed most to its success?

(A full page of white space followed here.)

- (2) What variables from outside the firm do you feel affected the results of the pre-start-up phase?

(Half a page of white space followed here.)

- (3) Please use this space to provide any further comments that you have regarding pre-start-up matters.

(Half a page of white space followed here.)

Scope and Limitations

Almost any organization can experience the management of pre-start-up events. Geographical coverage of this study is limited to the United States. To avoid duplication, the writer randomly addressed those private organizations which have no superior to which they report; these are estimated to total some 11,000, and may or may not have subsidiaries.⁵ Public organizations queried were randomly selected from (1) some 12,000 cities of the United States with populations greater than 2,500,⁶ (2) the 50 state organizations,⁷ and (3) some 400 federal executive agencies and offices which tend to justify and manage complete budgets approved by the United States Congress.⁸ Counties were excluded, as their input was believed to be well represented by cities or states of the study. Those public and private organizations initially addressed were asked to refer the instrument to an individual who had been involved in pre-start-up management whether in the headquarters organization, a subordinate organization, or subsidiary.

Cities under 2,500 were excluded because it was believed that their facility start-up activity would be minimal. Counties were excluded

⁵ Juvenal L. Angel, Directory of Intercorporate Ownership (New York: Simon and Shuster, Inc., 1974).

⁶ _____, The Municipal Yearbook (Washington, D. C.: International City Management Assoc., 1977).

⁷ _____, The Book of the States, Volume XIX, 1972 - 1973 (Lexington, Ky.: The Council of State Governments, 1972), pp. 604 - 653.

⁸ _____, United States Government Manual (Washington, D. C.: Office of the Federal Register, National Archives and Records Services, General Services Administration, 1973).

as stated above. Judiciary and legislative agencies of the federal government were excluded because it was believed that their constituents would be adequately represented by those of the executive branch. The addressing of only private organizations with no superiors did not eliminate any corporation to the writer's knowledge, because the instrument was noted as transferrable to subordinates. Appendix 1 discusses the sampling and Table XV summarizes the numbers of each category addressed.

Those benefiting from this study should be any who must pre-plan or manage pre-start-up events in the public and private sectors. It should point up for them needs for attention in the management functions of planning, organizing, staffing, directing and controlling as associated with new facilities prior to start-up.

Organization of the Study

The organization of the study is described as follows:

I. Introduction

In addition to giving the purpose of the study, definition of terms, listing of research questions, statement of narrative hypotheses, the population is identified, the questionnaire and its organization are shown, scope and limitations of the study are stated; and a description of the organization of the study is given.

II. Literature

Research of reference literature from books, periodicals, and other sources is presented and discussed by category.

III. Data Collection, Methodology, and Analysis

The relationship of research questions and narrative

hypotheses to the questionnaire framework is established. Procedures for data collection are given and definition of methodology for manipulating and analyzing the data is developed.

IV. Findings

Analysis and demonstration of relationships found in the data as pertaining to the research questions and narrative hypotheses are given here.

V. Summary and Conclusions, and Recommendations

This chapter contains summarized results, contributions to theory and application, and recommendations for study by others.

Bibliography

A listing of books, periodicals, and other sources used in this study is made.

Appendix 1

A discussion is given of the sampling methods used, intended addresses, and respondents. Coding is outlined. Some bias in terms of respondents is noted.

Appendix 2

Cover letters and content of typical follow-ups and notes covering repeated mailouts are given.

Appendix 3

Bias in demographics of Part I of the instrument is evaluated.

Appendix 4

Definition of responses by coded, paraphrased statements is shown in tabular form.

CHAPTER II

LITERATURE

Both public and private organizations must start-up new facilities. There are thousands of private organizations in the United States, and thousands of public ones, which at some time, often repetitively, find that they must expand, combine, relocate, or otherwise get into new facilities.

A Factory editor⁹ has shown new facility design going toward innovative heating, ventilating and air conditioning systems, TV monitoring for security and process observation, computer process control, and the like. Even though all of them may not be present in a new facility, even one can require close attention to pre-start-up events by assigned managers.

Industry Week¹⁰ in 1974 reported that building a new plant was significantly different than in 1964. Shortages and fuel consideration were changing new plant design. Managers were quoted concerning new facilities as saying:

⁹ _____, "Plant Trends: A Look at the Future" Factory, 4, June, 1971, 69 - 72.

¹⁰ _____, "Building a New Plant? Expect to Get Involved." Industry Week, 183, No. 11: November 11, 1974, 38 - 41.

(1) Company cost accounting has become much more accurate.

(2) The whole time sequence in the building industry is wrong. The inflation rate makes it desirable to charge ahead in design and construction and to make modifications and corrections after-the-fact.

(3) Coal energy was and will be a big factor in facility design. Young engineers often had no experience with such equipment design, however.

Jackson¹¹ indicated in 1976 that the city of New Orleans, which gets its water from the Mississippi River, was having a new intake system (facility) planned to expand capacity by 200 million gallons per day, at a cost of \$10 million. Planning had to include how to deal with the various pollutants present.

Meyer¹² observed in 1974 that the USSR was building a billion dollar facility and an associated company town for manufacture of large trucks. To do this, it had assigned a "supreme" manager of what was called a "production association", which, in our terms is a vertically integrated, mammoth company. Although there were problems in quality of trucks to be produced and roads to carry them, the general approach seemed to be preventing the usual interference from Moscow bureaucrats with Soviet managers.

¹¹M. F. Jackson, et als, "Big Intake is Coming to New Orleans." Water and Waste Engineering, 13, No. 5: May, 1976, 20 - 24.

¹²Herbert E. Meyer, "A Plant that Could Change the Scope of Soviet Industry." Fortune, LXXX, No. 5: November, 1974, 150 - 156 and 229 - 232.

A text by Chase and Aquilano,¹³ using a life cycle approach, shows phases of a productive system to be (1) design, then (2) start-up planning, then (3) installation and break-in of equipment, then (4) steady state. By steady state is meant that the facility is recognized as being in regular production. In their start-up planning phase¹⁴ they cite broad strategies for management to include (1) having the same personnel intended to man the "steady state" organization also initiate it, or (2) have a special start-up team of the parent organization be there during start-up, or (3) use outside specialists to direct or wholly perform the activities. Emphasis is placed on planning through PERT (Program Evaluation and Review Technique), use of learning curves, and concern is expressed for maintenance, quality control, budgeting, information flow, training, and equipment testing.¹⁵ However, they affirm:¹⁶

Despite the fact that every productive system encounters some transition period between design and steady state operation, there is nothing like a complete body of literature on the topic. . . . Management researchers . . . have preferred to focus efforts on design and steady state problems.

Judson¹⁷ states:

How much any management achieves of the full benefits that could be derived from a change is determined by three independent variables:

¹³ Richard B. Chase and Nicholas J. Aquilano, Production and Operations Management: A Life Cycle Approach (Homewood, Ill.: Richard D. Irwin, Inc., 1977), p. 521.

¹⁴ Ibid, p. 521. ¹⁵ Ibid, pp. 521 - 535.

¹⁶ Ibid, pp. 524 - 543.

¹⁷ A. S. Judson, A Manager's Guide to Making Changes (New York: John Wylie and Sons, 1966), p. viii.

- * Their skill in identifying and analyzing the objectives of that change, and those problems requiring solutions.
- * Their skill in devising successful methods to accomplish these objectives and solve these problems.
- * Their skill in gaining acceptance and support for both the objectives and the methods for their achievement from the people affected by and involved in the change.

Management of pre-start-up events can involve great change, and it may be that affected managers should have Judson's three skills.

Payne¹⁸ shows that decisions made in locating and equipping a plant (facility) are virtually irrevocable and that investments made for them are therefore the key to success of the activating enterprise. If Payne is right, involvement by the activating managers in such pre-start-up decisions may be important.

Some evaluation may be possible for appraisal of management functions.

Management Functions and Their Appraisal

Leonard¹⁹ lists these factors as being important to appraisal of management: The economic outlook, the adequacy of the organization structure, compliance with policies and procedures, accuracy and reliability of controls, adequate protective methods, causes for variances, proper utilization of manpower and equipment, and satisfactory methods of operation. Another practitioner in the management appraisal field²⁰ proposes and uses these evaluative categories: economic function, corporate

¹⁸ Bruce Payne, Planning for Company Growth (New York: McGraw-Hill, 1963), p. viii.

¹⁹ W. P. Leonard, The Management Audit (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1962), p. 35.

²⁰ J. Martindell, The Appraisal of Management (New York: Harper and Row, 1965), p. 4. 7

structure, health of earnings, service to stockholders, research and development, directorate analysis, fiscal policies, production efficiency, sales vigor, and executive evaluation. He uses an instrument like that of this study (some 301 questions), to get original data for the above ten categories.²¹ Simmons, et al.²² show that:

Meeting venture milestones in actual practice provides . . . learning. A study . . . of 24 technology based ventures showed a marked difference in performance between 12 first generation ventures and 12 second generation ventures. The second generation was far more product-oriented. . . , had a more balanced team. . . , and had significantly higher profits in . . . most recent year of operation. This performance indicates . . . a learning process that occurs for a venture team going through the steps or milestones necessary to start a venture.

It is noted that parallels could be drawn from managing the starting of a venture (business) to that of managing pre-start-up events for a new facility.

Many variations could be used to obtain the necessary data of and from an organization in order to appraise or compare its management functions with those of its peers. The on-site study, submission of accounting documents and special reports, interviews, and others, are often supplemented or replaced with questionnaires seeking opinion, attitude, or knowledge of events and facts. The questionnaire provides the vehicle for this study.

The Pre-Start-Up Process

The pre-start-up process involves a multitude of events, and

²¹ Ibid.

²² J. A. Simmons, L. E. Smollen, and A. L. Dingee, Jr., New Venture Creation (Homewood, Ill.: Richard Irwin, Inc., 1977), p. 483.

plants are built for many reasons. Much has been done in writing about parts of the process of managing pre-start-up events. Other parts do not appear cohesively in the literature! One which is covered, and by much verbiage, is that of plant location decision making.

Location

McKnight²³ edits an annual giving various statistics regarding plant potential locations by section of the U. S. and Canada, and by states and Canadian provinces. Thompson²⁴ has edited a checklist approach to plant site selection, moving from preliminary planning through general area selection, community selection, and sources of assistance and information. He studied various companies, stating:²⁵

Of all the companies studied, those in the "20,000 employees and over" and "5,000 to 20,000 employees" groups were most likely to treat plant location as a regular, continuing function Many . . . maintained plant location files . . . and several had developed their own specialized forms for use in site selection.

Steinhoff²⁶ affirms that city or town facilities are public transportation, banks, and the like, and those considering locations must know of their quality. Further,²⁷ manufacturers and producers considering locations must also look for "nearness to raw materials or

²³R. W. McKnight (Ed), Plant Location (Chicago, Ill.: Simmons-Boardman Publishing Corp., 1972).

²⁴James H. Thompson, Methods of Plant Site Selection Available to Small Manufacturing Firms (West Virginia University, 1961).

²⁵Ibid, p. 10.

²⁶Dan Steinhoff, Small Business Management Fundamentals (New York: McGraw-Hill Book Company, 1974), pp. 94 - 95.

²⁷Ibid, p. 95.

markets, availability of cheap fuel, power and water, skilled labor . . . and financing."

Others²⁸ are interested in minimizing total cost of the facility and associated transportation in the private sector. They discuss six approaches to this. In public sector facilities, they show a criterion function involving their social utility, with constraint by budgetary or facility quantity ceiling. Five such models are compared.

Merchant²⁹ has a mathematical treatment for determining plant locations based upon capacity, with constraints of customer coordinates, customer demand, and transport cost. His approach is an operations research application to allocation decisions for plant location using a transportation method of linear programming. Rand³⁰ faults Merchant's approach as not being general enough and questions his use of capacity constraints, while stating that the procedure is not new, but only an application of the transportation algorithm. Merchant³¹ defended himself against Rand's criticism, showing his approach as a practical one which works.

²⁸C. Reville, D. Marks, and J. Liebman, "An Analysis of Private and Public Sector Location Models." Management Science, 16, No. 11 (July, 1970), 692 - 707.

²⁹J. R. Merchant, "The Location of Facilities with Constraints on Capacities," International Journal of Physical Distribution, 6, No. 1 (1975), 13 - 21.

³⁰Graham K. Rand, "On the Location of Facilities with Constraints on Capacities," International Journal of Physical Distribution, 6, No. 5 (1976), 284 - 288.

³¹J. R. Merchant, "A Reply to Rand's Criticisms," International Journal of Physical Distribution, 6, No. 5 (1976), 288 - 289.

McAllister³² discusses linear programming and graphical solutions for locating public sector facilities with emphasis on providing equity to constituents served as the more important of the criteria.

A factor matrix method for selecting plant sites when unable to do a thorough study of each is illustrated in Factory.³³ It lists the factors that have a bearing, assigns weights to them, then adds them up. It recommends that the list of factors of their weights be the product of multidisciplinary experts. The top four ranked choices would then be subjected to the cost-benefit analysis. A previous Factory study³⁴ shows that the old criteria for plant site selection tended toward (1) good supply and cost of labor, (2) attractive site at reasonable cost, (3) minimum transportation and utility costs with dependable service, (4) moderate local cost-of-living, and (5) reasonable tax structures. New criteria which are surfacing are (a) employment of minorities, (b) environment, (c) reliance on car commuting, (d) technical and educational backgrounds in the work force, (e) inflation, (f) pressure of foreign competition, and (g) others. Again, a factor matrix is recommended.

A more comprehensive approach to management of pre-start-up events is outlined by Shubin and Madeheim:³⁵

³²D. M. McAllister, "Equity and Efficiency in Public Facility Location, Geographical Analysis, 8, No. 1 (January, 1976), 47 - 63.

³³Factory Report, "Picking the Right Plant Site," Factory, May, 1976, 61 - 62.

³⁴Factory Report, "New Plants and Expansions," Factory, 8, No. 9 (September, 1975), 55 - 58.

³⁵John A. Shubin and H. Madeheim, Plant Layout: Developing and Improving Manufacturing Plants (New York: Prentice Hall, Inc., 1951), p. 1.

Before a new plant . . . is started, a thorough-going survey should be undertaken . . .

- (1) Analyze the product and survey the market.
- (2) Make an economic survey.
- (3) Determine the major objectives and scope of operations.
- (4) Design the product.
- (5) Determine the volume of output and size of plant.
- (6) Select the location.
- (7) Decide whether to buy or make parts.
- (8) Develop and select the manufacturing process and equipment.
- (9) Develop a plant layout and select type of building.
- (10) Determine the capital needs, profitability, and financial plan.
- (11) Develop an internal organization structure and select personnel.
- (12) Launch the enterprise.

Their step 12 contains much of the balance of what is a management phase in this study. Planning, too, is a major subject in the literature.

Planning

Versagi³⁶ says that new plants are sought due to economic considerations, supply of labor, tax incentive and simply need for more space. He offers examples in Bendix-Westinghouse, Trane, Space Conditioning, Day and Night/Payne, and others. His human aspects are:

- * Getting enough people State agencies often help obtain and train. Some also transfer into the new facility.
- * Giving better employment for underdeveloped people.

The Small Business Administration has issued booklets pointed toward helping the small business person considering starting-up a business, expansion, relocation, and other subjects. One³⁷ is given to

³⁶F.J. Versagi, "Human Aspects in Getting a New Plant Going," Air Conditioning, Heating and Refrigeration, 117 (May 10, 1969), 22 & 30.

³⁷Small Business Administration, Business Plan for Small Manufacturers, No. 218 (Washington, D.C.: U.S. Government Printing Office, 1973).

guidelines in self-analysis and analysis of the market, production, construction, financial, and general management. A second³⁸ contains a checklist of questions to ask oneself before going into business covering start-up and personal factors. The pros and cons of physical expansion are discussed in the third.³⁹ It also has a checklist of questions for guidance on interior arrangement and layout for facilities. The body of this one includes matter on the management functions. A fourth⁴⁰ covers location, the management functions, production and marketing. It, too, has a checklist of questions suggested to be used prior to starting-up. (Emphasis is the writer's.)

Planning can include other interest areas: Stainthorp and West⁴¹ show plants can be planned for automatic start-up each day by computer. A device called a "status array" is presented as a means of improving communication between control operators and computers involved in decisions. Another writer⁴² recommends treating service as manufacturing, using a technocratic approach to be carefully planned, controlled

³⁸Small Business Administration, Checklist for Going Into Business, No. 71 (Washington, D. C.: U. S. Government Printing Office, 1970).

³⁹Small Business Administration, Small Store Planning for Growth, No. 33 (Washington, D. C.: U. S. Government Printing Office, 1966).

⁴⁰Small Business Administration, Starting and Managing a Small Business of Your Own, Volume 1 (Washington, D. C.: U. S. Government Printing Office, 1973).

⁴¹F. P. Stainthorp and B. West, "Computer Controlled Start-Up," Chemical Engineer, No. 289 (September, 1974), 526 - 530.

⁴²Theodore Levitt, "Production-Line Approach to Service," Harvard Business Review, 50 (September - October, 1972), 41 - 52.

(automated where possible), audited for quality, reviewed for performance improvement, and screened for customer reaction. (McDonald's restaurant franchises would be an example of this.) In other words, apply the labor-saving, systems approaches to customer service as they are applied to manufacturing operations. Baloff⁴³ would plan for as few changes in the period of the first production run as possible, because relearning is minimized if the first run is longer. He suggests that the planned rapidity of start-up should be inversely related to the number of new conditions to be faced in the new facility. Julian Carter⁴⁴ wants to have someone connected with accomplishing the primary objectives of an organization responsible for planning, equipping, and operation of the new facility. Richard Carter, Sr.⁴⁵ shows how four such "line" personnel helped plan a facility, one working as a coordinator with the architect. Several others reviewed the architect's plans before they were forwarded to the approval authority of the user organization. Thurston⁴⁶ writes, in the area of planning for inventory control, that statistical averaging methods should be set aside to substitute planning for what parts to put in inventory, and when. The method would be one of working backward from scheduled completion dates to determine

⁴³Nicholas Baloff, "Start-Up Management," IEEE Transactions on Engineering Management, EM17, No. 4 (November, 1970), 132 - 141.

