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AN INVESTIGATION OF THE STRUCTURE AND  
RELATIONSHIPS AMONG PERFORMANCE  
CRITERIA USING FACTOR ANALYTIC METHODS

by

Paul Albert Aikin

Abstract of a Master's Thesis  
Completed Summer Term, 1964

Theory and research involving organizational effectiveness and the criteria used to measure effectiveness suggest that effectiveness research should incorporate people with organizations and organizations with people, be of an empirical, objective nature, and be multidimensional, employing as many measures of the organization as possible.

Factor analyses of operational accounting, finance, personnel, engineering, and manufacturing records were carried out in order to explore the usefulness of this approach in revealing the underlying structure and relationships among the criterion variables and their relationship to the established relative effectiveness of two organizations. Interpretation and discussion of the factors was made in light of experience and familiarity with the organization studied. Results supported the usefulness of this approach in identifying psychologically meaningful dimensions of performance.

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Two general conclusions were: first, factor analytic techniques appeared to be useful in the analysis of operational records in that five dimensions of performance seemed to parsimoniously account for most of the common variance among the particular performance criteria used in the study; second, comparison of the factors and the relationships among the variables loaded on the factors suggested that some variables may hang together whether the organization be effective or ineffective. On the other hand, there seemed to be important contrasts in the relationships among the variables loaded on the factors which might define relative differences between an effective and an ineffective organization.

Approved: Carl Frost

Committee Chairman

Date: 6/4/64

Thesis Committee:

Carl F. Frost  
Terrance M. Allen  
Alfred G. Dietze



AN INVESTIGATION OF THE STRUCTURE AND  
RELATIONSHIPS AMONG PERFORMANCE  
CRITERIA USING FACTOR ANALYTIC METHODS

by

Paul Albert Aikin

A THESIS

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## TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS . . . . .	ii
LIST OF TABLES . . . . .	iv
Introduction . . . . .	1
Background of Theory and Research . . . . .	3
Relevant empirical research . . . . .	11
Rationale of the study . . . . .	16
Problem . . . . .	19
Method . . . . .	21
Results . . . . .	27
Discussion . . . . .	44
Summary and Conclusions. . . . .	58
BIBLIOGRAPHY. . . . .	63
APPENDICES. . . . .	66



Table

1. Varima  
M

2. Variab

3. Varia

4. Varia

5. Varia

6. Varia

7. Varia

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13. Vari

14. Vari

15. Vari

## LIST OF TABLES

Table	Page
1. Varimax Rotated Factors and Loadings for 52 Variable Matrix . . . . .	28
2. Variables Loaded on Factor I . . . . .	29
3. Variables Loaded on Factor II. . . . .	30
4. Variables Loaded on Factor III . . . . .	30
5. Variables Loaded on Factor IV. . . . .	31
6. Variables Loaded on Factor V . . . . .	32
7. Variables Loaded on Factor VI. . . . .	32
8. Varimax and Quartimax Rotated Factors and Factor Loadings . . . . .	34
9. Four Year and Six Year Varimax Rotated Factors and Factor Loadings . . . . .	36
10. Variables Loaded on Factor I . . . . .	41
11. Variables Loaded on Factor II. . . . .	42
12. Variables Loaded on Factor III . . . . .	42
13. Variables Loaded on Factor IV. . . . .	42
14. Variables Loaded on Factor V . . . . .	42
15. Variables Loaded on Factor VI. . . . .	43

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## INTRODUCTION

Organizations, it seems, are an important part of our present way of life. Man's life in society today can be characterized largely as one of organizational memberships. A major portion of one's working hours are committed to participation in one or more organizations. His aspirations, his motivations, and his general way of life, are tied to the organizations of which he is a part. It follows that if organizations are such an essential part of our way of life, an organization's performance will greatly influence the behavior of its members. The United States today is especially concerned with the economic performance of organizations. Economic analysts constantly evaluate the performance of the nation's economy, the stock market, and individual organizations. Management constantly seeks to evaluate the effectiveness of various decisions and more importantly to evaluate the effectiveness of the total organization. It is essentially at this point that problems arise for the scientific investigator. How is one to measure the effectiveness of an organization? Or even more basic: what is effectiveness?

Organizational effectiveness has usually been defined in terms of reaching the organizations' goals or objectives. Barnard (1954) states, "effectiveness refers to the degree to which the organizational goal is achieved." Georgopoulos and Tannenbaum (1957) further qualify the term as follows: organizational effectiveness is, "the extent to which an



organization as a social system, given certain resources and means, fulfills its objectives without incapacitating its means and resources and without placing undue strain upon its members. "

At the present time a universally accepted, operational definition of the term effectiveness does not exist. A great deal more empirical research is needed in this area of investigation. It is paramount to the whole area of organization research that an objective, operational definition and measure of organizational effectiveness be developed. It is therefore hoped that the present investigation will add important information to the growing body of literature concerned with organizational effectiveness, although no attempt has been made in this study to further define the term.





## BACKGROUND OF THEORY AND RESEARCH

It would appear that concern with effectiveness has been important to the development of organization theory. The term seems requisite to almost any discussion of organizations. In fact, concern with effectiveness was probably a major reason for the emergence of organization theory. Thus we find that the development of the term "organizational effectiveness" is woven into the developmental scheme of organization theory itself.

Recent approaches by students of organization theory have been to classify past theories into two broad categories. On the one hand, we have the categories variously labeled traditional, classical, mechanistic, bureaucratic, or "theory X" and on the other hand, we have the theories commonly referred to as modern, humanistic, democratic, participative, or "theory Y."

The traditional organization theories have been influenced by two quite independent sources. One source of influence was attributed to the scientific management theory of F. W. Taylor (1947). He tended to view the human organism as a simple machine. An attempt was made to describe the capacities, speeds, durabilities, and costs of the human organism. Taylor's conception of organizational effectiveness was best conceived as maximizing the productive process by transforming the rather inefficient human organism into a more efficient productive organism. The increase in efficiency was to be accomplished by specifying a detailed program of

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Another important contribution to traditional organization theory was made by Max Weber and his writings on bureaucracy (1947). Weber's view of man was largely pessimistic. The bureaucracy, as an impassionate and rational system, was designed to take advantage of the individual's specialized skills while maintaining the discipline necessary to keep the worker from making decisions that benefit himself at the expense of the organization. According to Weber, the effectiveness of an organization would be increased if the bureaucratic form of organization structure was utilized, since this was the most efficient form of complex organization.

A number of factors including labor shortages, unionization, World War II, economic prosperity, and findings from the behavioral sciences, suggested that the bureaucratic form of organization did not function perfectly in operational situations. As a result the second broad category of organization theory developed and was termed the modern approach. Of particular importance to this approach was the pioneering work of Mayo, Roethlisberger, Dickson, et al., and their findings demonstrating the influence of "informal" social structure on effectiveness as contrasted to the influence of formal bureaucratic structure. According to Bennis (1959), there were a number of other strong intellectual currents during this period which gave even more substance to this approach than the aforementioned individuals. Among these were the research and writings of Freud, Lewin, and Rogers. Freud's concern with "unconscious motivation" directed

attention to the individual worker at his work place as his behavior influenced the organization. Lewin and his students contributed to this approach by their investigations of group dynamics, climate of groups, and group leadership. Carl Roger's theory of client-centered therapy provided much of the theoretical basis for the whole human-relations approach. The new look in organization theory took into consideration the worker's feelings, beliefs, perceptions, ideas, and sentiments. The basic tenet of the human-relations approach was that organizational effectiveness would be increased if the workers were considered more as human beings and less like machines. It assumed that happy workers were more productive workers.

The limitations of the traditional, classical or bureaucratic organizational approach have been discussed in recent behavioral literature. One of the major limitations of this approach has been its failure to take into account a number of resultants indicating organizational ineffectiveness, such as: restriction of output, conflict among organizational subunits, rigidity of job performance resulting in poorer service to clients, low productivity, low job satisfaction, resistance to and withholding of innovations and improvements, hostility to superiors, feelings of apathy and failure, and arrested personal development (Katzell, 1962; Bose, 1957; Kahn, 1956; Katz, Maccoby, and Morse, 1950; Whyte, 1952). But there appeared to be major limitations in the human-relations approach also. A major concern to this approach was the low or inverse relationships found between worker satisfaction and productivity. (Katz et al., 1951; Weschler,

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Kahane, and Tannenbaum, 1952; Morse and Reimer, 1956). Thus, it was not always found that the happiest workers were the most effective workers.

So we see that all was not well with the traditional and modern approaches to organization theory and their attempts to account for the variables influencing organizational effectiveness. Bennis (1959) aptly summarized the situation when he remarked that classical organization theory has addressed itself to "organizations without people," and human relations theory tended to think in terms of "people without organizations."

In the last decade several authors have made attempts to reconcile or in some way show points of conflict between classical and modern points of view. Bennis terms these authors "revisionists." They were concerned with external economic factors, with productivity, formal status etc., but not to the exclusion of human elements. Some of the more important revisionist theories have been presented by McMurry (1958), Argyris (1957), McGregor (1960), Likert (1961), March & Simon (1958), and Stogdill (1959).

None of these theories have been accepted as a comprehensive and complete theory of organizations, nor were most of them intended to be. It may be that at this stage in theory building we cannot hope for such a comprehensive theory. This seems to be the view of Katzell (1962). He feels one of the major problems of organization theories is that they have not followed the pattern of scientific theories: "whereas scientific theory is largely developed by induction from facts, organization theory has relied heavily on deduction from assumption" (page 104). New organization

theories following the same pattern are not apt to fare any better. Instead what is needed, according to Katzell, is "... a scientific, descriptive theory of organization which spells out the relationships among given dependent variables and various independent variables under various situational conditions or parameters. The outcome of such an organizational theory would not be a blueprint or approved pattern, but rather a defined network of relationships among phenomena that permits one to adopt a course of action which, in the light of the circumstances defining the situation, is most likely to achieve some approximation to optimum results among the valued criteria or dependent variables" (page 104). It is with the dependent variables, i.e., the organizational effectiveness criteria, that this study is concerned. The resolution of the criterion problem in organization theory would appear to be important. Before a clear conception of the important qualities of effective organizations can be determined, it is paramount that one be able to distinguish between effective and ineffective organizations in terms of generally acceptable, objective criteria. The next step in this discussion will be to review the theoretical and empirical literature dealing with the specific problem of criteria of organizational effectiveness.

Early theoretical interest in the criterion problem centered around the establishment of a single "ultimate" criterion or the establishment of several basic ultimate criteria that may be weighted in some way to establish a composite effectiveness measure. Thorndike (1949) described theoretically



the characteristics of the ultimate criterion. "The ultimate criterion is the complete final goal of a particular type of evaluative program. It is often stated in broad terms and often not susceptible to practical qualitative evaluation." Regarding specific ultimate criteria of organizational effectiveness, Bass (1952) proposed that the criterion of organizational worth should be used as an ultimate criterion of organizational success. The success of an organization should be evaluated on: (1) The extent to which its members are of value to society and (2) the degree to which it and its members are of value to society. Bass suggested this evaluation should be made apart from any consideration of the effect these two criteria may have on the traditional criteria of profits, productivity, and self maintenance.

Several authors have apparently slightly modified their views on the ultimate criterion. Although postulating a single, fundamental criterion, the inclusion of several other more specific criteria were also felt necessary. Caplow (1953) postulated that the fundamental criterion of organizational success was that an organization must, "maintain itself in continuous operation." In addition, he proposed three related criteria which were also essential:

1. the performance of the objective functions of the organization
2. the minimization of spontaneous internal conflict
3. the maximization of satisfactions for individuals.

Lloyd (1962) was of the opinion that there existed a fundamental, comprehensive objective of commercial organizations as well as a number of

specific objectives. Some of the more commonly stated specific objectives were:

1. to establish stability of income
2. to achieve some given return on investment
3. to obtain or continue growth.

The overall, comprehensive objective of an organization, according to Lloyd, was to increase the efficiency of supplying society with goods and services, i.e., to maximize the efficiency of the group effort. For maximum effectiveness, the specific objectives needed to be in harmony with the overall objective.

At the opposite end of the continuum from a single ultimate criterion, was the view that a number of criteria were required to account for organizational effectiveness. Drucker (1954) was of the opinion that there was little hope of isolating a unitary dimension of organizational effectiveness. He states, "the search for one objective is essentially a search for a magic formula that will make judgment unnecessary." If an organization measures its effectiveness in terms of only one objective, i.e., profit, it may endanger the survival of the organization by shortchanging other areas, i.e., research. Drucker recommended that multiple objectives be set. "Objectives are needed in every area where performance and results directly and vitally affect the survival and prosperity of the business." The setting of objectives enable management to evaluate the effectiveness of the organization.

Dunnette (1963) also has become disillusioned with the search for a single ultimate criterion. He states, "thus I say: junk 'the' criterion! Let us cease searching for single or composite measures of job success and proceed to undertake research which accepts the world of success dimensionally as it really exists."

