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Ph. D.

MATHEMATICAL MODEL OF ATTITUDE CHANGE IN A LONGITUDINAL STUDY OF LARGE ORGANIZATIONS

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ABSTRACT

MATHEMATICAL MODELS OF ATTITUDE CHANGE
IN A LONGITUDINAL STUDY OF LARGE ORGANIZATIONS

By

Jim L. Tarter

The study of managerial behavior uses a wide range of research techniques ranging from simple observation to sophisticated experimental methods. Recently, there has been increased interest in longitudinal studies which facilitate the inference of causality. The research reported here represents one phase of a longitudinal field study designed to increase the understanding and generalizability of the attitude change relationships found in a Management By Objectives (MBO) system used in two large organizations.

The specific research problem addressed by this project is best described as an attempt to answer the question: "Are the changes in managerial attitudes observed in organizations utilizing an MBO system of management the result of real or apparent change?" The Chesser study of change relationships in the MBO system provided a foundation for this research (Chesser, 1971). First, data were collected at two points in time from a large organization and were used to replicate the Chesser study. Then the data were reanalyzed and a revised research model of change relationships was developed. The replication and the revision of the Chesser model produced contradictory conclusions about the change in

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the system. These contradictory results were evident when the data were compared to the predictions of two change models.

The first, the "general factor" model, assumes that there is a general factor of real change which is represented by the variables in the MBO system. It is not precisely defined but a close analysis of the data shows that five of the seven variables in the MBO system are very highly correlated and serve as estimates of this general factor. When the data were compared to the predictions of this hypothesized model, it was concluded that there was real change in the system.

The second model, which predicted no real change in the true scores for the managers, was called the "mood" model. In effect, the mood model assumes that there is some transient component in the observed scores for the managers which produces apparent change in attitude. Thus, under the assumptions for this model, the data did also fit its predictions.

The dilemma posed by these obviously contradictory inferences was attacked by analyzing a third set of data. It was concluded that there was real change in the attitudes and perceptions of the subjects and that the general factor of real change model was the most plausible and appropriate theoretical formulation of that attitude change process.

The results reported here point to important considerations in the implementing of organization change programs such as MBO. More importantly, a theoretical framework has been provided for further longitudinal studies of organization change.

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MATHEMATICAL MODEL OF ATTITUDE CHANGE IN A LONGITUDINAL STUDY OF LARGE ORGANIZATIONS

By

Jim Lee Tarter

A THESIS

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Michigan State University
in partial fulfillment of the requirements
for the degree of

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It is a pleasure to acknowledge those who contributed to this thesis and say a special "thank you" to each of them.

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My wife, Ann, to whom I dedicate this thesis, for her love, faith, understanding, and ever present encouragement.

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CHAPTER 1

GENERAL RESEARCH PROBLEM, REVIEW OF THE LITERATURE, RESEARCH STRATEGY, AND PRELIMINARY FINDINGS

General Research Problem

The study of managerial behavior uses a wide range of research techniques ranging from simple observation to sophisticated experimental methods. Recently, there has been increased interest in longitudinal studies which facilitate the inference of causality (Lawler, 1968; Kavanaugh, 1971; Bentz, 1971). The research reported here is one phase of a longitudinal causation - field study project designed to increase the understanding and generalizability of the attitude change relationships found in a Management By Objectives (MBO) System used in a large organization.

MBO is a results-oriented subsystem directed at planning and controlling the organization. The activities in the system carried out by the superior and subordinate are (1) the interaction of superior and subordinate to mutually establish and communicate organizational performance and development goals; (2) the periodic review of the goals and assessment of goal attainment; and (3) final review of the subordinate's performance using the established goals as a criteria for evaluation.

The general research problem addressed by this project is an attempt to answer the question: "Are the changes in managerial attitudes observed in organizations utilizing an MBO system the result

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of real or apparent changes in attitude?" This research effort specifically seeks to describe empirically and account mathematically for the attitude change processes (e.g., changes in goal clarification, superior-subordinate interaction, performance-reward association, and job satisfaction) found in two large industrial organizations which utilize a Management By Objectives system.

Review of the Literature

This research seeks to extend the theoretical understanding of MBO. The theory underlying MBO has been drawn from related research into goals and motivation (Locke and Bryan, 1966); participation in decision making (Vroom, 1965; Likert, 1961); and organizational climate and motivation (Litwin and Stringer, 1969).

Research into the effectiveness of MBO and the Goal Setting Process has been performed by several groups of researchers. The first study, a longitudinal one, was performed by the General Electric research team of Meyer, Kay and French (Meyer, Kay and French, 1964). The GE program, called Work Planning and Review, was an alternative to the traditional performance appraisal system. They concluded that those managers who had participated in the development of goals for their job had a more favorable attitude toward the content and challenge of those jobs.

A second longitudinal study was performed by Raia in Purex Corporation, Ltd. (Raia, 1965, 1966). Immediately after the firm had instituted an MBO program, there was an increase in productivity and a greater awareness of organizational goals by the managers. However, in a follow-up study, Raia found a decline in the effectiveness of MBO as a motivator

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a motivator for job performance. There was a fourteen-month time span between the 1965 study and the 1966 study.

Mendleson studied managerial goal setting of superior-subordinate pairs in eight different companies (Mendleson, 1967). This research assessed the relationships between goal setting activity and (1) the degree of job understanding between superior and subordinate, and (2) ratings of subordinate effectiveness (present effectiveness and potential for promotion). Mendleson found a positive relationship between the extent of goal setting activity and the superior's rating of his subordinate's promotability.

Ivancevich, Donnelly, and Lyon examined the relationship between satisfaction and different methods of implementing MBO (Ivancevich, et al., 1970). In one company the personnel manager conducted the implementation of MBO. In the other, top-level executives handled the MBO implementation. The major finding was that when MBO was implemented and administered by the company executives, there was a significantly higher level of perceived need satisfaction of the managers.

Research by Tosi and Carroll (1968, 1970) has centered on the investigation of relationships between process and end-result variables. The process variables are considered fundamental to MBO and serve as independent variables in their research model. They include characteristics of goals, feedback characteristics, and the nature of the superior-subordinate relationship. End-result variables are seen as the dependent variables of the behavioral system. They include level of goal achievement, effort expended, level of the goals set, and satisfaction with the MBO program. The results of the Tosi and Carroll research indicate that establishing clear and important goals (i.e., process variables) p

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variables) produced favorable results (i.e., favorable responses to the end-result variables) especially for certain personality types.

The Chesser Study

Utilizing an instrument designed by Tosi and Carroll for a manufacturing company (Firm A), data related to the Management By Objectives (MBO) process were collected at two points in time, eighteen months apart. The forty-seven item, Likert-type questionnaire contained items to measure the following: (See Appendix A.)

1. Goal Characteristics
2. Feedback Characteristics
3. Boss-Subordinate Relationships
4. Job Characteristics
5. Orientation Toward Management By Objectives

The instrument was cluster analyzed and yielded seven (7) subscales (see Appendix B). These were:

1. Superior-Subordinate Relationship--This variable represents a complex description of the overall relationship between the superior and the subordinate. It incorporates three aspects of the relationship: (1) the frequency of interaction in goal-oriented activity; (2) the subordinate's perception of the usefulness of the interaction to job performance; and (3) the subordinate's evaluation of his superior as a superior.

2. Goal Clarity and Relevance--Represents a measure of the degree to which the goals set reflect organizational and personal needs. It also reflects whether or not the goals were clearly stated and priorities established.

3. Orientation Toward MBO--Is a measure of the perceived utility of the MBO program as experienced by the participants. It assesses the degree to which MBO is viewed as being helpful in meeting job requirements.

4. Performance-Reward Association--Assesses the degree to which rewards in the form of salary increases and promotion are viewed as being based on an evaluation of actual job performance.

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5. Subordinate's Influence Over Goals--Measures the relative influence shared by the subordinate and his superior in the goal setting process.

6. Satisfaction With Job--Measures the subordinate's satisfaction with the job situation.

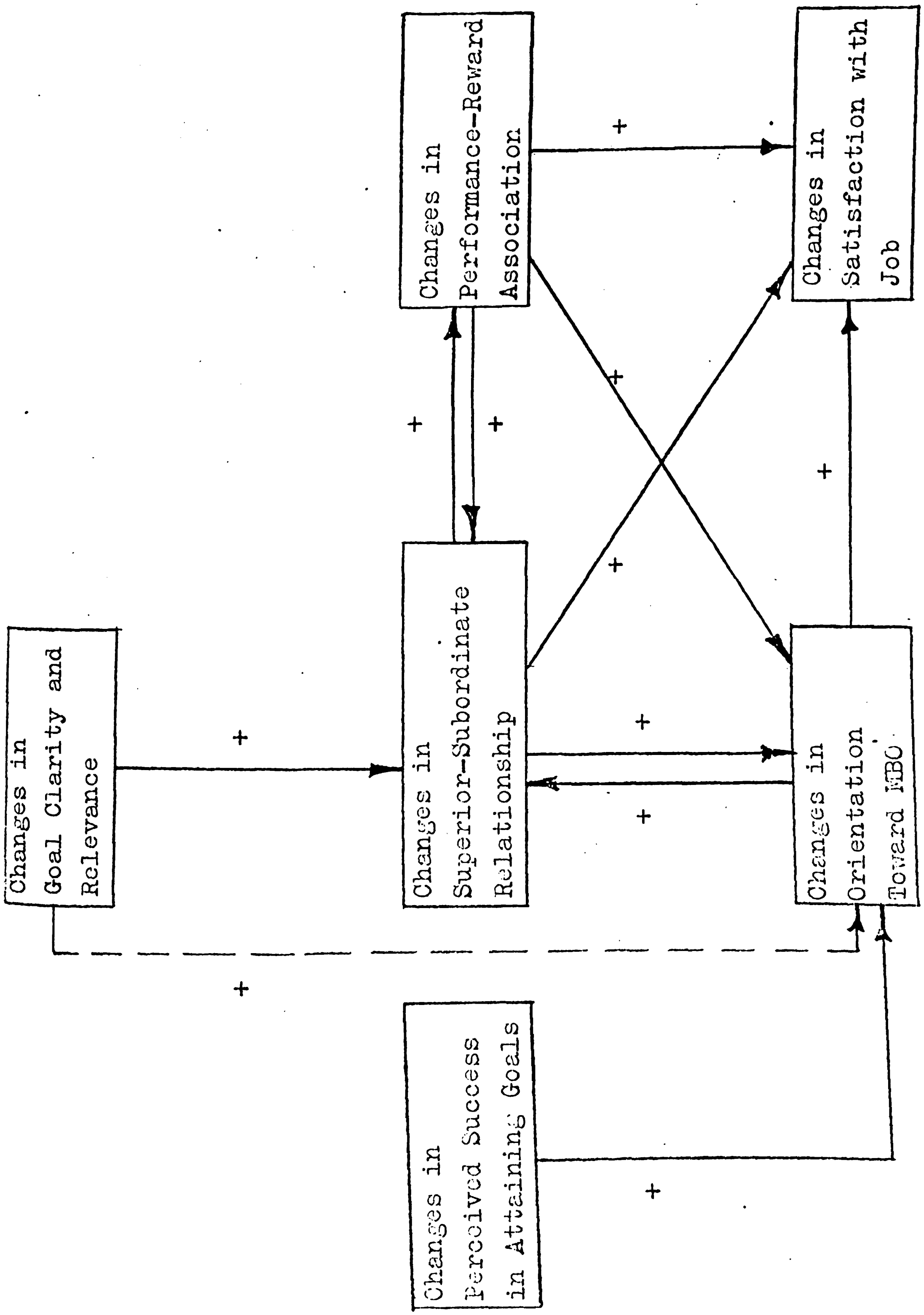
7. Perceived Success--Assesses the perceived relationship between performance and established goals.

Chesser focused the research design directly on the dynamic relationships in the model (i.e., the behavior over time of the variables) and the inference of causality. Using dynamic correlations and cross-lagged panel correlations, a causal set of change relationships in the system was developed (see Figure 1-1). Chesser concluded that there were changes in the variables over time which were statistically related and that by analyzing the relationships across time, changes in certain variables (e.g., changes in goal clarity and relevance, changes in orientation toward MBO) were concluded to be causally related to changes in other variables (e.g., changes in superior-subordinate relationship, satisfaction with job) (see Chesser, pp. 105-110).

A close examination of the Chesser data which support his conclusions reveals several reasons for concern. First, for the two administrations of the questionnaire, the means and variances for each of the seven scales showed little change between administrations (see Chesser, Table 2-8, p. 55). If there was, in fact, real change in the system variables between administrations there would usually be a corresponding increase in the variance of the scales.

A second concern is found in the analysis of the 7 x 7 initial score - change score correlation matrix for the Chesser data. Seventy percent of these correlations were negative. The negatives along the diagonal could be attributed to regression toward the mean. This

Figure 1-1.--Effects Diagram for Change Relationships in the MBO Behavioral System - Firm A
(Reference: Chesser, 1971, page 106)



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regression toward the mean implied that managers who rated high on a variable in the first administration tended to decrease in score on the same and other variables during the second administration, while managers who initially scored low on a variable tended to increase. The negatives down the diagonal of this matrix could also be due to unreliability. However, the off-diagonals (the initial score on a variable correlated with changes in another system variable) would not be spuriously negative, since errors of measurement or unreliability are uncorrelated between measures.

These problems in the Chesser analysis (constant scale means and variance across administrations, negative initial score - change score correlations, and low change score reliabilities) force consideration of a very interesting question: "Were the changes in the scales due to real change or were they only 'apparent' changes?" There are two alternative answers to the question.

First, it can be assumed that there is real change in managerial attitudes within the MBO system. The data will support this if it is assumed that the absence of change in the scale variance is due to real regression toward the mean (as shown by the negative initial score - change score correlations) and that the real change is in part due to random factors.

The second explanation of the data is that there is no change in the true scores of managers for the scales between administrations of the questionnaire. Unreliable measures and their spurious effects could be the cause of the negative diagonal correlations (the regression toward the mean effect) in the initial score - change score correlation matrix, but further assumptions would be required to account for the negative of

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negative off-diagonals. Such a model will be presented in Chapter Three. This No Change Hypothesis assumes that the managers demonstrate very stable dispositions toward their work and their relationships with their boss. It is the pursuit of an answer to this question of real versus apparent change that forms the basis of the research reported in this dissertation.

Research Strategy and Preliminary Findings

Using the Chesser study of change relationships in the MBO system as a starting point, this research focuses upon a test of the general hypothesis that these change relationships are the result of real changes in managerial attitudes. To test this hypothesis, the Chesser study has been replicated. An expanded version of the questionnaire developed by Tosi and Carroll (see Appendix A) was administered to the managers of a second large manufacturing organization (Firm B) at two points in time, eighteen months apart.

The methodology used by Chesser to develop the effects diagrams and to infer causal relationships was also applied to the Firm B data. The results of this replication (see Chapter Two) are such that it is not possible in the two time period study to conclude decisively that the changes in managerial attitudes are real, and not apparent, changes.

To improve the scales of the research model, the Firm B data collected with the revised instrument was cluster analyzed. Using the same methodology as in the replication, the analysis of this data also produced inconclusive results. Extensive reporting of the findings from the replication study and the study using the revised scales is found in Appendices C, D, E, and F.

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The analysis of the data from both organizations presented in Chapter Two produced equivocal evidence of real change over the two time periods. Several models which assume real change are considered in Chapter Three. Models developed to explain the data in terms of the phenomena of the hypothesis of no change are presented in Chapter Four. One model in each set (real change and no change) was found to fit the data for two time periods. However, a direct empirical test of real change requires data from another administration of the questionnaire (time 3). This data was made available for Firm A and the real change hypothesis was further evaluated. These results appear in Chapter Five.

Summary

The research reported here focuses upon the assessment of real or apparent change in the attitudes of managers participating in the MBO programs of two large organizations. Using the same methodology as Chesser (1971), the data from these managers have suggested that the changes in attitudes from the first to the second administration of the questionnaire are not real changes, but only apparent. The results of the replication study and the revision of the research model are presented in the next chapter.

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CHAPTER 2

THE REPLICATION OF THE CHESSER STUDY AND A REVISED RESEARCH MODEL

This chapter presents the major results of the replication of the Chesser study, using data from Firm B. The first section of the chapter describes that organization and the sample of managers who participated in the MBO study. The next section presents the major findings which are used to test the general research hypothesis. The third section describes the development of a revised research model and presents additional results for the test of the general research hypothesis.

The Replication of the Chesser Study

The Tosi and Carroll questionnaire with some additional items was administered to a group of Firm B managers (see Appendix A). Firm B is a container manufacturing division of a large conglomerate and has an ongoing MBO program. The first administration of the questionnaire in March, 1970, produced 600 completed questionnaires. From the second administration in August, 1971, 548 usable questionnaires were received. The 117 managers who identified themselves in both administrations constitute the sample for Firm B that will be used in the present study. Table 2-1 and Table 2-2 show the classification of the Firm B managers by organization level and functional area. Table 2-3 and Table 2-4 present similar statistics for the Firm A managers who participated in both administrations.

Table 2-1

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Table 2-1.-- Classification of Firm B Managers by Functional Area

Functional Area	Number	Percent
General Management	19	16%
Production	33	28
Sales	39	33
Staff	26	23
Total	117	100%

Table 2-2.-- Classification of Firm B Managers by Organizational Level

Organizational Level	Number	Percent
Senior Officer	1	1%
Major Area or Activity Manager	11	9
Plant or Special Staff Manager	19	16
Department Manager	29	25
Section Manager or Foreman	57	49
Total	117	100%

Table 2-3

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Table 2-3.-- Classification of Firm A Managers by Functional Area

Functional Area	Number	Percent
Marketing	30	41%
Research and Development	20	27
Production	13	18
Administration	10	14
Total	73	100%

Table 2-4.-- Classification of Firm A Managers by Organizational Level

Organizational Level	Number	Percent
Vice President	3	4%
Directors	7	10
Middle Management	38	52
Lower Management	25	34
Total	73	100%

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The methodology utilized in the replication was the same as that employed by Chesser. The responses by the Firm B managers were scored using the seven scale research model developed for the Firm A managers. Then, the changes in the scales (second administration scale scores minus first administration scale scores) were calculated and "dynamic correlations" between the change scores for the Firm B sample were obtained. These dynamic correlations are Pearson Product-Moment correlations for the changes in the variables (Vroom, 1966). The cross-lagged panel correlation technique (Pelz and Andrews, 1964) was used to infer the causal priority of the variables in the MBO system. These results were then used to develop an effects diagram for the Firm B managers. The detailed development of the effects diagram for the Firm B managers is contained in Appendix C.

Findings

The means and standard deviations for the seven scales of Chesser's model are presented in Table 2-5. There is some change in the scale means from the first administration to the second administration; however, the standard deviations do not change significantly. This relatively constant variance (the standard deviation squared) suggests that the change calculated in the analysis of the data was not real change, but spurious. Chesser also found no change in means or variances for Firm A (See Chesser, Table 2-8, p. 55).

The reliability of the change scores is very important in considering either the dynamic correlations or the initial score-change score correlations. Table 2-6 shows both the internal scale reliabilities and the change score reliabilities for Firm A and Firm B subjects.

...d Deviations for First and Second Administration of Questionnaires
... A and Film B

Table 2-5.-- Means and Standard Deviations for First and Second Administration of Questionnaire for Firm A and Firm B

	Means				Standard Deviations			
Scales	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2
1. Superior-Subordinate Relationship	3.1	3.2	3.3	3.3	.33	.37	.43	.38
2. Goal Clarity and Relevance	2.8	3.0	3.0	3.0	.48	.48	.42	.39
3. Orientation Toward MBO	3.0	3.4	3.7	3.5	.86	.98	.89	.92
4. Performance-Reward Association	3.8	3.7	3.9	3.8	.70	.71	.64	.66
5. Subordinate's Influence Over Goals	2.8	3.0	2.6	2.8	1.1	.95	.90	.90
6. Satisfaction With Job	3.1	3.2	3.3	3.3	.91	.80	.89	.88
7. Perceived Success	3.0	3.1	3.1	3.0	.90	.85	.77	.79

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Table 2-6.-- Reliabilities of Seven Scales

Scale	Internal Reliability[a] r_{xx}		Change Score Reliability[c] r_{x-x}	
	Firm A[b]	Firm B	Firm A	Firm B
1. Superior-Subordinate Relationship	.96	.94	.94	.90
2. Goal Clarity and Relevance	.90	.80	.87	.60
3. Orientation Toward MBO	.80	.84	.50	.50
4. Performance-Reward Association	.84	.70	.68	.25
5. Subordinate's Influence Over Goals	.75	.72	.50	.50
6. Satisfaction With Job	.58	.59	.35	.13
7. Success in Attaining Goals	.65	.57	.30	.13

[a]Coefficient alpha scale reliabilities.

[b]Chesser, page 47.

[c]See formula on page 15.

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The change score reliability is sensitive to changes in the internal reliability as well as the test-retest correlation of the scales.

Change score reliabilities are calculated using this formula:

$$r_{dd} = \frac{\frac{r_{11} + r_{22}}{2} - r_{12}}{1 - r_{12}}$$

where:

r_{dd} = reliability of change score

r_{11} = internal reliability of scale at Time 1

r_{22} = internal reliability of scale at Time 2

r_{12} = correlation of the scale between Time 1 and Time 2

(McNemar, p. 157)

Given that the internal reliabilities for the scales are adequate (approximately .60 or better), the test-retest scale correlation is the key variable in the calculation of the change score reliability. If there are no substantial changes in the scales between the administrations, then the correlation between the scales will approach the internal scale reliability as a limit. That is, a high test-retest correlation means that real change on that variable is negligible. In the replication, three of the seven scales have a change score reliability of .25 or less. These same three scales also have the lowest internal reliabilities (each of these scales has four or less items). One objective of the revised research model presented below is to increase the number of items in each scale and thereby increase the reliabilities.

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Correlational Data for Replication Study

The correlational data which resulted from the replication study is found in Table 2-7, page 17. The legend at the lower right corner of that page provides a guide for the location of relevant matrices.

Static Correlations

There are two matrices in Table 2-7 which contain "static correlations," i.e., the Pearson Product-Moment correlations between the seven scales of the model at a single point in time. One matrix is the set of correlations between the variables at the time of the first administration ("time 1 static correlations"). The second matrix is the set of correlations between the variables at the time of the second administration ("time 2 static correlations"). These matrices may be compared in order to note the similarities of the correlations (magnitudes and signs) at each administration, i.e., the stability of the static correlations across time. As expected in this data, the pattern of static correlations was very similar for the Firm B managers during both administrations.

There is also important information contained within each matrix individually. These matrices show remarkable consistency between variables in both time periods. For example, Job Satisfaction and the Superior-Subordinate Relationship are positively and significantly correlated (time 1, $r=.37$, $p < .01$ and time 2, $r=.36$, $p < .01$). The correlations shown in the static correlation matrices are necessarily symmetrical ($r_{x_1x_6} = r_{x_6x_1}$). That is, the static correlation is used to specify the degree of relationship between two variables. The static correlation would be exactly the same when either of those two variables

Table 2-7.-- Correlation Matrices for the First Administration Scores (Time 1), Second Administration Scores (Time 2), and Change Scores (Time 1 - Time 2) in the Seven Scale Research Model for Firm B Managers (n=117)

Table 2-7.-- Correlation Matrices for the First Administration Scores (Time 1), Second Administration Scores (Time 2), and Change Scores (Time 1 - Time 2) in the Seven Scale Research Model for Firm B Managers (n=117)

	Time 1							Time 2							Time 2 - Time 1						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	100	54	41	43	16	37	8	45	22	33	30	-13	6	25	-61	-34	-2	-16	-25	-31	17
2	54	100	33	22	12	11	9	31	46	24	17	-20	-6	13	-27	-58	-10	-5	-28	-16	4
3	41	33	100	43	2	30	3	36	39	66	32	-4	12	24	-9	3	-38	-11	-5	-18	22
4	43	22	43	100	12	33	8	38	31	36	60	8	22	7	-14	7	-7	-41	-4	-16	-1
5	16	12	2	12	100	4	-8	4	7	-5	1	35	-2	-4	-12	-5	-8	-13	-57	-5	4
6	37	11	30	33	4	100	2	32	16	27	37	5	52	18	-8	3	-2	1	1	-50	16
7	8	9	3	8	-8	2	100	20	26	12	10	-16	6	51	10	15	12	3	-8	3	-47
8	45	31	36	38	4	32	20	100	50	43	55	1	36	38	44	15	11	21	-2	3	19
9	22	46	39	31	7	16	26	50	100	41	36	5	17	24	23	46	5	7	-2	1	-1
10	33	24	66	36	-5	27	12	43	41	100	39	-10	20	31	1	14	44	5	-5	-8	19
11	30	17	32	60	1	37	10	55	36	39	100	11	43	21	19	16	11	48	9	6	11
12	-13	-20	-4	8	35	5	-16	1	5	-10	11	100	4	-1	14	25	-9	3	57	-1	16
13	6	-6	12	22	-2	52	6	36	17	20	43	4	100	6	26	22	10	25	5	48	1
14	25	13	24	7	-4	18	51	38	24	31	21	-1	6	100	8	10	10	16	3	-12	51
15	-61	-27	-9	-14	-12	-3	10	44	23	1	19	14	26	8	100	48	12	37	23	35	-1
16	-34	-58	3	7	-5	3	15	15	46	14	16	25	22	10	48	100	14	11	27	19	-5
17	-2	-10	-38	-7	-8	-2	12	11	5	44	11	-9	10	10	12	14	100	20	-1	12	-2
18	-16	-5	-11	-41	-13	1	3	21	7	5	48	3	25	16	37	11	20	100	14	24	14
19	-25	-28	-5	-4	-57	1	-8	-2	-2	-5	9	57	5	3	23	27	-1	14	10	4	11
20	-31	-18	-13	-16	-5	-50	3	3	1	-8	6	-1	48	-12	35	19	12	24	4	100	-15
21	17	4	22	-1	4	16	-47	19	-1	19	11	16	1	51	-1	-5	-2	14	11	-15	100

Significant value of r:

.05 level = .18

.01 level = .24

LEGEND:

Static	Cross-Lagged	Impact
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is used as the predictor and the other the predicted variable. The net result of this is that the off-diagonals of the static correlation matrix are "reflections" of each other, i.e., symmetrical.