⁴⁴Julian M. Carter, "Planning High School Facilities," Agricultural Education, 49, No. 3 (September, 1976), 58 - 59.

⁴⁵Richard B. Carter, Sr., "A Facility Dream Coming True," Agricultural Education, 49, No. 3 (September, 1976), 53 - 54.

⁴⁶Philip H. Thurston, "Requirements Planning for Inventory Control," Harvard Business Review, 50 (May - June, 1972), 67 - 71.

ordering dates for components and sub-assemblies. This approach appears to have possible application to pre-start-up ordering of spares, tools, and special service equipments. He decries statistical methods of inventory planning.

There are problems to be met in pre-start-up.

Saunders⁴⁷ states that cost overruns on large construction projects in Britain in 1971 ran 14%. He proposes the use of nomadic labor, firming up design at an early stage, improved working conditions, and better equipment to cope with overruns. He also makes allusions to the catastrophic conditions in America where purportedly locally hired laborers/craftsmen often earn twice what "management" employees in contractors' firms earn. Of course other events may cause overruns, and solutions can vary.

One manager writes:

Construction of a manufacturing plant can become a race against time, with considerable sums of money riding on the outcome. A prolonged building schedule invites inflated construction costs, delays in implementing systems, and the loss of a competitive edge in getting new products on the market.⁴⁸

He goes on to show how one expanding firm and its architectural engineer built a plant on-budget, on-time. This was reported to be done by:

- (1) Pinning down needs based upon preliminary layouts by the firm's industrial engineer.
- (2) Hiring the right architectural firm based upon a background check.

⁴⁷D. Saunders, "Huge Losses Still in Building Delays," Industrial Management, 1 (February, 1971), 74 - 79.

⁴⁸Scovill Manufacturing, "Building a Plant on Schedule, On Budget." Management Review, 61: August, 1972, p. 61.

- (3) Establishing good contact between the firm and the architect.
- (4) Anticipating problems of weather, strikes, and materials.⁴⁹

Then there is the problem of getting the facility built within available funds. Burt,⁵⁰ a professor of Logistics at the Air Force Institute of Technology, discusses five methods of purchasing building construction:

- (1) Conventional -- Architectural design is completed, then the contractor is hired.
- (2) Design and Build Firm on Agreed Price -- One firm, construction with gratuitous design.
- (3) Design and Build with Cost Reimbursement -- Segmentation of design and build into components.
- (4) Negotiated -- Owner contracts for designer and builder. Builder makes inputs during design. Builder hires subcontractors.
- (5) Owner is his own general contractor.

He argues that number (2) is most economical, requiring the least calendar time; he has number (1) as being the most expensive and requires the most time.

How may a firm best control pre-start-up events after the decision to build is made? One company accomplished it via visits to the

⁴⁹ Ibid.

⁵⁰ D. W. Burt, "Stretching Your Building Dollar," California Management Review, 15: Summer, 1973, pp. 54 - 60.

site from a distance of 600 miles, checking on material and equipment receipts and monitoring construction schedules versus progress by a company accountant and a hired architectural firm near the site.⁵¹

Another placed its appointed managers at the site from the time of first excavation to the hiring and training of the last employee and final equipment readiness.⁵²

Equipment layout can also be a pre-start-up concern and advantage.

Equipment Layout

Buxey et al⁵³ discuss flow-line types, feed intervals, allocation of product to lines, division of labor, line balancing, use of buffer stocks, allocation of workers to lines, behavioral considerations and other subjects affecting other than automated flow and transfer lines. A Factory⁵⁴ article shows advantage in using $\frac{1}{4}$ inch scale, three-dimensional blocks ahead of blue-print layout development, saying that functions will tend not to be left out and traffic problems will be minimized. Another author⁵⁵ uses a developing mathematical methodology

⁵¹J. R. Leach, "Cost Control at a New Plant." Management Accounting, 51: February, 1970, pp. 23 - 24.

⁵²Edmund S. Whitman, Plant Relocation: A Case History of a Move (New York: American Management Association, 1966).

⁵³G. M. Buxey, N. D. Slack, and R. Wild, "Production Flow-Line System Design - A Review," AIIE Transactions, 5, No. 1 (March, 1973), 37 - 48.

⁵⁴Factory Report, "Blocking Out Plant Layout Problems," Factory Management, May, 1977, p. 51.

⁵⁵James M. Moore, "Facilities Design with Graph Theory and Strings," OMEGA, 4, No. 2 (1976), 193 - 203.

called graph theory to apply to layout planning. Computer assistance makes possible solutions based upon interconnections of "closeness priorities" called strings. This method has a network with nodes and intercommunication application. He then proceeds to suggest consideration of moving from manual graphic solutions to computer solutions.

Chase⁵⁶ gives some advice and guidelines which can be summarized thusly: Consider that in addition to layout errors wherein assembly lines should be used but are not, and wherein assembly lines are used when not appropriate, there is danger that facility planners will choose inappropriate types of assembly lines when they are indicated, e. g. conveyor, line configuration, pacing, product mix, and other types. He discusses various production, behavioral, and managerial characteristics associated with some of these, and then suggests:

1. Consider the type of assembly line determination as just as important as whether or not to have one.
2. Avoid rigid pacing.
3. Use short lines.
4. Avoid mixed product lines.
5. Use group-control on lines where feasible.
6. Remember in the selection procedures, that some people like assembly-line, repetitive work and others do not like it.
7. Minimize line balancing applications; this may represent a "plum" for engineering and computer system experimenters.

⁵⁶Richard B. Chase, "Strategic Considerations in Assembly-Line Selection," California Management Review, 18, No. 1 (Fall, 1975), pp. 17 - 23.

8. Bring together engineering and personnel types to select the best line characteristics.

Scheduling is an activity thought of as both a pre-start-up concern and a concern of the post-start-up, steady-state facility operation.

Scheduling

Both mathematical and non-mathematical applications can be found.

In the mathematical category are these: Towill⁵⁷ states that provided adequate targets are set before start-up, management can interact rapidly in achieving optimum post-start-up performance. He uses a "decay" equation with smoothing effects to predict types of improved production which may be obtained. The equation is the form of $Y_t = Y_0 + Y_f (1 - e^{-\frac{t}{\tau}})$, where Y_t is productivity at time t , Y_0 is initial productivity, Y_f is the gain in productivity, e is the base of natural logarithms, and τ is a time constant for the model. To predict model parameters before start-up, the author uses MIM labor standards modified by learning-curve knowledge or other standards available; regression analysis related to scheduling, operator experience, and product mix; and optimum production rates allied to marketing and sales strategies. After start-up, experience may dictate some parameter changes.

⁵⁷ Denis R. Towill, "An Industrial Model for Start-Up Management," IEEE Transactions on Engineering Management, EM 20, No. 2 (May, 1973), 44 - 51.

Sobel⁵⁸ has a linear programming approach to production smoothing by backlogging excess demand. Again, this too is an application to planning production scheduling in a plant before it begins. Later⁵⁹ he wrote of a mathematical approach to production smoothing for optimal cost controls for starting up or shutting down production after start-up. This approach would permit advance planning of schedule ahead of start-up. Mastor⁶⁰ speaks of a variety of approximating techniques giving good rather than optimal solution mathematically. He says that on large problems there can be wide variance in results, but not on smaller problems.

In a non-mathematical discussion of production smoothing Galbraith⁶¹ analyzes balancing of resource capacity utilization against costs of user delay or inventory investment. He discusses ways of dropping the cost curve by classifying the techniques, such as buffering substitutes, influencing quantities and timing of demand, and others.

Neel⁶² made a study of planning of schedules in industrial

⁵⁸ Mathew J. Sobel, "Production Smoothing with Stochastic Demand I: Finite Horizon Case," Management Science, 16, No. 3 (November, 1969), 195 - 207.

⁵⁹ Mathew J. Sobel, "Smoothing Start-Up and Shut-Down Costs: Concave Case," Management Science, 17, No. 1 (September, 1970), 78 - 91.

⁶⁰ Anthony A. Mastor, "An Experimental Investigation and Comparative Evaluation of Production Line Balancing Techniques," Management Science, 16, No. 11 (July, 1970), 728 - 746.

⁶¹ J. R. Galbraith, "Solving Production Smoothing Problems," Management Science, 15, No. 12 (August, 1969), 665 - 674.

⁶² C. Warren Neel, "Evaluation of Network Models Use in Industrial Construction," IEEE Transactions on Engineering Management, EM18, No. 1 (February, 1971), 7 - 11.

construction. He found that network scheduling was not being extensively used in 1970, but that 68 per cent of those who did used CPM (Critical Path Method), and only nine per cent used PERT and four per cent used PERT/Cost. Decentralized managements used Gantt (milestone) charts more than networks. His reasons given for the low use overall of network scheduling were "low data availability", and inability of planners to incorporate intangibles. Another writer,⁶³ in 1973, categorized the then-existing project scheduling procedures. He defined the state-of-the-art for project scheduling, showing many varieties, often supplemented by computer support. He believed that procedures for optimizing smaller project planning had progressed, but that large project planning needed better tools, possibly a cut at use of networks in the larger project scheduling.

In this chapter have been seen the evidence of some changes in construction designs and problems found in new construction in recent years, and literature emphasis on management functions appraisal, pre-start-up as a process, location, planning, equipment layout, and scheduling. Chapter III will outline the data collection and the associated methodology and analysis.

⁶³E. W. Davis, "Project Scheduling Under Resource Constraints - Historical Review," AIIE Transactions, 5, No. 4 (December, 1973), 297 - 311.

CHAPTER III

DATA COLLECTION, METHODOLOGY, AND ANALYSIS

The questionnaire data instrument is in three parts: I, II, and III. Part I has questions asking responses that in marketing terms would be called demographic in nature. It was used to get proportions (percentages), ranges, and size information for analysis corresponding to research questions 1-9, as well as to show the overall size of the total organization. Also, response data from questions 2 and 3 in Part I enabled dealing with research question 12, and with the narrative hypotheses when combined with the response to the 15 attitude questions of Part II. The data gained in response to the three "open-ended" questions of Part III provide a base for analysis corresponding to research questions 10 and 11. This discussion, in a similar form, is also contained in the section of Chapter I entitled: Data Gathering: The Questionnaire.

Table I, Research Questions and Narrative Hypotheses Versus Parts and Questions of the Questionnaire, shows the correspondence as indicated in its title and the means of achieving measures. Findings are given in Chapter IV.

Data were obtained after early mailout of questionnaires to five public sector and five private sector organizations and later general mailings to 234 public and 234 private sector organizations, with final

TABLE I

RESEARCH QUESTIONS AND NARRATIVE HYPOTHESES VERSUS PARTS
AND QUESTIONS OF THE QUESTIONNAIRE

<u>Research Questions</u>	<u>Narrative Hypotheses</u>	<u>Questionnaire Part</u>	<u>Number</u>	<u>Analysis Measure</u>
1.	N/A	I	(1)	Proportion showing some pre-start-up experience obtained by ratio of these to total responses. Broken down into percentages pre-1965, 1965 to 1969, and 1970 to present.
2.	(Sortation for 1., 3., and 4.)	I	(2)	Proportion showing some pre-start-up experience with facility cost greater than or equal to \$10 million and proportion that are less than \$10 million. Further sortable to public sector as obtained from question (3) of this Part.
3.	(Sortation for 3., and 4.)	I	(3)	Ratios of experienced respondents of private or public sectors to all showing experience.
4.	N/A	I	(4)	Range of proportions having some pre-start-up experience concerning in-house, contract or other design in ratio to all those experienced.
5.	N/A	I	(5)	Range of proportions having some pre-start-up experience, concerning ratios of those reporting varying contingency construction and installation funds, to all reporting.

TABLE I (Continued)

<u>Research Questions</u>	<u>Narrative Hypotheses</u>	<u>Questionnaire</u>		<u>Analysis Measure</u>
		<u>Part</u>	<u>Number</u>	
6.	N/A	I	(6)	Ratio of firms/organizations which used formal management information systems to total responding with some pre-start-up experience. Ratios also for no system or lack of knowledge.
7.	N/A	I	(7)	Ratios of firms/organizations which had skills training for most new employees to total responding with some pre-start-up experience. Ratios also for "no," "do not know," and "N/A" responses.
8.	N/A	I	(8)	Ratios of those having some pre-start-up experience responding from plants or facilities of less than 100 employees, and larger sizes, to all experienced respondents.
9.	N/A	I	(9)	Ratios as above on access to the facility by organization's employees.
10.	N/A	III	(1) & (3)	Coded typical responses as paraphrased by the author, by frequency, to show information pertaining in respondents' valuations to successful facility start-up.
11.	N/A	III	(2) & (3)	Coded typical responses as paraphrased by the author, by frequency, to show information pertaining to variables from outside the firm which were felt by respondents to affect results of pre-start-up phase. By frequency of occurrence.

TABLE I (Continued)

<u>Research Questions</u>	<u>Narrative Hypotheses</u>	<u>Questionnaire Part Number</u>	<u>Analysis Measure</u>
12.	1., 2., 3., and 4.	II (1)--(15)	χ^2 test for independence. Questions' responses on this Part are sorted as made possible by responses to questions 2. and 3. of Part I. Measure is to reject narrative hypotheses when computed χ^2 values exceed limiting values expected at probability of .05 (95% confidence), but not to reject when computed χ^2 values are less than the limiting values.

- Notes: 1. N/A = Not Applicable.
2. Question (10) of Part I and actual facility costs also reported in responses to question (2) of Part I are to be discussed, but do not appear in this table.

telephone follow-ups to approximately 50 in the general mailing list, but not heard from at a point about 30 days after the general mailing. Then these 50, and 25 others selected to attempt to get as broad geographical coverage as feasible, were mailed repeat copies of the questionnaire. Sampling considerations, addressee coding, geographical evaluations, and comments are contained in Appendix 1. Typical cover letters, personal notes, greeting lines and comments are contained in Appendix 2. Appendix 3 contains a framework of evaluation of possible bias in Part I question responses.

χ^2 Analysis

Both the checks on Part I response bias of Appendix 3, and the evaluation of Part II attitudinal data pertaining to the narrative hypotheses are made through χ^2 test for independence. The construction of the five-position scales for response to the 15 questions of Part II lend themselves to the χ^2 methodology because they are summative in nature, as discussed by Kerlinger.⁶⁴ By summative he means that the five positions of this writer's Part II scales would be considered of equal weight or value. (These are Strongly Agree, Agree, Indifferent, Disagree, and Strongly Disagree.) Thus, responses to each scale position can be simply added by these five as categories to get arithmetic frequencies. A disadvantage may be response-set variance due to tendencies of individuals to have a "halo" effect in a series of responses to scaled questions. An advantage is that five or more scale positions

⁶⁴Fred N. Kerlinger, Foundations of Behavioral Research, (New York: Holt, Rinehart and Winston, Inc., 1973), p. 496.

tend to achieve greater response variance than that obtained with only two-or-three-point scales.⁶⁵ The author of this research does not feel that individuals can necessarily be able to discriminate to higher scale levels than five; thus scales of five were chosen.

Smith and Williams⁶⁶ give an excellent exposition of chi-square methodology. They note it as having application to distributions of data to:

- (1) setting confidence intervals and testing hypotheses for the variance of a normal population.
- (2) conducting goodness of fit tests, and
- (3) conducting tests of independence.⁶⁷

The application in this study is that of (3), and is stated as follows:

(a) If we have k random variables (corresponding to the five points of Part II scales) the distribution $U = Z_1^2 + Z_2^2 + \dots + Z_k^2$ approximates χ^2 , a system of independent, normally distributed variables.

(b) When values are sampled from a population of scaled variables, χ^2 itself becomes a variable, but one which can be predicted based upon calculated and tabularized values posted against coordinates of degrees of freedom versus their probability of occurrence to a maximum value.

(c) Since values of Z are independent variables, they cannot be added together to form new scaled relationships for analysis.

⁶⁵Ibid.

⁶⁶Lee H. Smith and Donald R. Williams, Statistical Analysis for Business: A Conceptual Approach (Belmont, California, 1976), pp. 383 - 417.

⁶⁷Ibid, 383.

(d) The general form of χ^2 calculation for a matrix of $r \times c$ variates is:
$$\chi^2 = \sum_{1}^r \sum_{1}^c \frac{(F_o - F_e)^2}{F_e}$$

wherein F_o values are those observed,

F_e values are those calculated to be expected,

r is the number of rows in the matrix, and

c is the number of columns in the matrix,

and degrees of freedom are the product of $(r-1)$ and $(c-1)$.

(e) If χ^2 calculated from observed data exceeds tabular (predicted) value at degrees of freedom and probability of occurrence thought to be appropriate, the hypothesis being tested is rejected; if not it is accepted.⁶⁸

An appropriate confidence level by many is thought to be 95%. The author of this study feels this is sufficient assurance of likelihood that significant difference is or is not indicated, and will use it throughout. See Table II from Edwards for a partial reproduction of χ^2 values for degrees of freedom applicable in this study and for a P-value of .05 (95% confidence).⁶⁹ Narrative hypotheses of this study and the bias content of Part I are tested in terms of relationships from Kerlinger,⁷⁰ Smith and Williams,⁷¹ and Edwards.⁷² In other words, $2 \times k$

⁶⁸Ibid, pp. 383 - 399.

⁶⁹Allen L. Edwards, Experimental Design in Psychological Research (New York: Holt, Rinehart and Winston, Inc., 1972), p. 448.

⁷⁰Kerlinger, p. 496.

⁷¹Smith and Williams, pp. 383 - 399.