It appears from the preceeding studies that organizational effectiveness is in a conflicting, confusing, and somewhat primitive state. Historically, the earlier views tended toward postulating an ultimate criterion of effectiveness. On the other hand, the more recent writings generally suggested that there exist a number of relevant criteria of effectiveness.

A number of criticisms can be made regarding these studies. One criticism generally applicable to all of the preceeding studies is that no empirical evidence was presented to support the authors propositions. A second criticism is that it would be extremely difficult, if not impossible, to operationalize and measure many of the suggested criteria. Thorndike (1949) himself states concerning the ultimate criterion, "in practice, the complete ultimate criterion is rarely, if ever, available for use in psychological research." He further states that it is usually not entirely accurate to specify a single and unified ultimate goal as it is usually multiple and complex in almost every case. The utility of the concept "ultimate criterion" therefore seems questionable if in reality it is rarely measurable. Also, other criteria suggested, such as: organizational worth, both to the members and to society, the efficiency of supplying society with goods

and services, performance of the objective functions of the organization, and being perceived by society as doing a necessary, useful, and productive job, appear to have face validity but clearly would be difficult to measure. A final criticism is that some of the suggested criteria appear self evident and would not differentiate between effective and ineffective organizations. For example, Caplow states that the fundamental criterion is that an organization must maintain itself in continuous operation. This may be considered a necessary criterion of organizational effectiveness but is not necessarily a sufficient criterion. In other words, it would only differentiate between the defunct and functioning organizations.

#### Relevant empirical research

There are also a number of empirical studies in which actual criteria have been operationalized and measured. Probably the most adequate study of organizational effectiveness criteria in terms of controls, validity, and design was a study by Georgopoulos and Tannenbaum (1957). Their conception of effectiveness subsumed the following general criteria:

1. organizational productivity
2. organizational flexibility (in terms of internally and externally induced change)
3. absence of intraorganizational strain.

The results of the study indicated that each of the three criteria was significantly related to an independent assessment of organizational effectiveness by a number of experts at the .05 level or better. This lended

support to the validity of the three criteria. In addition, the three criteria were also significantly interrelated.

In a study by Fleishman and Harris (1952), the relationship between leadership behavior and two primary indices of group effectiveness, labor grievances and employee turnover, were investigated. Each criterion measure was objectively derived from company files. It is of special interest to note that the correlation between these two criteria was .37. This would indicate that while the high grievance work groups tended to have higher turnover, the relationship was not exceedingly high. Thus it would probably be best to treat each measure as a separate aspect of group behavior. The odd-even week-corrected Spearman-Brown reliability coefficients for the grievance and turnover measures were .73 and .59 respectively. The fact that these criteria were fairly reliable was an important finding in its own right.

Comrey (1955) investigated the relationships between four separate criteria of organizational effectiveness. Two of the criteria were quality control measures, i.e., work-rework and accepted job rate, while the third criterion was a measure of production and the fourth measure a subjective supervisor rating. Spearman-Brown odd-even reliabilities of the three objective criteria were all .95 or better. Rank order intercorrelations among the criteria were all insignificant. The rating criterion correlated .06 with work-rework ratios,  $-.03$  with acceptance ratios, and .23 with production ratios. The work-rework criterion correlated .10 with acceptance

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ratios and .16 with production ratios. The acceptance criterion and production criterion correlated .03.

A study on morale was undertaken by Morse (1953) in which 742 clerical workers in a large industrial organization were interviewed. Morale was defined for this study as, "the amount of satisfaction achieved through being in a social organization." The authors felt it most advisable to investigate the degree of satisfaction which individuals obtain from the various roles they play in the organization in terms of four separate indices of morale: intrinsic job satisfaction, company involvement, financial and job status satisfaction, and pride-in-group-performance. Each index was derived from a number of interview items. Regarding the interrelationship among the indices, results showed some areas were more closely related than others. Pride-in-group-performance was the least related to other areas while the company involvement area was the least clearly delineated index. Intrinsic job satisfaction, company involvement, and the financial and job status indices were significantly related with a correlation of .35. Even though significant, the intercorrelations among the criteria were low.

Seashore, Indik, and Georgopoulos (1960) examined the relationships between five criteria of effectiveness. These were productivity, general rated effectiveness, accidents, absences, and errors. All criteria but rated effectiveness were objectively derived from company records. Specifically, the authors tested the hypothesis that the intercorrelations among a set of criterion measures for a given homogenous population will



be consistent and relatively high. This hypothesis was not supported. Results indicated that of the 10 intercorrelations only five had consistent signs and only four were significant at the 5 percent level. Only rated effectiveness, productivity, and errors constituted a set of internally consistent criteria in terms of sign and high relationship. The authors concluded that what was required is a complex theory of job performance which takes into account systems of causal and conditioning variables. Until this is accomplished, the use of criterion variables will remain at a primitive level and one might best treat each criterion separately.

Some additional criteria which have been used to measure organizational effectiveness were: percentage of sales, the yearly increase in profits and sales, the ratio of profits to net worth, net income, and the amount of revenue (Price, 1963). Dent (1959) interviewed 145 executives who represented large and small, unionized and non-unionized organizations ranging geographically from New England to California. Each executive was asked the open-ended question, "what are the aims of management?" The most frequently mentioned aims were: profit, good product, employee welfare, and growth. Two other less frequently mentioned aims were meeting competition and public service. Over 50 percent of the respondents indicated profit. Although profit seemed to be the most salient single goal of business, the data suggested that the profit motive was declining. Also, one must be cautious in generalizing these findings as the survey did not include a representative sample of U. S. cities.

Thus, a brief look at relevant empirical research with specific organizational effectiveness criteria revealed that a wide range and large number of specific criteria had been investigated. This fact in itself lends a great deal of support to the theoretical positions of Drucker and Dunnette that we should give up the search for a single criterion measure and accept organizational effectiveness as a multi-dimensional concept.

Another striking observation revealed by these studies is the low and in many cases the lack of correlation between the criterion measures. It would appear that there are a number of independent dimensions of organizational effectiveness such that an objective evaluation of an organization's effectiveness requires a number of separate criterion measures. This observation also lends support to the theoretical approach expounding the multidimensional nature of organizational effectiveness.

In addition there exists a number of conceptual and measurement problems associated with various criteria (Georgopoulos & Tannenbaum, 1957; Dent, 1959; Drucker, 1954). For example, a major problem in using turnover and absenteeism as criteria of effectiveness is their differential sensitivity to such third considerations as the nature and volume of work to be processed, organizational level effected, and season of occurrence. Net profit also is a poor criterion in view of the many unanticipated fluctuations external to the system, i.e., fluctuations in the general economy, markets, sales, and prices. Another problem with using profits as a criterion of effectiveness is that many small businessmen are unwilling to divulge

profits. Using growth in employment as a measure of success also has some limitations. Even though employment were stable, the output of a business might be expanding with technological change. These difficulties also serve to intensify the argument against the use of a single criterion measure of effectiveness.

#### Rationale of this study

To briefly summarize, early attempts by organization theorists to describe the components and important variables associated with organizational effectiveness lead to, as Bennis put it, either "organizations without people" or "people without organizations." It was suggested therefore, that any attempt to investigate organizational effectiveness must be made in terms of both "organization" and "people" variables. The present study made use of both kinds of variables.

A review of theoretical positions on the criterion question revealed that the area was unclear. Some theorists postulated a single criterion measure; others postulated that a number of distinct criteria were required to evaluate effectiveness. Examination of empirical criterion studies showed that a large number of specific criteria had been investigated and that of those investigated many low intercorrelations were found among the criteria. It would appear that we have not as yet found a resolution to the problem of appropriate criteria for measuring organizational effectiveness.

There are basically two ways that one may approach the study of the criterion problem. One approach would be to manipulate particular independent

variables and study the relationship of these variables to the dependent or criterion variables. The second approach would be the study of the dependent variables per se. It would seem that the first step in criterion research should involve the second approach. A knowledge of the relationships among the criterion measures would greatly facilitate the proper choice of criterion measures in research with such independent variables as leadership, communication, or training which are concerned with organizational effectiveness.

It would appear that the best approach to the direct study of organizational effectiveness criteria should be guided by the following principles derived from a review of previous studies. First, the approach must be of an empirical, objective nature. As Katzell stated previously, in building theories of organizations we must build inductively upon empirical, factual research instead of deductively from assumption. Second, organizational effectiveness research must not neglect either people or organization variables, but must incorporate both people with organizations and organizations with people. Finally, approaches to effectiveness research should take into consideration the extreme complexity of an organization and thus involve as many measures as possible of its entirety. Thus, a multidimensional approach to criterion research of organizational effectiveness was accepted because:

1. attempts at the development of a single, ultimate criterion of effectiveness have failed;
2. actual empirical studies have found it necessary to use a variety

of criteria in a variety of situations;

3. among the studies actually empirically investigating organizational effectiveness criteria, the majority of these studies found low or a lack of relationship among measures;
4. there are a number of conceptual and measurement problems involved in equating single effectiveness criteria across organizations;
5. the organization itself is complex and multifaceted.

Several of the previously mentioned authors (Seashore, Indik, and Georgopoulos, 1960; Comrey, 1955) demonstrated that not all measures or criteria of effectiveness are related. However, they restricted their studies to, at the most, five variables.

One study making an attempt to investigate a larger number of criterion measures was conducted by Boyles (1962) and Eddy (1962). They hypothesized that the accounting and personnel records kept by many organizations are actually measures of organizational behavior. The study was unique in that it took advantage of a large number of accounting and personnel records not usually considered psychological data. Yet many of these variables such as waste, grievances, and turnover are very much people variables and all are certainly indicators of total organization behavior. This point is important because every organization has a large number of output variables on hand in the form of records. The study of these operational records thus appeared to be a logical starting place for the revealing and structuring of the relationships among the many criterion measures.

## PROBLEM

Boyles' investigation was concerned with three questions: (1) are correlational and factor analytic techniques useful in handling the complexity of variables involved in the development of criteria of effectiveness, (2) can these methods actually identify particular combinations of organizational performance measures which best describe the effectiveness of a particular organization, and (3) are operational accounting data and personnel data useful in studying the relationships between certain measures of personnel performance and the performance of the organization as a whole.

Inasmuch as Boyles' conclusions were restricted to the study of only one organization, it seemed appropriate and even necessary to ask these questions in another entirely different organization. Thus, the first purpose of this study was to repeat the procedures used by Boyles but in another organization. Inasmuch as Boyles' study was restricted to a single five year period, the second purpose of this study was to explore the effect of varying periods of time over which the analysis was made had on the resulting factors and relationships among the variables loaded on the factors. Inasmuch as Boyles' study was restricted to a quartimax rotation solution, the third purpose of this study was to explore the effect of both the varimax and quartimax rotations on the resulting factors. Inasmuch as Boyles' study was restricted to 24 variables, the fourth purpose of this study was to explore the effect an increased number of criterion variables

had on the resulting factors and relationships among the variables loaded on the factors. Finally, inasmuch as Boyles' conclusions were restricted to the study of an organization since characterized as ineffective (David Silkiner, 1964; David Erickson, 1964), the fifth purpose of this study was to investigate the factors and the relationships among the factors as they were related to the established differences in effectiveness of the two organizations.

## METHOD

The organization selected for study was a medium sized, nonunion, manufacturing firm located in the midwestern United States. A more complete description of the firm is found in Appendix II. Three conditions were required of the firm selected in order to carry out the study: (1) access to extensive and complete operational data, both of an "organizational" and "people" nature, (2) the available data and organization from which they were drawn had to be comparable to the data of Boyles' and Eddy's studies, and (3) an evaluation of relative organizational effectiveness had to have been established. The firm selected for study met each of the three conditions. The relative effectiveness of the firm investigated in the Boyles and Eddy studies were established by Erickson (1964) and Silkiner (1964). See Appendix III for the criteria and comparison of the relative effectiveness of companies A and B.

The next step in the study involved the determination of the periods of time over which the variables should be investigated. The observations in this study consist of months. In other more traditional studies involving the factor analysis of a number of tests, the observations, i.e., the number of months, would be equivalent to the number of subjects. Two investigations of varying lengths were carried out. One investigation consisted of four fiscal years in the life of the organization from May 1960 through April 1964, a period providing 48 monthly observations. The second



investigation represented six fiscal years from May 1958 through April 1964, a period providing 72 monthly observations. Forty-eight variables were included in the six year investigation and 52 variables were included in the four year investigation. All records of the company, i.e., accounting, financial, manufacturing, engineering, and personnel were examined to obtain the important and appropriate variables for study. The variables used in the investigation were selected on the basis of the following criteria: (1) the variables must appear to be indicative of overall performance in terms of people or the organization itself, (2) the data must be available continuously for the periods covered by the investigation i.e., four or six years respectively, and (3) the data must show some degree of variability over time. These were the major criteria used by Boyles and Eddy to select the variables used in their study.

The following forty-eight variables were used in the six year investigation which included the months of May 1958 through April 1964.