Dynamic Correlations

The lower right-hand matrix found in Table 2-7 contains the "dynamic correlations" or the Pearson Product-Moment correlations between change scores in the system variables. These change scores are calculated by subtracting the time 1 score from the time 2 score (i.e., change score = time 2 score - time 1 score). As in the static correlation matrices, the dynamic correlation matrices, the dynamic correlations are necessarily symmetric about the diagonal.

The dynamic correlations are used in this study to determine the significant relationships between changes in the system variables. Using the same variables as before--Job Satisfaction and Superior-Subordinate Relationship--it can be seen that there is a significant dynamic correlation ($r = .35$, $p < .01$) between Changes in Job Satisfaction (variable 20 in the table) and Changes in Superior-Subordinate Relationship (variable 15 in the table). This dynamic correlation suggests that Changes in Job Satisfaction are related to Changes in Superior-Subordinate Relationship.

Cross-Lagged Correlations

There are two sections of Table 2-7 which contain the "cross-lagged" correlations. These cross-lagged correlations are Pearson Product-Moment correlations between the system variables at time 1 and time 2.

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The diagonals of this matrix are the test-retest correlations for the MBO variables. If there were no real change, then this correlation would be an estimate of the reliability for each of the variables. It is the test-retest correlation which is used in the calculation of the change score reliabilities discussed previously.

The off-diagonal correlations of this matrix are not necessarily symmetric. That is, if x_1 is the score on x at time 1, x_2 is the score on x at time 2, and y_1 and y_2 are the two measurements on y, then the two matched correlations in this matrix are the two correlations involving x and y, i.e., $r_{x_1y_2}$ and $r_{y_1x_2}$. Since the two correlations are calculated for mathematically different variables, it would be possible for the two correlations to be completely different. For example, let Job Satisfaction be x and let Superior-Subordinate Relationship be y. Then x_1 is variable 6, x_2 is variable 13, y_1 is variable 1, and y_2 is variable 8. The two cross-lag correlations are thus $r_{x_1y_2} = r_{6,8} = .32$ and $r_{y_1x_2} = r_{1,13} = .06$. And indeed they are not equal but are "asymmetrical."

As a matter of fact, it is the asymmetry of these correlations that facilitates the inference of causal priority in the system. To illustrate Chesser's test for causality, consider again the two variables, Job Satisfaction and Superior-Subordinate Relationship. Job Satisfaction and Superior-Subordinate Relationship have significant static correlations ($r_{x_1y_1} = r_{6,1} = .37$, $r_{x_2y_2} = r_{13,8} = .36$) and a significant dynamic correlation ($r_{\Delta x,\Delta y} = r_{20,15} = .35$). Thus not only is there a relation between the variables at one point in time, but a change in one tends to be accompanied by a change in the other. Therefore, Chesser (following Vroom, 1966) concluded that these variables are usuall [illegible]

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causally related. Assume (for the moment) that this is so. What is the direction of the causality? Suppose that Job Satisfaction exerts a causal influence on Superior-Subordinate Relationship but not vice versa (i.e., an arrow from x to y in the effects diagram). Then if x_1 is large, y will tend to increase while if x_1 is small, y will tend to decrease. This tends to create a "considerable" correlation between x_1 and y_2. However, if Superior-Subordinate Relationship exerts no causal influence on Job Satisfaction, then there will be no analagous influence on the correlation between y_1 and x_2. Thus the assumption "x influences y and not vice versa" leads to the inference $r_{x_1y_2} > r_{y_1x_2}$, i.e., asymmetric cross-lag correlations (Pelz and Andrews, 1964). In the present example $r_{x_1y_2} = .32$ while $r_{y_1x_2} = .06$. This difference is significant at the .10 level and hence provides rather weak evidence for an asymmetric causal relationship.

Chesser's synthesis of Vroom (1966) and Pelz and Andrews (1964) can now be succinctly stated: If x and y have significant static correlations ($r_{x_1y_1}$, $r_{x_2y_2}$) and a significant dynamic correlation ($r_{\Delta x,\Delta y}$), then infer them to be causally related. If the cross-lag correlations are asymmetric, then either $r_{x_1y_2} > r_{y_1x_2}$ or $r_{y_1x_2} > r_{x_1y_2}$. If $r_{x_1y_2} > r_{y_1x_2}$, then infer "x causes y." If $r_{y_1x_2} > r_{x_1y_2}$, then infer "y causes x." If the cross-lag correlations are symmetrical, i.e., if $r_{x_1y_2} = r_{y_1x_2}$, then infer mutual causation. For small samples these inequalities could be replaced by significance tests in the usual way.

This methodology will be shown to be wanting on both empirical grounds and theoretically in succeeding chapters. On the other hand, the cross-lag correlations are important in their own right. Large cross-lag correlations mean that the value of one variable at one time can pre

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can predict the value of the other variable at a later time. Thus significant cross-lag correlations imply the existence of a lasting bond between the variables and rule out many of the spurious static relationships that can arise from response sets, demand characteristics, etc.

Impact Correlations

The only remaining sections of Table 2-7 which contain information relevant to this study are "impact correlation" matrices. The impact correlations are Pearson r's, the initial or time 1 score correlated with change scores for the system variables.

The diagonals of this matrix contain the correlations of a system variable with changes in that same variable. Since the diagonals of this matrix are negative, two possibilities suggest themselves: one, the true regression of change score on initial score and, two, the spurious negative effect of unreliability. Because of the low change score reliabilities and because of problems with transient factors that will be explained below, the spurious negative effect is known to be large but cannot be estimated and corrected for.

The off-diagonals do not contain the spurious component of unreliability since errors of measurement are uncorrelated. The high percentage of negative off-diagonals contradicts many of the conclusions represented by the effects diagram. While the dynamic correlation for Changes in Job Satisfaction and Changes in Superior-Subordinate Relationship indicates a positive relationship ($r_{x\Delta y} = .35$, $p < .01$), the impact correlations for those same variables are : $r_{x_1\Delta y} = -.31$ and $r_{x_6\Delta y} = -.08$. Both of these indicate that initial score and change score are inversely related rather than directly related as implied by a positive causal relation. This contradiction will be addressed below.

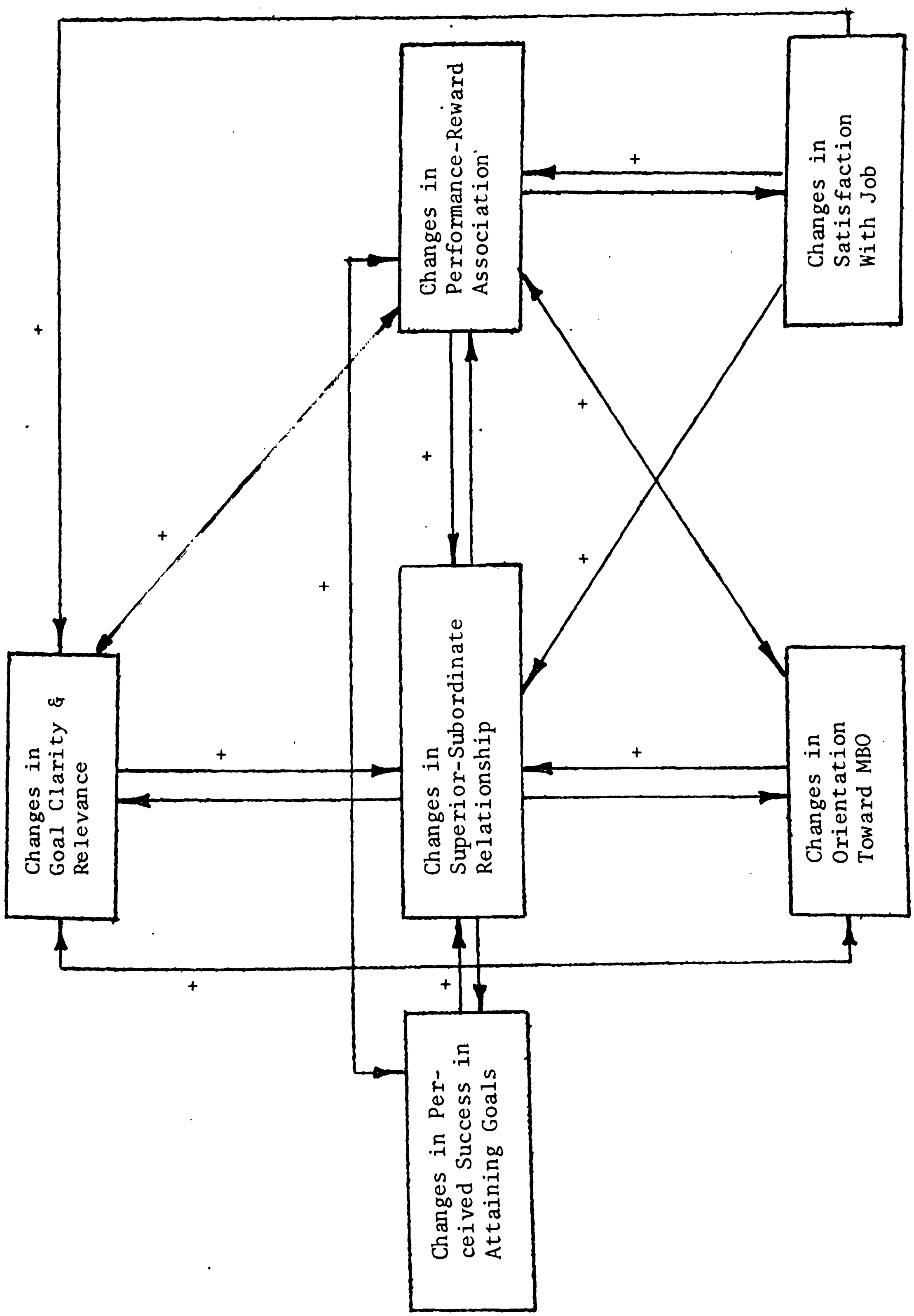
Effects Diagrams

The analysis of the data for the Firm B managers produced a number of significant dynamic correlations. These dynamic correlations provide the major support for acceptance of the Real Change Hypothesis. These correlations between change scores are, for the most part, positive and significant. This means that changes in one of the variables explain a major portion of the variance in changes of the other. Used in conjunction with the cross-lagged correlations, these statistical relationships for the Firm B managers have been interpreted in the form of an effects diagram of the change relationships between variables of the MBO system (Figure 2-1).

This effects diagram was developed in the same manner as Chesser (Chesser, p. 105). When there was a significant dynamic correlation, the two variables in the relationship are connected by a straight line. When the cross-lagged correlations are symmetrical, the relationship is defined as mutually reinforcing and is indicated by an arrowhead at both ends of the connecting line. For an asymmetrical relationship, e.g., Changes in Job Satisfaction and Changes in Superior-Subordinate Relationship, the arrow is unidirectional and indicates the causal relationship.

On balance, the data from the Firm B managers produced results quite similar to those found in the study by Chesser. The effects diagram for the replication study does show two significant differences when compared to the Chesser effects diagram (see page 6). First, the

Figure 2-1.-- Effects Diagram of Change Relationships for the MBO Behavioral System - Firm B Managers (n=117)



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relationship between Changes in Goal Clarity and Relevance and Superior-Subordinate Relationship is reversed in the two diagrams. Second, the "driver" or causal variable for the Firm B managers is Changes in Job Satisfaction while for the Firm A managers it is Goal Clarity and Relevance. One possible explanation for this is that for the Firm A managers there was a change agent present between administrations of the questionnaire. That change agent was the introduction of MBO as a management policy. Since one purpose of MBO is to improve the subordinate's expectations, Goal Clarity may have taken on added importance. For the Firm B managers, MBO was an on-going program prior to the first administration of the questionnaire. The Firm B managers had already been utilizing MBO and thus job satisfaction was a key attitude in that firm.

Given similar results in both studies, a decision was made to pool the samples. This was accomplished simply by averaging the correlations between similar variables from both studies. With the larger sample, there were a larger number of significant dynamic correlations; however, the pattern of cross-lagged panel correlations did not change. The significant asymmetrical relationships required for causal inferences were not present. (See Appendix C for a more detailed discussion of the methods and results of the pooling technique.)

The fact that a statistically more reliable matrix showed <u>no</u> asymmetric relations causes some concern. After all, what this strongly suggests is that all the asymmetries in the smaller samples for Firm A and Firm B separately were the product of sampling error. But this would imply that all the causal relations in the MBO system are mutually reinforcing. This not only contradicts existing theories but seems

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seems rather implausible on the face of it. These "contradictory" results for the pooled sample cross-lag correlations tended to make the negative impact correlations that much more salient.

Contradictions to the Real Change Hypothesis

To this point in the replication study, the development of these effects diagrams was based on the assumption of real change in the system. This section will summarize the various pieces of evidence which are counter to the assumption of real change in a multivariate system such as that depicted in the effects diagrams. The first piece of evidence is found in the means of the seven scales. They did not increase. This could happen only if the positive changes produced by high values on the MBO system variables were exactly balanced by negative changes produced by the low values on the MBO system variables. But this precise balance can happen only if all seven means are exactly at the zero effects point of the system. Furthermore this must be true of both firms! Although this explanation cannot be absolutely ruled out, it is so unlikely on a priori grounds as to be highly implausible.

The second finding which challenges the assumption of real change in the data is the fact that the variance of each variable was unchanged from time 1 to time 2. Real positive causal influences normally produce a sharp increase in variance. This is particularly true if high scores are producing positive changes while low scores are producing negative changes. That is, if the managers who score high at time 1, score higher at time 2, and the managers who score low at time 1, score lower at time 2, then the variance will necessarily increase. And this is precisely what is implied by positive causal relations without a

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change in the means. In the data the variances did not increase; they stayed the same. Therefore if there is real change, it can only be real regression to the mean, i.e., a negative relation between initial score and change score. Furthermore for the variance to stay exactly the same, the decrease in variance produced by regression to the mean must be exactly balanced by the increase in variance due to change produced by factors outside the system. While such perfect balance is not impossible, there are no sound a priori grounds for such a finding and it must therefore be viewed with some suspicion. Furthermore it should be noted that this balance must be assumed for each of the seven variables and in both Firm A and Firm B.

Table 2-7 contains evidence which suggests that there was no real change in the system between administrations of the questionnaire. If real change in attitudes had taken place, the static correlations between the system variables should have exhibited different patterns in both time periods. This did not happen. An examination of the correlations between the variables for both administrations reveals that they are not statistically different (see Table C-7 in Appendix C).

The impact correlation matrix has almost all negative correlation. All of the diagonals are negative which implies an observed "regression to the mean" effect. A sizable portion of this observed regression to the mean is definitely known to be a spurious artifact of unreliability in the measuring instruments. And since certain other spurious effects cannot be estimated in the data for two time measurements, it is possible to disregard the negative diagonals altogether; i.e., the diagonals for perfect measures <u>might</u> have been positive.

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The negative off-diagonals are not as easily explained and are actually a contradiction to the assumption of real change. As previously discussed, the positive dynamic correlation between Changes in Job Satisfaction and Changes in Superior-Subordinate Relationship implies a real and positively related change. The off-diagonal impact correlations suggest that changes in either of these variables are negatively related to the initial score on the other. This is not consistent since the status, cross-lags, and dynamic correlations are all positive.

When coupled with the finding of no change in the means and standard deviations for the scales, the evidence points toward a conclusion which rejects the general hypothesis of MBO as a multivariate system of causally related variables. Could it be that there is no real change in the actual MBO variables? That is, could the evidence of change be due to some artifact of measurement? This would be a drastic outcome indeed and it seemed unwise to consider such hypotheses when the additional items existed to improve the Chesser scales.

In order to provide more distinct results using the Firm B data, an attempt was made to construct improved scales. Chesser's methodology was again employed to build a revised research model to test the hypothesis of real change. The results of this revision of the research model are reported in the next section.

Results of Revised Research Model Development

In an effort to increase the internal scale reliability and to assess the influence of the new items in the questionnaire, the responses for the total sample of Firm B managers were cluster analyzed. The results of the cluster analysis and the revised scales are found in

Appendix D.

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Appendix D. The new scales are very similar to the Chesser scales. The major differences between the Chesser model and the revised model are: (1) the Goal Clarity and Relevance scale was replaced by two scales called Importance of Goals and Goal Setting Behavior; (2) Orientation Toward MBO was renamed Utility of MBO; (3) a scale derived from new items--Importance of Competence--was formed; and (4) two Chesser scales--Subordinate's Influence Over Goals and Perceived Success in Attaining Goals--were meshed into larger scales. Since only seven additional items were available for the analysis, this similarity was not unexpected. (See Appendix E for other results of this analysis.)

Table 2-8 contains the means and standard deviations for the Firm B responses to the revised scales. Again the data show a very consistent pattern of no change across time.

Table 2-9 presents the reliabilities, test-retest correlations, and change score reliabilities for each of the seven scales in the improved research model. Several of the revised scales have poor change score reliabilities. While the internal scale reliabilities maintain an acceptable level, the test-retest correlation for each of the four scales is very close to the internal reliability for that scale. This reduces the change score reliability to essentially zero and suggests there is little or no change on the four scales in question.

The static, dynamic, and cross-lagged correlations show patterns of relationships similar to those for Chesser (Table 2-10). The dynamic correlations also indicate about the same number of significant relations between change scores. The cross-lags, for the most part, are symmetrical about the diagonals. Significant differences are found at the .20 level or better for only four correlations.

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Table 2-8.-- Means and Standard Deviations for Revised Seven Scale Model

		Means		Standard Deviations	
Scale	Description	Time 1	Time 2	Time 1	Time 2
1.	Importance of Goals	2.94	2.97	0.42	0.41
2.	Goal Setting Behavior	2.85	2.91	.44	.46
3.	Superior-Subordinate Relationship	3.31	3.32	.39	.34
4.	Utility of MBO	3.59	3.53	.64	.61
5.	Importance of Competence	4.36	4.30	.54	.55
6.	Job Satisfaction	3.30	3.34	.89	.88
7.	Performance-Reward Association	3.50	3.38	0.59	0.63

Table 2-9.-- Internal Scale Reliabilities and Change Score Reliabilities for Revised Seven Scale Model

Table 2-9.-- Internal Scale Reliabilities and Change Score Reliabilities for Revised Seven Scale Model

Scale	Description	Internal Reliability[a] Time 1 (r_{11})	Internal Reliability[a] Time 2 (r_{22})	Time 1-Time 2 Correlation (r_{12})	Change Score Reliability (r_{dd})
1.	Importance of Goals	.75	.78	.53	.51
2.	Goal Setting Behavior	.45	.56	.44	.11
3.	Superior-Subordinate Relationship	.89	.88	.27	.84
4.	Utility of MBO	.84	.87	.68	.56
5.	Importance of Competence	.49	.59	.56	.00
6.	Job Satisfaction	.56	.59	.52	.12
7.	Performance-Reward Association	.59	.58	.58	.00

[a]Coefficient alpha scale reliabilities.

Table 2-10.-- Correlation Matrices for the First Administration Scores (Time 1), Second Administration (Time 2), and Change Scores (Time 2 - Time 1) in the Revised Seven Scale Research Firm B Managers (n = 117).

Table 2-10.-- Correlation Matrices for the First Administration Scores (Time 1), Second Administration Scores (Time 2), and Change Scores (Time 2 - Time 1) in the Revised Seven Scale Research Model for Firm B Managers (n = 117).

	Time 1							Time 2							Time 2 - Time 1						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	100	31	36	66	33	18	30	53	-3	31	41	22	2	28	-52	-31	-8	-34	-11	-16	-1
2	31	100	-2	25	4	14	-1	20	44	5	13	0	2	12	-12	-50	5	-16	-4	-12	14
3	36	-2	100	35	13	28	24	6	-19	27	13	-1	-1	6	-32	-17	-68	-28	-15	-30	-19
4	66	25	35	100	36	39	50	49	6	24	68	31	16	47	-19	-18	-13	-44	-4	-23	-1
5	33	4	13	36	100	18	29	27	-13	8	25	56	13	30	-7	-16	-6	-15	-45	-6	2
6	18	14	28	39	18	100	30	24	7	21	36	10	52	33	5	-7	-9	-5	-8	-50	6
7	30	-1	24	50	29	30	100	41	5	18	42	33	13	53	9	5	-8	-12	4	-17	-40
8	53	20	6	49	27	24	41	100	28	30	66	36	22	54	40	8	18	18	10	-3	18
9	-3	44	-19	6	-13	7	5	28	100	2	19	1	1	9	31	56	18	16	14	-6	5
10	31	5	27	24	8	21	18	30	2	100	41	20	32	37	-2	-2	52	20	12	11	23
11	41	13	13	68	25	36	42	66	19	41	100	37	37	59	24	6	20	35	13	1	22
12	22	0	-1	31	56	10	33	36	1	20	37	100	19	51	13	1	15	5	48	8	23
13	2	2	-1	16	13	52	13	22	1	32	37	19	100	33	19	-1	25	25	7	48	23
14	28	12	6	47	30	33	58	54	9	37	59	51	33	100	25	-2	23	13	24	-1	51
15	-52	-12	-32	-19	-7	5	9	40	31	-2	24	13	19	25	100	41	27	54	22	15	19
16	-31	-50	-17	-18	-16	-7	5	8	56	-2	6	1	-1	-2	41	100	13	30	18	6	-8
17	-8	5	-68	-13	-6	-9	-8	18	18	52	20	15	25	23	27	13	100	40	23	34	34
18	-34	-16	-28	-44	-15	-5	-12	18	16	20	35	5	25	13	54	30	40	100	22	31	27
19	-11	-4	-15	-4	-45	-8	4	10	14	12	13	48	7	24	22	18	23	22	100	15	22
20	-16	-12	-30	-23	-6	-50	-17	-3	-6	11	1	8	48	-1	15	6	34	31	15	100	18
21	-1	14	-19	-1	2	6	-40	18	5	23	22	23	23	51	19	-8	34	27	22	18	100

Significant value of r:

.05 level = .18

.01 level = .24

LEGEND:

Static	Cross-Lagged	Impact
Cross-Lagged	Static	
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The impact correlations also show a pattern similar to that of the Firm A data. Forty-one of the possible forty-nine correlations (83%) found in the initial score and change score combination matrix are negative.

Summary

The replication of the Chesser study produced inconclusive results regarding the real change hypothesis. The replication did produce scale means, variances, and scale clusters which were quite similar to those of the original Chesser study. The dynamic correlations were also similar for both organizations. However, several of the cross-lagged correlations were different and resulted in some differences in the effects diagrams.

A close examination of the correlation matrices for both organizations produced some contradictions to the hypothesis of real change observed in the system. The dynamic correlations suggest that the variables of the system are changing and are positively related, while the majority of the impact correlations indicate a negative relationship. Also, the constant variances, constant static correlations, and poor change score reliabilities cast doubt on the assumption of real change in a multivariate system.

The next chapter will consider several models that assume real change in the MBO system. The "general factor" model will be shown to fit the data. The chapter following that will present several models which assume that there is <u>no</u> real change in the MBO system. The "mood" model will be shown to fit the data. These contradictory results will then be discussed in the chapter on the critical importance of a third administration of the questionnaire.

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CHAPTER 3

MODELS THAT ASSUME REAL CHANGE

The intent of the replication of the Chesser study, as well as the development of the revised research model, has been to assess real changes in the MBO study. The data for all three analyses have suggested that the hypothesis of real change is not well supported. To more explicitly illustrate this, three models of real change are presented along with appropriate elements from the data. The first model is actually that underlying the Chesser interpretation. It suggests that real changes in the variables are endogenously generated within the MBO system. The second model assumes that changes within the system are brought about by some factor exogenous to the system. The third model is derived by assuming that there is a single variable or "general factor" that produces all the observed correlations among the explicit variables of the MBO system.

The Endogenously Generated Real Change Model

The effects diagram which was derived by Chesser for the change relationships in the MBO system is representative of a model which assumes that these changes are generated within that system. Each variable (Superior-Subordinate Relationship, Goal Clarity and Relevance, etc.) is identified as a separate entity within the system. It is implicit in the description of this model that the boundaries of the system are identified. Then the critical assumption that the variables of the system are all positively and causally related can be made. Model descriptions and assumptions such as these are common in traditional path analysis and cybernetic model studies.

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This model can be interpreted mathematically as:

$$x_i = T + e$$

where: x_i = observed score for the i^{th} system variable

T = true score for the i^{th} system variable

e = measurement error

(See note below)

From this model, all of the correlations for the variables (static, dynamic, cross-lagged, and impact) can be predicted.

For the static correlations, the covariance of the observed scores during each administration will have a strong positive component due to the true scores. There will be no influence due to error. The data for all of the studies show a large number of significant positive correlations.

The cross-lagged correlations will be a little smaller than the statics assuming there is real change in the variables and a subsequent change in the variance for the variables. The data support this prediction.

The dynamic correlations will be similar in pattern of relationships to the static correlations. Positive dynamic correlations are generally found between all the variables that have significant static correlations in this study.

This model does not run into difficulty until the off-diagonals of the impact matrix are examined. For the assumed real change model,

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Note: All equations and models presented in this study will be stated in standard score form rather than raw score form. This facilitates the calculation of predicted correlations from the models.

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the off-diagonal correlations should be positive. As an example, consider the assumed causal relationship between Goal Clarity and Relevance and Changes in Superior-Subordinate Relationship. The dynamic correlations for change in these two variables are positive and the cross-lags indicate that changes in Goal Clarity is the driver or causal variable in the relationship in both the Firm A and Firm B data.

Consider a manager who feels that his goals have been stated with very high clarity. If his superior-subordinate relations are already high, then perhaps there will be only a slight increase. But if his relations had been low, then there should be a considerable increase. In any case, for the managers who are high on Goal Clarity, then there should be an average increase in their Superior-Subordinate Relations. On the other hand, consider a manager who feels that his goals are very vague. If his relations with his boss are already poor, then perhaps his frustration over goal setting will not lead to a decrease in Superior-Subordinate Relations. But if his relations had been good, then there should be considerable frustration and a sharp decrease in his positive regard for his boss. In any case, for the managers who score low on Goal Clarity, there should be an average decrease on Superior-Subordinate Relations. Considering all the managers together, the model assumption that Goal Clarity exerts a positive causal influence on Superior-Subordinate Relations clearly predicts that managers who are high on Goal Clarity will increase on Superior-Subordinate Relations while managers who are low on Goal Clarity will decrease on Superior-Subordinate Relations (or increase by less if "low" means only "relatively low"). Thus the positive arrow from Goal Clarity to Superior-Subordinate Relations in Chesser's model implies a positive correlation between ir

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between initial score on Goal Clarity and Change in Superior Subordinate Relations. The dynamic correlations and cross-lags suggest that the impact correlation of this assumed relationship should be positive. However, the impact correlation is negative in the data. In fact, over seventy percent of these correlations in the impact matrix for each of the three studies are negative. The model which assumes that the changes in the system are real and are endogenously generated is thus contradicted by this data.