⁷²Edwards, p. 448.

TABLE II
 CHI-SQUARE VALUES AT P = .05⁷³

Degrees of Freedom	3	4	5	6	7
χ^2	7.815	9.488	11.070	12.592	14.067

⁷³ Edwards, p. 448. extracted from a table of values with varying degrees of freedom and P.

matrixes of response frequencies will be obtained in a summative manner, as made necessary by the narrative hypotheses and five-point scales of Part II of the instrument, and as needed for bias checks on Part I responses in Appendix 3. Wherein the calculated χ^2 values exceed the appropriate values in Table II, the hypotheses will be rejected; or in the case of possible bias as expressed in the null form in Appendix 3, the null statement therein will be rejected. If calculated values do not exceed the tabular values, null statements are not rejected.

Responses to Part I, Question 10

The responses to Part I, question 10 will be summarized based upon a "Data Screen" computer printout showing number of employees in the "total" organization on average, and occurrence frequencies within size ranges. The information was biased by one report of total organization work force in a response of three million; in part of the calculations, this figure will be excluded in order not to have one extreme amount bias all the government sub-population of which it is a part. No such extreme amount was reported from the industry sub-population. (It is believed the three-million total organizations' employees figure represented all of the federal work force.)

Data Responses to Questionnaire, Part III

The writer assigned general response statement wording and codes corresponding to them for computer counts on data responding to the "open-ended" questions of Part III. These are listed in Tables XVI - XXI in Appendix 4. Corresponding frequencies and discussions of these responses are carried in Chapter IV, Findings, and in Chapter V,

Summary and Conclusions, and Recommendations.

Data Recording and Manipulation

Data in the questionnaire responses were punched in cards for analysis support on Parts I and III. Although responses for Part II were punched, physical counts of frequencies were made, and χ^2 values based upon them were obtained after inputting matrix values to a Monroe 1860 Programmable Calculator.

Chapter IV follows in which findings and their interpretation are given.

CHAPTER IV

FINDINGS

This discussion in this chapter will follow the outline of Table I, Research Questions and Narrative Hypotheses Versus Parts and Questions of the Questionnaire (page 37). Additional comments regarding total populations reported in response to question 10, Part I, and the frequency distribution of facility costs of \$10 million or greater as shown in responses to question 10, Part I are presented and discussed as well.

Research Question 1

Public Sector

Fifty of the 82 public sector respondents or 61 per cent had pre-start-up experience. A review of these indicates that the more prominent of the inexperienced are small-town mayors whose facilities are adequate and have existed for some time, or are leased. This type occupancy or requirement often results in no construction activity, and thus, reports of no experience.

Of the fifty showing experience, the proportions whose experience was gained in respective most recent time periods are:

Prior to 1965 — $2/50 = 4\%$,

1965 to 1969 -- $3/50 = 6\%$,

1970 to Present -- $45/50 = 90\%$.

The results should not be interpreted to mean that most facilities available to public sector organizations are new, but that those showing experience with pre-start-up do have recent knowledge for the most part.

Private Sector

The proportion of the private sector showing some experience with pre-start-up is:

$51/65 = 78\%$.

Of course, some businesses totally lease their facilities, while others remain fairly static in terms of growth or changes, and would not then necessarily need to add facilities. A greater per cent of private sector respondents do show pre-start-up experience, as compared with those of the public sector.

Of the fifty-one showing experience, proportions whose experience was gained in respective most recent time periods are:

Prior to 1965 -- $2/51 = 4\%$,

1965 to 1969 -- $2/51 = 4\%$,

1970 to Present -- $47/51 = 92\%$.

Again, this shows the predominance of recent experience in respondents of the private sector, of similar magnitude to that of the public sector respondents.

Research Question 2 responses follow.

Research Question 2Public Sector

Of the forty-nine showing some experience (one not responding to this item), the proportion having facility costs of \$10 million or greater are:

$$7/49 = 14\%.$$

This leaves a balance of 86% of new facility costs under \$10 million.

Private Sector

Of the fifty-one showing some experience, the proportion having facility costs of \$10 million or greater are:

$$13/51 = 25\%.$$

This results in a balance of 75% of new facility costs under \$10 million. These figures show about twice as many businesses constructing the higher cost facilities. So, then, government is not the only organization form which can afford very large fund commitments. This may be an indication of ability of the private sector to respond to need for large investments vis-a-vis that of the public sector.

The next information applies to Research Question 3.

Research Question 3Public Sector

Of the 101 respondents showing some experience, 50/101 or 50% are of the public sector.

Private Sector

Of these respondents, 51/101 or 50% are of the private sector.

It is noted that the original sample contains 234 of each sector and results in an almost exactly equivalent response numerically.

Design performance is the subject of Research Question 4.

Research Question 4

Public Sector

Of those responding with some experience, proportions showing varying design performance are:

In-House: $10/50 = 20\%$,

Contract: $36/50 = 72\%$,

Others: $4/50 = 8\%$. (These are combinations of in-house design with contract or other outside support.)

Private Sector

Of those responding with some experience, proportions showing varying design performance are:

In-House: $13/51 = 25\%$,

Contract: $26/51 = 51\%$,

Others: $12/51 = 24\%$. (These are combinations of in-house design with contract support.)

In-House design appears to be of the same order of magnitude; contract design as such seems greater in the public sector, while other applications look greater in the private sector.

Use of contingency funds is the subject of Research Question 5.

Research Question 5

Of those responding with some experience (two did not respond

to this item but did respond to the questionnaire proper), those showing use of contingency funds for costs exceeding base estimates for construction and equipment installation, by ranges of the contingency amounts, are:

50% or greater: $5/48 = 10\%$,

25% to 50%: $6/48 = 13\%$,

10% to 25%: $14/48 = 29\%$,

Less than 10%: $19/48 = 40\%$,

None: $4/48 = 8\%$.

Private Sector

Of those responding with some experience, those showing use of contingency funds for costs exceeding base estimates for construction and equipment installation, by ranges of the contingency amounts, are:

50% or greater: $2/49 = 4\%$,

25% to 50%: $1/49 = 2\%$,

10% to 25%: $25/49 = 51\%$,

Less than 10%: $20/49 = 41\%$,

None: $1/49 = 2\%$.

(Two of the 51 are not responsive to this item.)

The full range of these contingency funds usages shows a generally lesser overrun in the private sector. No figures are obtained for underruns, but it is believed that such would be small.

The following concerns application of formal management information systems.

Research Question 6Public Sector

Respondents experienced in pre-start-up show the following use or non-use of formal management information systems in support of their activities:

System is used: $17/50 = 34\%$,

System is not used: $30/50 = 60\%$,

Do not know: $3/50 = 6\%$.

Private Sector

Experienced respondents show use or non-use of formal management information systems as follows:

System is used: $21/51 = 41\%$

System is not used: $27/51 = 53\%$,

Do not know: $3/51 = 6\%$.

Applications appear to be of about the same order of magnitude in each of the sectors, but it is noted that less than half show such usage in each.

Skill training for new employees is the subject of Research Question 7.

Research Question 7Public Sector

Experienced respondents show skill training is provided or not provided for new employees as listed:

Yes: $33/50 = 66\%$,

No: 8/50 = 16%,

Not Applicable: 9/50 = 18%.

Private Sector

Experienced respondents show skill training is provided or not provided for new employees as listed:

Yes: 35/51 = 68%,

No: 8/51 = 16%,

Do not know: 1/51 = 2%,

Not Applicable: 7/51 = 14%.

The sector comparisons are similar. It appears that about two-thirds of the new employees need training for work in new facilities, but that another one-third either do not need training, or there are no new employees as such.

Research Question 8 concerns the number of employees in the new facility at start-up.

Research Question 8

Public Sector

Experienced respondents show number of employees at start-up of:

Less than 100: 37/50 = 74%,

100 to 499: 5/50 = 10%,

500 to 999: 4/50 = 8%,

1,000 or more: 4/50 = 8%.

Private Sector

Experienced respondents (one did not answer) show number of

employees at start up of:

Less than 100: $24/50 = 48\%$,

100 to 499: $23/50 = 46\%$,

500 to 999: $2/50 = 4\%$,

1,000 or more: $1/50 = 2\%$.

The range of these response percentages shows private sector staffing at new facilities to be generally larger than public sector except those percentages of much smaller magnitude in the higher staffing ranges.

The next concern is access to the new facility before start-up.

Research Question 9

Public Sector

Experienced respondents report the following on access by their employees to the new facility before start-up:

Yes: $29/50 = 58\%$,

No: $19/50 = 38\%$,

Do not know: $2/50 = 4\%$.

Private Sector

Experienced respondents report the following on access by their employees to the new facility before start-up:

Yes: $37/51 = 73\%$,

No: $13/51 = 25\%$,

Do not know: $1/51 = 2\%$.

It is seen here that private sector employees have higher proportionate access. It may be that there are regulatory or other

matters that would influence this result. But coordination by the owner's employees demands access ahead of construction completion in many cases.

Discussion of findings associated to Research Question 10 continues.

Research Question 10

Because those responding here give multiple comments, these comments result in larger counts than could be expected for single statement responses. In other words, there are more than 30 positive counts of open-ended responses to question 1, Part III of the questionnaire, even though 20 of the 50 public sector experienced respondents give no data for this item. The same applies to private sector responses wherein 13 of 51 are not responsive to question 1, Part III.

Public Sector

The concern here is with respondents' ideas of what can help make for successful facility start-up. Some items are then reversed in statement to show positive effects rather than negative as is found in the manner of the original statements. The items are from Table XVI and those applicable from Table XVIII, Appendix 4. In Table III, following, they are listed in order of frequency of mention.

TABLE III

HELPS TO SUCCESSFUL START-UP, PUBLIC SECTOR

<u>Frequency</u>	<u>Helps</u>
1	Use of contractor penalty clauses.
1	Shake-down tests.
1	Spare parts inventory for operating equipment.

TABLE III (Continued)

Frequency	Helps
1	Strong top management support.
1	Flexibility of start-up staff.
1	Free consultants from local college.
1	Municipal committee for site selection.
1	Federal Government guidelines governing Military Construction Projects.
1	Plan for delays and deadlines and have contingencies such as alternate, temporary facility in mind.
1	Use of a general checklist.
1	No problems encountered.
1	Schedule of pre-testing.
2	Adequate maintenance and operations manuals and data.
3	Advanced training.
3	Accurate manning.
3	Involvement by line supervisors in pre-start-up.
3	Backing of Chamber of Commerce or municipality.
3	Qualified architect.
3	Need to consider requirements of people, such as transportation, eating facilities, and training.
3	Knowledgeable people.
4	Full-time management participants in pre-start-up.
4	Input of requirements data by intended users.
4	Planning and scheduling by user management.
5	Previous similar experience.
7	Coordination between user management and contractor and/or architect.
15	Complete plans, milestone controls, and schedules.

Some of the above for the public sector respondents are felt to be more important than others, as can be seen from the counts.

Listing of these, as well as an attempt at logical groupings will be made in summary in Chapter V, Summary and Conclusions and Recommendations.

Private Sector

As with the Public Sector, the following are from respondents'

ideas from Table XIX and those applicable from Table XXI, Appendix 4, by order of frequency reported, as shown below in Table IV.

TABLE IV

HELPS TO SUCCESSFUL START-UP, PRIVATE SECTOR

Frequency	Helps
1	Field management in-place during construction.
1	Tight cost and scope controls during construction.
1	Complete specifications.
1	Weekly follow-up.
1	Follow-through on job responsibilities.
1	Testing and modification of equipment.
1	Pilot plant experience.
1	Internal communication and support.
1	Cooperation of government industrial development agencies.
1	Rapport with local government, business, and financial leaders.
1	Communication between shipper and receiver.
1	Clear assignment of responsibility and authority.
1	Coordinated relocation.
1	Preplanned department locations and interrelations.
1	No union.
1	Technology transfer (licensed).
1	Strong profit motive.
1	Competent local people.
1	Promoting of managers from within.
1	Maintenance personnel work with construction crews.
1	Planned sequencing for start-up of equipment.
1	Qualified consultants on siting, design, costs, and controls.
1	Cooperation of consultant experts and contractors with inside management during construction.
1	Single manager in charge.
1	Safety awareness throughout period.
1	Equipment problems a minimum.
2	Filling vacancies with right selections, even if delayed.
2	Excellence of consultant architect/engineer/contractor.
2	Cost and quality controls.
2	Contractual outside maintenance support.
2	Start-up production goals definition.
2	Time to make field start-up fixes on equipment bugs.
2	Hire key managers in proper time phase.
2	Selection and training programs for operations and maintenance personnel and their early hiring or placement.
3	Attention to detail by pre-start-up personnel.
3	Full-time responsibility of one company manager in charge.
3	On-site engineers during construction.

TABLE IV (Continued)

Frequency	Helps
3	Training of managers.
3	High caliber department managers and supervisors.
3	Site choice and analysis.
3	Proper design.
3	Competence of pre-start-up staff.
4	Commitment and cooperation of management.
6	Strong support and attention of management.
7	Training of maintenance and operations personnel prior to start-up.
7	Training and experience of managers in similar existing facilities.
7	Schedules planned and adhered to.
23	Scheduling and planning of pre-start-up events.

As in Table III for the public sector, some of the above for the private sector respondents are felt to be more important than others, as can be seen from the counts. These, too, will be listed and grouped in what seem logical combinations in Chapter V, Summary and Conclusions, and Recommendations.

Agreement in the most frequent comments of the private and public sector respondents can be seen in the importance attached to training, experience, planning and scheduling.

The discussion which ensues is concerned with Research Question 11.

Research Question 11

This question concerns the outside variables affecting the pre-start-up phase. The data comes from replies to question 2, Part III, and some from question 3 of Part III, often given in multiple comments, as is true for Research Question 10.

Public Sector

Variables from outside the organizations affect management of the pre-start-up phase. As in discussion above for Research Question 10, items reported as listed in Table XVII and those applying in Table XVIII, Appendix 4, are listed in Table V in ascending order of frequency reported.

TABLE V

OUTSIDE VARIABLES AFFECTING PRE-START-UP, PUBLIC SECTOR

Frequency	Outside Variables
1	Poor penalty clauses.
1	Weather.
1	User personnel not free to access facility during pre-start-up to make known needed modifications prior to general contract ending.
1	Proper funding.
1	Materials availability.
1	Interference by politicians.
1	Quality of maintenance and operating instructions.
1	Attaining key start-up personnel.
1	Design changes during construction.
1	Contractor solvency problems during construction.
1	Site restrictions by the contractor.
1	Free consultants arranged by local college.
1	No-growth attitude in municipality.
1	Enough time.
1	Federal agency requirements and controls.
1	Site selection influenced by construction labor availability.
1	Donated or low cost services by individuals or municipalities.
2	Site selection.
2	Poor construction or equipment quality.
2	Problems in a joint investment with another municipality.
3	Requirements of state and local governments interfered.
3	Helpful attributes of designers, consultants, or general contractor.
3	Cost escalation during construction.
3	Poor higher level coordination.
4	Federal compliance rules by funding agency interfered.
5	Contractor responsiveness on construction deficiencies and/or general performance.

Some of the variables shown in Table V for the public sector respondents are felt to be more important than others, as can be seen from the counts. Listing of these, as well as an attempt at logical groupings will be made in summary in Chapter V, Summary and Conclusions, and Recommendations.

Private Sector

As with the public sector, Table VI shows respondents' ideas from Table XX and those applicable from Table XXI, Appendix 4, by order of frequency reported.

TABLE VI

OUTSIDE VARIABLES AFFECTING PRE-START-UP, PRIVATE SECTOR

Frequency	Outside Variables
1	Uncalled for government agency architectural requirements.
1	Reliable service or material from local firms difficult to obtain.
1	No time pressures.
1	Good construction manager.
1	Pre-planning of space.
1	No union.
1	Licensors.
1	Government effects are negative at all levels.
1	Local agency interference in land purchase and beginning construction.
1	Right-to-work laws.
1	Hostile government at all levels.
2	Technical knowledge.
2	Responsive architect and/or contractor.
2	Poor equipment design.
2	Government training grants or manuals.
3	Weather.
3	Qualified consultants.
4	Skilled personnel available in area.
5	Cooperation of area authorities/industry people.
5	Construction schedule and adherence.

TABLE VI (Continued)

Frequency	Outside Variables
5	Vendor deliveries.
6	Supplies meeting specifications, shipping dates, and service.

As seen in Table V for the public sector, some of the above for the private sector respondents were felt to be more important than others, as can be seen from the counts. These, too, will be listed and grouped in what seem to be logical combinations in Chapter V, Summary and Conclusions, and Recommendations.

Agreement in the most frequent comments of the private and public sector respondents with regard to outside variables is not apparent. It may be that public and private sector participants in pre-start-up management are just not subject to like contact/communication/coordination needs with factors outside the organization.

The narrative hypotheses will now be taken up.

Research Question 12

This question asks if there is difference in terms of the five management functions when comparing management in pre-start-up facilities which differ in cost, and in these functions as implemented for private versus public sector. It will be addressed through a compilation of results for the narrative hypotheses. Since responses to all of the fifteen questions in Part II of the instrument are on a five-point scale, and since all comparisons in the chi-square approach then became "2 x 5" arrays, degrees of freedom are always four:

$$(r-1) (c-1) = (2-1) (5-1) = 4.$$

The value used for rejecting, or not rejecting, the null hypotheses is

$\chi^2 = 9.488$, as listed in Table II for $P = .05$ with confidence level of .95. Tables VII, VIII, IX, and X show results interpreted.

Consensus can be seen in not rejecting any of the comparative responses as groups, corresponding to the management functions as evaluated in sets of three each. These evidences of consensus are shown in Table XI. Consensus for not rejecting any of the null statements of the narrative hypotheses related to the attitude items of Part II of the instrument is seen in Table XI; most are by a margin of 3 to 0 (14 of 20 tabular entries), while the remainder show a margin of 2 to 1 (6 of 20 tabular entries). An item by item discussion of agreement or disagreement of respondent groups, along with indications of indifference to the item and possible explanations of rejection of respective null statements is to be found in Chapter V, Summary and Conclusions, and Recommendations.