1. Returns and allowances
2. Net sales
3. Inventory variation at sales value
4. Total production
5. Allowable expenses
6. Actual expenses
7. Expense variance (variation of actual expenses contrasted to allowed expense, i.e., variable #5 minus variable #6)
8. Gross bonus

9. Deficit reserve
10. Actual payroll cost
11. Bonus percentage
12. End of year deficit reserve
13. Payroll fringes benefit cost
14. Direct materials cost
15. Operating supplies cost
16. Miscellaneous expenses
17. Direct labor payroll
18. Supervision salaries
19. Indirect labor payroll
20. Building maintenance payroll
21. Engineering salaries
22. Equipment maintenance payroll
23. Selling salaries
24. Administrative salaries
25. Overtime premium
26. Dies, jigs, and tooling costs
27. Number of salaried employees
28. Number of injuries
29. Total number of employees
30. Total hours worked including salaried personnel
31. Number of production workers

32. Number of production worker man hours
33. Average hourly wage without bonus
34. Average hourly wage with bonus
35. Dollars derived from total units manufactured
36. Dollars derived from sale of major product
37. Dollars derived from sale of all other units
38. Difficulty of product mix (Major product/total units produced--the major product is the most easily produced item.)
39. Number of new suggestions
40. Number of suggestions completed
41. Number of suggestions not completed
42. Incomplete suggestions still under consideration from previous months
43. Shipments/returns and allowances
44. Profits before taxes
45. Net worth
46. Number of layoffs
47. Number of hirings and rehiring
48. Number of job changes.

The following four variables, in addition to the above forty-eight, were used in the four year investigation which included the months of May 1960 through April 1964.

49. Number of grievances
50. Percent yield of major product (This is a quality control measure.)



51. Ratio of current assets to liabilities
52. Percent net profit to net worth (This is an index of return on investment.)

Pearson product moment correlation coefficients were first computed for all pairs of variables for both the 48 and 52 variable investigations in order to establish the relationships among the criterion variables. The use of the Pearson product moment correlation technique was consistent with the analysis of continuous data. In order to interpret such a large number of intercorrelations, principle axes factor analyses of the correlation matrices were carried out. The main advantages of a factor analytic solution to the data are: (1) it allows one to determine the basic structure or interrelationships among the multitude of variables when this would be extremely difficult and subjective by a simple comparison of variables, (2) it summarizes the data, and (3) it reveals the independent or uncorrelated factors or groups of variables when an orthogonal rotation is used. The major reason for employing a principal axes factor solution rather than other available factor solution techniques is that it results in a mathematically unique solution (Harmon, 1960). Unities were placed in the principal diagonal.

The next step in the analysis of the data involved both varimax and quartimax orthogonal rotations of each principal axes solution. The purpose of the varimax rotation is to transform the original principal axes solution into a simple-structure solution by yielding high loadings on as few variables as possible (Kaiser, 1958). The purpose of the quartimax

rotation is to yield high loadings on as few factors as possible with the remaining loadings as close to zero as possible, i.e., to reduce the number of factors necessary to account for the common variance in the matrix (Neuhaus and Wrigley, 1954). A Kiel-Wrigley criterion of three was used to stop factoring on the first varimax rotation (Kiel and Wrigley, 1960). Finally, principal axes solutions and varimax rotations were carried out on the 52 variable matrix and the 48 variable matrix with the months of July removed.

## RESULTS

Pearson product moment correlation coefficients were computed between all pairs of variables for both the 48 and 52 variable investigations. The resulting 48 and 52 variable intercorrelation matrices are found in Appendix I, Table 1. Examination of the correlation table revealed a total of 1300 intercorrelations for the 52 variable matrix and a total of 1104 intercorrelations for the 48 variable matrix.

Results of the varimax orthogonal rotation of the four year, 52 variable matrix are presented in Table 1. In order to simplify the table, only variables with factor loadings of .39 and greater are included. The complete varimax factor solution is found in Appendix I, Table 2. The varimax rotation with a Kiel-Wrigley criterion of three yielded six factors accounting for 74 percent of the variance in the matrix.

Factor I was the largest factor accounting for 27 percent of the common variance in the matrix. The twenty-eight variables with factor loadings of .39 or greater loaded on factor I are shown in Table 2 ranked according to size of loading. Those loadings which are the highest loading for a particular variable are indicated by an asterisk. Eighteen out of 52 variables had highest loadings on this factor.

Factor II accounted for 8 percent of the common variance and had eight variables of .39 or greater loaded on it. Table 3 shows the eight variables ranked according to size of loading. Highest loadings of a particular variable are indicated by an asterisk. Variable 27, number of injuries, is included in the table even though it is less than .39 because it was the highest loading for that variable.





Table 1. Varimax Rotated Factors and Loadings for 52 Variable Matrix

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	--	--	78	--	--	--
2. Net sales	73*	--	47	-40	--	--
3. Inventory variation	--	--	--	71	--	-46
4. Total production	79	--	55	--	--	--
5. Allowable expenses	79	--	54	--	--	--
6. Actual expenses	55	44	62	--	--	--
7. Expense variance	94	--	--	--	--	--
8. Gross bonus	94	--	--	--	--	--
9. Deficit reserve	94	--	--	--	--	--
10. Actual payroll	62	--	74	--	--	--
11. Bonus percentage	93	--	--	--	--	--
12. End of year deficit	59	-51	--	--	--	42
13. Payroll fringes	--	--	49	--	--	--
14. Direct materials	--	90	--	--	--	--
15. Operating supplies	48	--	60	--	--	-39
16. Miscellaneous expenses	52	--	--	--	--	--
17. Direct labor payroll	63	--	73	--	--	--
18. Supervision salaries	--	--	--	--	--	-60
19. Indirect labor payroll	60	--	73	--	--	--
20. Maintenance payroll	--	--	41	-39	--	--
21. Engineering salaries	--	-47	72	--	--	--
22. Equipment payroll	--	--	70	--	--	--
23. Selling salaries	48	--	65	--	--	--
24. Administrative salaries	48	--	71	--	--	--
25. Overtime premium	50	--	74	--	--	--
26. Dies, jigs, and tooling	--	--	62	--	--	--
27. Number of injuries	--	(36)	--	--	--	--
28. Number of salaried employees	--	-42	71	--	--	--
29. Total number of employees	--	--	84	--	--	--
30. Total hours worked	--	--	76	--	--	--
31. Number of production workers	--	--	80	--	--	--
32. Production worker man hours	40	--	72	--	--	--
33. Average hourly wage	65	--	--	--	--	--
34. Average hourly wage/bonus	91	--	--	--	--	--
35. Sales of total units	73	--	47	--	--	--
36. Sales of major product	62	--	47	-49	--	--
37. Sales of all other units	67	--	--	--	--	--
38. Difficulty of product mix	--	--	--	-60	--	--
39. Number of new suggestions	--	--	--	--	--	-65
40. Suggestions completed	--	--	--	--	70	--
41. Suggestions not completed	--	--	--	--	75	--

Table 1--Continued

Variables	Factors					
	I	II	III	IV	V	VI
42. Accumulative suggestions	--	--	--	--	39	-59
43. Shipments/returns and allowances	--	--	73	--	--	--
44. Profits before taxes	86	--	--	--	--	--
45. Net worth	66	-41	58	--	--	--
46. Number of layoffs	-48	--	--	--	--	--
47. Hire and rehiring	--	--	--	65	--	--
48. Number of job changes	--	--	--	69	--	--
49. Number of grievances	--	--	--	--	42	--
50. Percent yield	56	-58	--	--	--	--
51. Assets/liabilities	--	--	--	--	--	45
52. Net profit/net worth	78	--	--	--	--	--

\*Loading and proportions are in hundredths, decimals omitted.

Table 2. Variables Loaded on Factor I.

Variable	Loading
7. Expense variance	.94*
8. Gross bonus	.94*
9. Deficit reserve	.94*
11. Bonus percentage	.93*
34. Average hourly wage/bonus	.91*
44. Profits before taxes	.86*
4. Total production	.79*
5. Allowable expense	.79*
52. Net profit/net worth	.78*
35. Sales of total units	.73*
2. Net sales	.73*
37. Sales of all other units	.67*
45. Net worth	.66*
33. Average hourly wage	.65*
17. Direct labor payroll	.63
10. Actual payroll	.63
36. Sales of major product	.62*
19. Indirect labor payroll	.60
12. End of year deficit reserve	.59*
50. Percent yield	.56
6. Actual expenses	.55
16. Miscellaneous expenses	.52*
25. Overtime premium	.50
24. Administrative payroll	.48
23. Selling payroll	.48
15. Operating supplies	.48
46. Number of layoffs	-.48*

Table 3. Variables Loaded on Factor II

Variable	Loading
14. Direct materials	.90*
50. Percent yield	-.58*
12. End of year deficit reserve	-.51
21. Engineering salaries	-.47
6. Actual expense	.44
28. Number of salaried employees	-.42
45. Net worth	-.41
27. Number of injuries	(.36)*

Factor III was the next largest factor after factor I having 26 variables with loadings of .39 or higher loaded on it. Factor III accounted for 24 percent of the common variance in the matrix. The variables ranked according to size of loading are shown in Table 4. The asterisk indicates highest loading of that variable. Nineteen out of a possible 52 variables had highest loadings on this factor. Thirty-eight of the possible 52 variables have highest loadings on either factors I or II.

Table 4. Variables Loaded on Factor III

Variable	Loading
29. Total number of employees	.84*
31. Number of production workers	.80*
1. Returns & allowances	.78*
30. Total hours worked	.76*
25. Overtime premium	.74*
10. Actual payroll	.74*
17. Direct labor payroll	.73*
19. Indirect labor payroll	.73*
43. Shipments/returns and allow.	.73*
21. Engineering salaries	.72*
32. Production worker man hours	.72*
24. Administrative salaries	.71*
28. Number of salaried employees	.71*

Table 4--Continued

Variable	Loading
22. Equipment payroll	.70*
23. Selling salaries	.65*
26. Dies, jigs, & tooling costs	.62*
6. Actual expense	.62*
15. Operating supplies	.60*
45. Net worth	.58
4. Total production	.55
5. Allowable expense	.54
13. Payroll fringes	.49*
2. Net sales	.47
35. Sales of total units	.47
36. Sales of major product	.47
20. Maintenance payroll	.41*

Six percent of the common variance was accounted for by factor IV. Table 5 shows the following seven variables with loadings above .39 on factor IV ranked according to size of loading.

Table 5. Variables Loaded on Factor IV

Variable	Loading
3. Inventory variation	.71*
48. Number of job changes	.69*
47. Hire & rehiring	.65*
38. Difficulty of product mix	-.60*
36. Sales of major product	-.49
2. Net sales	-.40
20. Maintenance payroll	-.39

\*Indicates a highest loading on that variable.

Factor V was the smallest factor accounting for only 4 percent of the common variance. The four variables and loadings above .39 ranked according to size of loading are shown in Table 6.

Table 6. Variables Loaded on Factor V

Variable	Loading
41. Suggestions not completed	.75
40. Suggestions completed	.70
49. Number of grievances	.42
42. Accumulative suggestions	.39

\*Indicates a highest loading on that variable.

Factor VI accounted for 5 percent of the common variance. Table 7 shows the variables and loadings above .39 ranked according to size of loading on this factor.

Table 7. Variables Loaded on Factor VI

Variable	Loading
39. Number of new suggestions	-.65*
18. Supervision salaries	-.60*
42. Accumulative suggestions	-.59*
3. Inventory variation	-.46
51. Assets/liabilities	.45*
12. End of year deficit reserve	.42
15. Operating supplies	-.39

\*Indicates a highest loading on that variable.

In order to explore the differences attributable to the particular rotational technique used, a quartimax rotation in addition to the varimax rotation was also computed on the four year, 52 variable principle axes solution. The complete six factor quartimax factor loading table is found in Appendix I, Table 3. The quartimax rotation accounted for 74 percent of the variance in the matrix. A breakdown of the common variances contributed by factors



one through six were, respectively: .44, .08, .07, .06, .04, & .05.

A comparison of the major factors and loadings obtained from the quartimax and varimax rotations is shown in the simplified Table 8. All loadings below .39 have been omitted for easier comparison, except when there are disagreements between rotations, in which case lower loadings have been placed in parentheses. There was a marked similarity between the two methods. Table 8 shows that factors II, IV, V, and VI of both rotational methods are almost identical. A close look at factors Iv and IIIv of the varimax rotation and factor Iq of the quartimax rotation reveals apparently that the quartimax rotation has combined varimax factors Iv and IIIv into a single general factor, Iq. Quartimax factor IIIq seemed to be the residual factor of the combination of the varimax factors Iv and IIIv.

In order to explore the effect a longer period of investigation, i.e., a greater number of observations or months, had on the factors, a varimax rotation was also performed on the six year, 48 variable principle axes solution. Results of this varimax rotation are found in Appendix I, Table 4. The common variances contributed by factors I through VI were, respectively: .30, .25, .06, .06, .05, and .04. A total of 76 percent of the variance in the matrix was accounted for by the rotation. Table 9 shows a simplified comparison of the six major factors and loadings obtained from the four year varimax solution and those obtained from the six year varimax solution. Again, all loadings below .39 have been omitted except in cases of disagreement, in which case lower loadings have been placed in parentheses.