The Exogenously Generated Real Change Model

If the changes that are observed in the dynamic correlations are not the result of causal influences from within the set of variables identified as the MBO system, then what else could cause the changes? One possibility is an "exogenous" factor or variable, i.e., some variable that influences the system from outside the identified system boundaries. Thus, factors such as external economic factors may be influencing each of the participants in the study. This influence could be different or the same during each administration of the questionnaire but the important assumption is that it affects each participant in the sample in some way.

This model is also represented mathematically as

$$x_i = T + e$$

and in general is quite consistent with the data. The critical assumption in this model is that real change in the system is the result of a factor outside the MBO system.

The static correlations, just as in the previous model, would be positive and stable across administrations. The cross-lagged correlati

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correlations would also be positive and would be of the same general magnitude as the statics. This is due to the assumption that the observed change is not the result of a variable within the system.

The dynamic correlations would be significant due to the effect of the exogenous factor upon the system. The large number of positive dynamic correlations would be interpreted in this model as implying that it is one exogenous factor instead of several that causes change within the system.

The negative impact correlations are only partly explained by the exogenous factor. The diagonals are negative and could well be the result of spurious correlation of measurement error. For the off-diagonals in this matrix, the correlation is

$$r_{x,\Delta y} = \frac{\Sigma(T + e)(\Delta U + \Delta\varepsilon)}{n\sigma_x\sigma_{\Delta y}}$$

where: $y = U + \varepsilon$

$\Delta y = \Delta U + \Delta\varepsilon$

y = observed score for an MBO variable different from x

U = true score for variable y

ε = measurement error for y

then by assuming that the errors of measurement are uncorrelated and that the changes in variable y are not related to the initial score for x but are the result of the exogenous factor, the off-diagonal impact correlation is:

$$r_{x,\Delta y} = \frac{\Sigma x\Delta y}{n\sigma_x\sigma_{\Delta y}} = 0$$

which again is not consistent with the data. This model would not predict the several large negative correlations which are present in the data. It is further contradicted by the constant variance and the constant

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constant static correlations. If there was real change in the system as the result of the exogenous factor, there would be an increase in the variance for the variables of the system. The data indicates constant variance for all three studies (see Tables 2-5 and 2-8). An increase in the variance would also show up as an increase in the static correlations. In other words, the static correlations for the second administration would be different than those for the first administration and there is no significant difference between the static correlations for the two administrations of the questionnaire for Firm A or Firm B. Since the data do not fit the predictions of this model, it must be rejected as an explanation of the changes observed in the MBO system.

General Factor Model

The possibility exists that instead of developing and soliciting responses to a number of independent factors related to the MBO system, the questionnaire is actually the explication of a single underlying global factor. The model which considers this possibility assumes that there is some general factor (G) which underlies the entire MBO system. This single factor is responsible for all of the correlations between the variables of the system. If the variables of the system represent this general factor, then the static, cross-lagged and dynamic correlation matrices will all have the distinguishing characteristic of a "Spearman Rank-One Matrix" (Spearman, 1904). That is, the variables which estimate and are highly correlated with the general factor will themselves be highly intercorrelated.

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The Basic Model and the Static Correlations

Spearman's (1904) general factor model assumes that there is one central variable which underlies some given domain, such as the MBO system. The correlational significance of any particular variable in his model is solely a function of the extent to which that particular variable correlates with the general factor. In a path diagram or effects diagram this means that the only arrows associated with the observed variables are the arrows from the general factor to the observed variable. More specifically, let x be the observed variable, G the general factor, and let y be any variable outside the domain. Then Spearman's theory assumes that the partial correlation between x and y with G removed is zero, i.e.,

$$r_{xy.G} = 0$$

for all x and y.

Thus the general factor model is a very strong theory in which the individual observed variables are robbed of all significance. That is, this model assumes that the difference between the observed variable and the general factor can be partitioned into two sets of essentially trivial determinants: the usual error of measurement and a "specific" factor. The specific factor is that part of the true score for the observed variable which is left when the general factor is partialled out. Thus in this model the specific factors are necessarily uncorrelated with any variable except themselves. The only statistical difference between "specific factors" and "errors" is that specific factors may be stable over time. Some of the constituents of the specific factor would be idiosyncratic semantic factors such as the peculiar elements of the job situation that a manager assigns to the words, "managem

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"management by objectives system," idiosyncratic meanings for the response categories such as "often" in a given context, individual differences in the importance assigned by managers to minor features of the goal setting process, etc. The critical test of a hypothesized constituent of a specific factor is: would it be uncorrelated with (1) the general factor, (2) all other specific factors, and (3) all variables outside the MBO system? This is a harsh criterion and if the general factor model holds, then there is little significance to the specific factors.

Mathematically, Spearman's general factor model is easily stated:

$$x_i = G + S_i + e_i$$

where: x_i = observed score

G = the general factor

S_i = the specific factor for variable i or the residual of the true score for variable x_i when G is partialled out

e_i = the measurement error for variable i

The specific factors, S_i, are recognized as separate but not very significant components of the model. It is assumed that each specific factor is uncorrelated with the general factor or with the specific factor of any other system variable.

If all the variables had been measured at only one point in time, then the only test for the general factor model would be a test of the predicted relations between the static correlations. This test was proposed by Spearman in 1904 and is classic.

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$$r_{x_i x_j} = \frac{\Sigma(G + S_i + e_i)(G + S_j + e_j)}{n\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\Sigma(G + S_i)(G + S_j) + \Sigma e_i x_j + \Sigma x_i e_j}{n\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\Sigma(G + S_i)(G + S_j)}{n\sigma_{x_i x_j}}$$

because the errors of measurement are uncorrelated. This formula is actually quite familiar once it is pointed out that $G + S_i$ is the true score T_i for the i^{th} system variable. To continue,

$$r_{x_i x_j} = \frac{\Sigma(GG + GS_j + S_iG + S_iS_j)}{n\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\Sigma G^2 + \Sigma GS_j + \Sigma S_iG + \Sigma S_iS_j}{n\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\Sigma G^2}{n\sigma_{x_i x_j}}$$

where strong use has been made of the assumptions that (1) the specific factors S_i and S_j are uncorrelated with G and (2) that the specific factors are uncorrelated with each other. Finally the formula can be rewritten

$$r_{x_i x_j} = \frac{\sigma^2 G}{\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\sigma G}{\sigma_{x_i}} \cdot \frac{\sigma G}{\sigma_{x_j}}$$

$$= \frac{\sigma^2 G}{\sigma_{x_i}\sigma_G} \cdot \frac{\sigma^2 G}{\sigma_G \sigma_{x_j}}$$

$$= r_{x_i G} \; r_{x_j G}$$

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If Spearman's general factor model holds in the data, then the correlation matrix must have a special form. If the variables are ordered from high to low on the basis of their average correlation with other variables, then the variables will also be ordered from high to low on the general factor. The general fit of the model can then be tested as follows. If the strongest variable is listed first, then the highest correlations should be in the top left-hand corner. Moving from left to right, the correlations should all decrease in magnitude (to within sampling error). Moving from the top down in the matrix, the correlations should decrease in magnitude (to within sampling error). Thus, by moving from the top left-hand corner of the matrix to the bottom right-hand corner of the matrix, the correlations should decrease from the highest in the matrix to the lowest (to within sampling error). Spearman called this "hierarchical structure"; the modern term is "rank one" matrix.

The static correlation matrices for the Chesser Firm A study, the replication of the Chesser study in Firm B, and the revised research model all demonstrate the presence of a general factor; i.e., the static correlations form a "rank one" matrix. For each study, the static correlations for both administrations have been averaged. This was done because the two time periods have shown very stable patterns across and within administrations. In Table 3-1 the averaged static correlations for Firm A managers studied by Chesser are presented. The data has been reordered to place the strongest variable, Superior-Subordinate Relationship, in the top left-hand corner of the table, then the next highest, Orientation Toward MBO, and so on for all seven variables. It is seen that the "rank one" characteristic is reasonably strong for five

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Table 3-1.-- Reordered Matrix of Averaged Static Correlations for the Chesser Study Firm A First and Second Administrations-- (n=73)[a]

Variables	Averaged First and Second Administration Static Correlations						
	1	3	6	4	2	7	5
1. Superior-Subordinate Relationship	1.00	.45	.35	.33	.31	.27	.05
3. Orientation Toward MBO	.45	1.00	.20	.14	.27	.27	.03
6. Satisfaction With Job	.35	.20	1.00	.42	.16	-.03	.00
4. Performance-Reward Association	.33	.14	.42	1.00	.18	.06	-.08
2. Goal Clarity and Relevance	.31	.27	.16	.18	1.00	-.01	.01
7. Perceived Success	.27	.27	-.03	.06	-.01	1.00	-.06
5. Subordinate's Influence Over Goals	.05	.03	.00	-.08	.01	-.06	1.00

[a]Correlations for this table are taken from Table 2-6, page 48 (Chesser, 1971).

Significant value of r:

.05 level = .23

.01 level = .30

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of the seven variables. The variables, Perceived Success and Subordinate's Influence, fall outside the rank one matrix.

Table 3-2, the reordered matrix of averaged static correlations for the Firm B managers, has been constructed in the same manner as described above. Again the rank one characteristic is quite evident. Also, it is the variables, Perceived Success and Subordinate's Influence, which fall outside the rank one matrix.

The scales of the revised research model also show the rank one characteristic (Table 3- 3). In the revised model, the scale development concentrated on making the variables both more reliable and more distinct within the system. In so doing, the items for the variables, Perceived Success and Subordinate's Influence, were absorbed into better scales. Thus in the reordering of this matrix, six of the seven variables show the strong hierarchial structure. Thus, all three averaged static correlation matrices show the rank one pattern characteristic of a general factor.

The Cross-Lagged Correlations

What does the general factor model predict for the cross-lag correlations? The critical assumption in answering this question is determined by examining the behavior of the specific factors. If the general factor model holds at time 1 and holds again at time 2, then the factors that are specific factors at time 1 are still specific factors at time 2. What this means is that the specific factors are not only uncorrelated with each other, but they do not causally interact over time either. Again, the essentially trivial character of the specific factors is evident in their correlational behavior.

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Table 3-2.-- Reordered Matrix of Averaged Static Correlations for the Replication Study First and Second Administrations-- Firm B (n=117)

Reordered Variables	Averaged First and Second Administration Static Correlations						
1. Superior-Subordinate Relationship	1.00	.52	.42	.52	.37	.23	.09
2. Goal Clarity and Relevance	.52	1.00	.37	.29	.14	.17	.09
3. Orientation Toward MBO	.42	.37	1.00	.41	.25	.17	-.04
4. Performance-Reward Association	.52	.29	.41	1.00	.41	.15	.12
6. Satisfaction with Job	.37	.14	.25	.41	1.00	.04	.04
7. Perceived Success	.23	.17	.17	.15	.04	1.00	-.05
5. Subordinate's Influence Over Goals	.09	.09	-.04	.12	.04	-.05	1.00

Significant values of r:

.05 level = .18

.01 level = .24

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Table 3-3.-- Reordered Matrix of Averaged Static Correlations for the First and Second Administrations - Revised Seven Scale Research Model - Firm B Managers (n = 117)[a]

	Averaged First and Second Administration Static Correlations						
Variables	1	4	7	5	3	6	2
1. Importance of Goals	1.00	.66	.42	.35	.33	.20	.30
4. Utility of MBO	.66	1.00	.55	.37	.38	.38	.22
7. Performance-Reward Association	.42	.55	1.00	.40	.31	.32	.04
5. Importance of Competence	.35	.37	.40	1.00	.17	.19	.03
3. Superior-Subordinate Relationship	.33	.38	.31	.17	1.00	.30	.00
6. Job Satisfaction	.20	.38	.32	.19	.30	1.00	.08
2. Goal Setting Behavior	.30	.22	.04	.03	.00	.08	1.00

[a]These correlations are taken from Table 2-7, page 17.

Significant values of r:

.05 level = .18

.01 level = .24

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Formulas for the cross-lagged correlations must provide for two different cases: the test-retest correlations that form the diagonal entries of the cross-lag matrix and the off-diagonal entries that involve the time 1 score on one variable and the time 2 score on another. Consider first the test-retest correlations. Since there is only one observed variable, denote it by x and use the subscripts for time 1 and time 2. Thus

$$x_1 = G_1 + S_1 + e_1$$
$$x_2 = G_2 + S_2 + e_2$$

The test-retest correlation will be

$$r_{x_1x_2} = \frac{\Sigma(G_1 + S_1 + e_1)(G_2 + S_2 + e_2)}{n\sigma_{x_1}\sigma_{x_2}}$$

$$= \frac{\Sigma(G_1 + S_1)(G_2 + S_2)}{n\sigma_{x_1}\sigma_{x_2}}$$

because the errors of measurement are not correlated with any other variable.

$$r_{x_1x_2} = \frac{\Sigma(G_1G_2 + G_1S_2 + S_1G_2 + S_1S_2)}{n\sigma_{x_1}\sigma_{x_2}}$$

$$= \frac{\Sigma G_1G_2 + \Sigma G_1S_2 + \Sigma S_1G_2 + \Sigma S_1S_2}{n\sigma_{x_1}\sigma_{x_2}}$$

$$= \frac{\Sigma G_1G_2 + \Sigma S_1S_2}{n\sigma_{x_1}\sigma_{x_2}}$$

since the specific factors do not interact over time with the general factor. To continue where the

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$$r_{x_1x_2} = \frac{\sigma_{G_1G_2}}{\sigma_{x_1}\sigma_{x_2}} \cdot \frac{\sigma_{S_1S_2}}{\sigma_{x_1}\sigma_{x_2}}$$

where the first term is for comparison with the off-diagonal cross-lag correlations and the second term represents the fact that since x_1 and x_2 are the same variable at two times, S_1 and S_2 are the two successive values of the same specific factor. Thus $r_{s_1s_2} \neq 0$ and the test-retest correlations should be larger than the off-diagonal cross-lag correlations by precisely the amount of the second term.

The prediction of the off-diagonal cross-lags is similar in character although notationally more difficult. Consider two variables x and y measured at two different times. Then

$$x_1 = G_1 + S_{x_1} + e_1$$

$$y_2 = G_2 + S_{y_2} + \varepsilon_2$$

The cross-lag correlation will be

$$r_{x_1y_2} = \frac{\Sigma(G_1 + S_{x_1} + e_1)(G_2 + S_{y_2} + \varepsilon_2)}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma(G_1 + S_{x_1})(G_2 + S_{x_2})}{n\sigma_{x_1}\sigma_{y_2}}$$

because the errors of measurement are uncorrelated. Continuing,

$$r_{x_1y_2} = \frac{\Sigma G_1G_2 + \Sigma G_1 S_{y_2} + \Sigma S_{x_1}G_2 + \Sigma S_{x_1}S_{y_2}}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma G_1G_2}{n\sigma_{x_1}\sigma_{y_2}}$$

because the specific factors do not interact causally with either the general factor or with each other. This in turn can be rewritten

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$$r_{x_1y_2} = \frac{\sigma_{G_1G_2}}{\sigma_{x_1}\sigma_{y_2}} = \frac{r_{G_1G_2}\,\sigma_{G_1}\,\sigma_{G_2}}{\sigma_{x_1}\,\sigma_{y_2}}$$

$$= r_{G_1G_2} \cdot \frac{\sigma_{G_1}}{\sigma_{x_1}} \cdot \frac{\sigma_{G_2}}{\sigma_{y_2}}$$

$$= r_{G_1G_2} \cdot \frac{\sigma^2_{G_1}}{\sigma_{x_1}\sigma_{G_1}} \cdot \frac{\sigma^2_{G_2}}{\sigma_{y_2}\sigma_{G_2}}$$

$$= r_{G_1G_2} \cdot r_{x_1G_1} \cdot r_{y_2G_2}$$

This triple product can be broken up into two parts. The first part is $r_{G_1G_2}$, the test-retest correlation of the general factor and is independent of which variables are taken to be x and y. Thus the test-retest correlation acts as a general multiplier of the entire cross lag correlation matrix. The second part of the triple product is the product $r_{x_1G_1} \cdot r_{y_2G_2}$. If the total amount of change in the system is not large, the ratio of the variance of the specific factor to the variance of the general factor will not be greatly changed over time. If this is true (and it is <u>exactly</u> true of the data in both firms), then $r_{y_2G_2} \approx r_{y_1G_1}$. That is

$$r_{x_1G_1}\, r_{y_2G_2} \approx r_{x_1G_1}\, r_{y_1G_1} = r_{x_1y_1}$$

Thus if $r_{y_2G_2} \approx r_{y_1G_1}$, then the second part of the triple product is essentially the static correlation at time 1, i.e.,

$$r_{x_1y_2} \approx r_{G_1G_2}\, r_{x_1y_1}$$

In particular, if the static correlations remain about the same from time 1 to time 2 (as they do in this study), then the cross-lag correlation matrix is obtained by simply multiplying the static correlation matrix by the test-retest correlation of the general factor.

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Thus if the test-retest correlations in the diagonal of the cross-lag matrix are ignored, then the general factor model predicts that the cross-lag correlation matrix will show exactly the same hierarchical order as did the static correlation matrix. That is, to within sampling error, the magnitudes will simply have been reduced by the multiplicative constant $r_{G_1G_2}$.

These derivations for the cross-lagged correlations predict that diagonals of the matrix (the test-retest correlations) will be greater than the off-diagonals by an amount equal to the correlation of specific factors for that particular variable at two points in time (i.e., $r_{S_1S_2} \neq 0$). The data for all three studies support this.

To illustrate, the cross-lagged correlation matrices for the three studies (Firm A, Firm B, and revised Firm B) have been reordered according to the hierarchical structure found for the static correlation matrices (Table 3-4 for Firm A, Table 3-5 for Firm B, and Table 3-6 for the revised Firm B model). As predicted, the diagonal correlations for each of these matrices are larger than the off-diagonal correlations.

In each case, the off-diagonal correlations in these cross-lagged correlation matrices show the same rank one pattern found in the corresponding averaged static correlation matrix. This is particularly clear for the revised scales in Firm B.

The Dynamic Correlations

The predictions for the dynamic correlations follow from the derivation of the formulas for the static correlations. That is, the model assumes real change in the general factor which accounts for the

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Table 3-4 .-- Reordered Cross-Lagged Correlation Matrix for the First and Second Administrations - Chesser Seven Scale Research Model - Firm A Managers (n=73).[a]

First Administration	Second Administration 1	3	6	4	2	7	5
1. Superior-Subordinate Relationship	.46[b]	.26	.35	.26	.01	.32	-.14
3. Orientation Toward MBO	.39	.51	.29	.19	.09	.08	-.10
6. Satisfaction With Job	.05	.02	.48	.33	-.05	-.01	-.07
4. Performance-Reward Association	.20	.03	.23	.42	.00	.12	-.23
2. Goal Clarity and Relevance	.23	.36	.17	.13	.23	-.06	-.04
7. Perceived Success	.31	.20	.19	.08	.07	.37	-.19
5. Subordinate's Influence Over Goals	-.10	.05	.08	.02	-.11	-.07	.17

[a]Correlations in this table are taken from Table 3-2, page 67 (Chesser, 1971).

[b]The diagonal entries are the test-retest correlations between each variable measured at time 1 and time 2. Off-diagonal entries are correlations between one variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .23

.01 level = .30

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Table 3-5.-- Reordered Cross-Lagged Correlation Matrix for the First and Second Administrations - Seven Scale Research Model Replication Study - Firm B Managers (n=117)

	Second Administration						
First Administration	1	3	6	4	2	7	5
1. Superior-Subordinate Relationship	.46[a]	.22	.38	.30	.06	.25	-.13
2. Goal Clarity and Relevance	.31	.46	.24	.17	-.06	.13	-.20
3. Orientation Toward MBO	.36	.39	.66	.32	.12	.24	-.04
4. Performance-Reward Association	.38	.31	.36	.60	.22	.07	.08
6. Satisfaction With Job	.32	.16	.27	.37	.52	.18	.05
7. Perceived Success	.20	.26	.12	.10	.06	.51	-.16
5. Subordinate's Influence Over Goals	.04	.07	-.05	.01	-.02	-.04	.35

[a]The diagonal entries are the test-retest correlations between each variable measured at time 1 and time 2. Off-diagonal entries are correlations between one variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .18

.01 level = .24

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ble 3-6 .-- Reordered Cross-Lagged Correlation Matrix for the First and Second Administrations - Revised Seven Scale Research Model - Firm B Managers (n = 117)[a]

	Second Administration						
First Administration	1	4	7	5	3	6	2
Importance of Goals	.53[b]	.41	.28	.22	.31	.02	-.03
Utility of MBO	.49	.68	.47	.31	.24	.16	.06
Performance-Reward Association	.41	.42	.58	.33	.18	.13	.05
Importance of Competence	.27	.25	.30	.56	.08	.13	-.13
Superior-Subordinate Relationship	.06	.13	.06	-.01	.27	-.01	-.19
Job Satisfaction	.24	.36	.33	.10	.21	.52	.07
Goal Setting Behavior	.20	.13	.12	.00	.05	.02	.44

se correlations are taken from Table 2-10, page 30.

diagonal entries are correlations between a variable measured at e 1 and time 2. Off-diagonal entries are correlations between a iable measured at time 1 and a second variable measured at time 2.

nificant values of r:

.05 level = .18

.01 level = .24

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erved dynamic correlations in the system. Thus, since there is nge in this model, the dynamic correlations will not be spurious but l be evidence of that change.

Mathematically, the equation for the dynamic correlations is ived as follows:

$$\text{Given, } \Delta x = x_2 - x_1 = \Delta G + \Delta S_i + \Delta e_i$$

$$\text{and } \Delta y = y_2 - y_1 = \Delta G + \Delta S_j + \Delta \varepsilon_j$$

where: y = an MBO variable different from x

ε = error of measurement in variable y

1 the dynamic correlations for the general factor model are given as

$$r_{\Delta x, \Delta y} = \frac{\Sigma(\Delta G + \Delta S_i + \Delta e_i)(\Delta G + \Delta S_i + \Delta e_i)}{n\sigma_{\Delta x}\,\sigma_{\Delta y}}$$

$$= \frac{\Sigma \Delta G^2 + \Sigma \Delta G \Delta S_j + \Sigma \Delta G \Delta S_i + \Sigma \Delta S_i \Delta S_j}{n\sigma_{\Delta x}\,\sigma_{\Delta y}}$$

use the errors of measurement are not correlated with any other able. When the assumption that the specific factors do not interact time with the general factor is used, the equation becomes

$$r_{\Delta x \Delta y} = \frac{\Sigma \Delta G^2 + \Sigma \Delta S_i \Delta S_j}{n\sigma_{\Delta x}\sigma_{\Delta y}}$$

additional assumption that the specific factors at time 1 are still ific at time 2 and do not causally interact with each other implies ΔS_i and ΔS_j are uncorrelated. Thus

$$r_{\Delta x \Delta y} = \frac{\Sigma \Delta G^2}{n\sigma_{\Delta x}\sigma_{\Delta y}} = \frac{\sigma^2_{\Delta G}}{\sigma_{\Delta x}\sigma_{\Delta y}}$$

1 yields a positive dynamic correlation. This can also be written $= r_{\Delta x \Delta G} \cdot r_{\Delta y \Delta G}$ which is Spearman's equation with observed varia- Δx and Δy and a general factor of ΔG. Thus the dynamic correlations ld also form a rank one matrix.

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Once again, the prediction derived by assuming the presence of a eral factor is corroborated in the data for all three studies. In le 3-7 the reordered dynamic correlation matrix for the Firm A agers and in Table 3-8 the matrix for the Firm B managers show ong positive dynamic correlations between the five variables which e assumed to correlate highly with the general factor. This same tern of strong positive dynamic correlations is seen in the revised el (Table 3-9). Each of the three matrices also shows the same rarchical structure as did the corresponding static and cross-lagged relations.

The Impact Correlations

The derivation of the off-diagonal impact correlations in the eral factor model is straightforward.

$$r_{x,\Delta y} = \frac{\Sigma(G + S_i + \ell_i)(\Delta G + \Delta S_j + \Delta\ell_j)}{n\sigma_x\sigma_{\Delta y}}$$

$$= \frac{\Sigma G\Delta G + \Sigma G\Delta S_j + \Sigma S_i\Delta G + \Sigma S_i\Delta S_j}{n\sigma_x\sigma_{\Delta y}}$$

$$= \frac{\Sigma G\Delta G}{n\sigma_x\sigma_{\Delta y}}$$

$$= \frac{\sigma G\Delta G}{\sigma_x\sigma_{\Delta y}} = r_{G\Delta G} \cdot \frac{\sigma_G\sigma_{\Delta G}}{\sigma_x\sigma_{\Delta y}}$$

in turn can be rewritten

$$r_{x\Delta y} = r_{G\Delta G} \cdot \frac{\sigma^2_G}{\sigma_x\sigma_G} \cdot \frac{\sigma^2_{\Delta G}}{\sigma_{\Delta y}\sigma_{\Delta G}}$$

$$= r_{G\Delta G}\, r_{xG}\, r_{\Delta y\Delta G}$$

h is a triple product much like that found for the cross-lagged elations. Again the first part of the product, $r_{G\Delta G}$, is independent

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Table 3-7.-- Reordered Dynamic Correlation Matrix for the First and Second Administrations - Seven Scale Research Model - Firm A Managers (n=73)[a]

Changes in Variable	1	3	6	4	2	7	5
Superior-Subordinate Relationship	1.00	.24	.34	.23	.30	-.16	.14
Orientation Toward MBO	.24	1.00	.23	.08	.05	.21	.07
Satisfaction With Job	.34	.23	1.00	.37	.11	-.13	-.06
Performance-Reward Association	.23	.08	.37	1.00	.12	-.10	-.01
Goal Clarity and Relevance	.30	.05	.11	.12	1.00	.06	.08
Perceived Success	-.16	.21	-.13	-.10	.06	1.00	-.07
Subordinate's Influence Over Goals	.14	.07	-.06	-.01	.08	-.07	1.00

:relations for this table are taken from Table 3-1, page 65
ıesser, 1971).