Information regarding the number of employees in the respondents' total organizations was requested, and that information is discussed in the following section.

Question 10, Part I of Questionnaire

A "Data-Screen" program was run on the data supplying number of employees in respondents' total organizations. Forty-five of the public sector and 48 of the private sector answered it. One of the public sector respondents showed total employees of 3,000,000 which may include all federal civil servants. Comparisons are given with the latter data included, and with it excluded, as shown in Table XII. It can be seen that including the 3,000,000 figure in the public sector totals somewhat spuriously shows large differences between the mean sizes,

TABLE VII

HYPOTHESIS 1. -- NULL STATEMENT CONCERNING RESPONDENT GROUPS
 HAVING FACILITY START-UP COSTS OF \$10 MILLION OR
 MORE, AND THOSE COSTING UNDER \$10 MILLION

<u>Management Function</u>	<u>Questionnaire Part II Item Number</u>	<u>Subject</u>	<u>Calculated χ^2 Value</u>	<u>Evaluation of Null Statement</u>
Planning	1	Equipment Modification	3.268	Not Rejected
Planning	2	Labor, Location Effect	3.646	Not Rejected
Planning	3	Written Objectives, Policies	4.384	Not Rejected
Organizing	4	Firm Organization	1.922	Not Rejected
Organizing	5	Known Functions	3.603	Not Rejected
Organizing	6	Known Interrelationships	3.004	Not Rejected
Staffing	7	Filling Vacancies	3.478	Not Rejected
Staffing	8	Formal Position Grading	11.288	REJECTED
Staffing	9	Initial Hiring	6.365	Not Rejected
Directing	10	Known Source for Assist- ance	2.394	Not Rejected
Directing	11	Known Responsibilities	5.915	Not Rejected
Directing	12	Equipment Test	5.949	Not Rejected
Controlling	13	Advance Tools and Equip- ment Determination	5.685	Not Rejected
Controlling	14	Construction Management	4.988	Not Rejected
Controlling	15	Facility Access	12.092	REJECTED

TABLE VIII

HYPOTHESIS 2. -- NULL STATEMENT CONCERNING RESPONDENT GROUPS
OF GOVERNMENT VERSUS INDUSTRY

<u>Management Function</u>	<u>Questionnaire Part II Item Number</u>	<u>Subject</u>	<u>Calculated χ^2 Value</u>	<u>Evaluation of Null Statement</u>
Planning	1	Equipment Modification	2.009	Not Rejected
Planning	2	Labor, Location Effect	13.279	REJECTED
Planning	3	Written Objectives, Policies	2.282	Not Rejected
Organizing	4	Firm Organization	5.850	Not Rejected
Organizing	5	Known Functions	4.868	Not Rejected
Organizing	6	Known Interrelationships	3.870	Not Rejected
Staffing	7	Filling Vacancies	5.103	Not Rejected
Staffing	8	Formal Position Grading	2.696	Not Rejected
Staffing	9	Initial Hiring	10.513	REJECTED
Directing	10	Known Source for Assistance	3.797	Not Rejected
Directing	11	Known Responsibilities	3.293	Not Rejected
Directing	12	Equipment Test	1.588	Not Rejected
Controlling	13	Advance Tools and Equip- ment Determination	1.698	Not Rejected
Controlling	14	Construction Management	6.264	Not Rejected
Controlling	15	Facility Access	2.741	Not Rejected

TABLE IX

HYPOTHESIS 3. -- NULL STATEMENT CONCERNING BOTH GOVERNMENT AND INDUSTRY
RESPONDENT GROUPS HAVING FACILITY START-UP COSTS UNDER \$10 MILLION

<u>Management Function</u>	<u>Questionnaire Part II Item Number</u>	<u>Subject</u>	<u>Calculated χ^2 Value</u>	<u>Evaluation of Null Statements</u>
Planning	1	Equipment Modification	1.033	Not Rejected
Planning	2	Labor, Location Effect	11.958	REJECTED
Planning	3	Written Objectives, Policies	2.109	Not Rejected
Organizing	4	Firm Organization	5.121	Not Rejected
Organizing	5	Known Functions	6.869	Not Rejected
Organizing	6	Known Interrelationships	2.329	Not Rejected
Staffing	7	Filling Vacancies	3.826	Not Rejected
Staffing	8	Formal Position Grading	2.091	Not Rejected
Staffing	9	Initial Hiring	13.950	REJECTED
Directing	10	Known Source for Assistance	7.314	Not Rejected
Directing	11	Known Responsibilities	7.544	Not Rejected
Directing	12	Equipment Test	1.703	Not Rejected
Controlling	13	Advance Tools and Equipment Determination	1.127	Not Rejected
Controlling	14	Construction Management	8.097	Not Rejected
Controlling	15	Facility Access	0.621	Not Rejected

TABLE X

HYPOTHESIS 4. -- NULL STATEMENT CONCERNING BOTH GOVERNMENT AND INDUSTRY RESPONDENT GROUPS HAVING FACILITY START-UP COSTS OF \$10 MILLION OR GREATER

<u>Management Function</u>	<u>Questionnaire Part II Item Number</u>	<u>Subject</u>	<u>Calculated χ^2 Value</u>	<u>Evaluation of Null Statement</u>
Planning	1	Equipment Modification	5.461	Not Rejected
Planning	2	Labor, Location Effect	4.615	Not Rejected
Planning	3	Written Objectives, Policies	0.952	Not Rejected
Organizing	4	Firm Organization	2.575	Not Rejected
Organizing	5	Known Functions	2.874	Not Rejected
Organizing	6	Known Interrelationships	3.545	Not Rejected
Staffing	7	Filling Vacancies	3.663	Not Rejected
Staffing	8	Formal Position Grading	3.150	Not Rejected
Staffing	9	Initial Hiring	8.557	Not Rejected
Directing	10	Known Source for Assistance	0.304	Not Rejected
Directing	11	Known Responsibilities	0.886	Not Rejected
Directing	12	Equipment Test	3.199	Not Rejected
Controlling	13	Advance Tools and Equipment Determination	4.016	Not Rejected
Controlling	14	Construction Management	2.198	Not Rejected
Controlling	15	Facility Access	4.486	Not Rejected

TABLE XI

CONSENSUS OF RESPONSES TO ATTITUDE QUESTIONS IN PART II OF THE QUESTIONNAIRE,
NOT REJECTING NULL STATEMENTS

	Management Function				
	Planning	Organizing	Staffing	Directing	Controlling
Hypothesis 1.:	3 to 0	3 to 0	2 to 1	3 to 0	2 to 1
Hypothesis 2.:	2 to 1	3 to 0	2 to 1	3 to 0	3 to 0
Hypothesis 3.:	2 to 1	3 to 0	2 to 1	3 to 0	3 to 0
Hypothesis 4.:	3 to 0	3 to 0	3 to 0	3 to 0	3 to 0
General Consensus:	Not Rejected	Not Rejected	Not Rejected	Not Rejected	Not Rejected

20

Notes: Consensus ratios are in terms of numbers of items from the attitude items of Part II of the questionnaire which do not justify being rejected at 95% confidence to those which are justified.

All data of this table are summarized from Tables VII to X.

TABLE XII

NUMBER OF EMPLOYEES IN TOTAL ORGANIZATION BY RANGE AND DISTRIBUTION

<u>Organizational Groupings</u>	<u>Number Responding By Total Size Ranges*</u>	<u>Mean Size</u>	<u>Standard Deviation</u>	<u>Minimum</u>	<u>Maximum</u>
Public and Private together, one Public Response of 3,000,000 included.	92 in range of 0 to 166,667) One in range of 166,668 to 3,000,000)	33,794	310,968	1	3,000,000
Public and Private together, one Public Response of 3,000,000 excluded.	85 from 0 to 4K) 2 from 4K to 8K) 2 from 8K to 12K) 1 from 12K to 16K) 1 from 20K to 24K) 1 from 36K to 40K)	1,553	5,257	1	40,000
Public Respondents alone with one response of 3,000,000 included.	44 from 0 to 300,000) One from 2,700,000 to 3,000,000)	68,164	447,027	1	3,000,000
Public Respondents alone with one response of 3,000,000 excluded.	41 from 0 to 4K) 1 from 4K to 8K) 1 from 8K to 12K) 1 from 36K to 40K)	1,532	6,212	1	40,000
Private Respondents alone.	42 from 0 to 2,350) 3 from 2,351-4700) 1 from 10,751-14,100) 1 from 14,101-16,450) 1 from 21,151-23,500)	1,572	4,266	3	23,500

*Note: Letter K signifies thousands.

standard deviations, and maximum size reported when comparing public and private sectors. These differences become of little apparent amount when the 3,000,000 amount is excluded, namely: Mean Size — 1,532 in the public sector to 1,572 in the private sector; Standard Deviation--6,212 and 4,266 respectively; and Maximum--40,000 to 23,500, showing that both are skewed to the higher population extremes.

A detailing of ranges of facility costs of \$10 million or more is now presented.

Question 2, Part I of Questionnaire

Tabulations in Table XIII show numbers and ranges for respondents having facility start-up costs of \$10 million or more.

TABLE XIII

NUMBERS OF RESPONDENTS AND RANGES OF FACILITY
START-UP COSTS OF \$10 MILLION OR MORE

		Public Sector
<u>Number of</u>		<u>Range of Costs</u>
<u>Respondents</u>		
3	-----	\$10 million but less than \$20 million
1	-----	\$20 million but less than \$40 million
2	-----	\$40 million but less than \$60 million
0	-----	\$60 million but less than \$100 million
1	-----	Greater than \$100 million
		Private Sector
<u>Number of</u>		<u>Range of Costs</u>
<u>Respondents</u>		
3	-----	\$10 million but less than \$20 million
1	-----	\$20 million but less than \$40 million
0	-----	\$40 million but less than \$60 million
2	-----	\$60 million but less than \$100 million
4	-----	Greater than \$100 million

It can be seen that (1) the number above the nominal figure of \$10 million is a small percentage of the total public and private sectors' respondents who had some experience with pre-start-up events, that is 17/101 or 17%. The private sector facility costs did tend to be larger, if the small number reporting is acknowledged.

The outline for data analysis as found in Table I (page 37), with additional comments regarding responses to question 10, Part I of the instrument has been followed in Chapter IV, and ranges of costs that were reported by experienced respondents having facility costs of \$10 million or more, in response to Question 2, Part I of the questionnaire, have been presented.

Findings have been interpreted as apparent relationships seem to be present. Differences and similarities in data responding to Part I of the instrument have been highlighted. Detailed and summary rejection or non-rejection of null hypotheses associated with Part II of the questionnaire have been stated. Open-ended question responses of Part III of the instrument have been listed, quantified, and briefly interpreted. Further interpretation of Part I of the instrument is contained in Appendix 3, Bias of Part I Questionnaire Responses. Elaboration and summarized comments on the hypothesis-matter of Part II, as well as grouping and discussion of the responses to Part III are a part of Chapter V.

In Chapter V, Summary and Conclusions, and Recommendations, any apparent problems with pursuing the Planning, Organizing, Staffing, Directing and Controlling functions of management are examined further, and the author considers how applications to these might be improved in pre-start-up, and will recommend possible applications and research subjects.

CHAPTER V

SUMMARY AND CONCLUSIONS, AND RECOMMENDATIONS

The pre-start-up process is one of extreme importance to the organization which has decided to expand. It consists of several of these steps: the identification of the need, objectives definition, funds obligation, design, contracting, construction and equipment installation, personnel selection and training, and in some cases shut-down of current facilities in order to consolidate and equip the new facility. It may involve coordinated effort of numbers of managers and other personnel over a period of years and sometimes be concerned with organization funds in the tens of millions of dollars.

Summary and Conclusions

This study finds that:

- (1) Although there definitely is a transition stage from design to production start-up of new facilities, which contains much for management attention and activity, a body of literature on the subject seems not to exist as a contiguous body.⁷⁴
- (2) There are individual articles being written, and some theory is being developed, which represent a start toward

⁷⁴Chase and Aquilano, pp. 542 - 543.

assisting management with pre-start-up guidance in areas such as facility location, planning, layout and scheduling, all of which are performable, at least in part, during the pre-start-up period.

- (3) This study finds evidence of similarity and difference in characteristics of public and private sector organizations in their experiences with pre-start-up of new facilities varying in costs as evidenced by report of findings in Chapter IV, as shown in the demographic responses of Part I of the instrument, and in the attitudinal results of Part II of the instrument. Part III data give indications of what respondents consider to have influenced success in start-up and what they consider to have affected pre-start-up management from outside the firm. Little bias in the responses is apparent, but is detailed in Appendix 3. Similarities and differences are listed and discussed hereafter in the order of their appearance in the questionnaire.

<u>Part I — Demographic Information</u>	<u>Public</u>	<u>Private</u>
Percentage showing pre-start-up experience:	61	78
Heaviest experience period (1970 to present), percentage:	90	92
Percentage having facility start-up costs under \$10 Million:	86	75
Percentage of those showing pre-start-up experience out of total experienced:	50	50

<u>Part I - Demographic Information (Continued)</u>	<u>Public</u>	<u>Private</u>
Most design performance is contract, %:	72	51
Most common uses of contingency funds are:		
10 to 25% range, % reporting:		51
Under 10%, % reporting:	40	
Use of formal management information systems, %:	34	41
Percentage having skill training for most new employees before start-up:	66	68
Predominate size of facility employee populations is under 100, at %s of:	74	48
(It is noted that private organization populations between 100 and 499 comprise 46% of the experienced respondents.)		
Percentages of pre-start-up personnel given access to the new facility before start-up are:	58	73

In the above and in Figure 1 are seen similarities in heaviest experience period (1970 to present), percent experienced of total experience, and skill training offered to new employees. Differences are seen in percentage showing pre-start-up experience of those responding, percentage having start-up costs under \$10 million, design performance, use of contingency funds, use of management information systems, size of employee populations,

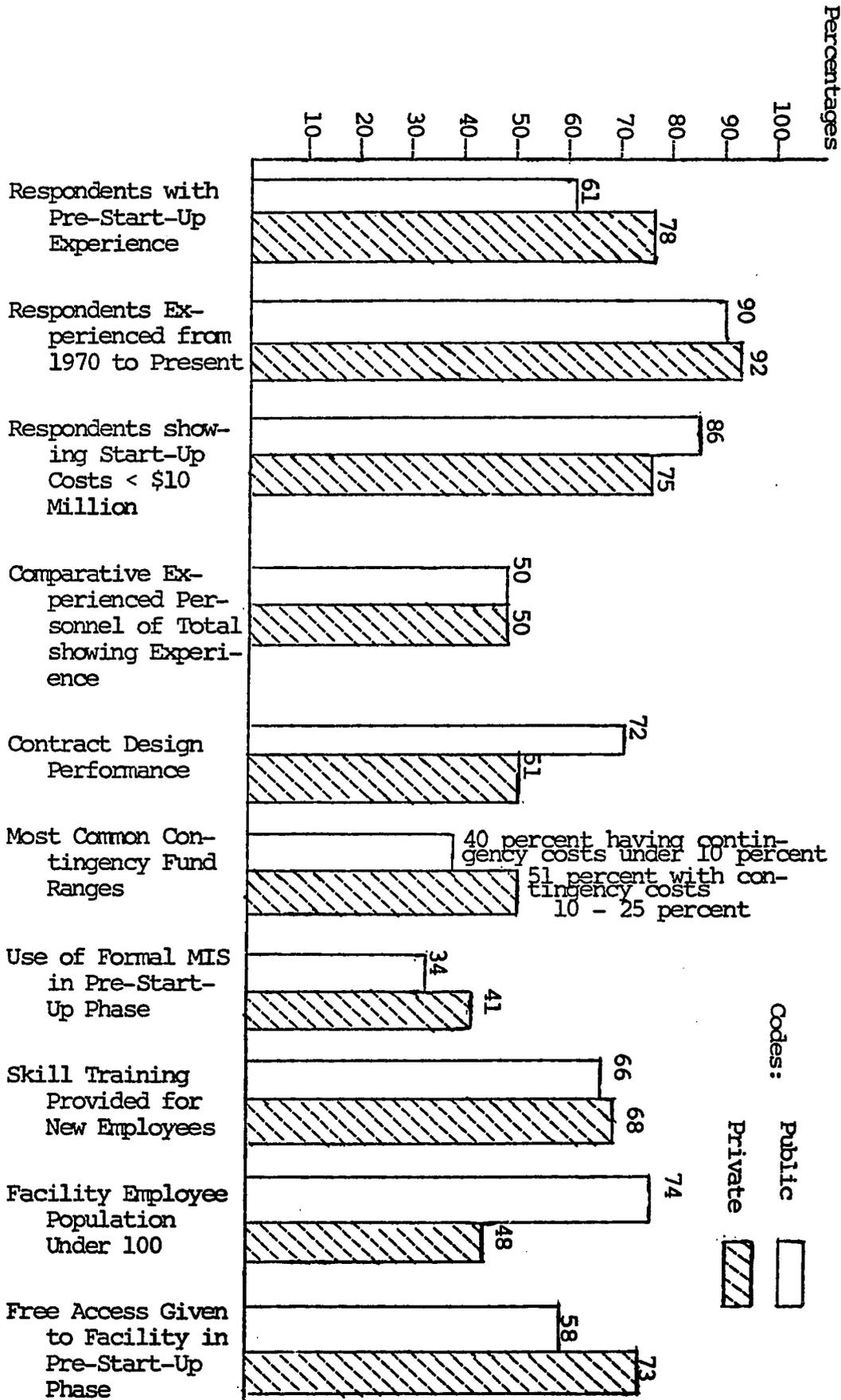


FIGURE 1
PUBLIC VERSUS PRIVATE SECTOR RESPONSES CONCERNING
DEMOGRAPHIC INFORMATION OF PART I

and facility access. Since these are purely demographic in nature, no comment is made as to their relative meanings. However, managers of the organizations represented surely could benefit from less use of contingency funds, more use of formal management information systems, and better access to the facility while under construction.