Table 8. Varimax and Quartimax Rotated Factors and Factor Loadings

Variables	Factors*											
	One		Two		Three		Four		Five		Six	
	Iv	Iq	IIv	IIq	IIIv	IIIq	IVv	IVq	Vv	Vq	VIv	VIq
1. Returns & allowances	(23)	68	--	--	78	44	--	--	--	--	--	--
2. Net sales	73	87	--	--	47	--	-40	(-35)	--	--	--	--
3. Inventory variation	--	--	--	--	--	--	71	74	--	--	-46	-42
4. Total production	79	96	--	--	55	--	--	--	--	--	--	--
5. Allowable expenses	79	94	--	--	54	--	--	--	--	--	--	--
6. Actual expenses	55	82	44	46	62	--	--	--	--	--	--	--
7. Expense variance	94	87	--	--	--	-43	--	--	--	--	--	--
8. Gross bonus	94	87	--	--	--	-44	--	--	--	--	--	--
9. Deficit reserve	94	87	--	--	--	-44	--	--	--	--	--	--
10. Actual payroll	62	96	--	--	74	--	--	--	--	--	--	--
11. Bonus percentage	93	76	--	--	--	-54	--	--	--	--	--	--
12. End of year deficit	59	43	-50	-48	--	--	--	--	--	--	42	47
13. Payroll fringes	(16)	46	--	--	49	--	--	--	--	--	--	--
14. Direct materials	--	--	90	90	--	--	--	--	--	--	--	--
15. Operating supplies	48	77	--	--	60	--	--	--	--	--	-39	-37
16. Miscellaneous expenses	52	64	--	--	--	--	--	--	--	--	--	--
17. Direct labor payroll	63	96	--	--	73	--	--	--	--	--	--	--
18. Supervision salaries	--	--	--	--	--	--	--	--	--	--	-60	-63
19. Indirect labor payroll	60	94	--	--	73	--	--	--	--	--	--	--
20. Maintenance payroll	(17)	43	--	--	41	--	-39	(-34)	--	--	--	--
21. Engineering salaries	(27)	70	-47	-46	72	--	--	--	--	--	--	--
22. Equipment payroll	(35)	74	--	--	70	--	--	--	--	--	--	--
23. Selling salaries	48	79	--	--	65	--	--	--	--	--	--	--
24. Administrative salaries	48	84	--	--	71	--	--	--	--	--	--	--
25. Overtime premium	50	86	--	--	41	--	--	--	--	--	--	--
26. Dies, jigs, and tooling	(06)	44	--	--	62	43	--	--	--	--	--	--
27. Number of injuries	--	--	--	--	--	--	--	--	--	--	--	--
28. Number of salaried employees	(27)	70	-42	-41	71	--	--	--	--	--	--	--

Table 8--Continued

Variables	Factors*											
	One		Two		Three		Four		Five		Six	
	Iv	Iq	IIv	IIq	IIIv	IIIq	IVv	IVq	Vv	Vq	VIv	VIq
29. Total number of employees	(21)	72	--	--	83	46	--	--	--	--	--	--
30. Total hours worked	(36)	79	--	--	76	--	--	--	--	--	--	--
31. Number of production workers	(18)	67	--	--	80	45	--	--	--	--	--	--
32. Production worker man hours	40	78	--	--	72	--	--	--	--	--	--	--
33. Average hourly wage	65	63	--	--	--	--	--	--	--	--	--	--
34. Average hourly wage/bonus	91	78	--	--	--	-49	--	--	--	--	--	--
35. Sales of total units	73	87	--	--	47	--	--	--	--	--	--	--
36. Sales of major product	62	80	--	--	47	--	-49	--	--	--	--	--
37. Sales of all other units	67	70	--	--	--	--	--	--	--	--	--	--
38. Difficulty of product mix	(38)	55	--	--	--	--	-60	--	--	--	--	--
39. Number of new suggestions	--	--	--	--	--	--	--	--	--	--	-65	-63
40. Suggestions completed	--	--	--	--	--	--	--	--	70	69	--	--
41. Suggestions not completed	--	--	--	--	--	--	--	--	75	79	--	--
42. Accumulative suggestions	--	--	--	--	--	--	--	--	39	(36)	-59	-62
43. Shipments/returns & allowances	(-04)	45	--	--	73	57	--	--	--	--	--	--
44. Profits before taxes	86	84	--	--	--	--	--	--	--	--	--	--
45. Net worth	66	89	-41	-39	58	--	--	--	--	--	--	--
46. Number of layoffs	-48	-53	--	--	--	--	--	--	--	--	--	--
47. Hire & rehiring	--	--	--	--	--	--	65	65	--	--	--	--
48. Number of job changes	--	--	--	--	--	--	69	70	--	--	--	--
49. Number of grievances	--	--	--	--	--	--	--	--	42	43	--	--
50. Percent yield	56	59	-58	-56	--	--	--	--	--	--	--	--
51. Assets/liabilities	--	--	--	--	--	--	--	--	--	--	45	44
52. Net profit/net worth	78	71	--	--	--	--	--	--	--	--	--	--

\*Factors Iv - VIv = Varimax factors; Factors Iq - VIq = Quartimax factors.



Table 9. Four Year and Six Year Varimax Rotated Factors and Factor Loadings

Variables	Factors*											
	One		Two		Three		Four		Five		Six	
	Iv4	Iv6	IIv4	IIv6	IIIv4	IIv6	IVv4	Vv6	Vv4	IVv6	VIv4	VIv6
1. Returns & allowances	--	--	--	--	78	46	--	--	(29)	72	--	--
2. Net sales	73	65	--	--	47	62	-40	(-38)	--	--	--	--
3. Inventory variation	--	--	--	--	--	--	71	85	--	--	-46	(23)
4. Total production	79	70	--	--	55	69	--	--	--	--	--	--
5. Allowable expenses	79	67	--	--	54	72	--	--	--	--	--	--
6. Actual expenses	55	(29)	44	(-01)	62	92	--	--	--	--	--	--
7. Expense variance	94	97	--	--	--	--	--	--	--	--	--	--
8. Gross bonus	94	97	--	--	--	--	--	--	--	--	--	--
9. Deficit reserve	94	97	--	--	--	--	--	--	--	--	--	--
10. Actual payroll	62	66	--	--	74	66	--	--	--	--	--	--
11. Bonus percentage	93	93	--	--	--	--	--	--	--	--	--	--
12. End of year deficit	59	62	-50	(-15)	--	--	--	--	--	--	42	(-36)
13. Payroll fringes	--	--	--	--	49	(39)	--	--	--	--	(13)	-50
14. Direct materials	--	--	90	(-08)	(02)	75	--	--	--	--	--	--
15. Operating supplies	48	(00)	--	--	60	71	--	--	--	--	-39	(00)
16. Miscellaneous expenses	52	48	--	--	(38)	50	--	--	--	--	--	--
17. Direct labor payroll	63	59	--	--	73	71	--	--	--	--	--	--
18. Supervision salaries	--	--	(10)	62	(16)	49	--	--	--	--	-60	(20)
19. Indirect labor payroll	60	59	--	--	73	71	--	--	--	--	--	--
20. Maintenance payroll	--	--	--	--	41	40	-39	(-33)	--	--	--	--
21. Engineering salaries	(27)	68	-47	40	72	(23)	--	--	--	--	--	--
22. Equipment payroll	(35)	53	--	--	70	53	--	--	--	--	--	--
23. Selling salaries	48	58	--	--	65	54	--	--	--	--	--	--
24. Administrative salaries	48	75	(-28)	48	71	(36)	--	--	--	--	--	--
25. Overtime premium	50	58	--	--	74	52	--	--	(01)	39	--	--
26. Dies, jigs, and tooling	--	--	--	--	62	58	--	--	--	--	--	--
27. Number of injuries	--	--	(36)	(02)	--	--	--	--	--	--	(02)	(31)
28. Number of salaried employees	(27)	63	-42	55	71	(36)	--	--	--	--	--	--

Table 9--Continued

Variables	Factors*											
	One		Two		Three		Four		Five		Six	
	Iv4	Iv6	IIv4	IIv6	IIIv4	IIIv6	IVv4	IVv6	Vv4	IVv6	VIv4	VIv6
29. Total number of employees	--	--	--	--	83	94	--	--	--	--	--	--
30. Total hours worked	--	--	--	--	76	84	--	--	--	--	--	--
31. Number of production workers	--	--	--	--	80	94	--	--	--	--	--	--
32. Production worker man hours	40	(09)	--	--	72	92	--	--	--	--	--	--
33. Average hourly wage	65	84	--	--	--	--	--	--	--	--	--	--
34. Average hourly wage/bonus	91	96	--	--	--	--	--	--	--	--	--	--
35. Sales of total units	73	64	--	--	47	62	--	--	--	--	--	--
36. Sales of major product	62	62	--	--	47	63	-49	-52	--	--	--	--
37. Sales of all other units	67	50	--	--	(31)	67	--	--	--	--	--	--
38. Difficulty of product mix	--	--	--	--	--	--	-60	-58	--	--	--	--
39. Number of new suggestions	--	--	--	--	--	--	--	--	--	--	-65	60
40. Suggestions completed	--	--	--	--	--	--	--	--	70	50	(09)	40
41. Suggestions not completed	--	--	--	--	--	--	--	--	75	(18)	--	--
42. Accumulative suggestions	--	--	--	--	--	--	--	--	39	57	-59	(36)
43. Shipments/returns & allowances	--	--	--	--	73	(34)	--	--	(32)	82	--	--
44. Profits before taxes	86	84	--	--	--	--	--	--	--	--	--	--
45. Net worth	66	87	-41	(22)	58	(26)	--	--	--	--	--	--
46. Number of layoffs	-48	-28	(-13)	61	--	--	--	--	--	--	--	--
47. Hire & rehiring	--	--	--	--	--	--	65	57	--	--	--	--
48. Number of job changes	--	--	(-07)	61	--	--	69	(39)	--	--	--	--
49. Number of grievances	--	--	--	--	--	--	--	--	42	--	--	--
50. Percent yield	56	--	-58	--	--	--	--	--	--	--	--	--
51. Assets/liabilities	--	--	--	--	--	--	--	--	--	--	45	--
52. Net profit/net worth	78	--	--	--	--	--	--	--	--	--	--	--

\*Factors Iv4 - VIv4 = four year varimax factors; Factors Iv6 - VIv6 = six year varimax factors.

Examination of Table 9 indicates that factor Iv4<sup>1</sup> and factor Iv6<sup>2</sup> factor IIIv4 and factor IIv6, and factor IVv4 and factor Vv6 are quite similar. But, on the other hand, factors IIv4, Vv4, and VIv4 differ from factors IIIv6, IVv6, and VIv6.

The three differing factors, IIIv6, IVv6, and VIv6 are described below. Factor IIIv6 indicated a positive relationship existed among supervision, engineering and administration salaries, the number of salaried employees, the number of layoffs, and the number of job changes. Factor IVv6 showed that returns and allowances, ratio of shipments to returns and allowances, overtime premium, suggestions completed, and incomplete suggestions still under consideration were all positively related. Factor VIv6 was positively loaded on the number of injuries, new suggestions, and new suggestions not completed and negatively loaded on payroll fringes.

In order to complete the exploration of possible differences among the factors attributable to the type of rotation used, a quartimax rotation was also carried out on the six year, 48 variable principle axes solution. The resulting table of factors is found in Appendix I, Table 5. Seventy-six percent of the variance in the matrix was accounted for by the six factors. The common variances contributed by each of the six factors are, respectively: .44, .12, .05, .05, .05 and .04. A comparison of both the varimax and quartimax rotations on the six year, 48 variable principle axes

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<sup>1</sup>Subscript v4 refers to the 52 variable, four year varimax solution.

<sup>2</sup>Subscript v6 refers to the 48 variable, six year varimax solution.



solution revealed about the same pattern that developed when these two rotations were compared on the 52 variable principle axes solution over the four year period. Varimax factors III, IV, V, and VI were similar to the same numbered quartimax factors. The quartimax factor I had combined the varimax factors I and II, in this case, into a single general factor. Again the quartimax factor II was a residual factor resulting from the combination of varimax factors I and II.

A comparison was also made between the four and six year quartimax solutions in order to complete the exploration of possible differences in the factors attributable to differing lengths of observations. Again, a pattern developed similar to that which occurred in the comparison between the two varimax rotations. Three factors in each rotation, i.e., factors I, III, and IV of the four year quartimax analysis, were similar. The remaining three factors in each analysis, factors II, V, and VI of the four year analysis and factors III, IV, and VI of the six year analysis differed.

In order to explore the influence on the factors of the irregular data from the months of July when the firm shuts down for a two-week vacation period, a varimax rotation was also performed on both the four year investigation and the six year investigation with the figures from the months of July removed. The resulting factor loading tables are found in Appendix I, Tables 6 and 7. Examination of these tables revealed almost identical factor structure between the full four year study and the four year study with the months of July removed. The six year study and the full six year study with the months of July removed were of almost identical structure also.