;nificant values of r:

.05 level = .23

.01 level = .30

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'able 3-8.-- Reordered Dynamic Correlation Matrix for the First and Second Administrations - Seven Scale Research Model Replication Study - Firm B Managers (n=117)

Changes in Variable	1	2	3	4	6	7	5
Superior-Subordinate Relationship	1.00	.48	.12	.37	.35	-.01	.23
Goal Clarity and Relevance	.48	1.00	.14	.11	.19	-.05	.27
Orientation Toward MBO	.12	.14	1.00	.20	.12	-.02	-.01
Performance-Reward Association	.37	.11	.20	1.00	.24	.14	.14
Job Satisfaction	.35	.19	.12	.24	1.00	-.15	.04
Perceived Success	-.01	-.05	-.02	.14	-.15	1.00	.11
Subordinate's Influence Over Goals	.23	.27	-.01	.14	.04	.11	1.00

ificant value of r:

.05 level = .18

.01 level = .24

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able 3-9.-- Reordered Dynamic Correlation Matrix for the First and Second Administrations - Revised Seven Scale Research Model - Firm B Managers (n = 117)[a]

Changes in Variable	1	4	7	5	3	6	2
Importance of Goals	1.00	.54	.19	.22	.27	.15	.41
Utility of MBO	.54	1.00	.27	.22	.40	.31	.30
Performance-Reward Association	.19	.27	1.00	.22	.34	.18	-.08
Importance of Competence	.22	.22	.22	1.00	.23	.15	.18
Superior-Subordinate Relationship	.27	.40	.34	.23	1.00	.34	.13
Job Satisfaction	.15	.31	.18	.15	.34	1.00	.06
Goal Setting Behavior	.41	.30	-.08	.18	.13	.06	1.00

se correlations are taken from Table 2-10, p. 30.

nificant value of r:

.05 level = .18

.01 level = .24

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which variables are represented by x and y. Thus $r_{G\Delta G}$ is a general
tiplier of the entire impact correlation matrix. The second part of
triple product is the product r_{xG} $r_{\Delta y\Delta G}$ and is more complex than the
uct for the cross-lag correlations. This term will be large to the
nt that the initial score in question is correlated with the general
or <u>and</u> the change score in question is correlated with the change in
general factor. If all the specific factors changed to the same
ee, then the rank order of the $r_{\Delta y\Delta G}$'s would be the same as the rank
r of the r_{yG}'s, i.e., the same as the rank order of the static
elations. However, if some specific factors change much more than
rs, then this rank order could be modified. A rough estimate of the
cted rank order of the $r_{\Delta y\Delta G}$'s is given by the reliabilities of the
e scores.

Thus going down a column of the impact correlation matrix, the
order of the numbers should be the same as the rank order of the
c correlations (to within sampling error). Going across a row of
mpact correlation matrix, the rank order of the correlations should
e same as the rank order of the change score reliabilities. The
al magnitude and the sign of the entire set of impact correlations
ermined by the impact correlation of the general factor, $r_{G\Delta G}$.

The most important point of this derivation is in the last sen-
If the general factor undergoes real regression to the mean, then
s negative and the general factor model predicts that every entry
impact correlation matrix will be negative (to within sampling
. And thus if regression to the mean in the general factor is
d, then there is at least qualitative fit for the predictions of
neral factor model and the impact correlations found in the data.

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The predicted pattern of impact correlations for the three
es does show a hierarchical structure (see Table 3-10 for Firm A, 3-11 for the Firm B replication study, and Table 3-12 for the Firm ised study). Although not as distinct as in the static, cross-d, and dynamic correlation matrices, the data do support the exis- of a general factor.

The Nature of the General Factor

The nature of the general factor is unknown. On one hand, it the manager's general attitude toward work--a generalized atti-f job satisfaction. Alternately, it could be more general. s the general factor in this system is the manager's general level f-esteem or self-confidence. On the other hand, the general may be less general than it appears to be. Suppose the general is simply how well the manager thinks the boss likes him. If the r defines competence, performance, etc., almost exclusively in of his ability to influence the boss; and if he defines the of MBO and other aspects of goal setting solely in terms of pro- an opportunity to get to the boss in an atmosphere of solemn ration; then a single narrow attitude could account for all the ation. The specific factors in this case would be the "trivial" ve aspects of the work situation that are brought to the 's attention by the specific words in the specific questions.

The definition of the general factor is actually a function of tem boundaries. There is evidence that five of the seven MBO es are estimates of the general factor. However, until it can be ned whether the general factor is completely within the present

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'able 3-10.-- Reordered Impact Correlation Matrix for the First and Second Administrations - Seven Scale Research Model - Firm A Managers (n=73)[a]

Initial Score	Change Score 1	3	6	4	2	7	5
Superior-Subordinate Relationship	-.46	-.15	.02	.02	-.32	-.03	-.03
Orientation Toward MBO	-.03	-.39	.21	.13	-.19	-.16	-.19
Satisfaction With Job	-.23	-.10	-.61	-.11	-.21	-.06	-.05
Performance-Reward Association	-.04	-.07	-.27	-.53	-.12	.01	-.15
Goal Clarity and Relevance	-.13	.08	.04	.11	-.62	-.23	-.04
Perceived Success	.05	.03	.26	.00	.01	-.57	-.02
Subordinate's Influence Over Goals	-.12	-.08	.04	.08	.00	.10	-.76

'relations for this table are taken from Table 2-7, page 54, esser, 1971).

nificant values of r:

.05 level = .23

.01 level = .30

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le 3-11.-- Reordered Impact Correlation Matrix for the First and Second Administrations - Seven Scale Research Model Replication Study - Firm B Managers (n=117)

	Change Score						
Initial Score	1	2	3	4	6	7	5
uperior-Subordinate elationship	-.61	-.34	-.02	-.18	-.31	-.17	-.25
oal Clarity and elevance	-.27	-.58	-.10	-.05	-.18	.04	-.28
rientation Toward MBO	-.09	.03	-.38	-.11	-.18	.22	-.05
erformance-Reward ssociation	-.14	.07	-.07	-.41	-.16	-.01	-.04
tisfaction With Job	-.08	.03	-.02	.01	-.50	.16	.01
rceived Success	.10	.15	.12	.03	.03	-.47	-.08
bordinate's Influence er Goals	-.12	-.05	-.08	-.13	-.05	.04	-.57

icant values of r:

05 level = .18

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le 3-12.-- Reordered Impact Correlation Matrix for the First and Second Administrations - Revised Seven Scale Research Model - Firm B Managers (n=117)

	Change Score						
Initial Score	1	4	7	5	3	6	2
portance of Goals	-.52	-.34	-.01	-.11	-.08	-.16	-.31
ility of MBO	-.19	-.44	-.01	-.04	-.13	-.23	-.18
rformance-Reward sociation	.09	-.12	-.40	.04	-.08	-.17	.05
portance of Competence	-.07	-.15	.02	-.45	-.06	-.06	-.16
perior-Subordinate lationship	-.32	-.28	-.19	-.15	-.68	-.30	-.17
b Satisfaction	.05	-.05	.06	-.08	-.09	-.50	-.07
al Setting Behavior	-.12	-.16	.14	-.04	.05	-.12	-.50

icant values of r:

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em, is part in and part out, or is a factor completely outside the
ently defined system, a sound definition cannot be established.

Discussion

Several models were developed to explain the results of the two rical studies. Only the general factor model adequately explained data and then only with some very delicate assumptions. First of there is the assumption that a single general factor produced all observed correlations in the system. This of course is completely radictory to all the theory in the literature. If in fact the ries that posit MBO as a multivariate system are right, then the dity of the general factor model in the present studies would amount n invalidation of the separate variables of the questionnaire used .

Second, there is the finding of no change in means, standard ations, and correlations over time. The fact that the variances t change means that the impact correlation is negative; i.e., gers who start low increase by more than the managers who start . The fact that the mean change is zero implies that the managers start high actually decrease over time. Again this contradicts ing beliefs regarding organizational development programs.

Two other facts in the data inhibit the plausibility of the ral factor model. First, the fact that the mean change is zero res the balance point between increase and decrease on the general or to be exactly the general factor mean for that firm. Second, the that the variance does not change means that the decrease in nce produced by the regression in managerial attitudes is exactly balance

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ıced by the increase in variance produced by factors outside the em. Furthermore, this exact balance must be assumed in both firms.

Another area of concern in the data is the poor change score ability for several of the scales. Since the change in the general or makes a contribution to every change score, no change score can zero reliability. However, it is possible that the low change e reliability is the result of sampling error. If the observed -retest correlation (the diagonals in the cross-lagged matrix) $r_{x_1x_2}$ higher than the population correlation because of sampling error, the reliability of the change score for that variable would be comitantly underestimated.

Thus, there are enough problems with the general factor model to t its plausibility. However, the general factor model cannot be cted on the basis of the two time period study.

Although the data from both organizations indicate the presence general factor, this is not proof of real change. Indeed, the lems in the general factor model arise from the constancy of means, dard deviations, and static correlations. All these problems would ppear if there were no change in underlying MBO variables. The next ter will present several models that assume no change in the MBO em. In particular, the "mood" model will be shown to fit the data ll as the general factor model without making so many special t balance" assumptions.

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CHAPTER 4

MODELS THAT ASSUME NO REAL CHANGE

The analysis of the two time period data for both organizations luced several contradictions to the hypothesis of real change in MBO tudes as a multivariate system. In an effort to explain these radictions, several models based on the assumption of real change developed in the previous chapter. The model which fit the data , the general factor model, required several delicate assumptions its development. Because of these, other models which account for pattern of results were developed and evaluated. These models are ted in this chapter.

The basic problem in the data from a theoretical point of view hat the means, variances, and correlations are unchanged over time. the only model which fit the data and assumed real change had to me that the MBO variables had no separate identity and that the c pattern of change was regression to the mean. There is an alterve assumption which fits the finding of no change in the means, dard deviations, and correlations very nicely: assume that there n fact no change in the fundamental MBO variables. That is, assume the questionnaire was basically valid but the managers are simply able at the time of life measured that there is no measurable e.

If there is no actual change, then why do the observed bles show change? This chapter presents three answers to this on, i.e., three agents which can produce "apparent" change in the ed variables. If each agent is paired with the assumption of no change

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in the MBO variables, then a different model to predict the ved data is obtained. Each can then be tested.

The first section of this chapter describes the effects of ability and the second section analyzes transient effects upon the s. The final section presents a model called the "mood" model explains the two time period data quite well.

A Model Based on Errors of Measurement

For this project, the questionnaire (Appendix A) was adminis- to the same managers in each organization on two or more occasions cored for direction and amount of change. The most certain conclu- hat could be reached was that the change scores, which represented served difference between administrations of the questionnaire, nreliable. One result of these unreliabilities is spurious sion toward the mean (Hunter and Cohen, 1972).

If there is no change in the underlying attitudes, then there e no change in the means, variances, or static correlations between served variables. Furthermore if there is no change, then the lagged correlations will be substantial. Thus a model which s no change automatically fits much of the data. Where does the ance of change come from? Consider unreliability. If there is no in the underlying true score, then the model can be derived as:

$$x_1 = T + e_1$$

$$x_2 = T + e_2$$

where

x_1 = observed score at time 1

x_2 = observed score at time 2

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T = true score for variable x

e_1 = measurement error at time 1

e_2 = measurement error at time 2

ange score is given by

$$\Delta x = x_2 - x_1 = (T + e_2) - (T + e_1)$$
$$= T - T + e_2 - e_1$$
$$= e_2 - e_1 \neq 0$$

is, in the change score, the two identical true scores cancel out ie two different errors of measurement do not. Thus the observed ; show change where there is none.

The finding which posed the greatest difficulty for Chesser's dology was the negative impact correlations. Could they be ous? Consider first the correlation between the initial score, x, ie change score, Δx

$$r_{x_{1},\Delta x} = \frac{\Sigma(T + e_1)(e_2 - e_1)}{n\sigma_{x_1}\sigma_{\Delta x}}$$

$$= \frac{\Sigma Te_2 + \Sigma Te_1 + \Sigma e_1 e_2 - \Sigma e_1^2}{n\sigma_{x_1}\sigma_{\Delta x}}$$

the errors of measurement are not correlated with each other or ier score, the correlation is

$$r_{x_1 \Delta x} = \frac{-\Sigma e_1^2}{n\,\sigma_{x_1}\sigma_{\Delta x}}$$

s a spurious negative correlation due to errors of measurement.

However, this argument for the negative $r_{x,\Delta x}$ applies only to* gonal impact correlations. What about the off-diagonals? The ion of initial administration variable x with the change in variable (y) is shown as:

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$$x_1 = T + e_1$$

$$y_1 = U + \varepsilon_1$$

$$y_2 = U + \varepsilon_2$$

$$\Delta y = (U + \varepsilon_2) - (U + \varepsilon_1) = \varepsilon_2 - \varepsilon_1$$

where: U = the true score for variable y_i

ε_i = the error of measurement for variable y_i

then,

$$r_{x,\Delta y} = \frac{\Sigma(T_1 + e_1)(\varepsilon_2 - \varepsilon_1)}{n_{\sigma_x \sigma_{\Delta y}}}$$

$$= \frac{\Sigma T_1 \varepsilon_2 + \Sigma e_1 \varepsilon_2 - \Sigma T_1 \varepsilon_1 - \Sigma e_1 \varepsilon_1}{n_{\sigma_x \sigma_{\Delta y}}}$$

errors of measurement are not correlated with any other score, they ɔt correlated with each other. Hence,

$$r_{x\Delta y} = 0$$

;imple unreliability predicts that the off-diagonal entries of the : correlation matrix should be zero. That is, simple unreliability .ot predict a spurious negative correlation between the initial on one variable and the change score on another. Hence, simple ability does not account for the off-diagonal negative impact ations found in both firms.

How would simple unreliability affect the correlation between ; in two system variables, x and y? For a starting point, assume:

$x_1 = T_1 + e_1$	$y_1 = U_1 + \varepsilon_1$
$x_2 = T_2 + e_2$	$y_2 = U_2 + \varepsilon_2$
$\Delta x = e_2 - e_1$	$\Delta y = \varepsilon_2 - \varepsilon_1$

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$$r_{\Delta x \Delta y} = \frac{\Sigma(e_2 - e_1)(\varepsilon_2 - \varepsilon_1)}{n\sigma_{\Delta x}\sigma_{\Delta y}}$$

$$= \frac{\Sigma e_2\varepsilon_2 - \Sigma e_2\varepsilon_1 - \Sigma e_1\varepsilon_2 + \Sigma e_1\varepsilon_1}{n\sigma_{\Delta x}\sigma_{\Delta y}}$$

he fact that errors of measurement are not correlated between or time periods means that every term is zero. Thus the dynamic ation is:

$$r_{\Delta x \Delta y} = 0$$

ain it has been shown that simple unreliability does not predict ous correlation for the correlation between change scores for nt variables. The one result in the impact and dynamic correla- hich might be an artifact produced by simple unreliability is the s negative regression found in the diagonal of the impact matrix.

A close examination of the quantitative predictions made by this or the cross-lagged correlations reveals one other failing. If

$$x_1 = T + e_1$$

$$y_2 = U + \varepsilon_2$$

re, then

$$r_{x_1y_2} = \frac{\Sigma(T + e_1)(U + \varepsilon_2)}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma TU + \Sigma e_1U + \Sigma T\varepsilon_2 + \Sigma e_1\varepsilon_2}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma TU}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\sigma_{TU}}{\sigma_{x_1}\sigma_{y_1}}$$

$$= r_{x_1y_1}$$

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at is, the cross-lagged correlations are predicted to be not just nilar to the static correlations, but they are predicted to be equal. ıs is not true in the data for either firm.

A side effect of this result is the fact that if the test-est correlation is equal to the reliability of the scale, then the erved reliability of the change score for each variable would be zero. ıs this model fails by predicting too many zero reliabilities.

The Transient Factor Model

There are a number of sources of variation in the responses to questionnaire by the managers of both Firms A and B. Some of that iation can be attributed to the unreliability in the measuring trument. Another portion of that variation is change in true scores. there another component? Consider the change in a person's weight n one week to another. Little of the variation is due to "unrelia-ty" in the sense of "error of measurement." Can it then be con-ded that all the variation is due to a change in true score? That ends on what sort of concept of "weight" is used as a reference. If ght" is defined as instantaneous mass, then by definition all fluc-ions in weight represent changes in true score. However for such oses as the study of obesity, heart disease, body types, etc., this nition would be pointless and misleading. To illustrate, consider fact that during a summer game a football player may show "apparent" ht loss of 25 or 30 pounds; i.e., a "water loss" which will vanish matter of hours. Clearly the relevant concept of "weight" in this ation is a hypothetical "true" weight which would have been obtained the person been weighed under "standard" conditions.

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Some time ago (1960) Cronbach noted the distinction between the
ions in observed scores produced by transient factors (i.e.,
bility") and errors of measurement. The usual reliability would
ained by administering two different instruments (designed to
re attitudes regarding the MBO system) at the same point in time.
orrelation between these alternate forms would indicate how well
easurement on form A agrees with the measurement of the same
oles using form B. Cronbach calls this correlation the "coefficient
uivalence." The difference in scores between these forms is the
e error of measurement discussed in the previous model.

Cronbach also defined a second reliability coefficient, the
ficient of stability," to assess the reliability of measures sub-
to transient conditions. The "coefficient of stability" is
ly a test-retest correlation obtained by administering the same
ment at two points in time that are far enough apart that one set
nsient factors is replaced by another set of transient factors,
close enough in time that there is no change in true score. This
cient of stability indicates how stable a particular measurement
r time. That is, the "true score" for this coefficient is the
attribute of a manager (e.g., general attitude towards work or
ich will be found in both administrations of the questionnaire.
rary condition such as a quarrel with the boss over some momen-
dget problem, feeling a financial pinch regarding a recent
investment, a temporary lull in sales, etc., may cause a
to respond, on all the items of some scale, higher or lower one
he would the next. The effect of such events is a lowering of
retest reliability or "coefficient of stability." The effect

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ansient factors on the coefficient of equivalence would be the ite. They would enter into the two measurements at the same time ence would spuriously inflate the coefficient of equivalence.

The coefficient used in this study to estimate scale relia- ies is coefficient alpha (Cronbach, 1951). Coefficient alpha is alent to an "alternate form" reliability coefficient, i.e., an ate of the coefficient of equivalence. If there are significant ient factors in the MBO questionnaire, then coefficient alpha is to extent an overestimate of the relevant dynamic reliability icient, i.e., the coefficient of stability. If coefficient alpha overestimate, then the reliabilities of the change scores will be spondingly inflated. This casts doubt upon the reliabilities of ange scores found in the replication that were not already zero.

Unfortunately in the present study the time interval between rements is eighteen months. Thus there is no way to differentiate n real change and instability. That is, there is no means to the effects of "instability" upon the reliability measures given wo administrations of the questionnaire. However, this can be f there are measurements made at <u>three</u> times. As will be shown in xt chapter, there is such data and it does suggest pronounced ent factors.

Mathematically the effect of instability on static correlations, lagged correlations, dynamic correlations, and impact correla- is indistinguishable from the effect of error of measurement. The m together in a single "error" term. Thus a model which contains rror of measurement and instability will make the same major pre- ns as the model built on simple unreliability alone. However, the

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xistence of significant transient factors makes the coefficient of quivalence (the usual "reliability") useless for statistically eliminatng the effect of "error" from the data by correcting for attenuation or ne like.

The "Mood" Model

To this point, the effects of unreliability and transient ictors and the assumption of no real change can be considered an alterative to the real change models to explain some of the results found in e data. However these no change models have not been able to explain e negative off-diagonals in the impact correlation matrix or the sitive dynamic correlations. The "mood" model will succeed in predictg both.

The "mood" model is an attempt to identify a component of the viation of the observed responses from the true score that would tually be common to the entire set of responses to the questionnaire. me days the manager will feel especially good and some days he will el especially bad. This could be the result of personal health, peral problems, a conflict situation, and so on. All of these are ndom and transient. However, if a manager's mood contributes signifintly to his measured attitude on one of the MBO dimensions, then it ll also contribute to the others. That is, if the manager's mood is a ctor in his questionnaire responses, then it is a factor that is mmon to all variables in the MBO system. Therefore consider a model ch assumes (1) that there is no change in the true score of the ager between administrations and (2) that the change observed is in t a function of the "mood" of the manager at that point in time.

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Mathematically, the mood model for two variables is

$$x_i = T + h_i + e_i$$

and $$y_i = U + h_i + \varepsilon_i$$

where: x_i = observed score for variable x

y_i = observed score for variable y

T = true score for variable x

h_i = mood variable at time i

e_i = error of measurement for variable x at time i

ε_i = error of measurement for variable y at time i

Since the mood variable is not correlated across administrations, the cross-lagged correlation formula is very simple. Thus,

$$r_{x_1 y_2} = \frac{\Sigma(T + h_1 + e_1)(U + h_2 + \varepsilon_2)}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma(T + h_1)(U + h_2)}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma TU + \Sigma h_1 U + \Sigma T h_2 + \Sigma h_1 h_2}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\Sigma TU}{n\sigma_{x_1}\sigma_{y_2}}$$

$$= \frac{\sigma_{TU}}{\sigma_x \sigma_y}$$

The time subscripts have been dropped from x and y in the last equation because $\sigma_{x_1} = \sigma_{x_2} = \sigma_x$ and $\sigma_{y_1} = \sigma_{y_2} = \sigma_y$.

The static correlations for the mood model are similarly derived

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$$r_{x_1y_1} = \frac{\Sigma(T + h_1 + e_1)(U + h_1 + \varepsilon_1)}{n\sigma_{x_1}\sigma_{y_1}}$$

$$= \frac{\Sigma TU + \Sigma h_1{}^2}{n\sigma_{x_1}\sigma_{y_1}}$$

$$= \frac{\Sigma TU}{n\sigma_{x_1}\sigma_{y_1}} + \frac{\Sigma h_1{}^2}{n\sigma_{x_1}\sigma_{y_1}}$$

$$= \frac{\sigma_{TU}}{\sigma_x\sigma_y} + \frac{\sigma^2{}_h}{\sigma_x\sigma_y}$$

$$r_{x_1y_1} > \frac{\sigma_{TU}}{\sigma_x\sigma_y}$$

ius since mood affects both x and y, mood produces a spurious increase 1 the static correlation between them. Furthermore, it will produce puriously high correlations for both administrations of the data.

Since mood increases the static correlations but not the cross-gs, it can greatly and falsely inflate the estimated reliability of e change scores for the system variables. That is, in the mood model $_{1}x_2$ = the coefficient of stability. Coefficient alpha as used in is study is $r_{x_1x_1} = r_{x_1x_2} + \frac{\sigma^2{}_h}{\sigma^2{}_x}$ which is inflated. This reflects the ct that mood is a transient factor for any one variable considered in olation.

For the diagonals of the impact correlation matrix, the mood del operates as follows:

$$x_1 = T + h_1 + e_1$$

$$x_2 = T + h_2 + e_2$$

$$\text{so} \quad \Delta x = h_2 - h_1 + e_2 - e_1 = \Delta h + \Delta e$$

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$$r_{x,\Delta x} = \frac{\Sigma(T_1 + h_1 + e_1)(\Delta h + \Delta e)}{n\sigma_x\sigma_{\Delta x}}$$

$$= \frac{\Sigma T_1\Delta h + \Sigma T\Delta e + \Sigma h_1\Delta h + \Sigma e_1\Delta h + \Sigma e_1\Delta e}{n\sigma_x\sigma_{\Delta x}}$$

Several assumptions must be made. The errors of measurement are defined to be uncorrelated with any other variable. Similarly, if mood is transient and random, it is also uncorrelated with any other variable. In particular, if mood is a transient variable, then mood at time 1 will not be correlated with mood at time 2. By using these assumptions,

$$r_{x\Delta x} = \frac{-\Sigma h_1^2 - \Sigma e_1^2}{n\sigma_x\sigma_{\Delta x}} = \frac{-\sigma^2_h - \sigma^2_e}{\sigma_x\sigma_{\Delta x}} = -\frac{\sigma^2_h + \sigma^2_e}{\sigma_x\sigma_{\Delta x}}$$

which is the negative diagonal impact correlation found in the data.

Now, for the off-diagonal impact correlations,

$$y_2 = U + h_2 + \varepsilon_2$$

$$y_1 = U + h_1 + \varepsilon_1$$

$$\text{so} \quad \Delta y = \Delta h + \Delta\varepsilon$$

Hence,

$$r_{x,\Delta y} = \frac{\Sigma(T + h_1 + e_1)(\Delta h + \Delta\varepsilon)}{n\sigma_x\sigma_{\Delta y}}$$

$$= \frac{\Sigma T\Delta h + \Sigma T\Delta\varepsilon + \Sigma h_1\Delta h + \Sigma h_1\Delta\varepsilon + \Sigma e_1\Delta h + \Sigma e_1\Delta\varepsilon}{n\sigma_x\sigma_{\Delta y}}$$

and by using the same assumptions as before,

$$r_{x\Delta y} = \frac{-\Sigma h_1^2}{n\sigma_x\sigma_{\Delta y}} = \frac{-\sigma^2_h}{\sigma_x\sigma_{\Delta y}}$$

which is negative but smaller than the $r_{x,\Delta x}$ correlation. Why? Because the off-diagonals do not have the error term which accounts for unreliability or the regression effect. Thus a model has been found which accounts

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counts for the off-diagonal negative correlation as artifacts. That , the mood model predicts negative impact correlations despite the ct that it assumes no real change between administrations.

What does the mood model predict for the dynamic correlations? r the correlation between change in variable x and change in variable

$$\Delta x = h_2 - h_1 + e_2 - e_1 = \Delta h + \Delta e$$

and

$$\Delta y = h_2 - h_1 + \varepsilon_2 - \varepsilon_1 = \Delta h + \Delta\varepsilon$$

so that

$$r_{\Delta x\Delta y} = \frac{\Sigma(\Delta h + \Delta e)(\Delta h + \Delta\varepsilon)}{n\sigma_x\sigma_{\Delta y}}$$

$$= \frac{\Sigma\Delta h^2 + \Sigma\Delta h\Delta\varepsilon + \Sigma\Delta h\Delta e + \Sigma\Delta e\Delta\varepsilon}{n\sigma_{\Delta x}\sigma_{\Delta y}}$$

llowing the previously established assumptions,

$$r_{\Delta x\Delta y} = \frac{\Sigma\Delta h^2}{n\sigma_{\Delta x}\sigma_{\Delta y}} = \frac{\sigma^2 h}{\sigma_{\Delta x}\sigma_{\Delta y}}$$

is is a positive correlation. Thus the fact that mood affects both and y not only produces a spuriously high static correlation between em, it produces a spurious dynamic correlation as well.