Part II -- Attitude Items

These items were detailed in Chapter IV, Findings, as to whether corresponding null hypotheses were rejected. The hypotheses are paraphrased as follows:

There is no difference in management approach between those . . .

1. Having start-up costs of \$10 million or more and those having costs less than \$10 million . . .
2. Public and private respondent groups . . .
3. Public and private respondent groups whose start-up costs are under \$10 million . . .
4. Public and private respondent groups whose start-up costs are \$10 million or more . . .

. . . in terms of planning, organizing, staffing, directing and controlling, and consensus of these when taken together. At the 95% confidence level, basis for rejection of null hypotheses is found on only one-in-three of questions bearing on:

- Hypothesis 1, staffing and controlling functions,
- Hypothesis 2, staffing and planning functions, and
- Hypothesis 3, staffing and planning functions.

No rejection pertaining to Hypothesis 4 is found. A better feel for what happens in the individual item cases is seen

when they are reviewed and discussed by related functional categories:

<u>Part II Items</u>	<u>Function of Management</u>
1 to 3	Planning
4 to 6	Organizing
7 to 9	Staffing
10 to 12	Directing
13 to 15	Controlling

Planning

Part II Item Number, Statement and Discussion

- (1) Few modifications of production equipment were necessary after start-up. Here, none of the hypotheses is rejected, based upon agreement with statement of the item, the highest frequency designating the Agree choice for all four hypotheses. From a cost and interference minimization standpoint after start-up, such a condition bringing this response is desired.
- (2) Location of the facility in the selected site was decided by our management based on consideration of organized labor in the vicinity. All respondent categories were in disagreement basically with this statement. However, there were differences:

Hypothesis 1 -- null not rejected, with the disagreement on the statement about evenly split between Disagree and Strongly Disagree answers.

Hypothesis 2 -- null rejected, primarily caused by high content of Disagree answers by private sector respondents, with evenly split Disagree and Strongly Disagree answers by public sector respondents. This is a matter of degree, but can indicate a softness in the private sector response. Companies do relocate sometimes so as to have more favorable employee organization characteristics in the new sites.

Hypothesis 3 -- null rejected, primarily caused by high content of Strongly Disagree answers by public respondents in the low cost facilities versus disproportionately high Strongly Agree answers from the private sector. This result may be an indication of the lack of employee organization presence in the public sector, but with some degree of employee organization presence and influence on the private sector, even with overall disagreement. The last comment for Hypothesis 2 on this item still applies.

Hypothesis 4 -- null not rejected, with the disagreement to the statement mainly that of Strongly Disagree answers.

- (3) Written objectives and policy statements affecting our pre-start-up managers were available ahead of start-up. None of the four hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice on all four. From a smooth operational standpoint, such a condition bringing this response is desired.

Even more polar responses are inferred as desirable in the general directions of agreement or disagreement on all three of these Planning items.

Organizing

Part II Item Number, Statement and Discussion

- (4) Our intended organization structure for the new facility was firm ahead of start-up. None of the hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice for all four hypotheses. To avoid coordination and communication problems, a firm organization is beneficial from the earliest phases when people are beginning to support the pre-start-up period, and then leading into post-start-up.
- (5) There was a statement of functions for personnel available to the on-site pre-start-up management. Again, none

of the hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice for all four hypotheses. For those organizing events into individual assignments for people to perform and to assure accomplishment of them, functions (broad areas of work to be done) need to be understood and specialized to groupings of responsible personnel.

- (6) Expected interrelationships between working elements of our pre-start-up organization were furnished to us by our management. Here, too, none of the hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice for all four hypotheses. Coordination of events which are dependent upon each being accomplished demands a measure of understanding of group interfaces, interworkings and cooperation, so that the end result is optimized. Without this coordination, bickering and nonaccomplishment are probable.

Even more polar responses are inferred as desirable in the general direction of agreement with these Organizing-type item statements.

Staffing

Part II Item Number, Statement and Discussion

- (7) Before start-up we knew how we would fill future vacancies caused by promotions or losses. None of the hypotheses is

rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice for all four hypotheses. Development of personnel for higher level assignments is a normal and expected concern during the pre-start-up phase, as well as in post-start-up (steady state). Further, no organization can afford to assume immunity from departures, transfers, and other vacating of positions in the structure of organization.

- (8) A job classification and wage program was used in ranking or grading the various positions in the new facility's organization structure. All respondent categories were in agreement with this statement of the item. However, there were these differences:

Hypothesis 1 -- null rejected, primarily caused by those having facility costs of \$10 million or greater showing high content of Strongly Agree answers, while those having facilities costing less than \$10 million show a high content of Agree answers. Those with less costly facilities come from the lesser-size organizations, wherein a softness of agreement with use/need can be expected and even understood concerning job classification

and wage programs. The lack of demand for such from the employee population is all that some small businesses and small-town mayors would see.

Hypothesis 2 -- null not rejected, with the agreement mainly by Agree responses. The softer agreement here is due to the type interpretation shown in the last statement of Hypothesis 1, above, with small public and private organizations being in a strong majority.

Hypothesis 3 -- null not rejected, with the agreement mainly by Agree responses. The same comment applies here as for Hypothesis 2, above.

Hypothesis 4 -- null not rejected, with the agreement mainly by Strongly Agree responses. Here, we have the responses from those having higher cost facilities and larger organizations. Such organizations will tend to need and expect job differentiation on some planned ranking or grading scale, and management will tend to respond to the demand.

The efficacy of job classification and wage programs is not universally agreed upon by managers. Even some large organizations get along without them. These tend not to be unionized, since unions are known to want progression patterns for their members.

- (9) We were able to meet hiring goals in the pre-start-up period for production-type employees as planned. All respondent categories were in agreement basically with this statement of the item. However, there were differences:

Hypothesis 1 -- null not rejected, with the agreement on the statement mainly by Agree responses. Some level of agreement is to be expected, since training and supportive activities during pre-start-up can benefit.

Hypothesis 2 -- null rejected, mainly due to high public sector responses showing indifference to the item, while private sector respondents showed high frequency Strongly Agree answers. Perhaps the public respondents have had little problem in this type staffing, while the private respondents may have a greater emphasis due to past experiences and wider

production skill requirements.

Hypothesis 3 -- null rejected, with relatively high frequency of Strongly Agree responses by those of the private sector with low cost facilities. This is part of the tendency as stated in the above on Hypothesis 2.

Hypothesis 4 -- null not rejected, with agreement about evenly split between Strongly Agree and Agree responses. Here, with the generally larger and more costly facilities and organizations, more emphasis is given to agreement with the need for production employees during pre-start-up as expressed by hiring emphasis.

General equivalence of agreement is seen above for Staffing function item on filling vacancies, while there are differences probably attributable to organization size and/or production requirements for items involved with ranking and grading, and with meeting production hiring goals.

Directing

Part II Item Number, Statement and Discussion

- (10) Organizations or personnel from which we could get assistance for solving pre-start-up problems were known to us. None of the hypotheses is rejected, based upon agreement

with this statement of the item, the highest frequency showing the Agree choice for all four hypotheses. A result for the item showing agreement with need of knowledge of proper-assistance contacts is acknowledged as that to be expected.

- (11) It was clear to those assigned as pre-start-up managers what their responsibilities were to be after start-up. None of the hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency showing the Agree choice for all four hypotheses. Again, respondents are expected to feel competence through knowledge of responsibilities.
- (12) An important directed effort prior to start-up was check-out or test of equipment in the new facility by some of our own employees who would later maintain or operate them. All respondents showed agreement with this statement, with none of the hypotheses being rejected, but those of the higher cost facilities related to Hypothesis 4 gave mainly Strongly Agree responses, while those of the Smaller organizations or of the composites represented in Hypotheses 1, 2 and 3 gave mainly Agree responses. The larger organizations, tending to have higher cost facilities, may better afford this additional pre-start-up expense; but all do agree as to the desirability.

As seen above, pre-start-up organizations do agree on the need to know where assistance will be forthcoming, on the need for

making responsibilities clear, and on the need for equipment testing in pre-start-up by those who would maintain or operate them.

Controlling

Part II Item Number, Statement and Discussion

- (13) Status of tools and equipment availability for operations after start-up were determined in the pre-start-up period. None of the hypotheses is rejected, based upon agreement with this statement of the item, the highest frequency designating the Agree choice for all four hypotheses. An attempt to have such material available before start-up is an understood requirement for these facilities; thus their determination in advance is expected.
- (14) An outside firm or organization acted as overall facility construction or installation contracting officer/controller. None of the hypotheses is rejected based upon this statement. However, agreement mainly via the Agree response is seen in the respondents represented in Hypotheses 1, 2, and 3, while disagreement mainly via the Strongly Disagree response is seen in the respondents represented in Hypothesis 4. The latter are comprised of those having high cost facilities, and could perhaps be showing consequent funds and abilities to manage their own construction/installation monitoring. Smaller organizations may not have these in-house characteristics.

(15) Access to the facility caused interference with the contractor prior to start-up. All respondent categories were in disagreement basically with this statement of the item.

There were some differences:

Hypothesis 1 -- null rejected, with respondents of higher cost facilities showing responses of mainly Disagree, while those of lower cost facilities showed prevalent responses of Strongly Disagree or indifference. Interpretation here could be that higher cost facilities were softer in terms of their disagreement, with an inference of some amount of access interference with the contractor. Similarly, inference is possible for the respondents of the lower cost facilities to have had less need for access, and thus either seeing no difficulty or indifferent to any interference having occurred.

Hypothesis 2 -- null not rejected, with disagreement shown primarily by Disagree responses. This is a soft answer by the public and private sector respondents, indicating possibility of some interference with the contractor due to

access ahead of start-up.

Hypothesis 3 -- null not rejected, with disagreement shown primarily by Disagree responses.

Comment of respondents on Hypothesis 2 applies also to those of the lower cost facilities.

Hypothesis 4 -- null not rejected, with disagreement shown by Disagree responses, primarily.

Comment on respondents of Hypothesis 2 applies also to those respondents of the higher cost facilities.

It is seen that agreement is present in the responses relative to advance determination of tools and equipment requirements. But there was mixed agreement and disagreement as to whether the using organization managed its own construction/installation contract. There was also mixed amount of disagreement as to possible interference with the contractor due to pre-start-up phase access to the facility.

In summary pertaining to Part II, Attitude Items, it is seen that differences of attitude and experience may be due to size or cost of facilities, unionization or its presence, production requirements, and need for management (or lack of it) by outside agencies during construction. Much similarity in attitude is seen in all 15 of the items. An average of "Indifferent" responses of 16% is true of the overall totals; respondents definitely tended to agree or disagree.

Part III -- Open-Ended Items

This part of the Summary and Conclusions deals with the responses to the open-ended items of Part III of the instrument. Chapter IV, Findings, carries a detailed listing of responses as related to Research Questions 10 and 11, and shown in Tables III and IV for comments on helps experienced toward facility start-up, and shown in Tables V and VI for comments on variables from outside the organization which affected pre-start-up. Hereafter, these same items will be grouped and consolidated for discussion as they appear to fall under the five management functions of planning, organizing, staffing, directing, and controlling. The overall grouping is (1) what can help make for successful facility start-up, and (2) what outside variables affect the pre-start-up phase. Those applicable to (1) will be consolidated from Tables III and IV, pages 54 to 57, and those applicable to (2) will be consolidated from data listed in Tables V and VI, pages 58 to 60. Frequency counts are summative.

What Can Help Make for Successful Facility Start-Up?Public Sector

	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
Planning	Municipal assistance in site selection, plan for contingencies, schedule of pre-testing, backing of municipality, qualified architect, planning and scheduling by user management, and complete plans.	20
Organizing	Adequate manuals and data, consider requirements of people, and input of requirements data by intended users.	9

Public Sector

	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
Staffing	Flexibility in staff, free consultants, advance training, accurate manning, and previous similar experience.	13
Directing	Top management support, minimize problems, involvement by line supervisors, knowledgeable people, and full-time managers in pre-start-up.	12
Controlling	Penalty clauses, shake-down tests, spares inventory, federal guidelines, use checklist, coordination of management with contractors and architect, and milestone controls and schedules.	<u>20</u>
	Public sector sub-total	74

Private Sector

	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
Planning	Complete specifications, cooperation and rapport of outside agencies, preplanned department locations/interrelations, no union, excellence of outside agents, start-up production goals definition, time to fix equipment bugs, site choice and analysis, proper design, schedules planned, and planning and scheduling of pre-start-up events.	42
Organizing	Clear assignment of duties and authority, technology transfer, planned sequencing for start-up of equipment, and fill vacancies optimally.	5
Staffing	Pilot plant experience, competent local people, promoting managers from within, qualified consultants,	

Private Sector

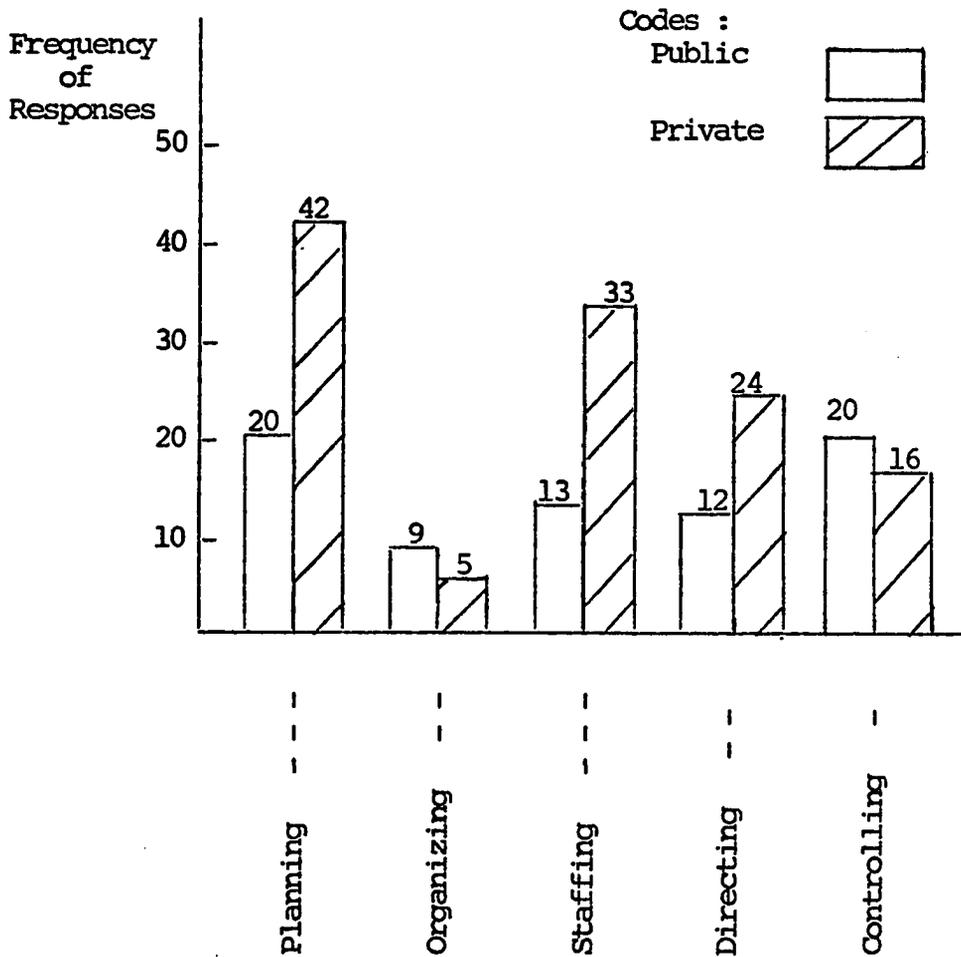
	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
	contractual outside maintenance support, hire key managers in-phase, select and train operations and maintenance personnel in-phase, training of managers, high caliber management, competence of staff, training of maintenance and operations personnel prior to start-up, and train managers in similar facilities.	33
Directing	Field management during construction, follow responsibilities, internal communication and support, strong profit motive, maintenance personnel work with construction crews, single manager-in-charge, safety awareness, minimize equipment problems, on-site engineers, commitment and cooperation of management and strong support and attention of management.	24
Controlling	Controlling costs and scope of construction, weekly follow-up, testing and modification of equipment, communication between shipper and receiver, coordinated relocation, cooperation between outside agents and management, cost and quality controls, attention to detail, and adherence to schedules.	<u>16</u>
	Private sector sub-total	120

Figure 2 shows the information concerning what can help make for successful facility start-up by a frequency histogram as taken from the summaries on pages 87 to 89. It can be seen that organizing effects are least important for both sectors. For the public sector, planning and controlling functions are considered more important than other functions. For the private sector, with the exception of the organizing

function, importance of planning through staffing, directing and controlling nearly follows a straight line downward, with controlling seen as least important.