In order to explore the factors and the relationships among the variables loaded on the factors as they are related to the established differences in effectiveness of the two organizations, it was necessary, inasmuch as possible, to use comparable variables and data. Because of differences in the record keeping procedures of the organization investigated in this study and the organization investigated in the Boyles and Eddy studies, it was not possible to measure all of the same 24 variables used in their study. A comparison was made between the 52 variable varimax solution from the present study and the 24 variable varimax solution from Eddy's study using 14 variables which were used in both studies. Those variables which were used in both studies are listed below:

1. Net profit
2. Total units produced
3. Sales of major product (comparable to contract units)
4. Sales of all other units (comparable to company units)
5. Man hours of direct labor
6. Number of direct labor employees
7. Number of indirect labor employees
8. Number of salaried employees
9. Difficulty of product mix
10. Bonus percentage
11. Number of grievances filed
12. Number of job changes

13. Average hourly wage

14. Average hourly wage with bonus

The reader is referred to Eddy (1962), page 54, for results of the complete quartimax rotation solution and to page 57 for results of the complete varimax rotation solution found in the Boyles and Eddy studies. The amount of common variance contributed by each of the factors is also found in these tables. These investigators found that the varimax rotation accounted for 77 percent of the variance and the quartimax rotation accounted for 89 percent of the variance in the matrix.

Finally, for easier comparison of the factors and the variables loaded on the factors in terms of the established relative effectiveness of the two organizations, the following six tables are presented with the variables and their loading, ranked according to size, for each of the six varimax rotated factors from the Boyles and Eddy studies.

Table 10. Variables Loaded on Factor I

Variable	Loading
12. Number of salaried personnel	.88
23. Hourly wages	-.83
17. Direct labor variance	-.79
24. Hourly wages with bonus	-.76
11. Size indirect labor force	.72
12. Size of direct labor force	.66
18. Number of grievances	.66
15. Percent of bonus	-.64
20. Factory overhead variance	-.51
9. Units per man hour	-.40

Table 11. Variables Loaded on Factor II

Variable	Loading
3. Contract units produced	.94
4. Contract dollars	.93
2. Total units produced	.79
20. Factor overhead variance	.65
8. Man hours worked	.59
7. Industry units	.56
9. Units per man hour	.55
13. Difficulty of mix	-.54
1. Operating profit	.50
10. Size of direct labor force	.49

Table 12. Variables Loaded on Factor III

Variable	Loading
21. Actual job changes	.85
22. Number bumps	.83
8. Man hours worked	.51
1. Operating profit	.47
11. Size of indirect labor force	.43

Table 13. Variables Loaded on Factor IV

Variable	Loading
19. Number bids	.81
16. Material variance	.65
18. Number of grievances	.52

Table 14. Variables Loaded on Factor V

Variable	Loading
6. Company dollars	.90
5. Company units produced	.88
1. Operating profit	.51
13. Difficulty of mix	.42

Table 15. Variables Loaded on Factor VI

Variable	Loading
14. Actual/scheduled production	.82
9. Units per man hour	.54



## DISCUSSION

One purpose of this study was to replicate the single study by Boyles in another organization. The basic question asked was: are factor analytic techniques useful in describing the underlying structure and relationships among a large number of output or performance criteria in more than one or any organization?

Interpretation of the varimax rotation of the four year, 52 variable principle axes solution will be discussed first and used as a basis for comparison of the other factorial analyses performed on the data. There are several reasons for selecting the varimax factorial solution as a basis for comparison. First, the varimax rotation tends to make more definite mathematically the intuitive notion of simple structure. Second, it tends to yield factors that are invariant under a changed sample of variables. Finally, the varimax solution was selected as a basis for comparison because it seemed to yield the most interpretable set of factors. The four year investigation was used as a basis of comparison because it seemed to yield the most interpretable set of factors. The four year investigation was used as a basis of comparison because it included a larger sample of variables than the six year investigation.

The four year, 52 variable varimax solution yielded six factors accounting for 74 percent of the variance in the matrix. Factor I is highly loaded on what might be termed "positive assets" or "corporate well being"

variables such as profit, net worth, percent of net profit to net worth, sales, bonus, production, and yields. These variables are all positively related and when high would appear to be indicative of positive or effective performance by the organization. Thus, when sales, production, and positive expense variance are high, one would expect profits, net worth, return on investment, and bonuses to also be high. If negative relationships existed among any of these variables, it might signify or be indicative of a warning flag suggesting further investigation might be appropriate. For example, if a negative relationship existed between sales and production, sales and profit, expense variance and profit, or sales and bonus earnings, further investigation would probably be appropriate.

Another important relationship which this factor reveals is that existing between bonus earned and percent yield of major product. Bonus earnings are a result of increased labor efficiency. As efficiency is increased in the organization, the entire labor force share in a percentage of the savings in the form of bonus payments. The percent yield variable is a quality control or efficiency measure. Thus, in months when efficiency is highest, bonus earnings are also. It is also interesting to note that efficiency and production are positively related. The positive relationship would seem to indicate that efficiency and quality do not suffer in months of increased production.

In addition, there are a number of expense variables that vary with the amount of sales and level of production. In months of high production,

cost of supplies, miscellaneous expenses, overtime premium, hourly wage, and payroll are also high. The loadings indicate, as one might expect, that the number of production workers are larger in months of high production while the number of layoffs are less. It is of interest to note that although direct labor, indirect labor, selling, and administrative payrolls are moderately positively loaded on this factor, maintenance payroll is only slightly loaded and supervision salaries are negatively loaded on the factor. Evidently, these expenses are tolerable and may even be prerequisites to more production, profit, etc.

Factor III appears to be a major expense variable principally concerned with people. Payroll at all levels, direct, indirect, staff, and management are highly loaded on this factor. Other highly loaded variables directly concerned with people are payroll fringes, overtime, operating supplies, dies, jigs, and tooling costs, returns and allowances, number of employees, and hours worked. Additional variables positively related but not as highly loaded on this factor are sales, production, and net worth.

Although many of the same variables load on both factors I and III, there are some very interesting and distinct differences. Examination of factors I and III reveal that the variables concerned with bonus earnings, profit and return on investment are highly loaded on factor I but not as highly loaded on factor III. Other factors exhibiting the same pattern but not as extensively are, sales, production, average hourly wage, and percent yield of major product. On the other hand, payroll at all levels, size



of labor force, hours worked, and returns and allowances are noticeably loaded higher on factor III than on factor I. Considering factor I a positive asset or corporate well being factor and factor III a people expense factor, the above relationships appear quite reasonable. For example, salaries, labor force, payroll, and payroll fringes would appear to be much more legitimately an expense element than a measure of the well being of a corporation. Also, these expense variables are not as essential to profit, production, and sales and therefore, they are more controllable by people. But profit, production, and sales appear to be more indicative of corporate well being than of people expenses.

Factor II would appear to be an operating expense factor differing from factor III, a people expense factor. The strongest relationship revealed by this factor is the inverse relationship between the percent yield of the major product produced and the cost of direct materials used in production. Such an inverse relationship indicates that in months when percent yield is up, cost of direct materials is down, although cause and effect is not suggested. To complete the operating expense configuration, factor II indicates that as percent yield, net worth, number of salaried employees, engineering salaries, ratio of assets to liabilities, average hourly wage, and end of year deficit reserve increase, the cost of direct materials, actual expenses, number of injuries, number of production workers, and the revenues received from the sale of all products but the major product decrease. Thus, it would appear that as efficiency increases, operating expenses decrease enhancing the net worth of the organization.

Factor IV appears to be a stability factor built around the production of the major product. The major product is the most profitable and easily produced item. Thus, in months when the production of the major product predominates, as indicated by a favorable production mix ratio, revenue from the major product, and net sales are high. At the same time inventory variation, number of people hired and rehired, and the number of job changes, all disruptive elements, are decreasing.

On the other hand, it appears that in months when the mix is more difficult, revenues from the major product, net sales and building maintenance salaries decrease with a concurring increase in the number of job changes, the number hired and rehired, and the amount of inventory variation. It would appear, therefore, that the predominant production of the major product is a major stabilizing force in this organization.

Factor V appears to be a human relations-communication factor. The number of suggestions completed per month, the inverse of this variable, i.e., the number of suggestions not completed per month, the incomplete suggestions from previous months which are still under consideration, and the number of grievances per month are all positively related. Possibly, as the number of suggestions not completed per month and the number of incomplete suggestions from previous months increase, the number of grievances rise irrespective of the number of suggestions completed and put into effect. Or possibly, the implementation of new suggestions might conceivably result in an increase in the number of grievances. On the

other hand, it may be that an increase in the number of grievances results in an increase in the number of suggestions being put into effect. The cause and effect of the relationships cannot be established from the factor loadings. The direct relationship among these variables suggests that both channels of communications, suggestions and grievances, are being used.

Factor VI indicates an inverse relationship between ratio of current assets to liabilities and end of year deficit reserve on the one hand and inventory variation, operating supplies, supervision salaries, number of new suggestions, and incomplete suggestions from previous months still being considered on the other. No attempt will be made to interpret this factor.

The second purpose of this study was to explore the effect the number of observations, i.e., the length of the period over which the analysis was conducted, had on the resulting factors and relationships among the variables. Thus another varimax rotation was carried out on the 48 variable, six year principle axes solution. Only forty-eight variables were used in this analysis because complete records were not available for four of the variables. When the number of factors were held constant at six, three factors similar to the factors from the four year varimax rotation and three factors apparently different from the four year study resulted. The two largest factors from the four year investigation and the two largest factors from the six year investigation were quite similar. In addition, the three differing factors resulting from the six year analysis were not readily interpretable and therefore added nothing additional to the psychological meaning

of the underlying structure of the performance criteria. Although the longer, six year analysis apparently added nothing to the understanding of the basic structure of this particular organization, the very fact that differences occurred suggests that length of analysis should be considered in the design of future studies. On the other hand, because apparently no additional information was gained from the additional period of time covered by this study, and because some information was lost by the reduced number of variables used in the analysis, it may be more appropriate to use a larger number of variables over a shorter period of time, if a choice is required between the number of variables to be used and the length of time covered by the study.

The third purpose of this study was to explore the effects of differing rotational techniques upon the resulting factors and relationships among the variables loaded on the factors. Therefore, a comparison was also made between varimax and quartimax rotations of the principle axes solution. The primary difference between these two solutions is that the Quartimax method aims at a description of the factor structure with as few factors as possible, whereas the aim of the Varimax method is to simplify the description of the columns or factors resulting in a greater spread of the variables across the factors.

The comparison between these two rotational techniques indicated little difference in basic structure. Holding the number of factors constant at six, the four smallest factors in both rotational solutions were very

similar. The two largest varimax factors, "corporate well being" and "people expenses" were apparently combined into a single general production factor by the quartimax rotation. Evidence for this statement was given by the fact that only those variables loading on either varimax factors I or III showed up in the general quartimax factor. A large general factor is typical of quartimax rotational solutions. The remaining quartimax factor appeared to be a residual factor resulting from the apparent combination of the two largest varimax factors into a general factor.

The residual quartimax factor from the four year analysis is quite interesting and possibly informative. All variables loading on this factor are directly concerned with bonus earnings or closely related to bonus earnings. The variables: percent bonus earned, bonus base, i.e., the figure from which the bonus is calculated, and average hourly wage with bonus are all loaded on this factor and inversely related to the variables: number of returned goods, dies, jigs, and tooling costs, total number of employees, and the number of production workers. Each of the last four variables adversely effect bonus earnings when they increase. For example, in months when the returned goods are high, it means that some items will be scrapped and other items will be reworked, both of which reduce efficiency and thereby reduce the bonus earnings. An increase in the number of production workers can also decrease bonus earnings. The primary reason is that an increase in labor force usually means an increase in learning time which reduces efficiency and decreases bonus earnings. Therefore,

although one quartimax factor reveals more clearly and independently the relationships among bonus variables, and although a single large general factor resulted from the quartimax rotation, it would appear that the remaining strong similarity between the varimax and quartimax rotational methods indicates that the structural dimensions underlying the variables are fairly stable.

During the month of July, the firm being studied closes down for several weeks vacation. When collecting data, the investigator noticed many irregularities in the data apparently produced by the shut down. It was felt therefore, that these irregularities in the data might effect the resulting factors. Thus additional varimax solutions were carried out on the four and six year analyses with the months of July removed. Comparison of the factors including the months of July with the factors not including the months of July revealed almost identical factor structure. Apparently the irregularities were constant across the months of July, thus accounting for the identical factor structure.

In answer to the first question raised by this study: are factor analytic techniques useful in describing the structure and relationships among a large number of performance criteria gathered from another organization, it would appear that the data supports an affirmative answer. Fifty-two criteria were parsimoniously grouped into six orthogonal factors. Thus, it would appear, that the performance of this organization can be summarized in terms of the following five interpretable factors:

1. Corporate well being
2. Operating expense
3. People expense
4. Major-product production stability
5. Suggestions-communication.

These findings suggest that factor analyses of performance criteria have proven useful in not only the organization studied by Boyles and Eddy but in the present organization also.