Thus the mood model predicts every result in the data. Since is model fits the data and assumes no real change in the MBO variables, e dynamic correlations and impact correlations may simply be artifacts d the reliability of the change scores could be spurious.

Summary

Two alternative models have been derived which explain the sults in the data, i.e., the pattern of correlations, the constant variance

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ariance, and the poor change score reliabilities. The mood model pre-icts results which are congruent with both the Chesser analysis and the esearch reported here. The mood model assumes that there is no real hange in the MBO system during the two time periods. However the eneral factor model also explains the data. And the general factor odel assumes real change in the system during the two time period tudy. Thus, the dilemma is posed. One model which fits the data ssumes real change while the other model which fits the data assumes hat all the observed change is spurious. Thus one cannot determine hether or not there was real change in the managers' attitudes from the ata gathered in two time measurements.

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CHAPTER 5

TEST OF THE REAL CHANGE HYPOTHESIS

Is there a direct empirical test of the hypothesis of real hange in the MBO system? This chapter will first show that if data rom three administrations of the MBO questionnaire are available, then here is indeed such a test. The test will then be applied to the hird administration data from Firm A. The result of the test will be n indication of which mathematical model best fits the data of the ongitudinal study of Firm A.

Transient Factors and Unreliability

Assume that there is no real change in an MBO system variable ver a three-year period (in this study the three administrations were ach 18 months apart). Then the three successive scores for variable x ould be characterized by

$$x_1 = T + e_1$$

$$x_2 = T + e_2$$

$$x_3 = T + e_3$$

where:

T = unchanging true score for variable x

e_i = aggregate of transient factors and unreliability for variable x at time i

ch of the static correlations for the three time periods is the same, e.,

$$r_{x_i x_j} = r_{ij} = \frac{\Sigma(T + e_i)(T + e_j)}{n\sigma_{x_i}\sigma_{x_j}}$$

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$$= \frac{\Sigma T^2 + \Sigma T e_j + \Sigma e_i T + \Sigma e_i e_j}{n \sigma_{x_i} \sigma_{x_j}}$$

$$= \frac{\sigma^2 T}{\sigma^2 x}$$

since $\sigma^2_{x_i} = \sigma^2_{x_j} = \sigma^2_T + \sigma^2_e$. Stated differently,

$$r_{13} = r_{12} = r_{23}$$

is the coefficient of stability as Cronbach defined it.

The most important feature of this model is that $r_{13} = r_{12}$ and $r_{13} = r_{23}$. To see the importance of this, suppose that there had been no unreliability or transient factors in the observed variable. Then r_{12} would be low to the extent that there was a large amount of real change from time 1 to time 2 and r_{23} would be small to the extent that there was a large amount of change from time 2 to time 3. But if there is considerable change from time 1 to time 2 and more change from time 2 to time 3, then there is greater change from time 1 to time 3 than from time 1 to time 2 and r_{13} would be expected to be less than r_{12}. The fact that r_{13} is not smaller than r_{12} in this model is a direct reflection of the assumption that the observed change from time 1 to time 2 was not real change but only apparent change.

What are the cross-lagged panel correlations in this model? Suppose there was perfect measurement for two variables, x and y. Then, in this no change model, T would be the true score for x_1 and x_2 and U would be the true score for variable y_1 and y_2. The cross-lagged correlations would be

$$r_{x_1 y_2} = r_{T y_2} = r_{TU}$$
$$r_{y_1 x_2} = r_{U x_2} = r_{UT}$$

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And since $r_{UT} = r_{TU}$,

$$r_{x_1y_2} = r_{TU} = r_{UT} = r_{y_1x_2}$$

hat is, the cross-lagged correlations are equal to each other. In fact, he cross-lagged correlations in this model satisfy an even stronger elation. Since

$$r_{x_1y_1} = r_{Ty_1} = r_{TU}$$

$$r_{x_2y_2} = r_{Ty_2} = r_{TU}$$

e cross-lagged correlations are actually equal to the static correlaons, $r_{x_1y_2} = r_{x_1y_1}$. For three time periods these symmetrical relationips are:

$$T_1 = T_2 = T_3 = T \text{ and } U_1 = U_2 = U_3 = U$$

us,

$$r_{x_1y_3} = r_{x_1U_3} = r_{x_1U} = r_{TU}$$

$$r_{y_1x_3} = r_{y_1T_3} = r_{y_1T} = r_{UT} = r_{TU} = r_{x_1y_3}$$

$$r_{x_1y_3} = r_{TU} = r_{x_1y_2}$$

$$r_{y_1x_3} = r_{UT} = r_{y_1x_2}$$

$$r_{x_2y_3} = r_{x_2U_3} = r_{x_2U} = r_{TU} = r_{y_2x_3}$$

$$r_{x_2y_3} = r_{TU} = r_{x_2y_1} = r_{x_1y_2} = r_{x_1y_3}$$

at is, for all i and j

$$r_{x_iy_j} = r_{T_iy_j} = r_{Ty_j} = r_{TU_j} = r_{TU}$$

ce the cross-lags are all equal. But actually this formula holds for = j as well as $i \neq j$, and so the static correlations are also all ual. Therefore, if there is perfect measurement, the cross-lags are equal to each other (i.e., they are symmetrical) and are equal to static correlations.

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If the variables in this model are less than perfect, i.e., have "error of measurement" of the simple kind, then for

$$x_i = T + e_i \text{ and } y_i = U + \varepsilon_j$$

the static correlation and the cross-lags are given by

$$r_{x_i y_j} = \frac{\Sigma(T + e_i)(U + \varepsilon_j)}{n\sigma_{x_i}\sigma_{y_j}}$$

$$= \frac{\Sigma TU + \Sigma e_i U + \Sigma T\varepsilon_j + \Sigma e_i \varepsilon_j}{n\sigma_{x_i}\sigma_{y_j}}$$

$$= \frac{\Sigma TU}{n\sigma_{x_i}\sigma_{y_j}}$$

$$= \frac{\sigma_{TU}}{\sigma_{x_i}\sigma_{x_j}}$$

$$= \frac{\sigma_{TU}}{\sigma_x \sigma_y}$$

That is, each $r_{x_i y_j}$ is equal to the same constant and hence equal to each other. Thus the fact that the cross-lags are all equal to each other and are equal to the static correlations is not affected by adding simple error of measurement or "error" due to transient factors.

However, for the mood model, the cross-lagged correlations are predicted to be less than the static correlations for a two time period study ($r_{x_1y_2} = r_{x_2y_1} < r_{x_1y_1} = r_{x_2y_2}$). But what about a three time period study? If there is no change in true score over time, the mood model can be written

$$x_i = T_i + h_i + e_i = T + h_i + e_i$$

$$y_i = U_i + h_i + \varepsilon_i = U + h_i + \varepsilon_i$$

where T_i, U_i, h_i, e_i, ε_i are defined as the values of T, U, h, e, and ε at time i. After eliminating the terms involving uncorrelated variables, For cro

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$$r_{x_i y_j} = \frac{\Sigma(T + h_i + e_i)(U + h_j + \varepsilon_j)}{n\sigma_{x_i}\sigma_{x_j}}$$ error in notation

$$= \frac{\Sigma TU + \Sigma h_i h_j}{n\sigma_x\sigma_y}$$

since $\sigma_{x_i} = \sigma_x$ and $\sigma_{y_j} = \sigma_y$.

For cross-lags, i and j refer to two different times so that the mood components, h_i and h_j, are uncorrelated. Thus for cross-lags

$$r_{x_i y_j} = \frac{\Sigma TU}{n\sigma_x\sigma_y}$$

$$= \frac{\sigma_{TU}}{\sigma_x\sigma_y} \quad \text{if } i \neq j$$

and the cross-lags are all equal to each other.

However for static correlations, i and j refer to the same time. That is, for correlations, j = i, so that

$$r_{x_i y_i} = \frac{\Sigma TU + \Sigma h_i h_i}{n\sigma_x\sigma_y}$$

$$= \frac{\sigma_{TU} + \sigma^2_h}{\sigma_x\sigma_y}$$

$$= \frac{\sigma_{TU}}{\sigma_x\sigma_y} + \frac{\sigma^2_h}{\sigma_x\sigma_y}$$

That is, the static correlations are always equal to each other, but are spuriously higher than the cross-lag correlations by the amount given in the second term of the last equation.

In summary, the mood model predicts that

$$r_{13} = r_{12} = r_{23} < r_{11} = r_{22} = r_{33}.$$

These relationships will be used to test the data for three administrations to the Firm A managers for the presence of real change in their attitudes.

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Real or Cumulative Change

In this section real change is assumed in the observed variable, .e., a change in the true score. To simplify the discussion, first onsider only true scores. Let the change in true scores be given by

$$\Delta T = \varepsilon$$

o simplify the discussion, assume that the variable T is not affected y the other variables in the system; i.e., consider a univariate model. urther assume that the change in T is not related to T itself; i.e., ssume that the change in T is a simple accumulation of random events n the person's environment. After this over-simplified model is ompleted, the effect of alternate assumptions will be considered.

From the equation $\Delta T = \varepsilon$ these specific equations can be derived

$$\Delta T = T_2 - T_1 = \varepsilon_1$$

$$\Delta T = T_3 - T_2 = \varepsilon_2$$

hen

$$T_2 = T_1 + (T_2 - T_1) = T_1 + \varepsilon_1$$

$$T_3 = T_2 + (T_3 - T_2) = T_2 + \varepsilon_2$$

$$T_3 = (T_1 + \varepsilon_1) + \varepsilon_2$$

$$T_3 = T_1 + \varepsilon_1 + \varepsilon_2$$

) contrast this model with the previous model of no change, "The" true :ore is identified as the value of the true score at time 1. Then

$$T_1 = T$$

$$T_2 = T + \varepsilon_1$$

$$T_3 = T + \varepsilon_1 + \varepsilon_2$$

e difference is that in the no real change model, the new value was tained by erasing the old e (aggregate of transient factor and reliability) and replacing it by a new e; i.e., the "change" from time 1 t

time 2 t

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where

test-time 1 to time 2 was mathematically obliterated before the "change" from time 2 to time 3 was introduced. In the real change model, once the ε_1 is introduced, it stays in the equation. This mathematical fact corresponds to the verbal statement that "real change should be cumulative or cumulated over time."

What then are the correlations? Since $x_i = T_i$,

$$r_{x_1x_2} = \frac{\Sigma T_1 T_2}{n\sigma_{T_1}\sigma_{T_2}}$$

$$= \frac{\Sigma T_1(T_1 + \varepsilon_1)}{n\sigma_{T_1}\sigma_{T_2}}$$

$$= \frac{\sigma^2{T_1}}{\sigma_1\sigma_2}$$

where σ_{T_i} is replaced by σ_i. If we also simplify the notation for the test-retest correlations from $r_{x_1x_2}$ to r_{12}, then

$$r_{12} = \frac{\sigma_1}{\sigma_2}$$

Similarly,

$$r_{x_2x_3} = \frac{\Sigma T_2 T_3}{n\sigma_{T_2}\sigma_{T_3}}$$

$$= \frac{\Sigma T_2(T_2 + \varepsilon_2)}{n\sigma_{T_2}\sigma_{T_3}}$$

$$= \frac{\sigma^2{T_2}}{\sigma_2\sigma_3}$$

and hence

$$r_{23} = \frac{\sigma_2}{\sigma_3}$$

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Finally,

$$r_{x_1x_3} = \frac{\Sigma T_1 T_3}{n\sigma_{T_1}\sigma_{T_3}}$$

$$= \frac{\Sigma T_1(T_1 + \varepsilon_1 + \varepsilon_2)}{n\sigma_{T_1}\sigma_{T_3}}$$

$$= \frac{\sigma^2 T_1}{\sigma_1 \sigma_3}$$

and hence

$$r_{13} = \frac{\sigma 1}{\sigma_3}$$

How are these correlations related to one another? The key relation is surprising, but simple:

$$r_{12} \cdot r_{23} = \frac{\sigma 1}{\sigma 2} \cdot \frac{\sigma 2}{\sigma 3} = \frac{\sigma 1}{\sigma 3} = r_{13}$$

That is,

$$r_{13} = r_{12} \cdot r_{23}$$

or the time 1, time 3 correlation (r_{13}) is the product of the time 1, time 2 correlation (r_{12}) and the time 2, time 3 correlation (r_{23}). These correlations would be fractions (i.e., $0 < r < 1$) in any context but one in which there is no change. Since $r_{23} < 1$, this means that

$$r_{13} = r_{12}\, r_{23} < r_{12} \cdot 1 = r_{12}$$

Thus if there is real change in the system, $r_{13} < r_{12}$. That is, $r_{13} = r_{12}$ only when there is no change between time 2 and time 3. Similarly, since $r_{12} < 1$,

$$r_{13} = r_{12}\, r_{23} < 1 \cdot r_{23} = r_{23}$$

Thus, $r_{13} < r_{12}$ and $r_{13} < r_{23}$; the time 1, time 3 correlation is less than either the time 1, time 2 correlation or the time 2, time 3 correlation. This corresponds precisely to the verbal statement: "If there is real

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real change from time 1 to time 2 and real change from time 2 to time then there is more change during the total interval from time 1 to ne 3 than there is in either subinterval."

Does this conclusion depend on the simplifying assumptions made the particular model above? First, remove the assumption that the nge in T is independent of its initial value. A more general assump-n is that the change in T is in part a linear function of T; i.e., sider the regression equation

$$\Delta T = \alpha T + \varepsilon$$

re: α = the regression coefficient of change on initial score. This duces

$$T_2 = T_1 + \Delta T = T_1 + \alpha T_1 + \varepsilon_1$$

$$= (1 + \alpha)T_1 + \varepsilon_1$$

$$T_3 = T_2 + \Delta T = T_2 + \alpha T_2 + \varepsilon_2$$

$$= (1 + \alpha)T_2 + \varepsilon_2$$

$$= (1 + \alpha)[(1 + \alpha)T_i + \varepsilon_1] + \varepsilon_2$$

$$= (1 + \alpha)^2 T_1 + (1 + \alpha)\varepsilon_1 + \varepsilon_2$$

can be arranged for contrast by identifying "the" true score with true score at time 1. Then,

$$T_1 = T$$

$$T_2 = (1 + \alpha)\ T + \varepsilon_1$$

$$T_3 = (1 + \alpha)^2\ T + (1 + \alpha)\ \varepsilon_1 + \varepsilon_2$$

e are two critical features of these equations. First, in compari-to the simplified real change model, it is shown that T is first iplied by $(1 + \alpha)$ and then by $(1 + \alpha)^2$. In the case of real ession to the mean," the constant would be negative and so $(1 + \alpha)$

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uld be less than 1. For fractions which act as multipliers of the ue score,

$$1 > (1 + \alpha) > (1 + \alpha)^2 > . . .$$

at is, if α is negative, then the multiplier of the true score creases as a function of the time interval involved. Thus, the influ- ce of the initial score on later measurements steadily decreases and e correlation between T_1 and later measurements T_n would go to zero as goes to infinity.

If there is no real regression to the mean, then α is positive. $\alpha > 0$, then $(1 + \alpha) > 1$ and hence

$$1 < (1 + \alpha) < (1 + \alpha)^2 < . . .$$

this case the influence of the initial score T on later measurements ıld decrease, but not to zero.

The second and most important feature of these equations for sent purposes is the fact that ε_1 continues to appear in the equation T_2. This again reflects the fact that real change will cumulate. multiplication by the constant $(1 + \alpha)$ only means that the "cumula- n" is not a simple additive process. What about the correlations? er some routine but tedious algebra, the test-retest correlations are wn to be

$$r_{12} = \frac{(1 + \alpha)\ \sigma^2{}_{T_1}}{\sigma_{T_1}\sigma_{T_2}}$$

$$r_{23} = \frac{(1 + \alpha)\ \sigma^2{}_{T_2}}{\sigma_{T_2}\sigma_{T_3}}$$

$$r_{13} = \frac{(1 + \alpha)^2\ \sigma^2{}_{T_1}}{\sigma_{T_1}\sigma_{T_3}}$$

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e "product rule" that held for the simplified model can now be tested
this more general model,

$$r_{12}\ r_{23} = \frac{(1+\alpha)\ \sigma^2{}_1}{\sigma_1\sigma_2} \cdot \frac{(1+\alpha)\ \sigma^2{}_2}{\sigma_2\sigma_3}$$

$$= \frac{(1+\alpha)^2\ \sigma_1{}^2\ \sigma_2{}^2}{\sigma_1\sigma_2{}^2\sigma_3}$$

$$= \frac{(1+\alpha)^2\ \sigma_1{}^2}{\sigma_1\sigma_3}$$

$$= r_{13}$$

t is,

$$r_{13} = r_{12} \cdot r_{23}$$

product rule still holds! Thus, the product rule still holds for a variate model in which the measurement of the variable is perfect and l change is cumulative. Again the immediate implication is that for l change,

$$r_{13} < r_{12} \text{ and } r_{13} < r_{23}.$$

A continuous variable whose test-retest correlations satisfy the duct rule is called a linear Markov process. A test-retest correla- n matrix for one variable that satisfies the product rule is called uttman Simplex (Guttman, 1954).

Now suppose that the assumption of perfect measurement is pped. That is,

$$X = T + e$$

re e is the sum of the random component due to unreliability and the dom component produced by transient factors. For true scores we have product rule

$$r_{T_1T_3} = r_{T_1T_2} = r_{T_2T_3}$$

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What about the observed variables? Actually these are quickly ned from the classic reliability formula for "correction for uation."

$$r_{xy} = r_{xT}\ r_{TU}\ r_{Uy}$$

T is the true score for variable x and U is the true score for ble y. If the right reliability coefficients are used, then the lations r_{xT} and r_{Uy} can be expressed in terms of the reliabili- of x and y. In the present context this means that the coefficient ability is used to write

$$r_{xT} = \sqrt{r_{xx}} \text{ and } r_{Uy} = \sqrt{r_{yy}}$$

ence

$$r_{xy} = \sqrt{r_{xx}}\ r_{TU} \sqrt{r_{yy}}$$

e present case, this yields correlations in the form

$$r_{x_1x_2} = \sqrt{r_{x_1x_1}}\quad r_{T_1T_2} \sqrt{r_{x_2x_2}}$$

$$r_{x_2x_3} = \sqrt{r_{x_2x_2}}\quad r_{T_2T_3} \sqrt{r_{x_3x_3}}$$

$$r_{x_1x_3} = \sqrt{r_{x_1x_1}}\quad r_{T_1T_3} \sqrt{r_{x_3x_3}}$$

tution into the product rule yields,

$$x_2\quad r_{x_2x_3} = \sqrt{r_{x_1x_1}}\quad r_{T_1T_2} \sqrt{r_{x_2x_2}} \sqrt{r_{x_2x_2}}\quad r_{T_2T_3} \sqrt{r_{x_3x_3}}$$

$$= \sqrt{r_{x_1x_1}}\quad r_{x_2x_2}\quad r_{T_1T_2}\quad r_{T_2T_3} \sqrt{r_{x_3x_3}}$$

$$= r_{x_2x_2} \sqrt{r_{x_1x_1}}\quad r_{T_1T_3} \sqrt{r_{x_3x_3}}$$

$$= r_{x_2x_2} \cdot r_{x_1x_3}$$

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s the product $r_{x_1x_2} \cdot r_{x_2x_3}$ is not equal to $r_{x_1x_3}$ unless $r_{x_2x_2} = 1$; ., unless the measurement is perfect. Instead, we have

$$r_{x_1x_3} = \frac{r_{x_1x_2} \cdot r_{x_2x_3}}{r_{x_2x_2}}$$

since

$$r_{x_2x_2} \quad 1, \; \frac{1}{r_{x_2x_2}} \quad 1$$

it is shown that

$$r_{x_1x_3} \quad r_{x_1x_2} \; r_{x_2x_3}$$

thermore this inequality does not yield the hypothesized inequali- s between $r_{x_1x_3}$ and $r_{x_1x_2}$ or $r_{x_2x_3}$. Does the hypothesized relation d? Or to phrase it negatively, can there be a combination of ameters in this model for which the reliabilities are changing so stically over time that the rank order of the correlations between erved scores is inverted from the rank order of the correlations the true scores? There are combinations which eliminate one uality or the other. However if the variance of observed scores eases over time, then $r_{13} > r_{12}$ (but not necessarily r_{13} r_{23}). If variance is increasing from time to time, then $r_{13} < r_{23}$ (but not ssarily $r_{13} < r_{12}$). Of major importance to the present study is the where the variance stays the same across time. In this case

$$r_{x_1x_1} = r_{x_2x_2} = r_{x_3x_3} = \text{constant}$$

hence

$$r_{x_1x_3} = \sqrt{r_{x_1x_1}} \quad r_{T_1T_3} \quad \sqrt{r_{x_3x_3}}$$

$$= \sqrt{r_{x_1x_1}} \quad r_{T_1T_2} \quad r_{T_2T_3} \quad \sqrt{r_{x_3x_3}}$$

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$$= \sqrt{r_{x_1x_1}} \; r_{T_1T_2} \sqrt{r_{x_2x_2}} \cdot r_{T_2T_3} \frac{\sqrt{r_{x_3x_3}}}{\sqrt{r_{x_2x_2}}}$$

$$= \quad r_{x_1x_2} \cdot r_{T_2T_3}$$

re is real change, then $r_{T_2T_3} < 1$ and so $r_{x_1x_3} < r_{x_1x_2}$
similar fashion

$$r_{x_1x_3} = \frac{\sqrt{r_{x_1x_1}}}{\sqrt{r_{x_2x_2}}} \; r_{T_1T_2} \sqrt{r_{x_2x_2}} \; r_{T2T3} \sqrt{r_{x_3x_3}}$$

$$= r_{T_1T_2} \sqrt{r_{x_2x_3}}$$

re is real change, then $r_{T_1T_2} < 1$ and so

$$r_{x_1x_3} < r_{x_2x_3}$$

f the variance is not changing, then both inequalities hold.

The one simplifying assumption in this model which has not been d is the assumption that a particular variable is not influenced other variables in the system.

If there is some (possibly unobserved) variable that does inter-usally over time with the observed variable, then the product rule ot hold and the inequalities might or might not stand up depend- the nature of the interaction. A general discussion of this case ond the scope of the present paper. However, in the case where riances of the causally interacting variables do not change from time and where the correlations are also constant, there is a t theorem. Under these conditions, let r_{ij} = the correlation the value of T at time i and time j. Then

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$$r_{in} \rightarrow 0 \text{ as } n \rightarrow \infty$$

ırticular this means that eventually r_{in} is less than r_{12}. Whether t the model predicts an immediate decrease ($r_{13} < r_{12}$) is not at the present time, though for most sets of possible mathe- al parameters it would be true. That is, the predictions, r_{12} and $r_{13} < r_{23}$, have been shown to be plausible under these tions but they have not been proved. Thus if the data showed, say, r_{12}, it would not absolutely rule out real change in a multi- te interactive system.

The Test for Real Change

How then can the hypothesis of real change be tested given the retest correlations for three measurements on a given variable? the strong test is applied: Does the product rule hold? If

$$r_{13} = r_{12} \cdot r_{23}$$

there is strong evidence that

1. the coefficient of equivalence is 1.00;
2. all observed change is real;
3. that part of the real change which is not attributable to differences in initial value is attributable to nonrecurrent random factors; i.e., the observed variable can be studied in isolation.

If the variable is not perfectly measured, the product rule will ld for the observed test-retest correlations (i.e., for the ed variables). However, if the coefficient of stability is known, he test-retest correlations should be corrected for attenuation. sulting correlations are the estimated correlations between <u>true</u>

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ores and those correlations should be tested for the product rule.

Suppose that the product rule does not hold. If $r_{13} < r_{12}\, r_{23}$ l this is not due to sampling error, then there must be strong ;ative interaction between the observed variable and some other riable. Thus there is real change but its nature depends in critical s on some other variable that may not have been observed.

On the other hand, suppose that $r_{13} > r_{12}\, r_{23}$. The question n becomes: how much bigger? In particular, is r_{13} so much bigger n $r_{12}\, r_{23}$ that $r_{13} > r_{12}$ or $r_{13} > r_{23}$? Suppose that both statements true, i.e., $r_{13} > r_{12}$ and $r_{13} > r_{23}$. Then there should be a strong itive interaction between the observed variable and some other iable. A second test for this is that there should be a sizable in- ase in the variance of the observed variable over time. Thus if $> r_{12}$ and $r_{13} > r_{23}$, then there is real change but its nature is // ongly determined by some other variable which may not have been erved.

The cases for which $r_{12}\, r_{23} < r_{13} < r_{12}$ and/or $r_{12}\, r_{23} < r_{13} <$ are more ambiguous. There is real change in the observed variable, unless the coefficient of stability is known there is no way to ss the relative contributions of instability and possible inter- ng outside variables.

Finally there is the case $r_{13} = r_{12} = r_{23}$. Here the strong umptive hypothesis must be "no change." If this is true, then $= r_{23} = r_{13}$ is the coefficient of stability for that variable. If coefficient of stability equals the coefficient of equivalence, then appropriate model is simple unreliability; both transient factors mood can be ruled out. If the coefficient of equivalence is larger than t

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the coefficient of stability, then the observed variable is
cted by transient factors. Whether or not mood makes a significant
ibution in this case cannot be tested in the data for any one Note.
rved variable but requires the cross-lag correlations for two or
variables.

Thus as was noted at the beginning of the chapter, the third
rvation is critical to distinguish between real and apparent change
ence critical for the differentiation of the mood and general
r models. The next section will present data from a third adminis-
on of the questionnaire to Firm A.

The Firm A Third Administration Data

The MBO study questionnaire (Appendix A) was administered in
ary, 1972 to the managers of Firm A who had participated in the
and second administrations. Seventy-three (73) questionnaires
sent and fifty-three (53) replies were received. Of the twenty
ers who did not respond, it was learned that fifteen managers had
nated, retired, or deceased in the eighteen months' time period
en the second and third administrations. These responses were
d according to the seven scale research model developed by Chesser
Appendix B). Then the seven scale results for the three adminis-
ons were correlated and became the basis for testing whether or not
was real change occurring in the MBO system.