FIGURE 2

PUBLIC VERSUS PRIVATE SECTOR RESPONSES
 CONCERNING FACTORS MAKING FOR
 SUCCESSFUL FACILITY START-UP



What Outside Variables Affect the Pre-Start-Up Phase?Public Sector

	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
Planning	Proper funding, interference by politicians, design changes during construction, contractor solvency, site restrictions by contractor, no-growth municipal attitude, enough time, local/state/federal requirements, site selection, joint municipal investment.	20
Organizing	Quality of maintenance and operating instructions.	1
Staffing	Attaining key personnel, free consultants, construction labor availability, donated outside services, and helpful outside persons.	6
Directing	Poor higher level coordination, and contractor responsiveness.	8
Controlling	Poor penalty clauses, lack of ready access, materials availability, poor construction/equipment quality, and cost escalation.	8
Not functional (Weather)		<u>1</u>
	Public sector sub-total	44

Private Sector

	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
Planning	Uncalled for government requirements, no time pressures, pre-planning of space, no union, licensor, local agency interference, right-to-work laws, poor equipment design, and planned schedules.	14
Organizing	Government Manuals	1
Staffing	Reliable service from local firms difficult to obtain, responsive	

Private Sector

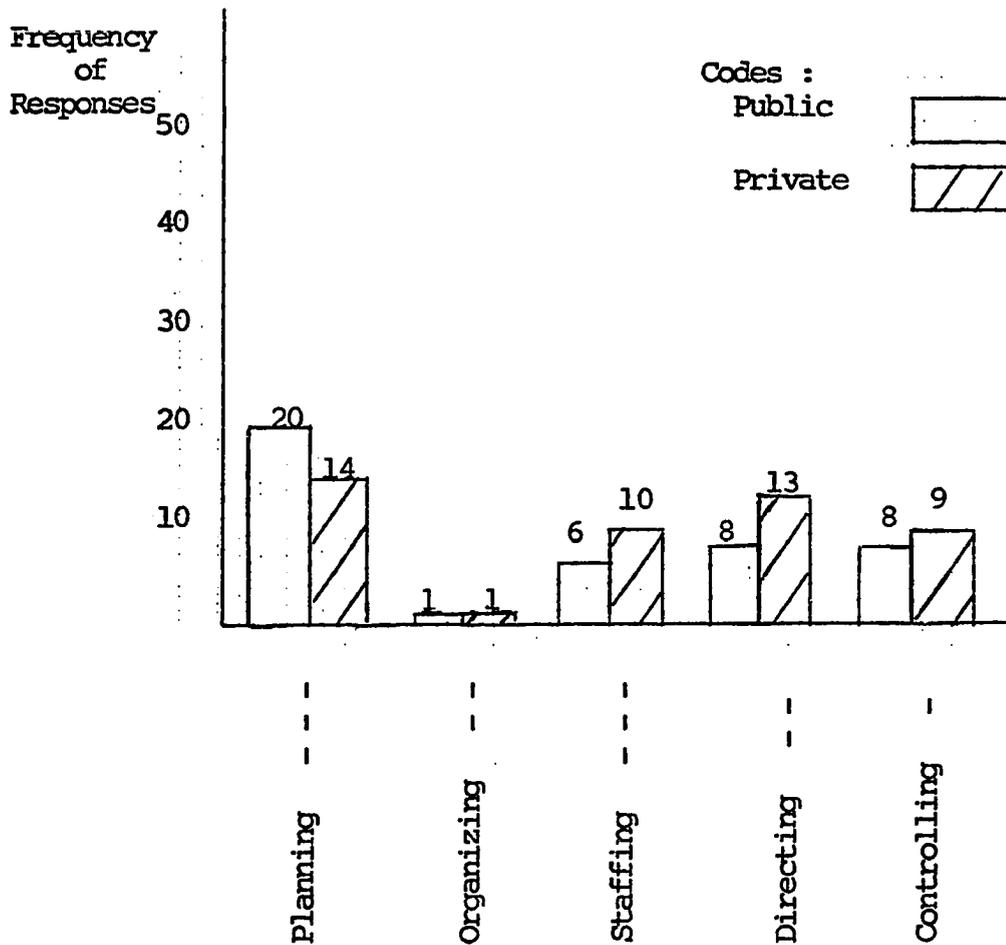
	<u>Paraphrased Consolidating Statement</u>	<u>Consolidated Frequency</u>
	contractors, government training grants, qualified consultants, and skilled local personnel.	10
Directing	Good construction manager, technical knowledge, cooperative area people, vendor deliveries.	13
Controlling	Adherence to schedules; supplies meeting specifications, dates and service.	9
Not Functional (Weather)		<u>3</u>
	Private sector sub-total	50

Figure 3 shows the information concerning what outside variables affecting the pre-start-up phase by a frequency histogram as taken from the previous summaries on pages 91 and 92. It can be seen that the weather is reported as a factor in both sectors and the organizing function is least important as affected by exogenous forces. For the public sector, planning is seen as easily the most important function affected. For the private sector there is similar effect upon the planning and directing functions, and the staffing and controlling functions are affected to a lesser degree.

When reviewing helps for successful facility start-up, heavy emphases by the public sector are given to planning and controlling activities and relationships, while the emphases in the private sector are in planning and staffing. A generally greater response rate was seen here from private sector officials. Most prevalent responses regarding the helps to facility start-up from the public sector are: complete plans, milestones and schedules (15); coordination between management

FIGURE 3

PUBLIC VERSUS PRIVATE SECTOR RESPONSES
 CONCERNING EXOGENOUS VARIABLES
 AFFECTING MANAGEMENT FUNCTIONS



and contractors (7); and previous similar experience (6). Most prevalent from the private sector are: scheduling and planning pre-start-up events (23); training (7); and support and attention of management (6). Here is seen the emphasis by both sectors on the importance comparatively of the planning function.

Review of the influence of outside variables on pre-start-up shows heavy emphasis by the public sector given to planning, with little effect in the organizing function, while the private sector sees

similar emphasis on all functions except organizing, which is low. It would be expected, perhaps, that since the organizing function is primarily concerned with structural effects and work assignment, that outside influences should be minimal. The light response rate on outside influences, other than that it might be expected to be light in volume of occurrence, may be explained by the fact that respondents tried to "say it all" on open-ended item number 1 of Part III, having to do with helps for successful start-up. Most prevalent responses from the public sector regarding outside influences are: contractor responsiveness on performance (5); and interference of federal compliance rules (4, mainly by mayors). Most prevalent from the private sector are supplies meeting requirements (6); cooperation of area people (5); construction schedule adherence (5); and vendor deliveries (5). No pattern is seen here to compare these higher frequency comments.

Attention is now given to the subject of recommendations.

Recommendations

The recommendations are stated in two parts: those appearing to be justified from the data of the study, and those concerned with possible future research.

Recommendations from the Study

Planning Function

1. Since many engineers have not had the advantage of having received training in the design and use of other energy systems than gas, mainly coal and oil, it is recommended:
 - a. That academic offerings be updated to provide the

necessary curricula required for current students in such systems. An example could be a course entitled "General Energy Systems."

- b. That seminars be provided under a continuing educational approach for graduate engineers. An example could be a seminar entitled "Updating of Energy Conversion Systems."
 - c. That current journals and periodicals within the field make a concerted effort to carry instructional articles concerning this subject matter. For example, a practical article entitled "General Energy Conversion Systems" could be written.
2. Site selection for the new facility can be a particular problem to smaller businesses and smaller-city officials, because of inappropriate and insufficient guidelines. The writer recommends that Small Business Administration (SBA) officials and/or other appropriate federal and state agencies, academic personnel from economics, management, marketing, and engineering provide publications, training, and seminars on this issue. The service could include supportive research guidelines of performance, and other assistance needed in selecting facility sites. From this should come more successful operations for profit and community service.
 3. Checklists of various sorts are recommended by the SBA for those starting business ventures. One respondent to the

instrument of this study recommended a planned checklist for management of pre-start-up events. The writer feels this is a good policy and recommends it as a general practice for private and public sector organizations planning new facilities. The General Services Administration (GSA) is the primary contributing agency to provide guidelines affecting federal construction. It is strongly recommended that GSA provide seminars for all federal engineers contemplating employment in pre-start-up activities as well as providing the appropriate information to enable the Civil Service Commission to set up continuing training programs aimed at the public sector overall.

4. Efficiency approaches such as methods study for improving manufacturing operations are equally applicable to those of service-type operations. Therefore, these methods applicable to manufacturing operations should also be applied in service-type operations as exemplified by the fast-food industry and real estate sales operations and their support. Plans for scheduling, procedural matters, priorities, and emphasis should be developed for all pre-start-up activities for any type operation including those of the public and private sectors or non-profit organizations.
5. Organizations engaging in pre-start-up activities should establish more effective methods for quantifying, ordering, and scheduling receipts of spares, tools, and initial

supplies. Improved systems in this area would assure a smoother start-up period and would support advance training of personnel, thus allowing slippages in parts of the schedules that would not cause overall time losses.

6. Arrangements should be provided in general contract wording to permit access to the facility by user personnel in the pre-start-up phase. Lack of full access, as reported in the response by representatives of both sectors, encourages oversights in requirements review and assessment of progress and quality of work by the contractor.
7. Contractors sometimes have problems in staying on schedule or meeting other requirements of contracts because of interference from workers, suppliers, and contractors. One means for encouraging improved performance is through the use of penalty clauses, as recommended by respondents and concurred in by this author. This writer acknowledges that penalty clauses may be difficult to design so that they are effective. In some cases stricter enforcement and closing loop-holes may help. But these clauses should be appropriate to the need and situation, and in all cases should be beneficial to the organization involved in managing pre-start-up activities.
8. In response to the instrument, private sector representatives affirmed that presence of unions or their absence did sometimes affect site selection. This writer believes that any advantage to the relocating private firm of lack of

union presence is very temporary, and that such inclination would need to be checked for impact by individual firms. This philosophy has tended to be proved wrong by those firms which have moved south to avoid union influence. The unions have simply moved with them after a very brief time-lag.

Organizing Function

9. Some organizations such as the U. S. Postal Service and General Motors Corporation provide handbooks or guidelines for important support or activity areas in the pre-start-up period. One cannot depend upon information of such importance to filter through the organizational structure to employees who have not had the advantage of earlier experience. Further, such reference information reinforces memory or is detailed enough to require discussion and specific instructions.
10. It may be feasible for organizations large enough to need the expertise, to appoint a "government affairs czar" to smooth the way and to adjust to various forms of government requirement. Such a person would deal with particular characteristics demanded in grants, location decisions, and specifications. This person would also deal with zoning requirements, ordinance exception requirements, and could be influential with access roads, rail right-of-ways, docking accommodations and other needs to accommodate flows.

11. It is recommended that contracts contain wording to encourage assignment of user operating and maintenance personnel to construction and equipment installation and testing activities during the pre-start-up period. This practice will enhance learning of equipment and operational considerations ahead of problems after the facility becomes operational. It will also allow time for the maintenance personnel to become comfortable with what will eventually be a prime support function.

Staffing Function

12. Both public and private sector respondents report assignment of a cadre or advance force by the user organization to the site during construction. Such a practice for facilities of any size is recommended by this writer. It is difficult to deal with design and other problems and decisions as they arise daily at arm's length of more than a few miles. Some organizations also authorize local approval of "avoid verbal order" type changes by engineers or other technical personnel on-site.
13. Managerial pay scales for contractors' staff members is not equitable as compared with those of hourly workers. This is part of a general trend which has been caused by differences in bargaining power and by across-the-board dollar amount raises rather than percentage increases. The result is compaction or even higher pay for hourly workers. When this is true, staff personnel tend toward instability

or marginal performance. An adjustment in pay scales may be warranted.

14. Early hiring, training, and placement of some operations and maintenance people were reported by both public and private sector respondents. For highly technological facilities these practices may be needed to get advanced equipment and systems knowledge, and should be considered by management in pre-start-up. Research and development personnel, engineering staffs, and manpower development staffs require total two-way communication processes prior to pre-start-up activities. It is too late for thinking about equipment knowledge and experience after the facility has been started-up.

Directing Function

15. Differences of opinion as to whether on-site management during pre-start-up is required, mean that organizations should be prepared to test the requirement throughout the period for optimal assignments and direction. Adjustments may be necessary due to contract developments or other changes. If contingency management theory and application is appropriate in every-day, on-line organizations, certainly a measure of flexibility is paramount in the pre-start-up period.
16. Reports of assistance from colleges, municipalities and other government sources are mentioned but not detailed by respondents of both the public and private sectors.

Since not everyone knows where or how to locate such free assistance, the writer recommends that organizations benefiting from such services develop compendiums of these for reference by others.

17. Top management support is felt by this writer to be essential for pre-start-up effectiveness, but it is mentioned by only one respondent of this study (representing the public sector). Means should be found for assuring such support so as to gain the emphasis, control, and coordination required for successful pre-start-up activities. Top management should state in advance its intended input to the pre-start-up phase, how it may be accessed by subordinates for assistance, and its strong interest in seeing the overall process be successful.

Controlling Function

18. Both public and private sector respondents reported little use of management information systems. This writer feels that organizations constructing new facilities of any size or scope would benefit greatly from such systems, even if needed by only parts of the on-site people. Maintenance, accounting, finance, and production departments are probable beneficial recipients of needed information and/or records that would be included in the system. However, one caution is shared with the reader:

MIS applications have been found to be extremely difficult to manage because of the broad range of

skills, knowledge and abilities required by the program manager. Such managers must be skilled in a broad range of functions so as to give appropriate attention to all needs.

19. Contingency funds control is greatly needed in the public sector. Amounts exceeding 25% are reported by 23% of such respondents in this study. The private sector experiences only 6% having overruns of 25% or greater. The writer recommends that laws/regulations applying to the public sector be passed or revised to incorporate requirements for justification of high overruns similar to that required for expanded budget needs. Public sector managers planning and administering pre-start-up planning need to know that they will be held accountable for excessive overruns.
20. Network scheduling techniques are not broadly used in the very organizations and companies which have large projects which could benefit in terms of schedules and cost control. No specific references are made to this type scheduling by respondents in this study to open-ended questions which might have elicited them. More network scheduling applications are felt to be justifiable. In line with item 19 above, this type of scheduling could reduce the volume of public sector overruns.
21. Minor use is reported by respondents of the public sector of shake-down tests and pilot plants, yet large industry has found these techniques to be practical. Perhaps more

justification could be found for this action in the public sector. However, current public sector funding procedures do not encourage such expenditures in budgeting processes.

Recommendations for Future Research

1. Methodologies generally applicable to management of pre-start-up events could be catalogued and published for those who may become involved to use as a reference. A smattering of such information already exists in the literature, but it is certainly not nearly complete.
2. Textbooks for use in higher education can and should be written. They could include theories by subject matter and phase of pre-start-up, applications, research reports and results, guidance, and methodology. The time period of concern could be expanded to include early post-start-up.
3. Specific sub-phases of the pre-start-up management of facilities provision could be researched and published in appropriate journals, encouraging attention and replication by others. For example, sub-phases might include: design, major construction, equipment installation, logistics, and de-bugging and/or completion groupings.
4. Part II of the instrument of this study, involving attitudes of pre-start-up respondents pertaining to the planning, organizing, staffing, directing and controlling functions of management could be replicated in one or more of these ways:

- a. Use different questions and make a comparison with results of this study. An attempt could be made to make it more a matter of opinion/attitude. A few respondents criticized items of Part II because they seemed to call for a statement of fact rather than an expression of attitude.
 - b. Research facility expansions, modifications, and rearrangements for comparison. This study has been concerned only with new facilities.
 - c. Research other government areas such as the judicial and legislative branch organizations, and other private sector groupings, such as the "Fortune 500," and make a comparison.
5. Such a study as this could be performed, in terms of facility cost intervals of more than just two intervals, e. g. \$0 to \$5 million, over \$5 million to \$10 million, over \$10 million to \$25 million, and upwards for additional ranges. The χ^2 model is effective for more than just 2 X k arrays. Some differences might be found which do not evidence themselves with 2 X k arrays.
6. In a study similar to this one, if replicated, the author recommends getting answers to these questions:
 - a. Will you explain how contingency fund allowances are established, applied, and administered? An open-ended response to this could give definite clues as to reasons for differences in amounts

experienced, and the possibility of development of better controls on amounts.

- b. Will you explain cases wherein skill training for new employees was not viewed by you as being applicable? An open-ended response here could give interpretation and evaluation to the original response of "Not Applicable."
 - c. Why were your employees not permitted access, if your answer to this item was "No"? An open-ended answer to this could result in more specifics on whether solutions are indicated, or even if any action is needed.
7. Some references by small-town mayors to unreasonable or stiff requirements by federal agencies suggest that there may be a need to have general guideline information furnished in advance by these agencies. The current procedures allow too many ex post facto decisions. Knowledge of what to expect along the way can at least mollify city officials who are working for and with grants or matching funds and the like.
 8. A research project needs to be done in the area of public sector cost overruns to determine causes and ways to reduce them.
 9. A research project could be accomplished in order to discern whether manpower development personnel are in concert with the engineering staffs for training needs.

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APPENDIX 1

THE POPULATION, CODING, AND SAMPLING
OF THE STUDY

APPENDIX 1

THE POPULATION, CODING, AND SAMPLING OF THE STUDY

The Population

Population from which Data was Drawn

The two basic overall groupings from which data was drawn are organizations of the public and private sectors in the United States. In the public sector, those of the federal executive, state, and city establishments were accessed, for the reason that these would be fairly autonomous in budgeting as are most industrial firms. Counties were not included based upon their data being believed similar to that obtainable from cities and states. In the private sector, only organizations having no listed superior were addressed: again, these should have had autonomous budget control.

General Mailing

There were 234 general mailing addressees which were government related, and 234 of industry. These were made up as follows:

Government

6 State offices, addressed to secretaries of state, two

in each of three regional parts of the United States: Northeastern, above the "Mason-Dixon" line and east of the Mississippi River; Southeastern, old states of the "Confederacy"; and Western, all states west of the first two regions. States were selected from these by drawing numbers. Mailings were to capital cities.

38 Federal organizations of the executive branch.⁷⁵ After determining how many pages needed to be traversed with each selection to obtain 38, a starting point was randomly chosen from the first group of pages. Then the next, and the next, and continuing were chosen to the point of reaching the sub-total. Wherein a header referring to an organization was not found on the designated page, the very next page that did contain such a header was chosen.

190 Mayors.⁷⁶ Here, the number of such in each of the fifty states was obtained by proportion of city populations in the state ratioed to the total of such nationally, except that for sparsely populated states, at least one city was picked. The starting place was determined in each case by successive coin flips, then successive cities at the arithmetic intervals necessary to obtain the desired
 _____ number in each state.