The fourth purpose of this study was to explore the effect an increased sample of variables had upon the resulting factors. Although a statistical test does not exist for evaluating this question, a few cautious statements may be made. Comparing the results of the present investigation with the results of Boyles and Eddy's investigation of 24 variables, it would appear that relatively little is gained in terms of the number of independent interpretable factors resulting from the additional variables. It may be that the most important point to consider is the quality of the variables, i.e., whether they are representative of the majority of the independent performance areas, not the quantity of variables included in the study. But at this point in the study of criterion variables, it is still unclear in any one organization what the representative variables are. Thus, it seems that more empirical investigations in a large variety of organizations will be required before one can adequately determine the effect the number of variables have upon the factors in terms of an increased understanding of the structure and relationships among the variables.

The final purpose of this investigation was to explore the factors and the relationships among the variables loaded on the factors as they are related to the established differences in effectiveness of the two organizations. According to a previous study by Erickson and Silkiner, the relative effectiveness of the organization investigated in this study and the relative effectiveness of the organization studied by Boyles and Eddy was established. The description of the criteria used to evaluate these two organizations and a description of the relative effectiveness of each organization on the criteria are found in Appendix III. Erickson and Silkiner suggested that the organization described in this study was relatively effective, whereas the organization studied by Boyles and Eddy was relatively ineffective.

Several interesting relationships are revealed by a comparison of the factors resulting from the two studies. First, there appears to be a factor concerned with labor costs or predominately people variables resulting from the analysis of both organizations. Table 10 concerning varimax factor I reveals that in the ineffective company the variables concerned with the size of the labor force are inversely related to wages and bonus, whereas Appendix I, Table 2 reveals that in the effective organization wages and bonus are either unrelated or only slightly positively related to size of labor force on varimax factor III. Possibly the ineffective company has increased labor costs to the extent that they must decrease their labor force in order to maintain a competitive position. On the other hand, in



the effective company labor costs are commensurate with the size of the labor force as shown by the lack of relationship between the variables, thus allowing the labor force to vary without adversely affecting the labor costs. The inverse relationship between size of labor force and bonus earnings in the ineffective firm would seem to indicate that the labor force must be small in order for the employees to earn a bonus. Whereas in the effective company, bonus earnings are slightly, positively related to size of labor force. This might suggest that the labor force in the effective company can vary without reducing bonus earnings to any great extent. In addition, as noted by Boyles, the bid and bump policy used in the ineffective company created a negative response to change which also might account for the inverse relationship between size of labor force and bonus earnings. Finally, another interesting difference between these factors is the relationship between grievances and size of labor force. In the ineffective company, grievances increase with the size of the labor force, while in the effective company, grievances are unrelated to size of labor force. It seems feasible that a relationship between grievances and the relative effectiveness of the organizations may be indicated by this relationship, but the cause and the effect cannot be established with the present data.

There are also some similarities between factor II of the ineffective company (see Table 11) and factor I of the effective company (see Appendix I, Table 2). Both factors show that the production and sales of total units

and major product, profit, man hours worked and difficulty of product mix hold together. It might not be obvious that difficulty of mix holds together as it is inversely related to the other variables in the ineffective company and directly related to the other variables in the effective company. The relationship becomes clear, though, when it is pointed out that the unit used to set up the ratio is the most difficult item to produce in the ineffective organization and the most easily produced item in the effective organization. Thus, the inverse relationship exhibited in the ineffective organization means that there exists an easy mix and the direct relationship exhibited in the effective organization also means that there exists an easy mix.

There would appear to be some important differences between these two factors also. Although both factors seem to be concerned with a "production-sales-profits" configuration in both the effective and ineffective organization, the variables loading on the factor from the effective organization show a greater margin and tolerance of expenses. For example, bonus earnings are highly related to profits and sales in the effective company and only slightly related in the ineffective company. Also, all units, both the major product and all other remaining products, are highly related to sales and profits in the effective firm, while only contract units but not company units are highly related to sales and profits in the ineffective company. Finally, average hourly wage is highly related to sales and profits in the effective company but unrelated to profits and sales in the ineffective company.

The largest difficulty encountered in making comparisons between the factors and relationships among the factors in terms of the established differences in effectiveness of the two organizations arises from the fact that only fourteen of the possible 24 variables were available for study in both organizations. Therefore, only limited comparisons could be made between the variables. Even though only limited comparisons between the organizations could be made, it seems important that the two largest factors from each analysis were concerned with a "people expenses" configuration and a "product-sales-profits" configuration. The similarities between the factor configurations for the two contrasting organizations may indicate that some variables hang together whether the organization is effective or ineffective. On the other hand, certain differences in the relationships among the variables were also pointed out. Some of these relationships may be indicative of important differences between effective and ineffective companies.

Extreme caution, though, must be employed in the generalization of these findings beyond the particular organizations discussed in this study. Only a limited number of variables were available for analysis in both the Boyles and Eddy studies and this study.

In addition, these relationships were examined over only relatively short periods of time in these organizations. More studies using these variables and if possible an even larger sample of variables on a number of other organizations will be necessary before any broader generalizations concerning the relationships among the criterion variables can be made.

## SUMMARY AND CONCLUSIONS

The background of theory and research was discussed involving first, the term effectiveness as viewed by various organization theorists and secondly, the more specific area of criteria of organizational effectiveness. General conclusions were that approaches to effectiveness criterion research must: (1) incorporate people with organizations and organizations with people, (2) be of an empirical, objective nature, and (3) be multi-dimensional, employing as many measures of the organization as possible.

Previous studies have established that some criteria of effectiveness are independent. But these studies have usually been done on a small scale. Therefore, it was suggested that the structuring of the relationships between a large number of performance criteria might be a valuable contribution to organizational effectiveness research.

The data used in the study was strictly operational. It was derived from the financial, personnel, engineering, accounting, and manufacturing records of a medium-sized manufacturing firm. These records are used by this organization and by many other organizations as well, as a basis for decision making. Inasmuch as "typical" psychological measures were not available over the periods of time covered by the study, it was felt that these records were the most appropriate measures available for study. As many variables as could be found were selected for study if they met certain requirements. This was consistent with the suggestion of Fruchter (1954).

He states, "If the purpose of the study is merely the identification of factors in a new area of investigation, the wider the range the better."

Fifty-two measures of performance over a four year period and forty-eight measures over a six year period in the life of an industrial organization were collected. Each of these two sets of data were first intercorrelated and then factor analyzed using the principal axes method. Both the four and six year principal axes solutions were then rotated by the varimax and quartimax methods. Finally, varimax rotations were also carried out on the four and six year investigations with the months of July removed.

The four year, 52 variable varimax solution was then discussed and interpreted in light of experience and familiarity with the organization studied. In addition, in order to determine the effect on the factors and the relationship among the variables loaded on the factors, comparisons were made between: (1) the four and six year studies, (2) the varimax and quartimax rotational solutions, (3) the increased number of variables used in this study and the number of variables used in the Boyles and Eddy studies, (4) the varimax solutions including the months of July and varimax solutions with the months of July removed, and (5) the two organizations in terms of established relative effectiveness.

The following conclusions were derived from the study:

1. Factor analytic techniques appear to be useful in describing the underlying structure and relationships among a large number of performance criteria.

2. Five dimensions of performance seemed to parsimoniously account for most of the common variance among the particular performance criteria used in the study.
3. Operational accounting, financial, manufacturing, engineering, and personnel records seem to be useful in describing the performance of the organization as a whole.
4. Length of time covered by the investigation should be considered when designing similar studies, but if a choice is required between length of time and the number of variables, the loss of information from a reduced number of performance variables may be greater than the loss of information from a shorter period of investigation.
5. Since little difference was found between the varimax and quartimax rotation solutions, a decision as to which technique provides the most adequate interpretation of the data might better be made on a theoretical rather than an empirical basis.
6. Since the data did not lend itself to a statistical test, many more empirical investigations in a variety of organizations will be required before one can adequately determine the effect an increased number of variables have on the factors and the psychological meaning of the factors.
7. The irregularities in the data caused by the vacation shut down during July had no effect on the factors or relationships among the variables loaded on the factors. Possibly, the irregularities were constant across the months of July.
8. Similarities between the two largest factors in the effective organization and the two largest factors in the ineffective organization may suggest that some variables hang together whether the organization be effective or ineffective.
9. Differences among the variables loaded on the factors in the effective and ineffective organizations possibly suggest that some of these relationships may be indicative of important relationships between the effective and ineffective companies.

It is important to remember that all findings and conclusions stated in this study are of a correlational nature. Only relationships between variables

and organizations can be discussed. The cause and effect of the relationships cannot be established with the present data. Also, a great deal of caution must be used in generalizing the findings of this study beyond the particular organization from which they were derived as the variables selected do not represent a random sample of the population of performance criteria. In addition, only a limited number of variables were available for analysis in both the effective and ineffective organizations.

There are several important ways the above established factor structure and relationships among the variables might be used. First, knowledge of the basic structure and relationships among the dependent or performance criterion variables can be of value to the management of the firm. Valuable, yet many times not so obvious, information about the structure and relationships of the many performance variables have been revealed, thereby increasing management's ability to better comprehend these operational variables with which they must contend and over which they must exercise "control" (Eddy, 1962). Second, knowledge of the factor structure and relationships among the performance criteria may enhance one's ability to understand the relationships possibly accounting for the differences in the relative effectiveness of the organizations. Third, knowledge of the relationships and independent groupings of the effectiveness criteria might be of value to future criterion research also. Thus in future research, if all criterion variables were not available in a particular organization, one measure from each independent group of highly intercorrelated measures

might be used as an appropriate measure for comparing the relative effectiveness of this organization with other organizations. Finally, in future research with independent variables, knowledge of the relationships and independent groupings of the variables might provide empirical support for the selection of appropriate dependent measures.



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APPENDIX I

CORRELATION AND ROTATED FACTOR TABLES

Table 1. Intercorrelation of Criterion Variables

[illegible]

\* Loadings and proportions are in hundredths, decimals omitted.

Table 2. Varimax Rotated Factor Loadings for Four Year Investigation

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	23*	01	78	06	29	07
2. Net sales	73	10	47	-40	12	13
3. Inventory variation	12	11	13	71	-27	-46
4. Total production	79	17	55	02	-05	-16
5. Allowable expenses	79	23	54	02	-06	-16
6. Actual expenses	55	44	62	07	-10	-23
7. Expense variance	94	-10	26	-04	01	-03
8. Gross bonus	94	-10	26	-04	02	-03
9. Deficit reserve	94	-10	26	-04	01	-03
10. Actual payroll	62	-12	74	-00	-00	-13
11. Bonus percentage	93	-09	11	-06	08	-09
12. End of year deficit	59	-50	01	15	-14	42
13. Payroll fringes	16	-23	49	-12	-18	13
14. Direct materials	00	90	02	09	-17	-11
15. Operating supplies	48	27	60	-01	-04	-39
16. Miscellaneous expenses	52	-11	37	03	16	00
17. Direct labor payroll	63	-11	73	-02	-00	-16
18. Supervision salaries	-24	10	16	-27	-11	-60
19. Indirect labor payroll	60	06	73	01	-13	-07
20. Maintenance payroll	17	05	41	-39	09	-15
21. Engineering salaries	27	-47	72	-06	03	-10
22. Equipment payroll	35	-19	70	-10	-15	04
23. Selling salaries	48	-23	65	05	-27	22
24. Administrative salaries	48	-28	71	-03	-18	-01
25. Overtime premium	50	-14	74	-01	01	03
26. Dies, jigs, and tooling	06	11	62	13	12	07
27. Number of injuries	-00	36	02	-03	-03	07
28. Number of salaried employees	27	-42	71	-08	-16	-01
29. Total number of employees	21	28	84	-08	-10	-20
30. Total hours worked	36	12	76	-05	06	-14
31. Number of production workers	18	37	80	-07	-08	-22
32. Production worker man hours	40	32	72	-02	02	-16
33. Average hourly wage	65	-38	23	04	-29	26
34. Average hourly wage/bonus	91	-23	16	-02	-08	08
35. Sales of total units	73	10	47	-38	09	15
36. Sales of major product	62	-09	47	-49	10	25
37. Sales of all other units	67	36	31	-09	04	-03
38. Difficulty of product mix	38	-22	34	-60	04	21
39. Number of new suggestions	14	-19	-06	05	-07	-65
40. Suggestions completed	-03	-15	09	-04	70	09
41. Suggestions not completed	17	-12	-10	-05	75	-00
42. Accumulative suggestions	-07	-14	17	-18	39	-59

Table 2--Continued

Variables	Factors					
	I	II	III	IV	V	VI
43. Shipments/returns & allowances	-04	02	73	16	32	-01
44. Profits before taxes	86	07	28	-28	12	-02
45. Net worth	66	-41	58	-09	-04	11
46. Number of layoffs	-48	-14	-23	12	25	26
47. Hire and rehiring	-13	-02	06	65	04	16
48. Number of job changes	-12	-07	19	69	13	22
49. Number of grievances	05	31	02	28	42	00
50. Percent yield	56	-58	25	02	24	-24
51. Assets/liabilities	-11	-37	-13	-11	05	45
52. Net profit/net worth	78	26	16	-36	10	-02

\*Loadings and proportions are in hundredths, decimals omitted.