The means and standard deviations of each of the seven scales at
point in time are shown in Table 5-1. Unlike the total sample for
or the sample for Firm B, the subsample from Firm A shows a
l pattern of increasing means over time. Two of the variables,

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able 5-1.-- Means and Standard Deviations for First, Second, and Third Administrations--Seven Scale Research Model--Firm A Managers (n=53)

		Means			Standard Deviations		
e	Description	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
	Superior-Subordinate Relationship	3.17	3.22	3.25	.36	.35	.38
	Goal Clarity and Relevance	2.77	2.97	3.01**	.61	.48**	.47**
	Orientation Toward MBO	3.09	3.36	3.26	.86	.96	1.01
	Performance-Reward Association	3.76	3.70	3.67	.87	.65**	.75
	Subordinate's Influence Over Goals	2.73	2.98	2.93	1.19	.83	.93
	Satisfaction With Job	3.13	3.12	3.35	.96	.78	.87
	Success in Attaining Goals	2.78	3.09	3.19*	1.28	.85	.69**

ignificant difference between time i value and time 1 at .05 level.

ignificant difference between time i value and time 1 at .01 level.

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oal Clarity and Perceived Success, show a significant increase over the ıree year period from first administration to third administration.

Using a test for the difference in variances (see note below), ıe variances (the standard deviations squared from Table 5-1) show a neral pattern of decreasing magnitude. There are two of the variables ich show a significant ($p < .01$) decrease in variance from time 1 to me 3. They are Goal Clarity and Relevance and Success in Attaining als. Also, variable 4--Performance-Reward Association--has a signifi- nt decrease from time 1 to time 2. These significant differences ggest real change within these system variables.

Table 5-2 presents the correlation matrices for the three time riod data. These correlations were calculated for the responses to questionnaire by the 53 managers from Firm A who were identified in three administrations. Change scores are not represented in the rix.

The product rule test for real change requires that the time 1, e 3 correlation (r_{13}) for an MBO variable be less than either the e 1, time 2 correlation (r_{12}) or the time 2, time 3 correlation (r_{23}). ıres 5-1 and 5-2 are used to test these predictions. In Figure 5-1, time 1, time 3 correlations are plotted against the time 1, time 2 relations. The variables--Subordinate's Influence and Perceived Suc- --were included in the graph even though they are not used to mate the general factor. Two variables--Goal Clarity and Relevance Performance-Reward Association, respectively--do not meet the

: The author is indebted to Professor John Edward Hunter, Michigan State University, for the derivation of this test.

the relationships between system variables at three points in time.)

REORDERED R-MATRIX

	1	8	15	2	9	16	3	10	17	4	11	18	5	12	19	6	13	20	7	14	21
1	100	49	33	25	4	-6	43	26	0	23	25	28	20	-12	5	30	37	36	28	33	23
8	49	100	55	31	22	18	30	27	26	8	33	32	12	16	-1	-4	28	42	45	3	31
15	33	55	100	29	28	53	35	31	40	22	14	50	-8	-7	-5	2	25	41	20	26	39
2	25	31	29	100	16	22	32	27	32	-8	32	24	-3	-6	7	12	13	-1	35	-4	9
9	4	22	23	16	100	52	8	29	41	-4	44	14	7	18	16	-3	16	7	-4	-2	-15
16	-6	13	53	22	52	100	31	48	64	3	28	28	17	-14	-6	5	22	18	7	15	3
3	43	30	35	32	8	31	100	53	44	1	12	17	22	-8	16	-1	31	16	36	10	5
10	26	27	31	27	29	48	53	100	63	-1	29	28	31	-12	6	-5	26	23	25	30	8
17	0	25	40	32	41	64	44	63	100	2	30	19	9	-16	-5	4	27	28	15	10	-2
4	23	3	22	-8	-4	3	1	-1	2	100	36	36	-7	-15	-0	48	26	16	-3	12	34
11	25	33	14	32	44	28	12	29	30	36	100	50	13	-7	2	24	23	23	25	-8	4
18	28	32	50	24	14	28	17	28	19	36	50	100	1	-35	4	12	21	31	9	22	7
5	20	12	-8	-3	7	17	22	31	9	-7	13	1	100	11	8	10	21	4	7	6	-6
12	-12	15	-7	-6	18	-14	-8	-12	-16	-15	-7	-35	11	100	40	-12	-16	-31	-21	-9	14
19	5	-1	-5	7	16	-6	16	6	-5	-0	2	4	8	40	100	3	-3	-28	-7	-1	-17
6	30	-4	2	12	-3	5	-1	-5	4	48	24	12	10	-12	3	100	50	24	-15	-21	7
13	37	23	25	13	16	22	31	26	27	26	23	21	21	-16	-3	50	100	54	32	-3	5
20	36	42	41	-1	7	18	16	23	28	16	23	31	4	-31	-28	24	54	100	10	14	-8
7	28	45	20	35	-4	7	36	25	15	-3	25	9	7	-21	-7	-15	32	10	100	16	16
14	33	3	26	-4	-2	15	10	30	10	12	-8	22	6	-9	-1	-21	-3	14	16	100	24
21	23	31	39	9	-15	3	5	8	-2	34	4	7	-6	14	-17	7	5	-8	16	24	100

Legend:

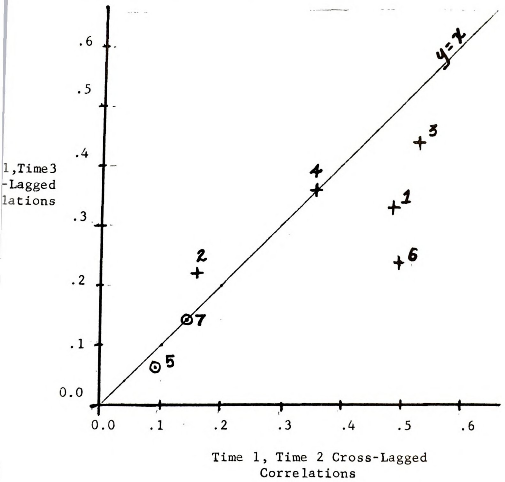
Variable Number (time 1,2,3)			Variable Description
1	8	15	Superior-Subordinate Relationship
2	9	16	Goal Clarity and Relevance
3	10	17	Orientation Toward MBO
4	11	18	Performance-Reward Association
5	12	19	Subordinate's Influence
6	13	20	Satisfaction With Job
7	14	21	Perceived Success

Significant value of r:

.05 level = .27

.01 level = .34

e 5-1.-- Scatterplot for Time 1,Time 3 versus Time 1,Time 2 Cross-Lagged Correlations for the MBO Variables which Estimate the General Factor - Firm A Managers (n = 53).



e Description
Superior-Subordinate Relationship
Goal Clarity and Relevance
Orientation toward MBO
Performance-Reward Association
Satisfaction with Job

Subordinate's Influence
Perceived Success

variables are not included in the estimate of the general
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rement for real change. The other variables do show a real change
rrelation. However, in Figure 5-2, all of the MBO variables meet
riteria for real change. Thus, the test-retest correlations
st that in each variable separately there has been real change.

Is there real change in the general factor? There are several
n which the three time period data can be used to answer this
on. First, the MBO variables which make up the general factor as
ted in Chapter Two have demonstrated real change when considered
tely. However this could mean change in the specific factors
t change in the general factor. The test for the general factor
test of $r_{13} < r_{12}$, r_{23} for the cross-lagged correlations. This
s displayed in Figure 5-3. In this figure, the time 1, time 2
and time 2, time 3 cross-lagged correlations (r_{23}) have been
ed for each of the MBO variables. These averages are then used
independent variable in the scatterplot and the time 1, time 3
ation (r_{13}) for each variable is the dependent value. This plot
equivocal results. For the variables with low average time 1,
and time 2, time 3 correlations there is an indication of real
[i.e., $r_{13} < (r_{12} + r_{23})/2$]. However, the variables with the
average correlations are approximately equal to the time 1,
correlations which suggest no change in these variables.

A second test for real change in the general factor utilizes an
d static and cross-lagged correlation for those variables which
the general factor within each of the three administrations.
, by averaging the off-diagonal static correlations among the
riables which represent the general factor, an average static
tion can be determined for each time period. Similarly, by

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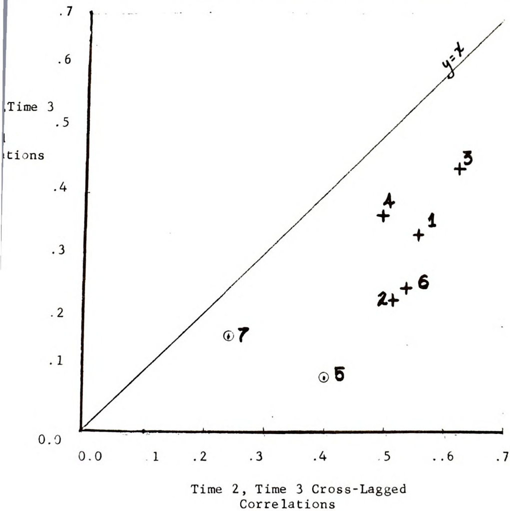
gure 5-2.-- Scatterplot for Time 1,Time 3 versus Time 2,Time 3 Cross-Lagged Correlations for the MBO Variables which Estimate the General Factor--Firm A Managers (n=53)



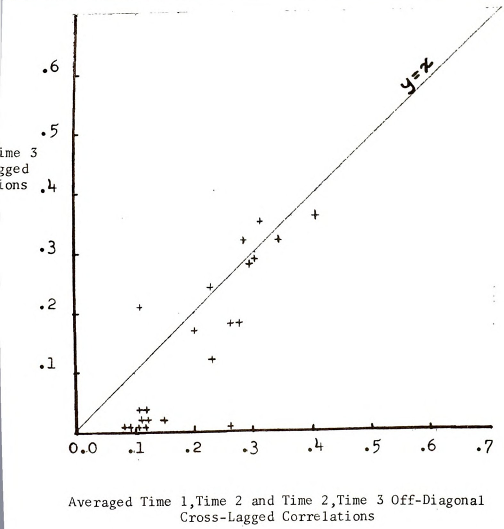
Description
Superior-Subordinate Relationship
Goal Clarity and Relevance
Orientation toward MBO
Performance-Reward Association
Satisfaction with Job

Subordinate's Influence
Perceived Success

riables are not included in the estimate of the general factor.

[illegible]

-3.-- Scatterplot for Time 1,Time 3 versus the Averaged Time 1, Time 2 and Time 2,Time 3 Off-Diagonal Cross-Lagged Correlations for the MBO Variables which Estimate the General Factor--Firm A Managers (n=53)



ıging the off-diagonal cross-lagged correlation for these same .bles within a particular cross-lagged matrix, an estimated cross- d correlation can be determined. The estimated static and cross- d correlations for the general factor are found in Table 5-3.

In the table it is shown that the averaged time 1, time 3 corre- n ($\overline{r}_{13}$) for the general factor is less than either the averaged 1, time 2 correlation ($\overline{r}_{12}$) or the averaged time 2, time 3 correla- ($\overline{r}_{23}$). That is,

$$\overline{r}_{13} < \overline{r}_{12} \text{ or } \overline{r}_{23}$$

is the requirement for real change in the general factor. But is actually the same evidence as shown in Figure 5-3, and that e showed that this test is equivocal. One-half of the component oles of the general factor show real change and one-half of them

The averaged static correlations increase in magnitude as a .on of time; that is, $\overline{r}_{11} < \overline{r}_{22} < \overline{r}_{33}$. Since the static correla- .s a function of the ratio of the relative strength of the general ', there are two ways in which the static correlation might .se--one, by an increase in the variance of the general factor, and y a decrease in the variance of the specific factor. This poses eresting question: "Does the variance of the general factor go does the variance of the specific factor go down?" The answer to s a test of the differences in the variance of the general factor. unately the general factor is not actually observed. Therefore a test cannot be performed. However, since five of the MBO vari- are highly correlated with the general factor, each can act as an tor of the general factor. Thus the sum of the five indicators give a reasonable estimate of it. Since the variables differ

Table 5-3.-- Matrix of Averaged Static and Cross Lagged Correlations for the General Factor During the First, Second, and Third Administrations-- Firm A Managers (n=53)

Variable	1	2	3
1. General Factor - time 1	.21	.23	.16
2. General Factor - time 2	.23	.30	.25
3. General Factor - time 3	.16	.25	.37

Significant value of r:

.05 level = .27

.01 level = .34

ly in their reliability and their correlation with the general r, the variables were summed at the level of items rather than as ard scores. That is, the general factor was estimated by pooling tems from the five highly saturated scales into one large test. test was then scored for all three administrations. It should be that this estimated general factor is actually a variable in its ight and has its own specific factor. That specific factor is a ted sum of the specific factors of the five MBO variables and ugh it is relatively smaller for the estimated general factor, it not be absent. Table 5-4 contains the means and standard deviafor the estimated general factor at each of the three points in There is no significant difference in the variance of the general r over time. This implies that the increasing static correlations variables that load highly on the general factor may be due to a ase in the variance of the specific factors. At present there is // to test this.

Another test of change in the general factor is to compare the correlations for the general factor with the cross-lagged corres for that factor. That is, from the table, it is observed that d $\overline{r}_{22}$ are greater than $\overline{r}_{12}$. Also, $\overline{r}_{22}$ and $\overline{r}_{33}$ are greater than This is the pattern of relationships expected in the mood model the transient factor spuriously inflated the static correlations. if there is no change in the general factor, then the static ation may be spuriously high due to a transient factor such as

A third test for real change is to directly calculate the test-correlations for the estimated general factor. To do this, the

able 5-4.-- Means and Standard Deviations for the General Factor and Changes in the General Factor During the First, Second, and Third Administrations-- Firm A (n=53)

cale	Description	Means	Standard Deviations
1.	General Factor - Time 1	3.096	0.35
2.	General Factor - Time 2	3.193	0.34
3.	General Factor - Time 3	3.224	0.39
4.	Change in General Factor (Time 2 - Time 1)	0.096	0.34
5.	Change in General Factor (Time 3 - Time 2)	0.031	0.31

esponses from the fifty-three Firm A managers to the five scales which stimate the general factor were scored as one molar factor. In addiion, change scores (time 3 - time 2 and time 2 - time 1) were calcuated. These scores were then used to calculate test-retest and impact rrelations. The matrix for these correlations are found in Table 4-5. e test-retest correlations for the estimated general factor when rrected for attenuation provide a test of the product rule. That is,

$r_{G_1G_2}$ = test-retest correlation between time 1 and time 2 for the estimated general factor

$r_{G_2G_3}$ = test-retest correlation between time 2 and time 3 for the estimated general factor

$r_{G_1G_3}$ = test-retest correlation between time 1 and time 3 for the estimated general factor

d

α_i = coefficient alpha internal reliability for the estimated general factor at time i (i = 1, 2, 3)

n, the product rule test is:

$$\frac{r_{G_1G_3}}{\sqrt{\alpha_1}\sqrt{\alpha_3}} = \frac{r_{G_1G_2}}{\sqrt{\alpha_1}\sqrt{\alpha_2}} \cdot \frac{r_{G_2G_3}}{\sqrt{\alpha_2}\sqrt{\alpha_3}}$$

ng the data from Table 4-5

$$\frac{.40}{\sqrt{.90}\sqrt{.87}} \doteq \frac{.51}{\sqrt{.90}\sqrt{.88}} \cdot \frac{.66}{\sqrt{.88}\sqrt{.87}}$$

indeed

$$.45 \doteq .43$$

h satisfies the test for the univariate model.

Could the differences in the test-retest correlations be due to ce? One test for this would be to examine the differences in the

ıle 5-5.-- General Factor Correlation Matrix for First, Second, and Third Administrations--Firm A (n=53)

	1	2	3	4	5
General Factor - Time 1	1.00	.51	.40	-.53	-.04
General Factor - Time 2	.51	1.00	.66	.46	-.26
General Factor - Time 3	.40	.66	1.00	.23	.56
Change in General Factor (Time 2 - Time 1)	-.53	.46	.23	1.00	-.21
Change in General Factor (Time 3 - Time 2)	-.04	-.26	.56	-.21	1.00

ee test-retest correlations of the estimated general factor for tistical significance (see note below).

The strategy for the test is to perform a z test on the sum of differences between the test-retest correlations of the three time iods. The standard error for the sum of these differences is

$$\sigma = \frac{6\ (1-\bar{s})\ s}{n-1}$$

where: $\bar{s}$ = average correlation for the three test-retest correlations

n = number of managers in the sample

ı for this study

$$\sigma = \frac{6\ (1-.52)}{53-1} = \frac{6\ (.48)}{52} = .23$$

the z score is calculated as

$$z = \frac{(r_{G_1G_2} - r_{G_1G_3}) + (r_{G_2G_3} - r_{G_1G_3}}{\sigma}$$

$$z = \frac{(.51 - .40) + (.66 - .40)}{.23}$$

$$z = 1.61$$

h in using a one-tailed test is on the border for being significant he .05 level (z @ .05 = 1.64). Interpreted this means that by a istical test the matrix of test-retest correlations of the esti-d general factor is not "flat"; i.e., there is a significant differ- between the test-retest correlations. This is support for the real ge hypothesis at the .05 level.

: The author is indebted to Professor John Edward Hunter of Michigan State University for the derivation of this test.

Conclusions

The results of these tests of the real change hypothesis cannot interpreted without qualification. In the three time period study ere is evidence, though not decisive, that there is real change in the served variables of the MBO system for a subsample of the Firm A nagers.

The means and standard deviations for the seven scales of the rm A research model do suggest real change for several of the riables. Also, the analysis of the cross-lagged correlations for the) variables produced evidence of real change. When five of the seven riables of the MBO system are grouped in order to provide an estimate the general factor, the corrected test-retest correlations do support product rule test for real change. Also, the average static corre- ions for the variables that correlate highly with the general factor crease as a function of time, which suggests that more of the variance explained by the general factor across time. If this increase in tic correlations were due to an increase in the absolute strength of general factor, then it would mean a self-facilitory growth law for general factor. This in turn would mean that the impact correlation ld be zero or positive and the variance of the general factor was reasing.

On the other hand, it was assumed in Chapter Three that the real nge in the general factor was regression to the mean. This was used explain the constant variance shown in the data. The data for the imated general factor does demonstrate regression to the mean and a stant variance across the three time periods. Why then do the static

correlations increase across time? One explanation would be to assume that there is a decrease in the variance of the specific factors over time. At present, there is no obvious hypothesis as to why this might be true.

A second qualification refers to the difference between the average static correlation and the average cross-lagged correlation. The fact that the static correlations are larger than the cross-lagged correlations could also be due to a spurious inflation of the static correlation due to the mood variable.

It is important to note that the subsample of fifty-three Firm A managers is deviant from the total sample of seventy-three Firm A managers in the two time period study. That is, the static correlations, as well as the dynamic correlations, for the subsample during time 1 and time 2 are different from those same correlations in the total sample. If this difference were due to the abnormally bad static correlations for the subsample at time 1, then most of the evidence for real change could be attributed to sampling error.

The data does suggest that there was real change in the general factor for the questionnaire used in this study. However, the test was weak. The qualifications placed on the conclusions of the test for real change can be removed only with the availability of additional data to provide a more precise analysis.

CHAPTER 6

SUMMARY AND IMPLICATIONS OF THIS RESEARCH

This research has addressed a number of methodological issues in ie assessment of attitude in a longitudinal study. These issues center ›on the assessment of real change in the variables of a Management By ›jectives (MBO) system.

Data were collected at three points in time in one organization irm A) and at two points in another (Firm B). During the replication the Chesser study and the subsequent revision of that research model veral contradictions to the basic assumption of real change were nsidered and evaluated. The analysis and explanation of these contra- ctions defined the direction of the research reported here. The ecific research objective for this project has been to determine ether the observed changes in attitude for managers who participated the MBO programs of two large organizations were real or only parent.

Several mathematical models have been derived to explain the al or apparent change in attitudes in that data. One model, which did the data, assumed real change and represented a general factor of at real change. This model with its various assumptions did explain data in the two time period study. At the same time another model, "mood" model, which assumed there was no real change in the atti- les of the managers, also explained this same data. It was concluded at two administrations of the MBO study questionnaire were not fficient to test either model.

The third administration of the questionnaire to the Firm A ıagers provided a test which resulted in the conclusion that real ınge was observed in the MBO system during the three time period ıdy. Then, the model for real change in the general factor, as ·ived in Chapter Two, was used as a basis for interpretation of the a from this longitudinal study.

A significant finding from this test for real change in mana- ial attitudes was the existence of a general factor which underlies MBO system in both organization samples. The content of this factor ears to be comprised of at least five of the seven variables eloped from the MBO study questionnaire that are highly correlated seem to be appropriate estimates of the general factor. These five iables are

1. Superior-Subordinate Relationship
2. Goal Clarity and Relevance
3. Orientation Toward MBO
4. Performance-Reward Association
5. Job Satisfaction

The General Factor model assumes that the one general, or molar, :or accounts for all of the observed correlations between the .ables of the MBO system. Another component of the observed scores, "specific" factor, is assumed to be the residual or that portion of ı of the true scores that remains after the general factor is par- .led out. This model also assumes that the specific factor is not ·elated with any of the other specific factors within one administra- or between administrations. Thus the specific factor may not be a meaningful one, although it is an important component in the model.

he general factor model does predict the three time period data quite ell and does meet the product rule requirements for real change.

There are several possible interpretations of the general actor. One is that it is some representation of the manager's satisfac- ion with life or life-style. Another might be the manager's attitude oward work and the environment in which that work is accomplished. A nird possibility might be designated as the manager's attitude toward ne mastery of the job or task assigned. The primary reason that the efinition cannot be more precisely defined is because the boundaries of e MBO system are not precisely defined.

A common denominator for all three of these interpretations for e general factor is that they are manifestations of attitudes that ll affect all managers and may be in part outside the identified stem under study. Also it is assumed that they would account for all e correlations in the system. Obviously there are other possibilities, d future research will be directed at the discovery and analysis of ese and other potential general factors.

A second finding which resulted from the consideration of the no al change models was the potential for some "mood" variable to be esent and influencing the managers of the study. Mood as used in the del was the consideration of a transient factor or a temporary psycho- gical condition that acted as an error of measurement in the longi- dinal study of observed scores for the managers. The mood variable erates as a significant component in the static, dynamic, and impact rrelations for the data. Since mood was assumed to be transient and ndom and therefore not correlated between administrations, it does not ve an influence on the cross-lagged correlations.

Could the "Hawthorne Effect" be the mood variable? No, as the Hawthorne studies indicated, the effect would be a constant for all managers and would be evident only in the changing means for the observed scores. Since the means in the variables for this study did not change, the traditional interpretation of the Hawthorne effect would not satisfy the requirements for the mood variable.

A second possibility which might define the mood variable is the 'situation at work." The Litwin and Stringer (1968) study of the ffects of organization climate (technology, leadership style, rules, olicies, organization structure, etc.) upon aroused motivation of anagers provides some indication of the determinants of a managerial ood. These "climate" variables must be transient conditions to be conidered as candidates for the mood variable. Also, unless these condiions are individualized, their effects will not cause a change in the ariance or the correlations for the variables of the system. Thus, rganization climate is not a candidate for the mood variable.

Although the data from the third administration of the MBO study estionnaire supported the test for real change and the general factor del, it is important to note that the general factor model does not le the possibility or presence of the mood variable. The two models e compatible. If it is assumed that the error term in the general ctor model is an aggregate of mood and unreliability, the mood coment and its influence in the model can be used in conjunction with real change in the general factor to interpret the data. Further earch will be required to fully test the compatibility of these els.

Implications of This Research

One of the most important contributions of the research reported ere is the relevance it has for further research into and the actual ractice of an organization change program such as MBO.

Implications for Practice

It is obvious that the assessment of real change in attitudes of anagers participating in change programs can have big payoffs for rganization developers. Real change in attitudes is a difficult ıenomenon to measure. Once measured, it is even more difficult to ıterpret effectively. One conclusion from this project which is very ıportant to organization change specialists is that at least three time ✓ eriods are required to arrive at a conclusion that change has occurred.

Another significant finding for organization change or development programs is that a variable outside the system under study may be e real source of change within a particular system. For example, the neral factor, however defined, is the real change component. A change ogram that does not attempt to identify, or recognize, the potential such a variable may not achieve the results desired. The same is ue for a "mood" variable. Future research will attempt to more early define the relevant variables that are correlated with present) variables. This will give more consideration to the identification the system boundaries.

The fact that the no change hypothesis could not be unequivo- oly rejected for the three time period study in Firm A deserves some ısideration. For the Firm A managers, an MBO program was implemented ween time 1 and time 2. Also, between time 2 and time 3, Firm A

ndertook a major reorganization. Yet, the real change in attitudes bserved in the MBO system was very small. Thus, the resistance to hange by the Firm A managers must be considerable. The resistance to a hange in attitude may be represented by these variables, mood and the eneral factor, which were not included in the original orientation of his longitudinal study. Organization development programs should ecognize the existence of factors such as these and direct some attenion toward the real change in these variables.

Implications for Further Research

This research project is not an end itself, but a means to a etter understanding of changes in the attitudes of managers participatng in a program such as MBO. The results of this project suggest ther hypotheses to be tested in the continuation of this longitudinal tudy.

One of these future hypotheses will consider the question: "What re the boundaries of the MBO system?" This question is based upon the idence that the causal factors for change in both the general factor d the mood model were not explicitly defined as entities in the iginal research model. This being the case, future research is quired to define the existence of the general factor and the mood ctor and to ascertain whether they are in part or in total a part of e explicit system. That is, are home, family, or community (political, rvice, and social organizations) a part of the system or just the work anization and MBO? Until the boundaries of the system are defined, general factor cannot be comprehended. If the questionnaire used e were incremented to assess the managers' commitment to these areas

of interest, the important parts of the boundaries of the system could be identified.

Future research must take into consideration some deficiencies in the instrument. Revisions would include

1. Some attempt to develop a set of items to measure mood directly.

2. Items which assess how MBO assists a manager in working with his subordinates.

3. Items to augment those scales which have poor internal scale reliability.

Firm B has granted permission to administer the questionnaire for a third time in the Spring of 1973. The third administration data should provide an important test of the real change hypothesis. Not nly will the sample be larger than that for the Firm A managers, the irm B managers could be pooled with the Firm A managers for a better est of the three time period data.

In summary, the research reported here is an important step in etter understanding the impact of organization development and change rograms and, in particular, Management By Objectives, upon the atti-udes of managers. The development of the mathematical models of ttitude change has explained a large amount of empirical data. Most portant, a theoretical framework for further longitudinal studies has en provided.

APPENDICES

APPENDIX A

MBO STUDY QUESTIONNAIRE

Note: 1. Items 1-47 common to administrations at time 1 and time 2 for both Firm A and Firm B.