234 -----Total for government.

⁷⁵ United States Government Manual.

⁷⁶ The Municipal Yearbook.

Industry

234 Companies not subordinated to other companies.⁷⁷ The starting place was determined randomly from the first set of pages by coin-flip, taking the first item appearing on that page. Then moving successively through the reference by number of pages needed to obtain the total, companies were picked.

Population Responding

Including five government and three industry pre-test questionnaires completed, and general mailouts made August 29, 1977 which got "full" response from 45 government employees and 48 industry employees, 101 full responses were gained. (By "full" is meant that only occasional failures to respond to individual questions were found on such completed questionnaires.) Thirty-two of government and 14 of industry responded but showed no experience (a few of these just asked to be excused.) Three government and thirty-two of industry mailings could not be delivered by the U. S. Postal Service; the former possibly were due to organization changes, and the latter to mergers, business failures, or other unknowns. A summary follows:

Full Responses

5 Government pre-test (4 federal and 1 city mayor)	
2 States	
13 Federal	
<u>30</u> Mayors	Government total-----50

⁷⁷ Directory of Intercorporate Ownership, Volume 2.

Full Responses (continued)

3 Industry pre-test	
<u>48</u> Industry, general mailing	
	Industry total----- <u>51</u>
	Full Response total--101.

No Experience

32 Government	
<u>14</u> Industry	
	Total, no experience----- <u>46</u>
	Total Responding-----147.

Including the 468 general mailings and ten pre-test mailings, but disallowing the 35 not delivered by the U. S. Postal Service, a response rate of over 33% was gotten, $\frac{147}{468 + 10 - 35}$. This was of

its final magnitude due to approximately fifty follow-up toll telephone calls, followed by mailings, and an additional 25 questionnaires re-mailed to geographical locations previously addressed by not responding initially. Prior to this follow up effort, only about 55 full responses had been received (as of approximately October 2, 1977). Within three weeks, the current level of full responses was reached (about October 25, 1977). No more have come in since the latter date.

Coding of AddresseesGovernment

On the face of the questionnaire, these codes were placed:

G001 to G006 -- State Office
 G007 to G044 -- Federal Offices
 G045 to G234 -- Mayors
 GP03, 04, 07, 08, and 09 -- Pre-Test.

Industry

On the face of the questionnaire, these codes were placed:

I001 to I234 -- Industrial firms.

IP01, 02, 05, 06, and 10 -- Pre-test.

A few respondents in the industrial group "volunteered" or masked-out their codes. The volunteers (there were two) apparently wanted to assure anonymity. (There were three of these.)

Wherever possible, original coding is preserved.

Geographical Dispersion of Respondent PopulationFull Responses50 Government Responses

States (2) -- Delaware and Vermont.

Federal (17) -- Washington, D. C. (13), Georgia (2), and Texas (2).

Cities (31) -- in states of Arkansas (1), California (1), Colorado (1), Connecticut (1), Florida (1), Georgia (1), Illinois (2), Indiana (1), Massachusetts (2), Michigan (2), Mississippi (1), Missouri (1), Nebraska (1), Nevada (1), New Jersey (1), New Mexico (1), New York (2), Ohio (1), Oklahoma (1), Oregon (1), Pennsylvania (1), South Carolina (1), Texas (3), Washington (1), and Wisconsin (1).

51 Industrial Responses

From States of Arkansas (1), California (5), Connecticut (2), Georgia (1), Illinois (7), Kansas (1), Maine (1), Maryland (1), Massachusetts (5), Michigan (4), Minnesota (1), Missouri (1), Nevada (1), New Jersey (2), New York (4), North Carolina (1), Ohio (1), Oklahoma (3), Pennsylvania (1), Texas (3), Utah (1), Washington (1), and Wisconsin (3).

Responses Showing No Experience, or Refusals32 Government Responses

States (4) -- Alabama, Arkansas, Idaho, and Nevada.

Responses Showing No Experience, or Refusals (continued)32 Government Responses (continued)

Federal (6) — Washington, D. C. (3), Illinois (1), Massachusetts (1), and Virginia (1).

Cities (22) — in states of California (2), Colorado (1), Iowa (1), Kentucky (1), Louisiana (1), Massachusetts (2), Michigan (1), Minnesota (1), New Jersey (1), New York (4), North Carolina (1), Pennsylvania (3), Virginia (2), and Washington (1).

14 Industry Responses

From states of California (3), Florida (1), Georgia (1), Idaho (1), Illinois (2), Maryland (2), New York (1), North Carolina (1), Ohio (1), and South Carolina (1).

All Responses: Full, No Experience, or Refusals82 Government Responses

States (6) — Alabama, Arkansas, Delaware, Idaho, Nevada, and Vermont.

Federal (23) — Washington, D. C. (16), Georgia (2), Illinois (1), Massachusetts (1), Texas (2), and Virginia (1).

Cities (53) — in states of Arkansas (1), California (3), Colorado (2), Connecticut (1), Florida (1), Georgia (1), Illinois (2), Indiana (1), Iowa (1), Kentucky (1), Louisiana (1), Massachusetts (4), Michigan (3), Minnesota (1), Mississippi (1), Missouri (1), Nebraska (1), Nevada (1), New Jersey (2), New Mexico (1), New York (6), North Carolina (1), Ohio (1), Oklahoma (1), Oregon (1), Pennsylvania (4), South Carolina (1), Texas (3), Virginia (2), Washington (2), and Wisconsin (1).

65 Industrial Responses

From states of Arkansas (1), California (8), Connecticut (2), Florida (1), Georgia (2), Idaho (1), Illinois (9), Kansas (1), Maine (1), Maryland (3), Massachusetts (5), Michigan (4), Minnesota (1), Missouri (1), Nevada (1), New Jersey (2), New York (5), North Carolina (2), Ohio (2), Oklahoma (3), Pennsylvania (1), South Carolina (1), Texas (3), Utah (1), Washington (1), and Wisconsin (3).

Comment on Geographical DispersionGovernment

Geographical dispersion was obtained in state replies: all six of the selected states responded.

Federal respondents would be expected to be mainly from their Washington, D. C. headquarters. There were 16 of these, and seven from elsewhere.

Cities responding were widely dispersed. Of the 53 respondents, 31 states were represented, and were scattered through the three regional areas: Northeast (12), Southeast (11), and West (8). Of the states not represented in these, 13 of the 19 had only one city mayor sent a questionnaire, and of the remaining six, Alabama had two, Rhode Island had two, and Tennessee had three original questionnaire mailings. Follow-ups to many of the mayors in the latter 19 states were made by telephone and repeat mailings of questionnaires with personal, handwritten notes attached. See Appendix 2.

Some bias as to location is contained in the federal respondents. Some bias as to location is contained because of non-responding cities in 19 of the 50 states.

Industry

Geographical dispersion of firms responding corresponds somewhat to known industrial states such as California, Illinois, Massachusetts, Michigan, New York, and

others. The three geographical regions are represented in some balance, but biased toward the northeast region, as follows:

Northeast: 12 states

Southeast: Seven states

West: Seven states.

In sampling from the referenced source,⁷⁸ companies were not obtained for mailings in fifteen of the fifty states. Nine states having companies sent mailings were followed-up, but did not reply.

Sampling Design of the Study

General Mailing

The sampling design of the study, because means of population and sample parameters are not employed in the χ^2 test for independence, was that of viewing respondent size groups as though all responses are dichotomous. The number of survey instruments mailed, 234 public and 234 private sector questionnaires, was determined as follows:

An error rate of .125 to .200 is believed to be in the range of acceptance for research studies seen by the writer. Each of the five management functions was tested with three questions. Agreement or disagreement within a management function concerning the respective hypotheses was viewed from results of at least two-out-of-three of the sets of responses to questions. With a permissible error of

⁷⁸
Ibid.

$$e = \sqrt{pq/n}$$

where e is error rate, p is proportion of like answers to one type of question in a sample, q is proportion of contrary answers, and n is the number responding after inapplicable responses such as "I do not know" are discarded.

The required sample size can be determined by solving for n to obtain

$$n = pq/e^2.$$

The required sample size for a .125 error rate ranges from 1 to 16 as shown by

(1) Wherein $p = .01$ and $q = .99$ (or their reverse):

$$n = (.01)(.99)/(.125)^2 = 1.$$

(2) Wherein $p = .50$ and $q = .50$:

$$n = (.50)(.50)/(.125)^2 = 16.$$

In a case of less than 16 responses of a type under comparison for validating a hypothesis, a check of required sample size versus the number responding when considering the experienced p and q values may represent an error rate between .125 and .200. For example:

Experience $n = 11$,

$p = .40$, and

$q = .60$.

$$\text{Required } n = (.40)(.60)/(.125) = 16.$$

Since experienced $n < \text{required } n$ ($11 < 16$), the error rate would lie between .125 and .200. (Highest n for $e = .200$ is 6 or 7.)

Table XIV shows varying p and q with resulting n -values when

TABLE XIV

RESPONSE SIZES FOR VARYING p or q VALUES, ERROR RATE = .125

<u>Observed p or q Value</u>	<u>Minimum n-Value</u>	<u>Observed p or q Value</u>	<u>Minimum n-Value</u>
.01	1	.26	12
.02	1	.27	13
.03	2	.28	13
.04	2	.29	13
.05	3	.30	13
.06	3	.31	14
.07	4	.32	14
.08	4	.33	14
.09	5	.34	14
.10	6	.35	15
.11	6	.36	15
.12	7	.37	15
.13	7	.38	15
.14	8	.39	15
.15	8	.40	15
.16	9	.41	15
.17	9	.42	15
.18	9	.43	16
.19	10	.44	16
.20	10	.45	16
.21	11	.46	16
.22	11	.47	16
.23	11	.48	16
.24	12	.49	16
.25	12	.50	16

$e = .125$. Responses 16 or greater in number will always be applicable for the permissible error rate $\leq .125$. Lesser numbers would be acceptable if 6 or greater in number for error rates up to .200. {A denominator of $e^2 = (.200)^2$ is productive of a smaller n-size.} But the error rate of .125 was used in determining mail-out size for this study, as described below.

1. A response rate of 40% was planned to be sought, though not quite realized in the study. Telephone contacts and remailings were to be used for follow-up.

2. Sixteen useable responses to each question for the narrative hypotheses were considered to be desirable to assure that any proportionate response may be evaluated with a maximum error rate of .125.

3. Mailout quantity, then, for each hypothesis' requirement is:

- a. Hypothesis 1. Concerns all respondents grouped as either having facility costs under \$10 million or of \$10 million or greater. Assume the ratio of these two groups to be 25% in the higher value category, and 80% giving dichotomous responses:

$$\frac{16}{.25(\text{ratio}) \times .8(\text{Dichotomous}) \times .4(\text{Response})} = 313, \text{ split}$$

equally to public and private sectors.

- b. Hypothesis 2. Concerns all public sector versus all private sector responses. If the mailout to satisfy hypothesis 1. is split equally, there are:

$$156 \times .4 \times .8 = 50 \text{ useable responses of each type.}$$

- c. Hypotheses 3. and 4. Concerns either comparison of

public and private sector responses valuing facilities under \$10 million, or \$10 million and greater. Assume that of the 313 mailouts of Hypotheses 1. and 2. that 22% of both public and private respondents had either start-up costs under \$10 million or the reverse, then:

$$156 \times .22 \times .4 \times .8 = 10.67 \text{ useable responses.}$$

If the mailout ratio is in terms of the desired sixteen useable ratios, each of the public and private sectors would be sent:

$$16/10.67 \times 156 = 234 \text{ questionnaires.}$$

All hypotheses response patterns would be satisfied by c., above. See Table XV for a mailout summary.

TABLE XV
MAILOUT SUMMARY

	<u>Item</u>	<u>Population</u>	<u>Mailout Quantity</u>
Public Sector:	States	50	6
	Cities over 2500	Approximately 12000	190
	Federal	Approximately <u>400</u>	<u>38</u>
	Totals-12450	- - -	234
Private Sector:	Major independent corporations	Approximately 11000	234

NOTE: The mailout sizes for the public sector were based upon the following:

Representativeness was sought geographically. This could not be done for federal organizations, since all but a few are headquartered in Washington, D. C. For the 50 states, they were to be represented by mailouts to at least one in each of three United States areas: Northeastern, Southeastern, and Western as described on pages 113 and 114. Two of each were selected. For the cities, at least one was to be picked from each state, but in proportion to approximately 100 million people in the United States cities of size 2500 or more, as related to the same for the respective states. When these were added, a city requirement of 190 was obtained. (This is further explained on page 114.) Thus, subtracting the (190 + 6) from the 234 total public requirement, yielded 38 federal organizations. Random selections were made on all.

Pre-Test

Prior to the general mailing, ten questionnaires were mailed to persons (five of each sector) who were known to the writer, or who had been referred by others. All were contacted and agreed to respond. Five of the public sector and three of the private sector did respond. Repeated contact by telephone to the other two did not get responses. After minor changes in the questionnaire and re-mailing to these eight, their responses were useable, and the general mailing was made. The responses from all were then combined.

The changes necessary to accommodate the pre-test responses to those which would be achieved with the revised questionnaire were:

Part I

Question 2, respondents were asked to show dollar amount of facility cost.

Question 6, the management information system was specified as "formal."

Question 7, training was to be in terms of "most" new employees.

Question 10, added.

Part II

No change.

Part III

Change wording of Question 1 to emphasize feelings as to what key factors contributed most to any successful facility start-up.

APPENDIX 2

COVER LETTERS, PERSONAL NOTES,
AND CONTACT INFORMATION

APPENDIX 2

COVER LETTERS, PERSONAL NOTES, AND CONTACT INFORMATION

Questionnaires were mailed to pre-test respondents with brief notes, referring to previous telephone contacts. On re-mailing with changes as listed in Appendix 1, again the mailing was preceded by telephone calls, and cover notes relating to the calls, with brief reference to the desired emphasis for the changes.

Questionnaires when mailed to general addressees had letters shown by Figures 4 and 5 covering them. Follow-up notes were of the type shown in Figures 6 and 7. Greeting lines, as appropriate were similar to those shown in Figure 8.

When it was decided that general mailing responses needed augmentation, geographic voids were checked and included, and contacts were made with approximately 50 people, most of whom had names known to the writer. These were followed with re-mailings. Another 25 whose names were not known, but in geographically void areas were also mailed. Approximately 40 new responses were obtained from these 75 contacts and re-mailings.

FIGURE 4

TYPICAL LETTER COVERING QUESTIONNAIRES
TO PUBLIC SECTOR

Business Division
Northeastern Oklahoma State University
August 29, 1977

(Note: Printed on
University
Letterhead
Stationary.)

(Greeting here)

I am interested in the improvement of the management of events preceding start-up of new facilities. Because of your organization's position in government, you have been selected to assist in a study concerning this matter. As a professional, I am sure that you will be interested in the study since its purpose is to reduce problems associated with pre-start-up management for managers in the future.

I am a Management instructor for a university and this subject is the topic of a research project on which I am working. A literature review has revealed very little information in this area. Thus your organization's assistance is needed in order to establish a data base from which to draw relationships, and to satisfy managerial need for practical aids in such projects.

If you will complete the enclosed questionnaire or pass it on to one of your managers or staff who has been directly involved in the events preceding a new facility start-up, then the expressed knowledge and experience will add much to my analysis. There is a return addressed envelope enclosed.

I assure you that your identity and that of your organization will not be disclosed in any manner. The coding on the questionnaire is for my control only. If you want a copy of the results, please have the place provided in the body of the questionnaire checked.

I will appreciate any response you can give.

Sincerely,

(Signature here)

Norris A. Griffith

Enclosure (See page 1 of the questionnaire for definitions.)

FIGURE 5

TYPICAL LETTER COVERING QUESTIONNAIRES
TO PRIVATE SECTOR

Business Division
Northeastern Oklahoma State University
August 29, 1977

(Note: Printed on
University
Letterhead
Stationary.)

(Greeting here)

I am interested in the improvement of the management of events preceding start-up of new facilities. Because of your organization's position in industry, you have been selected to assist in a study concerning this matter. As a professional, I am sure that you will be interested in the study since its purpose is to reduce problems associated with pre-start-up management for managers in the future.

I am a Management instructor for a university and this subject is the topic of a research project on which I am working. A literature review has revealed very little information in this area. Thus your firm's assistance is needed in order to establish a data base from which to draw relationships, and to satisfy managerial need for practical aids in such projects.

If you will complete the enclosed questionnaire or pass it on to one of your managers or staff who has been directly involved in the events preceding a new facility start-up, then the expressed knowledge and experience will add much to my analysis. There is a return addressed envelope enclosed.

I assure you that your identity and that of your firm will not be disclosed in any manner. The coding on the questionnaire is for my control only. If you want a copy of the results, please have the place provided in the body of the questionnaire checked.

I will appreciate any response you can give.

Sincerely,

(Signature here)

Norris A. Griffith

Enclosure (See page 1 of the questionnaire for definitions.)

FIGURE 6

TYPICAL FOLLOW-UP BY HANDWRITTEN NOTE TO INDIVIDUALS
PREVIOUSLY CONTACTED BY TELEPHONE

(Date)
Business Division
Northeastern Okla. State Univ.
Tahlequah, OK 74464

Mr. (Name), President (or Director, etc.)
(Organization and address, or home address)

Dear Mr. (Name)

When I spoke with you on (date) you said that you had not seen the original questionnaire and cover letter which I sent August 29. I am therefore mailing another copy as you asked, with a return envelope. The study should help those managing events preceding new facilities' start-up in the future. I hope you will respond quickly so that I may include it in this formal study. Your name was selected from a broad list of companies to obtain pertinent total data.

I will appreciate your spending valuable time for this purpose. Someone with experience in your employ could respond for you.