Table 3. Quartimax Rotated Factor Loadings for Six Year Investigation

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	60*	15	-05	66	05	-06
2. Net sales	91	13	-09	-06	-31	01
3. Inventory variation	09	11	-17	01	85	23
4. Total production	95	19	-16	-06	09	13
5. Allowable expenses	93	24	-16	-08	09	14
6. Actual expenses	75	61	-07	-00	10	13
7. Expense variance	80	-46	-25	-17	05	10
8. Gross bonus	80	-46	-25	-17	05	10
9. Deficit reserve	80	-46	-25	-17	05	10
10. Actual payroll	96	15	03	12	06	-01
11. Bonus percentage	78	-40	-25	-20	03	16
12. End of year deficit	34	-57	-25	-08	06	-30
13. Payroll fringes	44	14	01	00	-01	-49
14. Direct materials	17	79	-05	-16	09	24
15. Operating supplies	38	59	-25	16	19	-01
16. Miscellaneous expenses	70	13	07	-01	-09	08
17. Direct labor payroll	92	23	-07	17	05	-03
18. Supervision salaries	52	25	57	-23	-05	21
19. Indirect labor payroll	92	23	06	07	09	02
20. Maintenance payroll	57	11	07	06	-28	04
21. Engineering salaries	77	-24	28	12	07	-12
22. Equipment payroll	79	10	08	21	03	-09
23. Selling salaries	84	07	19	07	09	-17
24. Administrative salaries	38	-16	34	-06	08	02
25. Overtime premium	82	07	-15	29	06	-21

Table 3--Continued

Variables	Factors					
	I	II	III	IV	V	VI
26. Dies, jigs, and tooling	55	32	19	25	13	-13
27. Number of injuries	-02	06	03	02	02	30
28. Number of salaried employees	80	-10	44	-02	04	02
29. Total number of employees	59	74	08	12	-07	-00
30. Total hours worked	71	53	07	13	-06	-03
31. Number of production workers	48	82	-00	13	-09	-01
32. Production worker man hours	61	70	-12	14	-04	-01
33. Average hourly wage	72	-49	17	-14	15	-03
34. Average hourly wage/bonus	81	-48	-04	-19	09	09
35. Sales of total units	90	14	-08	-07	-28	01
36. Sales of major product	80	-02	-20	08	-46	-15
37. Sales of all other units	78	29	07	-22	-00	19
38. Difficulty of product mix	28	-15	-42	21	-57	-26
39. Number of new suggestions	12	08	-01	10	06	61
40. Suggestions completed	10	-00	17	51	-32	39
41. Suggestions not completed	17	-31	21	14	-23	25
42. Accumulative suggestions	-05	10	-14	59	-04	34
43. Shipments/returns & allowances	32	19	00	80	12	-02
44. Profits before taxes	82	-23	-30	-11	-16	13
45. Net worth	91	-31	07	02	01	-10
46. Number of layoffs	-25	-06	66	-00	-10	08
47. Hire and rehiring	-19	-15	12	15	57	-33
48. Number of job changes	19	-09	57	02	42	-20

\*Loadings and proportions are in hundredths, decimals omitted.



Table 4. Varimax Rotated Factor Loadings,  
Four Year Study Without July

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	27*	52	04	66	-01	20
2. Net sales	62	66	-13	-01	35	02
3. Inventory variation	12	06	08	15	-87	-19
4. Total production	68	71	-09	06	-06	-09
5. Allowable expenses	64	73	-10	03	-06	-11
6. Actual expenses	24	93	-07	03	-10	-15
7. Expense variance	97	09	-12	02	01	01
8. Gross bonus	97	09	-12	02	01	01
9. Deficit reserve	97	09	-12	02	01	01
10. Actual payroll	63	72	09	17	-01	01
11. Bonus percentage	94	10	-14	-00	05	-05
12. End of year deficit	61	-22	-05	-06	-03	45
13. Payroll fringes	22	43	13	-09	06	44
14. Direct materials	-31	69	-14	-18	-13	-28
15. Operating supplies	-07	69	-21	14	-25	04
16. Miscellaneous expenses	47	50	13	11	23	-09
17. Direct labor payroll	56	75	00	23	-03	05
18. Supervision salaries	23	52	44	-15	09	-50
19. Indirect labor payroll	57	76	13	10	-03	-03
20. Maintenance payroll	36	50	-08	08	18	-16
21. Engineering salaries	70	35	35	16	-03	02
22. Equipment payroll	53	66	11	19	-09	05
23. Selling salaries	55	63	28	04	-04	12
24. Administrative salaries	75	44	38	02	-00	-14
25. Overtime premium	55	60	-02	26	-05	30
26. Dies, jigs, and tooling	19	62	27	28	-03	08
27. Number of injuries	-00	02	05	-03	01	-28
28. Number of salaried employees	66	46	45	01	03	-16
29. Total number of employees	-02	95	02	09	06	-08
30. Total hours worked	21	86	06	13	10	-02
31. Number of production workers	-14	94	-07	10	05	-05
32. Production worker man hours	07	94	-10	17	04	02
33. Average hourly wage	87	05	26	-08	-08	02
34. Average hourly wage/bonus	96	08	06	-04	-00	-03
35. Sales of total units	61	66	-12	-02	32	02
36. Sales of major product	60	53	-24	08	44	20
37. Sales of all other units	48	67	06	-15	10	-20
38. Difficulty of product mix	29	16	-50	18	43	30
39. Number of new suggestions	09	07	-12	19	-10	-60
40. Suggestions completed	-03	06	06	54	45	-22
41. Suggestions not completed	26	-16	19	31	42	-11
42. Accumulative suggestions	-14	06	-21	61	-05	-23

Table 4--Continued

Variables	Factors					
	I	II	III	IV	V	VI
43. Shipments/returns & allowances	01	38	08	78	-09	17
44. Profits before taxes	83	29	-27	03	18	-01
45. Net worth	88	34	17	09	05	11
46. Number of layoffs	-27	-22	62	-01	33	-15
47. Hire and rehiring	-07	-21	34	06	-45	41
48. Number of job changes	10	05	75	-01	-16	17

\*Loadings and proportions are in hundredths, decimals omitted.

Table 5. Varimax Rotated Factor Loadings for Six Year Investigation

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	30*	46	01	72	-01	-08
2. Net sales	65	62	01	05	-38	-03
3. Inventory variation	12	15	-13	04	85	23
4. Total production	70	69	-03	06	02	08
5. Allowable expenses	67	72	-04	03	02	10
6. Actual expenses	29	92	-01	05	06	13
7. Expense variance	97	08	-10	-01	-02	02
8. Gross bonus	97	07	-09	-01	-02	02
9. Deficit reserve	97	08	-10	-01	-02	02
10. Actual payroll	66	66	15	24	-02	-05
11. Bonus percentage	93	11	-10	-06	-04	08
12. End of year deficit	62	-26	-15	02	02	-36
13. Payroll fringes	23	38	06	06	-04	-50
14. Direct materials	-24	75	-08	-21	11	27
15. Operating supplies	00	71	-24	17	18	00
16. Miscellaneous expenses	48	50	16	07	-14	05
17. Direct labor payroll	59	71	04	28	-02	-07
18. Supervision salaries	24	49	62	-18	-09	20
19. Indirect labor payroll	59	71	17	17	02	-02
20. Maintenance payroll	36	40	12	12	-33	01
21. Engineering salaries	68	23	40	25	-01	-18
22. Equipment payroll	53	53	17	31	-04	-12
23. Selling salaries	58	54	31	18	02	-21
24. Administrative salaries	75	36	48	08	-01	-03
25. Overtime premium	58	52	-04	39	-00	-25
26. Dies, jigs, and tooling	19	58	24	30	09	-13
27. Number of injuries	-03	03	02	01	02	31
28. Number of salaried employees	63	36	55	10	-05	-02

Table 5--Continued

Variables	Factors					
	I	II	III	IV	V	VI
29. Total number of employees	03	94	09	13	-10	01
30. Total hours worked	24	84	12	18	-10	-04
31. Number of production workers	-10	94	-01	12	-10	02
32. Production worker man hours	09	92	-09	16	-06	-00
33. Average hourly wage	84	00	31	01	07	-10
34. Average hourly wage/bonus	96	06	12	-03	01	01
35. Sales of total units	64	62	02	04	-35	-04
36. Sales of major product	62	43	-11	18	-52	-20
37. Sales of all other units	50	67	16	-14	-06	16
38. Difficulty of product mix	27	03	-39	24	-58	-29
39. Number of new suggestions	10	12	-00	10	04	60
40. Suggestions completed	-02	04	16	50	-37	40
41. Suggestions not completed	25	-17	25	18	-26	23
42. Accumulative suggestions	-15	05	-17	57	-04	36
43. Shipments/returns & allowances	03	34	02	82	09	-01
44. Profits before taxes	84	27	-17	02	-22	07
45. Net worth	87	26	22	17	-08	-17
46. Number of layoffs	-28	-21	61	-04	-10	10
47. Hire and rehiring	-10	-22	12	16	57	-33
48. Number of job changes	11	04	61	06	39	-21

\*Loadings and proportions are in hundredths, decimals omitted.

Table 6. Varimax Rotated Factor Loadings for Six Year Study Without July

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	20*	74	-13	39	-20	15
2. Net sales	63	54	-07	10	-14	-49
3. Inventory variation	07	18	-18	-21	45	73
4. Total production	69	67	-19	-02	14	-07
5. Allowable expenses	67	66	-24	-05	14	-09
6. Actual expenses	38	76	-44	-10	18	-06
7. Expense variance	91	35	06	04	04	-09
8. Gross bonus	91	35	06	04	04	-09
9. Deficit reserve	91	35	06	04	04	-09
10. Actual payroll	54	81	09	04	13	-02
11. Bonus percentage	92	19	06	11	08	-12
12. End of year deficit	66	01	46	-15	-34	21
13. Payroll fringes	08	53	42	-20	-07	-16
14. Direct materials	-21	11	-81	-28	07	-14

Table 6--Continued

Variables	Factors					
	I	II	III	IV	V	VI
15. Operating supplies	35	68	-35	03	34	-05
16. Miscellaneous expenses	39	46	29	15	00	-10
17. Direct labor payroll	56	79	07	06	14	-01
18. Supervision salaries	-27	21	-18	-01	65	-20
19. Indirect labor payroll	49	81	-04	-12	06	-05
20. Maintenance payroll	22	44	-25	20	13	-27
21. Engineering salaries	33	73	32	15	10	11
22. Equipment payroll	42	75	01	-07	-04	06
23. Selling salaries	47	69	18	-26	-18	09
24. Administrative salaries	45	76	21	-13	04	04
25. Overtime premium	46	77	11	04	-04	-00
26. Dies, jigs, and tooling	05	61	-12	21	-23	19
27. Number of injuries	-03	-00	-43	00	-17	-01
28. Number of salaried employees	34	76	29	-08	04	07
29. Total number of employees	06	92	-16	-08	16	-14
30. Total hours worked	24	83	-05	08	09	-12
31. Number of production workers	02	90	-21	-08	17	-17
32. Production worker man hours	26	88	-15	03	12	-14
33. Average hourly wage	76	22	17	-26	-24	16
34. Average hourly wage/bonus	94	20	10	-04	-08	-01
35. Sales of total units	64	54	-06	07	-16	-47
36. Sales of major products	61	50	04	13	-28	-46
37. Sales of all other units	50	45	-21	-06	07	-34
38. Difficulty of product mix	51	34	04	15	-28	-45
39. Number of new suggestions	09	-01	18	-06	74	-02
40. Suggestions completed	-11	06	27	62	-07	-19
41. Suggestions not completed	17	-11	15	74	-03	-10
42. Accumulative suggestions	02	13	-12	54	50	-05
43. Shipments/returns & allowances	-05	66	-15	44	-14	28
44. Profits before taxes	79	35	-08	11	02	-38
45. Net worth	68	62	33	02	-09	-02
46. Number of layoffs	-57	-28	38	15	-21	01
47. Hire and rehiring	-05	-00	-07	01	-18	65
48. Number of job changes	-18	13	11	05	-17	60
49. Number of grievances	-04	00	-31	39	-03	18
50. Percent yield	61	25	47	33	25	08
51. Assets/liabilities	-10	-13	55	-03	-34	-14
52. Net profit/net worth	67	25	-24	07	01	-52

\*Loadings and proportions are in hundredths, decimals omitted.