2. Items 48-55 administered at time 1 and time 2 to Firm B only.

Plea
ness
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1.

answer the following questions as truthfully as you can. The success of this study depends on your willing-
answer questions in a truthful and careful manner. Your responses will be held in the strictest confidence
wo academic researchers conducting this study. The company will receive only summary data concerning this

ering questions having to do with the Management by Objectives, assume the question is referring to last
MBO effort unless the question specifically states this is not the case.

at, in your opinion, was the level of difficulty of the objectives set for your position?

- Extremely difficult ______
- Quite difficult ______
- Moderately difficult ______
- Not too difficult ______
- Easy ______

at, in your opinion, was the level of difficulty of the personal development objectives set for you?

- Quite difficult ______
- Moderately difficult ______
- Not too difficult ______
- Easy ______
- No personal development objective ______

what Extent did the objectives set for you under MBO reflect the most serious and pressing needs of your department and the company?

- To a very great degree ______
- To a great degree ______
- To a moderate degree ______
- To a minor degree ______
- Did not focus on any real needs of department or company ______

what degree did the personal development objectives set for you reflect your personal development needs?

- To a very great degree ______
- To a great degree ______
- To a moderate degree ______
- To a minor degree ______
- Did not focus on real deficiencies ______

w often were you given feedback on your progress on your objectives?

- Very frequently ______
- Frequently ______
- Occasionally ______
- Rarely ______
- Never ______

what extent were your objectives clearly stated with respect to results expected?

- To a very great degree ______
- To a great degree ______
- To a moderate degree ______
- To a minor degree ______
- Not at all clearly stated ______

hat extent was the relative importance of
our various objectives pointed out to you ?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
No clues given as to the relative importance of performance goals ______

hat extent do you feel you control the means
reaching your objective ?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
Do not control means of reaching goals ______

often were you given feedback on your pro-
ess on your personal development objectives?

Very frequently ______
Frequently ______
Occasionally ______
Rarely ______
Never ______

hat extent do you feel you had too many
jectives ?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
Not given too many performance goals ______

much emphasis did your boss put on attain-
your personal development objectives ?

A very strong emphasis ______
A strong emphasis ______
A moderate emphasis ______
A minor emphasis ______
No emphasis at all ______

did the amount of effort you put into your
last year compare to that of previous years ?

Very much greater ______
Much greater ______
Somewhat greater ______
A little less ______
A great deal less ______

do relations with your boss at the present
e compare to your relations with him dur-
previous years ?

Our relationship is much improved ______
Our relationship is moderately improved ______
No change ______
Our relationship is somewhat worse ______
Our relationship is much worse ______

uccessful were you in attaining the
ectives set for you under MBO ?

Performance was much higher ______
Performance was a little higher than the goals set ______
Performance was about equal to the goals set ______
Performance was a little less than the goals set ______
Performance was much less than the goals set ______

uccessful were you in attaining
sonal development objectives
year ?

Improvement was much higher than goals set ______
Improvement was a little higher than the goals set ______
Improvement was about equal to the goals set ______
Improvement was a little less than the goals set ______
Improvement was much less than the goals set ______

bjectives have been set for you for 1972 under MBO. How does the level of objectives compare with the level of these goals last year?

- Very much higher ______
- Much higher ______
- A little higher ______
- About the same
- A little lower ______
- Much lower ______

his year new personal development objectives have been set for you under the MBO system. How does the difficulty of these objectives compare to those of last year?

- Much more difficult ______
- A little more difficult ______
- About the same ______
- A little less difficult ______
- Much less difficult ______

ho had the most influence on setting the objectives for you?

- My boss had much more influence than I ______
- My boss had somewhat more influence than I ______
- My boss and I had about equal influence ______
- I had somewhat more influence than my boss ______
- I had much more influence than my boss ______

e amount of change associated with my job is:

- Much more than most other jobs at my level ______
- More than most other jobs at my level ______
- Equal to most other jobs at my level ______
- Less than most other jobs at my level ______
- Much less than most other jobs at my level ______

e number of contacts w/persons outside my Dept. are:

- Much more frequent than contacts w/persons inside my dept. ______
- More frequent than contacts w/persons inside my dept. ______
- Equal in frequency to the contacts w/persons inside my dept. ______
- Less frequent than contacts w/persons inside my dept. ______
- Much less frequent than contacts w/persons inside my dept. ______

w much of an interest do you think the company has in the MBO system?

- A great deal of interest ______
- A moderate amount of interest ______
- Some interest ______
- Very little interest ______
- No interest ______

w much of an interest do you think your boss has in the MBO system?

- A great deal of interest ______
- A moderate amount of interest ______
- Some interest ______
- Very little interest ______
- No interest ______

ch statement best describes the manner in which your boss helps you in performing your ob?

- He rarely makes suggestions to me ______
- He gives me some ideas but I could use much more help. ______
- Sometimes my boss helps me how to plan to reach an objective and sometimes he doesn't. ______
- Generally when I encounter a serious obstacle my boss will suggest ways of overcoming it. ______
- Generally when a serious obstacle arises, I discuss it with my boss and we revise the strategy and the objective. ______

hich statement best describes the present difficulty your boss has in measuring your performance?

- My work is too complex to express in terms of standards of performance ______
- My boss is barely able to determine if I have done a good job ______
- Sometimes my boss knows enough about the work I do to make a judgement about my performance, sometimes he doesn't. ______
- I have some measures of performance in practically every area of responsibility. ______
- I have verifiable work objectives: I mean, at the date agreed upon, my boss can tell readily how close I've come to accomplishing my goal. ______

hich statement best describes the concern of your boss for your career?

- My boss feels this is my responsibility, not his. ______
- He might discuss career plan with me but views this outside his responsibility. ______
- He will discuss my long term career objectives with me if I push him to do so. ______
- We have agreed on specific things I need to do for my self-improvement. ______
- My boss is interested in my development and views setting work objectives as part of this process. ______

ich statement best describes the kind of feedback you generally get from your boss about your performance?

- I'm lucky if I get any hint from higher management on how well I'm doing my job. ______
- There are too many times when I really don't know what my boss expects of me. ______
- The only real feedback about my performance comes through official channels. ______
- I get some specific feedback about my performance but I need more. ______
- Much of the information I get about my performance is objective and not just subjective and this helps. ______

w often does your boss ask your opinion when a problem comes up that involves your work?

- Almost always ______
- Most of the time ______
- Sometimes ______
- Rarely ______

what extent you do feel you can influence the decisions of your boss regarding things about which you are concerned?

- To a very great degree ______
- To a great degree ______
- To a moderate degree ______
- To a minor degree ______
- Not at all ______

our opinion, how capable a manager is your boss?

- Extremely capable ______
- Quite capable ______
- Capable ______
- Not too capable ______
- Not capable ______

good is your boss in dealing with people?

- Very effective ______
- Quite effective ______
- Moderately effective ______
- Not too effective ______
- Ineffective ______

n all, how satisfied are you with your boss?

- Very satisfied ______
- Quite satisfied ______
- Fairly well satisfied ______
- A little dissatisfied ______
- Very dissatisfi[illegible] ______

onsidering your skills and the effort you put into the job, how satisfied are you with the pay?

Very satisfied ______
Quite satisfied ______
Fairly well satisfied
A little dissatisfied
Very dissatisfied

you had a chance to get a much better paying job working for another company in this area, how would you feel about changing?

I would strongly prefer to stay here ______
I would somewhat prefer to stay here ______
I would have a hard time deciding ______
I would somewhat prefer to change ______
I would strongly prefer to change to the other company ______

your opinion, to what extent will your actual job performance affect your future salary increases?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
It will not affect it at all ______

your opinion, to what extent will your actual job performance now affect your future promotions?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
They will not be related at all ______

general, how much time did your boss devote to the MBO system during 1970?

A great deal of time ______
Quite a bit of time ______
A moderate amount of time ______
A small amount of time ______
Very little time ______

o had the most influence on setting personal development objectives for you?

My boss had much more influence than I ______
My boss had somewhat more influence than I ______
My boss and I had equal influence ______
I had somewhat more influence than my boss ______
I had much more influence than my boss ______

your boss indicate any priorities for your personal development objectives?

Yes ______
No ______

well do you like the MBO system?

I like it very much ______
I like it pretty well ______
I like it in some ways but not in others ______
I don't like it very much ______
I don't like it at all ______

general, how applicable do you think the MBO system is to your job?

Very applicable ______
Quite applicable ______
Fairly applicable ______
Not too applicable ______
Not at all applicable ______

helpful has the MBO system been to you in performing the duties of your job?

Very helpful ______
Quite helpful ______
Fairly helpful ______
Not too helpful ______
Not at all helpful ______

... interesting is the work in your present job?	Extremely interesting ______
	Quite interesting ______
	Fairly interesting ______
	Neither interesting nor uninteresting ______
	Not at all interesting ______
...h of the statements best describes ...e amount of praise you received ...om your boss about your performance ...st year?	Received only praise with no criticism ______
	Received mostly praise with just a little criticism ______
	Received about an equal amount of praise and criticism ______
	Received mostly criticism with just a little praise ______
	Received only criticism with no praise ______
... concerned do you feel your boss would be if you ...iled to achieve the objectives established for ...our job to a significant degree?	Very concerned ______
	Quite concerned ______
	Somewhat concerned ______
	Just slightly concerned ______
	Not at all concerned ______
...t kind of criticism would you receive from your ...oss if you failed to achieve the objectives es-...blished for your job to a significant degree?	Extremely severe criticism ______
	Quite severe criticism ______
	Somewhat severe criticism ______
	Mild criticism ______
	No criticism at all ______
... important is it for you to know what your boss ...ants you to do?	Extremely important ______
	Quite important ______
	Somewhat important ______
	Slightly important ______
	Not at all important ______
... important is it for you to have definite policies ...d procedures to help you in performing your job?	Extremely important ______
	Quite important ______
	Somewhat important ______
	Slightly important ______
	Not at all important ______
...your boss establish priorities for your perform-...nce goals?	Yes ______
	No ______
...n your performance goals were estab-...shed, what did you feel about the pro-...ability of their attainment?	I felt I had more than a 90% chance of attainment ______
	I felt I had about a 75% chance of attainment ______
	I felt I had about a 50% chance of attainment ______
	I felt I had about a 25% chance of attainment ______
	I felt I had less than a 10% chance of attainment ______

w satisfied are you with the present amount of influence you have on the decisions of your boss that relate to your work?

Very satisfied ______
Quite satisfied ______
Fairly well satisfied ______
A little dissatisfied ______
Very dissatisfied ______

w important is it to you that you do a better job than other people who have or had your job?

Extremely important ______
Quite important ______
Somewhat important ______
Slightly important ______
Not at all important ______

our opinion, to what extent will effort increases n your part lead to increases in the level of your ob performance?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
They will not be related at all ______

what extent do you experience a feeling of personal accomplishment and satisfaction in fully completing your goal assignments?

To a very great degree ______
To a great degree ______
To a moderate degree ______
To a minor degree ______
No feeling of personal accomplishment and satisfaction ______

en your present situation in life, rank he following items in order of their mportance, 1 thru 7, considering 1 to e most important and 7 the least mportant.

Opportunity to use one's skill ______
Opportunity to experience a sense of accomplishment ______
Salary ______
Recognition in current job ______
Promotions ______
Pleasant co-workers ______
Job Stability ______

en your present situation in life, how important re future promotions to you?

Extremely important ______
Quite important ______
Somewhat important ______
Slightly important ______
Not at all important ______

ase make additional comments about MBO strengths or weaknesses. Suggestions changes and/or improvements will be particularly helpful. ______

APPENDIX B

CHESSER SEVEN SCALE RESEARCH MODEL

Note: These scales were developed by Chesser using data from Firm A managers (Chesser, 1971, pp. 9-15).

APPENDIX B

This Appendix lists the items in each of the seven scales of the ioral Model and its corresponding coefficient of internal relia- y (r_{11}) and change score reliability (r_{dd}).

<u>perior-Subordinate Relationship</u>

$r_{11} = .96 \qquad r_{dd} = .94$

The scale is composed of the following items, keyed numerically e sample questionnaire in Appendix A:

5. How often were you given feedback in your progress on your performance goals?

8. To what extent do you feel you control the means of reaching your performance goals?

9. How often were you given feedback on your progress on your self-improvement goals?

11. How much emphasis did your boss put on attaining your self-improvement goals?

21. How much of an interest do you think the company has in the OPA program?

22. How much of an interest do you think your boss has in the work planning and review program?

23. Which statement best describes the manner in which your boss helps you in performing your job?

25. Which statement best describes the concern of your boss for your career?

26. Which statement best describes the kind of feedback you generally get from your boss about your performance?

27. How often does your boss ask your opinion when a problem comes up that involves your work?

28. To what extent do you feel that you can influence the decisions of your boss regarding things about which you are concerned?

29. In your opinion, how capable a manager is your boss?

30. How good is your boss in dealing with people?

31. All in all, how satisfied are you with your boss?

36. In general, how much time did your boss devote to the OPA program?

43. Which of the statements best describes the amount of praise you received from your boss about your performance last year?

44. How concerned do you feel your boss would be if you failed to achieve the goals established for your job to a significant degree?

45. What kind of criticism would you receive from your boss if you failed to achieve the goals established for your job to a significant degree?

al Clarity and Relevance

$r_{11} = .90$ $r_{dd} = .87$

The scale is composed of the following eight items:

1. What, in your opinion, was the level of difficulty of the performance goals set for you?

2. What, in your opinion, was the level of difficulty of the self-improvement goals set for you?

3. To what extent did the performance goals set for you under the program reflect the most serious and pressing needs of your department and the company?

4. To what extent did the self-improvement goals set for you reflect your personal development needs?

6. To what extent were your performance goals clearly stated with respect to results expected?

7. To what extent was the relative importance of your various performance goals pointed out to you?

24. Which statement best describes the present difficulty your boss has in measuring your performance?

38. Did your boss indicate any priorities for your self-improvement goals?

rientation Toward MBO

$_{11}$ = .80 r_{dd} = .50

The scale consists of the following three items:

39. How well do you like the OPA program?

40. In general, how applicable do you think the OPA program is to your job?

41. How helpful has the OPA program been to you in performing the duties of your job?

erformance-Reward Association

r_{11} = .84 r_{dd} = .68

The four items in the scale are:

34. In your opinion, to what extent will your actual job performance affect your future salary increases?

35. In your opinion, to what extent will your actual job performance affect your future promotions?

46. How important is it for you to know what your boss wants you to do?

47. How important is it for you to have definite policies and procedures to help you in performing your job?

ordinate Influence Over Goals

r_{11} = .75 r_{dd} = .50

The scale is composed of two items:

18. Who had the most influence in setting the performance goals for you?

37. Who had the most influence in setting self-improvement goals for you?

Satisfaction With Job

$r_{11} = .58$ $r_{dd} = .35$

32. Considering your skills and the effort you put into the job, how satisfied are you with your pay?

33. If you had a chance to get a much better paying job working for another company in this area, how would you feel about changing?

Perceived Success

$r_{11} = .65$ $r_{dd} = .30$

14. How successful were you in attaining the performance goals set for you under the overall Performance Appraisal Program?

15. How successful were you in attaining the self-improvement goals set for you last year?

APPENDIX C

OTHER FINDINGS IN THE REPLICATION OF THE CHESSER MBO STUDY

Note: The data from two administrations of the MBO questionnaires for Firm B managers (n=117) were used in this replication study.

APPENDIX C

OTHER FINDINGS IN THE REPLICATION OF THE CHESSER MBO STUDY

This appendix describes the step-by-step replication of the [Che]sser research using data from Firm B. The appendix begins with a [des]cription of the fourteen scale model of the MBO behavioral system. [Thi]s section includes a detail analysis of the inter-scale correlations, [sca]le reliabilities, scale means, and standard deviations for that [mod]el. The next section presents a similar analysis for the seven scale [mod]el. The third section describes the use of dynamic and cross-lagged [pan]el correlations for the assessment of causal relationships and to [bui]ld an effects diagram of the MBO system.

Fourteen Scale Model

The 55-item, Likert type questionnaire was administered to [man]agers of Firm B at two points in time. The first administration in [Mar]ch 1970 produced 600 completed questionnaires and the second adminis[tra]tion in August 1971 yielded 548. These responses were multiple group [fac]tor analyzed using the system of correlational analysis programs [cal]led "PACKAGE" developed by Hunter and Cohen (Hunter and Cohen, 1971).

Table C-1 shows the structure of the fourteen scale research [mod]el originally developed by Chesser (see Chesser, p. 10). The scales [rep]resent the following variables in the MBO system.

Table C-1.-- Fourteen Scale Model

ale	Description	Questionnaire Item Numbers
1.	Use of goal oriented methods	5,9,11,21,22,36
2.	Satisfaction with boss	29,30,31
3.	Self-improvement goal clarity	2,4,38
4.	Performance goal clarity	3,6,7,24
5.	Orientation toward MBO	39,40,41
6.	Boss concern with failure	44,45
7.	Boss supportiveness	23,25,26,43
8.	Influence over boss	8,27,28
9.	Need for policy	46,47
0.	Association between performance and rewards	34,35
1.	Influence over goals	37,18
2.	Performance goal difficulty	1,10
3.	Satisfaction with job	32,33
4.	Success in attaining goals	14,15

ef: Chesser, p. 10.

Scale Number	Description
1.	Use of goal-oriented methods
2.	Satisfaction with boss
3.	Self-improvement goal clarity
4.	Performance goal clarity
5.	Orientation toward MBO
6.	Boss concern with failure
7.	Boss supportiveness
8.	Influence over boss
9.	Need for policy
10.	Association between performance and reward
11.	Influence over goals
12.	Performance goal difficulty
13.	Satisfaction with job
14.	Success in attaining goals

ll of these variables are perceptions of the manager or a reflection of is attitude toward the goal oriented system.

Table C-2 presents the inter-scale correlations for the first and econd administrations of the questionnaire to both Firm A and Firm B. he pattern of correlations between the two administrations is very imilar. To determine any statistically significant difference between he Time 1 and Time 2 correlations, both are transformed to z values (a ischer r to z transformation). The standard error of the difference etween the two correlations is obtained by:

$$\sigma_{z_1-z_2} = \sqrt{\frac{1}{n_1-3} + \frac{1}{n_2-3}}$$

where: n_1 = number of subjects in Time 1 sample

n_2 = number of subjects in Time 2 sample

(McNemar, p. 190)

en the ratio of (z_1-z_2) to its standard error $(\sigma_{z_1-z_2})$ is calculated to tain a z value. Mathematically, this is:

$$z = (z_1-z_2)/\sigma_{z_1-z_2}$$

Second Administration (B_2)

Variables	Variable Names and Correlation Coefficients																			
	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2
	1				2				3				4				5			
1	*Use of Goal Oriented Methods																			
2	.61	.51	.62	.59	*Satisfaction with Superior															
3	.44	.21	.60	.65	.33	.19	.28	.28	*Self-Improvement Goal Clarity											
4	.61	.61	.82	.84	.43	.26	.50	.49	.38	.42	.67	.64	*Performance Goal Clarity							
5	.53	.40	.48	.56	.22	.26	.21	.26	.29	.21	.42	.34	.51	.41	.64	.59	*Orientation Toward MBO			
6	.39	.24	.71	.66	.35	.07	.51	.41	.18	.03	.40	.41	.29	.05	.76	.75	.18	.13	.47	.43
7	.63	.66	.75	.77	.67	.74	.80	.81	.26	.14	.39	.39	.44	.41	.66	.65	.21	.36	.30	.37
8	.40	.49	.60	.60	.47	.58	.65	.69	.21	.24	.32	.26	.37	.42	.54	.54	.18	.38	.34	.32
9	.29	.25	.32	.38	.26	.12	.25	.29	.13	.20	.30	.26	.08	.07	.40	.33	.16	.08	.37	.42
10	.22	.36	.53	.53	.26	.39	.42	.38	.28	.05	.50	.40	.12	.30	.56	.55	.20	.17	.50	.46
11	.21	.16	.31	.28	.04	.10	.16	-.01	.14	.05	.27	.29	.02	.06	.33	.21	.09	-.09	.06	.09
12	.01	.02	.29	.36	-.02	-.12	.05	.12	.08	.04	.55	.63	.00	.02	.27	.50	.10	.22	.13	.00
13	.15	.38	.52	.46	.19	.30	.42	.52	.15	.01	.37	.18	.14	.28	.46	.37	.12	.30	.42	.33
14	.15	.15	.26	.28	.18	.18	.14	.12	.21	.10	.08	.12	.03	.06	.24	.20	.10	.27	.23	.27

Variable Names and Correlation Coefficients

Variables	6 A_1	6 A_2	6 B_1	6 B_2	7 A_1	7 A_2	7 B_1	7 B_2	8 A_1	8 A_2	8 B_1	8 B_2	9 A_1	9 A_2	9 B_1	9 B_2	10 A_1	10 A_2	10 B_1	10 B_2
1																				
2																				
3																				
4																				
5																				
6	*Superior Concern with Future																			
7	.38	.14	.56	.43	*Superior Supportiveness															
8	.15	.24	.42	.31	.47	.65	.74	.88	*Influence over Means											
9	.27	.10	.32	.43	.17	.01	.25	.22	-.03	.00	.11	.08	*Need for Policy							
10	.21	.10	.45	.36	.28	.39	.52	.52	.24	.36	.46	.45	.14	.11	.32	.21	*Performance-Reward Ass'n			
11	-.06	.01	.30	.29	.02	.08	.18	.03	-.20	-.01	-.16	-.18	.04	.16	.17	.24	-.09	-.12	.10	.14
12	.09	.01	.24	.40	-.16	-.19	.08	.06	-.03	-.30	.02	.13	.02	.09	.19	-.01	.04	.00	.09	.10
13	.17	.13	.29	.23	.16	.40	.49	.54	.09	.31	.44	.44	.24	.10	.21	.17	.44	.34	.54	.49
14	-.01	.26	.31	.24	.21	.22	.23	.19	.13	.19	.20	.28	-.01	.02	.05	.17	.09	.02	-.08	.16

Variable Names and Correlation Coefficients

Variable	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2
	11				12				13				14			
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11	*Influence over Goal															
12	-.10	.05	.21	.22	*Goal Difficulty											
13	.12	.11	.10	-.01	.11	-.10	.14	.08	*Job Satisfaction							
14	-.04	-.13	-.08	-.10	-.12	-.26	-.35	-.17	-.15	.07	.06	.01	*Perceived Success			

Significant values of r:

Firm A -- .05 level = .23; .01 level = .30
Firm B -- .05 level = .08; .01 level = .11

If the z value is found to be significant, this indicates that the correlations are different. Table C-3 shows the significant r value differences for Firm A and Firm B.

Table C-3.-- Significant Differences Between Correlations for Firm A and Firm B

Firm	N_1	N_2	$\sigma_{z_1-z_2}$	Significance Level	(r_1-r_2) Significant Difference
A	128	119	.119	.05	.233
				.01	.277
B	600	548	.044	.05	.086
				.01	.119

The fourteen scale research model shows a very similar correlational pattern across the samples. The scale reliabilities for the fourteen scales are exhibited in Table C-4. These reliabilities are the average of the coefficient alpha reliability measures produced by the PACKAGE program for the Time 1 and Time 2 administrations. Coefficient alpha is a measure of the expected correlation of one test with an alternative form of the test containing an equal number of items (Nunnally, p. 196). Kesser collapsed the fourteen scales down to seven in order to improve the internal and change score reliabilities. The resulting seven scale model is discussed in the following section.

Table C-4.--Comparison between Firm A and Firm B Reliabilities of Fourteen Scales

Scale	Description	Internal Reliability (r_{xx})		Change Score Reliability (r_{dd})	
		Firm A[a]	Firm B[b]	Firm A[a]	Firm B[c]
1.	Use of goal-oriented methods	.95	.87	.90	.74
2.	Satisfaction with boss	.90	.91	.88	.85
3.	Self-improvement goal clarity	.60	.48	.54	.12
4.	Performance goal clarity	.68	.69	.53	.45
5.	Orientation toward MBO	.80	.86	.50	.59
6.	Boss concern with failure	.57	.62	.35	.24
7.	Boss supportiveness	.78	.72	.70	.55
8.	Influence over boss	.60	.64	.29	.38
9.	Need for policy	.48	.59	.31	.09
10.	Association between performance and reward	.84	.77	.68	.52
11.	Influence over goals	.75	.69	.50	.52
12.	Performance goal difficulty	.44	.38	.44	.00
13.	Satisfaction with job	.58	.58	.35	.12
14.	Success in attaining goals	.65	.54	.30	.06

[a]Chesser, p. 44.

[b]Internal reliability for Firm B is the averaged standard score coefficient alphas for fourteen scales from data samples of 600 managers in first administration and 548 managers in second administration.

[c]Calculated by Equation 10.25, McNemar, p. 157.

Table C-5 contains the means and standard deviations for the fourteen scale model. These statistics are based on the responses from 117 Firm B managers identified in both the Time 1 and Time 2 samples.

Seven Scale Model

The results of the condensation of the fourteen scale model into a seven scale model are displayed in Table C-6. Appendix B contains a description of the scales and the items which make up each scale.

One scale, Superior-Subordinate Relationship, contains eighteen items. Another, Goal Clarity and Relevance, combines those scales which previously measured both performance goals and self-development goals. The scale, Performance-Reward Association, consolidated responses by the managers to subscales representing the perceived relationship between dollar rewards and performance plus a response to the subscale representing the individual's need for rules and policies.