Sincerely,

(Signed)
Norris A. Griffith
Assistant Professor of Management

FIGURE 7

TYPICAL FOLLOW-UP BY HANDWRITTEN NOTE TO INDIVIDUALS
NOT REACHED PREVIOUSLY BY TELEPHONE

(Date)
Business Division
Northeastern Okla. State Univ.
Tahlequah, OK 74464

(Address)

Dear Mr. (or Mrs.)—(Name)

On August 29, 1977, I mailed a questionnaire and cover letter to your (office or address). The questionnaire purpose is to do a formal study of management methods and problems during the period preceding start-up of new facilities. I hope the study will be of much value to management personnel who will be engaged in such activity in the future. Your (name, organization) was selected as one of a broad group of (firms, organizations) to obtain pertinent total information. I need you to complete the questionnaire and send it back as quickly as possible in the enclosed, self-addressed envelope.

Here is another copy of the questionnaire and the mailing envelope. As you can see, I am writing this to you on a copy of the original cover letter mailed to (heads of industry, mayors, etc.)

I will appreciate your spending your valuable time for this purpose.

Sincerely,

(Signed)
Norris A. Griffith
Assistant Professor of Management

FIGURE 8

TYPICAL ADDRESS OR GREETING LINES FOR COVER LETTERS
AND FOLLOW-UP NOTES

1. Public Sector

(a) Cities

Mr. or Mrs. (Name), Mayor -- wherein individual is known.
Office of the mayor -- wherein individual is not known.

(b) States

Office of the Secretary of State (in the capital city).

(c) Federal administrative office

Mr. (Name), Director, or
Administrator,
Commander, and
Chief executive or other as known.

2. Private Sector

Chief Executive, or

Mr. (or Mrs.) -- (Name) where name is known.

APPENDIX 3

BIAS OF QUESTIONNAIRE PART I RESPONSES

APPENDIX 3

BIAS OF QUESTIONNAIRE PART I RESPONSES

The questions of Part I of the questionnaire are demographic in nature, and were used to show characteristics of respondees, as well as to enable groupings of data for testing the narrative hypotheses. Just how comparable are respondents of public and private sectors as seen in the full responses obtained?

Because of the 2 X k arrays which can be associated with this data, a χ^2 test for independence was run, similar to that described for dealing with the narrative hypotheses of the body of the study. The rows are always 2 (public versus private sectors), and the number of columns vary with the number of answer-types possible on each of the questions of Part I of the instrument. A null hypothesis can be stated in each case to the effect that the public sector respondents' data is no different than the private sector respondents' data with respect to the subject matter of each of these questions. Exceptions not included in this treatment would be question (3), since this merely confirms whether respondent is from the public or private sector; and question (10), which had to do with overall organization size, and which was not responded to consistent with real size appropriate in at least one overriding case.

Degrees of freedom vary, thus χ^2 values from Table II are appropriate, as applicable at $P = .05$ (95% confidence level).

Question (1) Has your firm effected a facility start-up
(select most current):

	<u>Frequencies of Response by Those of:</u>					
	<u>Prior to 1965</u>	<u>1965- 1969</u>	<u>1970- Present</u>	<u>None of These</u>	<u>Other</u>	<u>Blank</u>
Public sector	2	3	45	0	0	0
Private sector	2	2	47	0	0	0

D. F. = 5; tabular $\chi^2 = 11.070$;
calculated $\chi^2 = 0.234$; null not rejected.

Question (2) Was the facility cost:

	<u>Frequencies of Response by Those of:</u>			
	<u>> \$10 Million</u>	<u>< \$10 Million</u>	<u>Other</u>	<u>Blank</u>
Public sector	7	42	0	1
Private sector	13	38	0	0

D. F. = 3; tabular $\chi^2 = 7.815$
calculated $\chi^2 = 2.990$; null not rejected.

Question (2) If facility cost was > \$10 Million, what was the
range:

	<u>Frequencies of Response by Those of:</u>						
	<u>\$10MM but < \$20MM</u>	<u>\$20MM but < \$40MM</u>	<u>\$40MM but < \$60MM</u>	<u>\$60MM but < \$100MM</u>	<u>> \$100MM</u>	<u>Other</u>	<u>Blank</u>
Public sector	3	1	2	0	1	0	43
Private sector	3	1	0	2	4	0	41

D. F. = 6; tabular $\chi^2 = 12.592$;
calculated $\chi^2 = 5.838$; null not rejected.

Question (4) Design of the new facility was mainly performed by:

Frequencies of Response by Those of:

	<u>Our Firm or Management</u>	<u>Contract</u>	<u>Other</u>	<u>Statement</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	10	36	2	2	0	0
Private sector	13	26	6	6	0	0

D. F. = 5; tabular $\chi^2 = 11.070$;
calculated $\chi^2 = 5.995$; null not rejected.

Question (5) Construction and installation funds included contingency amounts of:

Frequencies of Response by Those of:

	<u>50% or ></u>	<u>25%- 50%</u>	<u>10%- 25%</u>	<u>10% None</u>	<u>None</u>	<u>Statement</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	5	6	14	19	4	0	0	2
Private sector	2	1	25	20	1	1	0	1

D. F. = 7; tabular $\chi^2 = 14.067$;
calculated $\chi^2 = 11.110$; null not rejected.

Question (6) Firm had a formal management information system in use during pre-start-up concerning the new facility, designed to assist:

Frequencies of Response by Those of:

	<u>Yes</u>	<u>No</u>	<u>Do not Know</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	17	30	3	0	0
Private sector	21	27	3	0	0

D. F. = 4; tabular $\chi^2 = 9.488$;
calculated $\chi^2 = 0.569$; null not rejected.

Question (7) Skills training programs for most new employees in advance of start-up:

Frequencies of Response by Those of:

	<u>Yes</u>	<u>No</u>	<u>Do not Know</u>	<u>Other N/A</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	33	8	0	9	0	0
Private sector	35	8	1	7	0	0

D. F. = 5; tabular $\chi^2 = 11.070$;
calculated $\chi^2 = 1.299$; null not rejected.

Question (8) The facility had an employment at start-up of:

Frequencies of Response by Those of:

	<u>100</u>	<u>100- 499</u>	<u>500- 999</u>	<u>1000 or more</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	37	5	4	4	0	0
Private sector	24	23	2	1	0	1

D. F. = 5; tabular $\chi^2 = 11.070$;
calculated $\chi^2 = 17.800$; null REJECTED.

Question (9) Did employees have access to facility prior to start-up:

Frequencies of Response by Those of:

	<u>Yes</u>	<u>No</u>	<u>Do not Know</u>	<u>Other Data</u>	<u>Blank</u>
Public sector	29	19	2	0	0
Private sector	37	13	1	0	0

D. F. = 4; tabular $\chi^2 = 9.488$;
calculated $\chi^2 = 2.418$; null not rejected.

Only in one of the nine is seen the rejection of the null: employment at start-up of the new facilities of the public sector was significantly different at the 95% confidence level in comparison with that of the private sector. Public sector employment figures were basically smaller. This could be due to the 190 cities in the public sector sample, which to a large degree were small in size, just having to be over 2500 population to have been chosen. The criterion for private corporations was only that they not be subordinate to other corporations. But all-in-all, there appears to be a minor bias in the samples taken.

APPENDIX 4

CODED GOVERNMENT AND INDUSTRIAL RESPONSES
TO PART III OF THE QUESTIONNAIRE

APPENDIX 4

CODED GOVERNMENT AND INDUSTRIAL RESPONSES TO PART III OF THE QUESTIONNAIRE

Contained herein are Tables XVI-XXI which list paraphrased, coded responses to the "open-ended" questions of Part III of the questionnaire. Question wording on each table is furnished for reference purposes. At the bottom of Table XVI, the code pattern used in all six of the government and industry listings in the tables is shown. Code parts do not agree unless there is exact correspondence of wording and meaning in the respective data. The left-most code (alpha character or blank) agrees between the two sets of listings — Tables XVI, XVII and XVIII for government and Tables XIX, XX and XXI respectively for industry if there is commonality of subject or idea being expressed by the two types of respondents. Some comments are paraphrased for consistency in wording.

Data as summarized by frequency in computer processing applications are appropriate for Chapter IV, Findings. Some of the material resulting is also a basis for comments contained in Chapter V, Summary and Conclusions, and Recommendations.

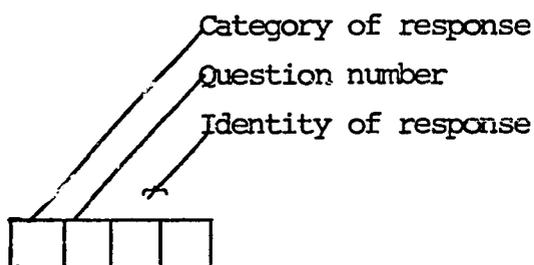
TABLE XVI

GOVERNMENT RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 1., CODING

The Question: If you feel that you had a successful facility start-up, what do you think were the key factors which contributed most to its success? (Responses listed are paraphrased as necessary for consistency.)

<u>Code</u>	<u>Response</u>
A101	No response or did not respond to the question asked.
B102	Full time management participants in pre-start-up.
C107	Use of contractor penalty clauses.
D109	Advance training.
E112	Accurate manning.
F114	Equipment capability knowledge.
G115	Involvement by line supervisors in pre-start-up.
H116	Complete plans, milestone controls and schedules.
I121	Shake-down tests.
K123	Previous similar experience.
L126	Input of requirements data by intended users.
M127	Coordination between user management and contractor and/or architect.
N128	Adequate maintenance and operations manuals and data.
Ø129	Spare parts inventory for operating equipment.
P130	Strong top management support.
Q134	Flexibility of start-up staff.
R136	Free consultants from local college.
S137	Municipal committee for site selection.
T139	Backing of Chamber of Commerce or municipality.
U143	Qualified architect.
V145	Federal government guidelines governing Military Construction Projects.

Code:



Special Characters:

- Ø = Alphabetic letter
- 0 = Numeric (zero)
- ∅ = Blank

TABLE XVII

GOVERNMENT RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 2., CODING

The Question: What variables from outside the firm do you feel affected the results of the pre-start-up phase? (Responses are paraphrased as necessary for consistency.)

<u>Code</u>	<u>Response</u>
A201	No response or did not respond to the question asked.
B202	Federal compliance rules by funding agency interfered.
C204	Requirements of state and local governments interfered.
D206	Strike delays.
E207	Poor penalty clauses.
F208	Weather.
G209	User personnel not free to access facility during pre-start-up to make known needed modifications prior to general contract completion.
H210	Contractor responsiveness on construction deficiencies and/or general performance.
I211	Poor higher level coordination.
J212	Proper funding.
K213	Site selection.
L214	Materials availability.
M217	Interference by politicians.
N218	Helpful attributes of designers, consultants, or general contractor.
Ø222	Poor construction or equipment quality.
P224	Quality of maintenance and operating instructions.
Q225	Attaining key start-up personnel.
R226	Design changes during construction.
S227	Cost escalation during construction.
T228	Contractor solvency problems during construction.
U229	Site restrictions by the contractor.
V230	Free consultants arranged by local college.
W231	No-growth attitude in municipality.
X232	Funding in municipality.
Y233	Enough time.
Z236	Problems in a joint investment with another municipality.

TABLE XVIII

GOVERNMENT RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 3., CODING

The Question: Please use this space to provide any further comments you have regarding pre-start-up matters. (Responses are paraphrased as necessary for consistency. Not so many responses were given to this open-ended question.)

<u>Code</u>	<u>Response</u>
A301	No response or did not respond to the question asked.
B302	Recommend less federal agency requirements and controls.
C303	Need planning and scheduling by user management.
D305	Need to consider requirements of people, such as transportation, eating facilities and training.
E306	Plan for delays and deadlines and have contingencies such as alternate, temporary facility in mind.
F307	Use of a general checklist.
G308	Part of site selection decision is influenced by availability of construction labor.
H309	Donated or low cost services by individuals serving municipalities very helpful.
I310	No problems encountered.
J311	Knowledgeable people important.
K314	Schedule of pre-testing needed.

TABLE XIX

INDUSTRIAL RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 1., CODING

The Question: If you feel that you had a successful facility start-up, what do you think were the key factors which contributed most to its success? (Responses are paraphrased for consistency.)

<u>Code</u>	<u>Response</u>
Al01	No response or did not respond to the question asked.
B103	Attention to detail by pre-start-up personnel.
B104	Full time responsibility of one company manager in charge.
B105	On site engineers during construction.
B106	Field management in-place during construction.
C108	Tight cost and scope controls during construction.
D110	Training of maintenance and operations personnel prior to start-up.
D111	Training of managers.
E113	Filling vacancies with right selections, even if delayed.
H117	Scheduling and planning of pre-start-up events.
H118	Complete specifications.
H119	Weekly follow-up.
H120	Follow-through on job responsibilities.
I122	Testing and modification of equipment.
K124	Training and experience of managers in similar existing facilities.
K125	Pilot plant experience.
Pl31	Internal communication and support.
Pl32	Commitment and cooperation of management.
Pl33	Strong support and attention of management.
Ql35	High caliber department managers and supervisors.
Sl38	Site choice and analysis.
Tl40	Community support.
Tl41	Cooperation of government industrial development agencies.
Tl42	Rapport with local government, business, and financial leaders.
Ul44	Excellence of consultant architect/engineer/contractor.
Vl46	Cost and quality controls.
Wl47	Communication between shipper and receiver.
Wl48	Clear assignment of responsibility and authority.
Yl49	Contractual outside maintenance support.
Zl50	Start-up production goals definition.
Øl51	Coordinated relocation.

TABLE XIX (Continued)

<u>Code</u>	<u>Response</u>
Ø152	Preplanned department locations and interrelations.
Ø153	No union.
Ø154	Technology transfer (licensed).
Ø155	Strong profit motive.
Ø156	Competent local people.
Ø157	Promoting of managers from within.
Ø158	Maintenance personnel work with construction crews.
Ø159	Planned sequencing for start-up of equipment.
Ø160	Cooperation from industry people experienced with new equipment.
Ø161	Proper design.

TABLE XX

INDUSTRIAL RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 2., CODING

The Question: What variables from outside the firm do you feel affected the results of the pre-start-up phase? (Responses are paraphrased for consistency as necessary.)

<u>Code</u>	<u>Responses</u>
A201	No response or did not respond to the question asked.
B203	Uncalled for government agency architectural requirements.
C205	Cooperation of area authorities/industry people.
F208	Weather.
L215	Supplies meeting specifications, shipping dates, and service.
L216	Reliable service or material from local firms difficult to obtain.
N219	Technical knowledge.
N220	Qualified consultants.
N221	Responsive architect and/or contractor.
Ø223	Poor equipment design.
Y234	Construction schedule and adherence.
Y235	No time pressures.
Ø237	Vendor deliveries.
Ø238	Government training grants or manuals.
Ø239	Skilled personnel available in immediate area.
Ø240	Good construction manager.
Ø241	Pre-planning of space.
Ø242	No union.
Ø243	Licensors.
Ø244	Government effects are negative at all levels.

TABLE XXI

INDUSTRIAL RESPONSES TO QUESTIONNAIRE, PART III, QUESTION 3., CODING

The Question: Please use this space to provide any further comments that you have regarding pre-start-up matters. (Responses are paraphrased as necessary for consistency. Not so many responses were given to this open-ended question.)

<u>Code</u>	<u>Response</u>
A301	No response or did not respond to the question asked.
C304	Schedules planned and adhered to.
J312	Competence of pre-start-up staff.
J313	Qualified consultants on siting, design, costs and controls.
Ø316	Local agency interference in land purchase and beginning construction.
Ø317	Hire key managers on proper time phase.
Ø318	Cooperation of consultant experts and contractors with inside management during construction.
Ø319	Selection and training programs for operations and maintenance personnel and their early hiring or placement.
Ø320	Single manager in charge.
Ø321	Safety awareness throughout the period.
Ø322	Equipment problems.
Ø323	Right-to-work laws.
Ø324	Hostile government at all levels.

VITA

Norris Aldredge Griffith

Candidate for the Degree of

Doctor of Philosophy

Dissertation: IMPROVEMENT OF THE MANAGEMENT OF EVENTS PRECEDING
FACILITY START-UP

Major Field: Business Administration

Biographical:

Personal Data: Born in Muskogee, Oklahoma, November 30, 1925,
the son of Mark L. and Cassie W. Griffith.

Education: Attended Washington Grade School in Muskogee, Oklahoma; graduated from Central High School in Muskogee, Oklahoma in 1943; attended Muskogee Junior College in the Fall of 1943; received the Bachelor of Science degree from the University of Oklahoma, with a major in Mathematics in June, 1950; attended the Oklahoma City University in the Summer of 1950; received the Bachelor of Science degree from Oklahoma State University, with a major in Industrial Engineering and Management in May, 1957; received the Master of Science degree in Industrial Engineering and Management from Oklahoma State University in August, 1963; attended the George Washington University as a part-time graduate student in 1969-1970; completed the requirements for Doctor of Philosophy in May, 1978.

Professional Experience: Employed from 1951-1956 in Industrial Engineering at Tinker Air Force Base, Oklahoma; from 1957 to 1960 at Western Electric Company, Oklahoma City in Mechanical Engineering; from 1960 to 1964 in Industrial Engineering at Robins Air Force Base and Tinker Air Force Base; from 1964 to 1968 in Industrial Engineering with the Federal Aviation Agency; from 1968-1970 with the U. S. Army Advanced Materiel Concepts Agency in Industrial Engineering; from 1970 to 1973 with the U. S. Postal Service in Maintenance Engineering; from 1973 to 1976 as a Manager of Plant Maintenance in the U. S. Postal Service; and from 1976 to the present as an Assistant Professor of Management at Northeastern Oklahoma State University.

Membership: Alpha Pi Mu; Academy of Management nationally and in its Southwest Division; registered professional engineer in Oklahoma, 1961.