Table 7. Quartimax Rotated Factor Loadings for  
Four Year Investigations

Variables	Factors					
	I	II	III	IV	V	VI
1. Returns and allowances	68*	01	44	14	26	05
2. Net sales	87	12	-08	-35	15	16
3. Inventory variation	14	13	-11	74	-26	-42
4. Total production	96	20	-14	09	-02	-10
5. Allowable expenses	94	27	-15	09	-03	-10
6. Actual expenses	82	46	07	14	-09	-19
7. Expense variance	87	-06	-43	-01	07	04
8. Gross bonus	87	-06	-44	-01	07	04
9. Deficit reserve	87	-06	-44	-01	07	04
10. Actual payroll	96	-10	12	08	-00	-11
11. Bonus percentage	76	-05	-54	-05	14	-01
12. End of year deficit	43	-48	-38	14	-10	47
13. Payroll fringes	46	-22	25	-07	-20	12
14. Direct materials	-00	90	01	09	-16	-09
15. Operating supplies	77	29	08	07	-04	-37
16. Miscellaneous expenses	64	-10	-06	07	17	03
17. Direct labor payroll	96	-09	09	07	00	-13
18. Supervision salaries	-02	10	23	-23	-15	-63
19. Indirect labor payroll	94	08	11	10	-13	-04
20. Maintenance payroll	43	05	22	-34	07	-16
21. Engineering salaries	70	-46	33	03	00	-11
22. Equipment payroll	74	-18	27	-02	-17	04
23. Selling salaries	79	-21	14	12	-26	24
24. Administrative salaries	84	-27	18	06	-19	00
25. Overtime premium	86	-13	21	07	00	04
26. Dies, jigs, and tooling	44	11	43	19	09	05
27. Number of injuries	00	36	04	-03	-03	07
28. Number of salaried employees	70	-41	31	-00	-19	-02
29. Total number of employees	72	29	46	02	-13	-21
30. Total hours worked	79	13	32	04	04	-14
31. Number of production workers	67	38	45	02	-11	-23
32. Production worker man hours	78	33	26	06	01	-15
33. Average hourly wage	63	-35	-28	06	-25	32
34. Average hourly wage/bonus	78	-19	-49	-01	-02	16
35. Sales of total units	87	12	-09	-34	11	19
36. Sales of major product	80	-08	08	-45	11	26
37. Sales of all other units	70	38	-20	-06	07	01
38. Difficulty of product mix	55	-22	07	-56	04	21
39. Number of new suggestions	09	-17	-22	06	-07	-63
40. Suggestions completed	03	-15	16	-04	69	06
41. Suggestions not completed	06	-12	-12	-07	77	-08
42. Accumulative suggestions	09	-14	16	-15	36	-62

Table 7---Continued

Variables	Factors					
	I	II	III	IV	V	VI
43. Shipments/returns & allowances	45	00	57	24	28	-05
44. Profits before taxes	84	10	-34	-26	16	04
45. Net worth	89	-39	-01	-03	-03	14
46. Number of layoffs	-53	-16	19	08	23	22
47. Hire and rehiring	-11	-02	10	65	04	16
48. Number of job changes	-02	-08	20	70	12	22
49. Number of grievances	01	31	01	28	43	01
50. Percent yield	59	-56	-21	06	26	-21
51. Assets/liabilities	-17	-38	01	-14	05	44
52. Net profit/net worth	71	28	-36	-35	15	04

\*Loadings and proportions are in hundredths, decimals omitted.

## APPENDIX II

### DESCRIPTION OF ORGANIZATION SELECTED FOR STUDY

The organization selected for this study was a medium sized, non-unionized manufacturing concern located in Midwestern United States. The firm manufactures a variety of related products. One product sold to automobile manufacturers has averaged more than 40 percent of all sales over the last several years. The major divisions of the firm include finance, marketing, manufacturing, and engineering. The managers of the firm are progressive and highly versed in human relations and recent behavioral and business science research. Management by objectives was introduced into each department in the firm in 1960 and has been effective in bringing about desired results. In 1952 the Scanlon plan was put into effect in the company. The Scanlon plan is an incentive plan in which all employees share in bonus earnings which result from increased labor efficiency. Bonus earnings are computed for each employee based on a percentage of his salary. These bonus earnings have averaged about 15 percent over the last several years. Excellent management practices and the effective use of management by objectives and the Scanlon plan have allowed this firm to become very competitive.

## APPENDIX III

### MUTUAL GOALS OF COMPANY A AND COMPANY B LISTING THE EFFECTIVENESS OF GOAL ATTAINMENT BY EACH

#### 1. Specified Level of Profit and Rate of Growth

Company A: 25% of previous net worth, both for the level of profit and the rate of growth, has been met or exceeded since it was established as a goal in 1961. This is a higher rate of growth than was experienced by the general economy. Of the earnings, 40% go for dividends and 60% are reinvested.

Company B: 4% of gross sales with a 15% increase in sales per year. Neither has ever been met since they were first set as goals in 1958. (1956 was a banner year for the company with sales of \$12.8 million. Profit in 1956 was 3.1% of sales.) Sales have been erratic. There is no consistent pattern of increase or decrease, except for the last two years, in which sales decreased. In 1963, with sales of \$10.3 million, the company suffered a net loss of \$467,000. Over a nine year period (1954-1962), sales have averaged \$9.7 million, and profit 1.7% of gross sales.

#### 2. Dividends to Stockholders

Company A: Dollar amount unknown since it is privately held. See above for percent of return on investment.

Company B: Generally erratic, ranging from nothing to \$.80 per share. The nine year average is \$.38.

#### 3. Expansion from Internally Generated Capital, i.e., from Profits

Company A: Yes, 60% of profit is reinvested each year.

Company B: No. The company has borrowed to the limit to meet payroll.



#### 4. Accurate Budgeting and Cost Control

Company A: Yes. Profits and costs are planned. Specified level of profit must be met before bonus is paid employees.

Company B: No. Budgets are not met and management cannot give reasons why. Maintained multiple budgets that allowed sales to be made at a lower price than manufacturing costs. In the past, bonus has been paid while company was actually losing money.

#### 5. Accurate Costing for Efficient Spread of Manpower

Company A: Time studies and manning are generally accurate.

Company B: Time studies are inaccurate. Exact manning requirements are not met. Company once had 120 excess direct workers -- 70, a paper mistake, and 50, a true excess unrecognized until an outside management consultant pointed it out. At one time, the union filed a grievance for over-manning, of which management was unaware.

#### 6. High Quality Production, Low Scrap, and Waste

Company A: Quality control is good. Returns and allowances for poor quality average about 1% of sales.

Company B: High scrap costs, poor quality. Rework costs are high. At times, to meet production quotas, "seconds" are knowingly produced and then run through the line again as rework.

#### 7. Quality Engineering on New Products

Company A: Yes. Technical problems are generally solved before a product is introduced to the production line.

Company B: No. As an example, 269 engineering changes were required on one product during a two-week production period.

#### 8. Meeting Predicted Development Times on New Products

Company A: Generally accurate.

Company B: Late in the majority of cases by as much as four years.

9. Confidence of Customers

Company A: Yes. The company works very closely with its customers. Since the inventory control program was installed, the relationship between manufacturer and customer is even closer.

Company B: No. There was a big loss of customer confidence in recent months. Products sold under the company brand-name are a drug on the market, forcing discontinuation of several lines.

10. Finding and Opening New Markets for Products

Company A: Yes. The company is competitive and has penetrated new markets through an aggressive expansion program. The foreign market for the company is just beginning to open up.

Company B: No. The company is not competitive, and its reputation for poor quality of its brand-name products has led to a drastic slump in sales for them. Consequently, to survive, the company depends heavily on contract production for other manufacturers, which is much less profitable than its own brand-name production.

11. Meetings Held as Scheduled

Company A: Yes.

Company B: No.

12. Staff Meets to Plan as a Team

Company A: Yes. Regular and frequent meetings are held.

Company B: No. Although established as a goal and cited frequently by top management, staff meetings are not held. Heads of staff work as individuals, sometimes holding their own informal meetings to coordinate programs without top management's knowledge.

13. Feedback of Company Plans and Other Information

Company A: Generally good. Employees are kept fairly well informed by minutes of meetings and company newsletters.

Company B: There is virtually none. Published minutes of meetings which are held do not reflect the true nature of discussions. Verbal communication downward is poor, at best, and the company paper has been discontinued.

14. Steady Employment Through All Cycles of the Business Year

(Both companies experience sharp increases and decreases in product demand during the year.)

Company A: In 1961, an inventory control program was installed to level out production. As a result, layoffs have been virtually eliminated; in fact, the work force has grown at a steady rate (from 102 employees in March 1961 to 157 in December 1963). This stable work force has resulted in great savings in company contribution for unemployment compensation.

Company B: Work force highly variable. Even with stated goal of steady, continuous employment, the work force during 1963 went from 300 to 500 to 200 to 120.

15. Paying Equitable Wages to Employees

Company A: Yes

Company B: Yes. The company pays the highest wages in its industry, which seems unrealistic in view of its situation.

16. High Continuous Bonus Under the Scanlon Plan

(Both companies have installed the Scanlon Plan, which is explained elsewhere in this report. Under this Plan, all employees, from the president to the janitor, receive a share of the reduction in production costs from month to month.)

Company A: Bonuses were earned in 12 months during the last year. The average bonus was approximately 17% of wages.

Company B: Approximately a 5% bonus was earned in one month during 1963.

17. Effective Use of Suggestion System

(Under the Scanlon Plan, a committee structure is established to solicit and review employee cost-reduction suggestions.)

Company A: The suggestion system is relatively effective. At times non-savings suggestions are made, but generally they are the exception. During 1963 there were 151 suggestions.

Company B: The suggestion system works poorly. Few good cost-reduction suggestions reach the committee, which meets infrequently. Many "suggestions" are more in the nature of grievances.

#### 18. Low Grievances

Company A: Although not unionized, there is a formal channel for airing grievances. Even so, this channel is used on very rare occasions. The personnel manager did not have accurate figures, but estimated that there were only 15 to 20 grievances per year. During 1963 all grievances were handled informally to the satisfaction of both employees and management.

Company B: During 1963, over 140 grievances were filed. The majority of these were withdrawn by the union because management "gave in to demands." These grievances dealt mainly with changing standards and the consequent reshuffling of manpower.

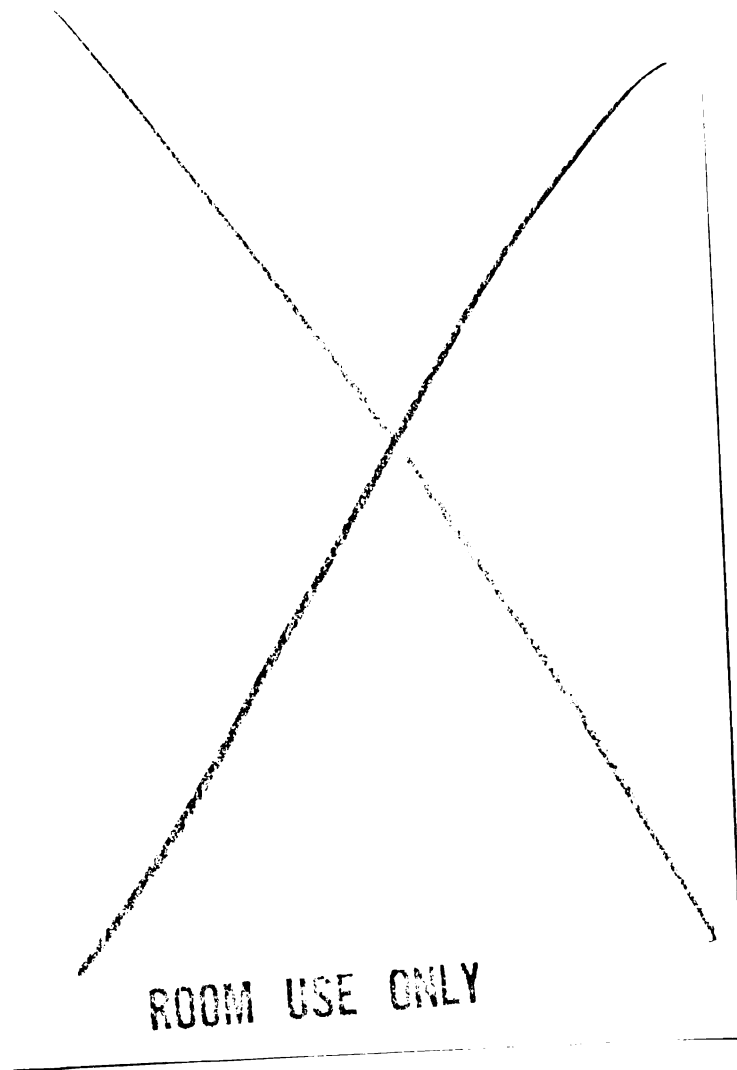
#### 19. The Company as a Psychologically Sound Environment

(As reported by the American Medical Association, the national annual rates for cardiac attacks among management personnel is 2.4 per 1000. The annual incidence of ulcers and other gastrointestinal illness is 20.9 per 1000 among men in general (1964).)

Company A: During the past three years, there was one case of ulcers and one mild cardiac attack. Both employees are working today. The management team numbers some 40 employees.

Company B: During the past three years, there have been 7 ulcers, two of which were quite serious, and 6 cardiac illnesses, 3 of which were fatal. In addition, there were 7 cases of alcoholism. The management team numbers about 75 at any given time.

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