Since the upper limit of scale combinations was defined by the number of items in the questionnaire, some change in the character of the scales was inevitable. The strategy for scale development was threefold. First, by "external" analysis, if scales or items do cluster together, they will demonstrate a similar pattern of correlations with other items not in the scale. Also as an external indicator, if items in a scale are similar they should not have opposite signs for their correlation coefficients with a third item. Second, as an "internal" analysis measure, the scales as augmented should have items which are highly related to one another. In other words, they should have an acceptable measure of internal reliability for a standard such as coefficient alpha. Third, the scales as condensed should possess a

ole C-5.-- Scale Means and Standard Deviations of Fourteen Scale Model For Firm B Managers at First and Second Administration of the Questionnaire

	Means		Standard Deviations	
es	First Administration	Second Administration	First Administration	Second Administration
	3.28	3.31	0.81	0.72
	3.95	4.04	0.98	0.88
	2.74	2.78	0.51	0.57
	3.16	3.21	0.57	0.47
	3.73	3.51	0.89	0.92
	3.39	3.33	0.79	0.76
	2.54	2.49	0.78	0.74
	3.48	3.51	0.64	0.65
	4.29	4.16	0.68	0.76
	3.54	3.35	1.01	1.01
	2.64	2.80	0.90	0.90
	2.51	2.58	0.63	0.65
	3.30	3.34	0.89	0.88
	3.10	2.98	0.77	0.79

Table C-6.--Seven Scale Research Model

Scales	Questionnaire Item Numbers
1. Superior-subordinate relationship	5,8,9,11,21,22, 23,25,26,27,28, 29,30,31,36,43, 44,45
2. Goal clarity and relevance	1,2,3,4,6,7,24, 38
3. Orientation toward MBO	39,40,41
4. Performance-reward association	34,35,46,47
5. Subordinate influence over goals	18,37
6. Satisfaction with job	32,33
7. Success in attaining goals	14,15

Reference: Chesser, 1971, p. 11.

similarity of content among the various items within that scale. The responses from Firm B have been scored using the seven scales developed for Firm A data. The inter-scale correlation coefficients are shown in Table C-7. The criteria for testing significant differences between Time 1 and Time 2 correlations are the same as those used in the fourteen scale model.

Development of Effects Diagram

In this section, the data from Firm B has been used to calculate the dynamic correlations and cross-lagged panel correlations between the scales of the seven variable model. From these correlations, an inference of causal relationships was made and an effects diagram was developed. This same methodology and presentation is used for the pooled data base for both organizations. A comparison of the effects diagrams developed from the Firm A and Firm B data will close this section.

Dynamic and Cross-Lagged Panel Correlations

Dynamic correlations are Pearson Product Moment correlations between the change scores for the variables in the model. The responses for the variables have been scored at two points in time (actually eighteen months apart). Then differences in these scale scores (Time 2 score - Time 1 score) were determined. By using dynamic correlations, the statistical association between these changes on pairs of variables within the model can be analyzed. The correlations between change scores (dynamic correlations between raw change scores) may contain variance that is due to managers in the Firm B sample having different initial scores. To eliminate the variance in these difference scores that is

Administration (A_1) and Second Administration (A_2) and Firm B
First Administration (B_1) and Second Administration (B_2)

Variable	Variable Description	1 A_1	1 A_2	1 B_1	1 B_2	2 A_1	2 A_2	2 B_1	2 B_2	3 A_1	3 A_2	3 B_1	3 B_2
1.	Superior-Subordinate Relationship	1.00	1.00	1.00	1.00								
2.	Goal Clarity and Relevance	.39	.22	.77	.78	1.00	1.00	1.00	1.00				
3.	Orientation Toward MBO	.45	.44	.43	.49	.33	.21	.64	.56	1.00	1.00	1.00	1.00
4.	Performance-Reward Association	.27	.39	.61	.67	.13	.23	.68	.67	.11	.17	.59	.61
5.	Subordinate Influence Over Goals	.02	.08	.21	.13	-.05	.07	.28	.22	.15	-.09	.06	.09
6.	Satisfaction With Job	.31	.39	.54	.54	.21	.10	.47	.33	.09	.31	.42	.33
7.	Perceived Success	.27	.27	.26	.27	.06	-.05	.20	.23	.24	.29	.23	.27

Variable	Variable Description	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2	A_1	A_2	B_1	B_2
		4				5				6				7			
1.	Superior-Subordinate Relationship																
2.	Goal Clarity and Relevance																
3.	Orientation Toward MBO																
4.	Performance-Reward Association	1.00	1.00	1.00	1.00												
5.	Subordinate Influence Over Goals	.00	-.15	.18	.27	1.00	1.00	1.00	1.00								
6.	Satisfaction With Job	.46	.37	.53	.50	.08	-.08	.10	-.01	1.00	1.00	1.00	1.00				
7.	Perceived Success	.08	.03	.19	.23	-.10	-.02	-.08	-.10	-.10	.04	.06	.01	1.00	1.00	1.00	1.00

Significant values of r:

Firm A -- .05 level = .23; .01 level = .30
Firm B -- .05 level = .08; .01 level = .11

predictable from the time 1 scores (initial scores), these dynamic correlations can be "corrected" (Vroom, p. 64). To do this, a measure of the difference between the observed change of a variable and the difference that would be expected of a variable with the same initial score on the variable is calculated. This method requires the computation of the second-order partial correlation between difference scores with initial scores on both variables held constant ($r_{\Delta x \Delta y\ .xy}$). Table C-8 shows the matrix of raw and "corrected" correlation coefficients between change scores for Firm A. Table C-9, page 143, is a presentation of similar data for Firm B. Table C-10 is a matrix of the differences between dynamic (corrected) correlations for the samples. Assuming that the dynamic (corrected) correlations ($r_{\Delta x \Delta y\ .\ xy}$) are equivalent to z values (by r to z transformation) a test of the differences between these coefficients can ascertain whether the organization affects the relationship between the variables. For both organizations at the .05 and .01 level, there is not a statistically significant difference between dynamic correlations for any of the relevant variables.

The logic of the cross-lagged panel correlation analysis is that there is a time lag that occurs when one variable causes another. Pelz and Andrews call this "causal priority" rather than causality (Pelz and Andrews, p. 836). If one variable is to have a causal relationship with another, the essential ingredient in that relationship is that it is asymmetrical. That is, if variable x causes y, then the present state of x should be more strongly associated with y's future state than with y's present state ($r_{x_1 y_2} > r_{y_1 x_2}$). Table C-11 and Table C-12 display the inter-scale correlation coefficients between the first and second administrations of the questionnaire to Firms A and B.

Table C-8.-- Matrix of Raw and Corrected Correlation Coefficients Between Change Scores for Firm A

Variable	Raw and Corrected Change Score Correlation Coefficients[a]													
	1		2		3		4		5		6		7	
1. Superior-Subordinate Relationship	1.0	1.0												
2. Goal Clarity and Relevance	.30	.25	1.0	1.0										
3. Orientation Toward MBO	.24	.31	.05	.15	1.0	1.0								
4. Performance-Reward Association	.23	.30	.12	.15	.08	.11	1.0	1.0						
5. Subordinate's Influence Over Goals	.14	.19	.08	.11	.07	-.04	-.01	-.06	1.0	1.0				
6. Satisfaction With Job	.34	.36	.11	.13	.23	.27	.37	.26	-.06	-.06	1.0	1.0		
7. Perceived Success	-.16	.07	.06	-.06	.21	.20	-.10	-.05	-.07	.06	-.13	.07	1.0	1.0

[a]The correlation between raw change scores is reported first, followed by the corrected coefficient.

Significant values of r:

.05 level = .23
.01 level = .30

Reference: Chesser, 1971, p. 65.

Table C-9 .-- Matrix of Raw and Corrected Correlation Coefficients Between Change Scores for Firm B

Variable	Raw and Corrected Change Score Correlation Coefficients[a]													
	1		2		3		4		5		6		7	
1. Superior-Subordinate Relationship	1.0	1.0												
2. Goal Clarity and Relevance	.48	.47	1.0	1.0										
3. Orientation Toward MBO	.12	.25	.14	.23	1.0	1.0								
4. Performance-Reward Association	.37	.45	.11	.23	.20	.24	1.0	1.0						
5. Subordinate's Influence Over Goals	.23	.10	.27	.17	-.01	-.09	.14	.11	1.0	1.0				
6. Satisfaction With Job	.35	.33	.19	.19	.12	.12	.24	.34	.04	.03	1.0	1.0		
7. Perceived Success	-.01	.25	-.05	.10	-.02	.16	.14	.20	.11	.10	-.15	-.07	1.0	1.0

[a]The correlation between raw change scores is reported first, followed by the corrected coefficient.

Significant values of r:

.05 level = .18
.01 level = .24

Table C-10.-- Matrix of Differences Between Dynamic (Corrected) Correlations of Variables of Seven Scale Model For Firm A and Firm B

Scales		1	2	3	4	5	6	7
	1							
	2	.22						
	3	.06	.08					
Scales	4	.15	.08	.13				
	5							
	6	.03	.03	.15	.08			
	7							

Note: 1) The correlation values are assumed to be equal to z values.

2) The standard error of correlational differences = .215.

3) Significant difference at .05 level = .42 and at .01 level = .50.

Table C-11.-- Inter-Scale Correlation Coefficients Between First and Second Administrations of the Questionnaire for Firm A

	Second Administration						
First Administration	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	.46[a]	.01	.26	.26	-.14	.35	.32
2. Goal Clarity and Relevance	.23	.23	.36	.13	-.04	.17	-.06
3. Orientation Toward MBO	.39	.09	.51	.19	-.10	.29	.08
4. Performance-Reward Association	.20	.00	.03	.42	-.23	.23	.12
5. Subordinate's Influence	-.10	-.11	.05	.02	.17	.08	-.07
6. Satisfaction With Job	.05	-.05	.02	.33	-.07	.48	-.01
7. Perceived Success	.31	.07	.20	.08	-.19	.19	.37

[a]The diagonal entries are correlations between a variable measured at time 1 and time 2. Off-diagonal entries are correlations between a variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .23
.01 level = .30

Reference: Chesser, 1971, p. 67.

Table C-12.-- Inter-Scale Correlation Coefficients Between First and Second Administrations of the Questionnaire for Firm B

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	.45[a]	.22	.38	.30	-.13	.06	.25
2. Goal Clarity and Relevance	.31	.46	.24	.17	-.20	-.06	.13
3. Orientation Toward MBO	.36	.39	.66	.32	-.04	.12	.24
4. Performance-Reward Association	.38	.31	.36	.60	.08	.22	.07
5. Subordinate's Influence	.04	.07	-.05	.01	.35	-.02	-.04
6. Satisfaction With Job	.32	.16	.27	.37	.05	.52	.18
7. Perceived Success	.20	.26	.12	.10	-.16	.06	.51

[a]The diagonal entries are correlations between a variable measured at time 1 and time 2. Off-diagonal entries are correlations between a variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .18
.01 level = .24

Table C-13 and Table C-14 are set up to display the difference between pairs of cross-lagged panel correlations for all pairs of variables in the seven scale model. These differences indicate the degree of the asymmetrical relationship for any variable x at Time 1 with any other Time 1 variable y. A negative difference is interpreted as the variable y being a better predictor of the future state of variable x rather than the hypothesized temporal sequence.

For the managers of Firm A, there are three asymmetrical relationships between variables of the seven scale model that are significant at the .10 level. For the managers of Firm B, there are two significant asymmetrical relationships between system variables. A relationship which is significant as indicated by the dynamic correlations and asymmetrical as indicated by the cross-lagged panel correlations is found between changes in Superior-Subordinate Relationship (variable 1) and changes in Job Satisfaction (variable 6). It is interesting that for the Firm A managers, changes in their relationship with their superior have a causal relationship with changes in their satisfaction with the job. Since this relationship is positive, after the Firm A manager perceives an increase in the relationship with his boss, his satisfaction with his job also increases. Although the relationship is still positive, the opposite causal relationship is found for the managers of Firm B. For the Firm B managers, an increase in job satisfaction causes an increase in the relationship between the manager and his superior.

Having compared the means and variances for the scales across the two organizations and finding them very similar, a decision was made to pool the samples and average their respective correlation matrices (see Table C-15 and Table C-16). The rationale for this pooling was that the

Table C-13.-- Matrix of Differences Between Cross-Lagged Panel Correlations for Firm A

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship		-.22	-.13	.06	-.04	.30	.01
2. Goal Clarity and Relevance			.27	.13	.07	.22	-.13
3. Orientation Toward MBO				.16	-.15	.27	-.12
4. Performance-Reward Association					-.25	-.10	.04
5. Subordinate's Influence						.15	.12
6. Satisfaction With Job							-.20
7. Perceived Success							

Table C-14.-- Matrix of Differences Between Cross-Lagged Panel Correlations for Firm B

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship		-.09	.02	-.08	.17	-.26	.05
2. Goal Clarity and Relevance			-.15	-.14	-.27	-.22	-.13
3. Orientation Toward MBO				-.04	.01	-.15	.12
4. Performance-Reward Association					.07	-.15	-.03
5. Subordinate's Influence						-.07	.12
6. Satisfaction With Job							.12
7. Perceived Success							

Table C-15.-- Matrix of Dynamic (Corrected) Correlations Coefficients for Pooled Firm A and Firm B Sample (Total n = 190)

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship							
2. Goal Clarity and Relevance	.36						
3. Orientation Toward MBO	.28	.19					
4. Performance-Reward Association	.38	.19	.18				
5. Subordinate's Influence	.15	.14	-.07	.03			
6. Satisfaction With Job	.35	.16	.20	.30	-.01		
7. Perceived Success	.16	.02	.18	.08	.08	.00	

Significant values of r:

.05 level = .14

.01 level = .18

Table C-16.-- Matrix of Inter-Scale Correlation Coefficients Between First and Second Administrations of the Questionnaire for the Pooled Sample

	Second Administration						
First Administration	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	.45	.12	.32	.28	-.14	.21	.28
2. Goal Clarity and Relevance	.27	.35	.30	.15	-.12	.06	.03
3. Orientation Toward MBO	.38	.24	.59	.26	-.07	.21	.16
4. Performance-Reward Association	.29	.16	.19	.51	-.07	.23	.10
5. Subordinate's Influence	-.03	-.02	.00	.02	.25	.03	-.05
6. Satisfaction With Job	.18	.05	.15	.35	-.01	.50	.09
7. Perceived Success	.25	.16	.16	.09	-.17	.13	.44

Significant values of r:

.05 level = .14

.01 level = .18

research model replicated within each firm and that the pooled sample would improve the generalizability of the model. As the sample size increased, the number of significant dynamic (corrected) correlations also increased. Table C-15 indicates the fourteen pairs of variables in the seven scale model that are significant. When the differences between cross-lagged panel correlations for the pooled sample are calculated, it is found that none of these differences is significant at the .10 level (see Table C-17).

Several conclusions are reached as the result of the analyses presented in this section. First, the variables in the seven scale model are similar across the samples. Second, the dynamic correlations indicate that there are statistically significant associations between changes in the variables in the model. Third, the inference of causal priority at the .10 level is not possible at this point due to the absence of significant differences between the cross-lagged panel correlations. In order to develop the effects diagrams of the behavioral system, a significance level for the asymmetrical relationships of .20 will be used.

Effects Diagrams

In the last few sections, the concept of changes of one variable "having an effect on" changes in another variable has been used quite often. To make this idea more precise, an effects diagram can be derived for the three samples of data: Firm A, Firm B, and the Pooled Sample (A + B). The process is as follows: It is assumed that the data are reliable and subject to minimum sampling or random error. The variables of the system are those of the seven scale model. For each significant

Table C-17.-- Matrix of Differences Between Cross-Lagged Panel Correlations for the Pooled Sample

	Second Administration						
First Administration	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship		-.15	-.06	-.01	-.11	.03	.03
2. Goal Clarity and Relevance			.06	-.01	-.10	.01	-.13
3. Orientation Toward MBO				.07	-.07	.06	.00
4. Performance-Reward Association					-.09	-.12	.01
5. Subordinate's Influence						.04	.12
6. Satisfaction With Job							-.04
7. Perceived Success							

dynamic (corrected) correlation in the system, a solid line is used to connect the variables. When the cross-lagged panel correlations indicate a causal relationship (at the .20 level or better), a unidirectional arrow shows the direction of that relationship. For those cross-lagged panel correlations which do not demonstrate an asymmetrical relationship, a mutually reinforcing relationship is shown using arrowheads at both ends of the solid line.

Figure C-1 is the effects diagram showing the change relationships in the MBO Behavioral System for Firm A and Figure C-2 is the effects diagram for the managers of Firm B. Changes in Goal Clarity and Relevance do not have the driver effect on the managers of Firm B as they did for those of FirmA. Satisfaction with Job is the driver for the managers of Firm B.

The effects diagram for the pooled sample (Figure C-3) demonstrates the expected result of canceling all causal relationships and having mutually reinforcing relationships between all the variables.

There are several possible explanations for the different temporal sequences of causal relationships shown in the models. First, the causal relationships shown in the effects diagrams of Firm A and Firm B may be due to spurious correlations and not due to real changes. The data as analyzed (i.e., constant means and standard deviations) and the scale unreliability support this notion. Second, there may be actual changes and causal relationships among the variables of the system but the time span of eighteen months may be too short or too long to assess these causal relationships. Third, the variables of the system are consistent across and within samples. However, the reliability of the change scores is too low to adequately discriminate between asymmetrical relationships.

Figure C-1.-- Effects Diagram for Change Relationships in the MBO Behavioral System - Firm A
(Reference: Chesser, 1971, page 106)

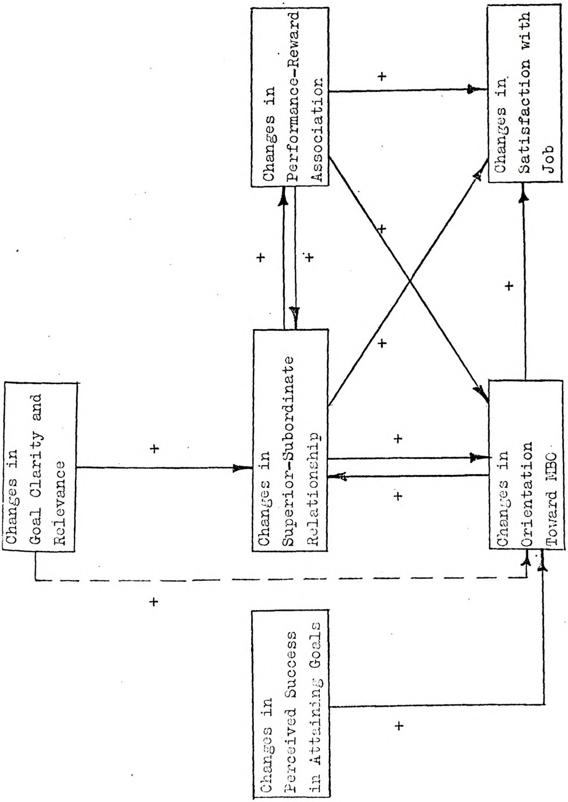


Figure C-2.-- Effects Diagram for Change Relationships in the MBO Behavioral System - Firm B

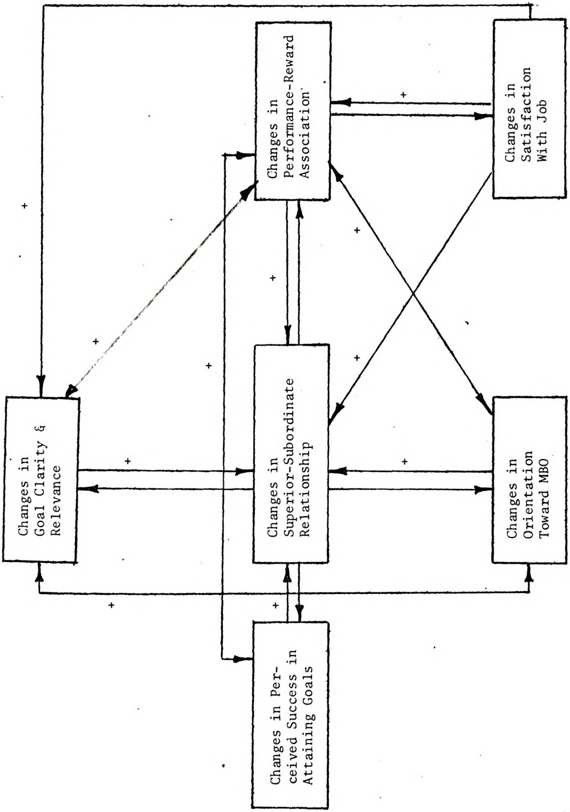
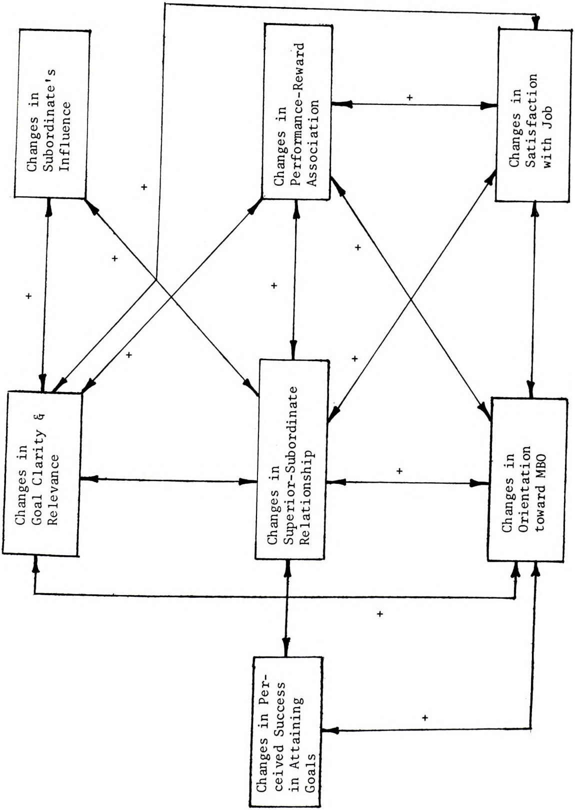


Figure C-3.-- Effects Diagram of Change Relationships in the MBO Behavioral System for Pooled Samples from Firm A and Firm B



APPENDIX D

MBO QUESTIONNAIRE ITEMS, SCALE INTERCORRELATIONS, AND LOADING MATRICES FOR THE REVISED FIFTEEN AND SEVEN SCALE RESEARCH MODELS

Note:

1. MBO Questionnaire, Appendix A, contains all items referenced herein.

2. Multiple group cluster analysis of 548 responses by Firm B managers to the second administration of MBO Questionnaire is reported herein.

APPENDIX D

MBO QUESTIONNAIRE ITEMS, SCALE INTERCORRELATIONS, AND LOADING MATRICES FOR THE REVISED FIFTEEN AND SEVEN SCALE RESEARCH MODELS

This appendix describes the scales produced by the multiple group cluster analysis of the Firm B data. A fifteen scale model was initially produced. In order to improve the internal scale reliabilities, the scales were condensed and a seven scale model was developed. The development of the fifteen scale model is presented first.

The Revised Fifteen Scale Research Model

For each of the scales in the fifteen scale model, a table is presented which displays the stems of the items from the MBO study questionnaire for that scale in addition to the correlations between and within the clusters. These correlations have been computed by the PACKAGE routine for oblique multiple groups factor analysis with communalities (Hunter and Cohen, 1971). By using communalities, the correlation between an item and a scale in which it is not included is corrected for attenuation. At the same time, the effect of unreliability within the scale has been removed. The effect of unreliability for a particular item has not been removed. The communalities which appear as diagonal entries in the item correlation matrices represent the specific reliabilities of the item in the scale to which they belong.

Objective Feedback

Table D-1 presents the three items which make up the objective feedback scale, their intercorrelations and their correlations with the other scales, corrected for attenuation. The diagonals indicate a strong-weak gradient within the cluster. The first two items are concerned with the manager's recall of the occasions on which he was given information about his performance. There is the potential for some confusion by the respondent if he includes personal development objectives under the general heading of objectives as in item five. The common denominator of these three items is the manager's feelings about how his superior is evaluating his qualifications and development needs.

Interest in MBO

Table D-2 displays the three items which make up the interest in MBO scale. Also included are their inter-item and inter-scale correlations. The intercorrelations of the items form a rank one matrix and have a strong-weak gradient from item 22 to item 21. These items are also quite consistent in their correlations with other scales. The content of these items is quite similar and seeks responses which concern the genuine interest and involvement of the superiors and the organization with MBO.

Goal Relevance

The eight items which make up the goal relevance scale are shown in Table D-3. The first three items measure the manager's perception of the congruence of his objectives with the needs of the organization. These items seek to ascertain goal clarity as well as goal relevance. The last five items concern the degree of understanding between the

Table D-1.-- Scale 501, Objective Feedback

Item	Description
9	How often were you given feedback on your progress on your personal development objectives?
5	How often were you given feedback on your progress on your objectives?
11	How much emphasis did your boss put on attaining your personal development objectives?

Scale Intercorrelations and Loading Matrix

	9	5	11	
9	88	80	61	
5	80	68	51	
11	61	51	42	
501	95	82	64	Objective Feedback
502	67	65	60	Interest In MBO
503	69	75	65	Goal Relevance
504	48	55	46	Boss Concern With Failure
505	46	40	41	Influence Upward
506	23	13	27	Need For Policy
507	47	50	47	Satisfaction With Boss
508	61	55	56	Boss Supportiveness
509	39	41	30	Orientation Toward MBO
510	24	17	31	Influence On Goals
511	45	41	47	Goal Difficulty
512	33	31	31	Job Satisfaction
513	30	23	35	Goal Success
514	42	41	34	Performance-Reward Association
515	37	33	33	Importance Of Competence
516	27	23	18	Residual

Table D-2.-- ~~Scale~~ 502, Interest In MBO

Item	Description
22	How much of an interest do you think your boss has in the MBO system?
36	How much time did your boss devote to the MBO system in 1970?
21	How much of an interest do you think the company has in the MBO system?

Scale Intercorrelations and Loading Matrix

22	75	67	58	
36	67	57	48	
21	58	48	45	
501	65	74	45	Objective Feedback
502	87	75	66	Interest in MBO
503	62	66	48	Goal Relevance
504	52	54	35	Boss Concern With Failure
505	42	49	36	Influence Upward
506	36	33	32	Need For Policy
507	55	58	43	Satisfaction With Boss
508	61	64	53	Boss Supportiveness
509	46	44	48	Orientation Toward MBO
510	23	24	7	Influence On Goals
511	29	31	20	Goal Difficulty
512	34	36	40	Job Satisfaction
513	18	16	24	Goal Success
514	37	45	33	Performance-Reward Association
515	31	34	30	Importance Of Competence
516	12	15	24	Residual

manager and his superior regarding the evaluation of performance and the priority of effort to be expended. The common elements in the entire set of items for this scale are goal relevance and goal clarity.

Boss Concern with Failure

Table D-4 shows the two items that form the boss concern with failure scale. The items are very consistent in their inter-item and inter-scale correlations. The items show homogeneous content and relatively strong reliability.

Influence Upward

The common element among the four items which make up this scale is the influence of the manager upon his superior. Table D-5 shows that the items are quite similar in content and have a consistent pattern of correlations with other scales.

Need for Policy

Scale 506, Need for Policy, is shown in Table D-6. The two items which form this scale are very compatible in content, internal consistency, and external correlational pattern with other scales. This scale measures the manager's need for structure or guidance as he participates in the organization.

Satisfaction with Boss

The four items which make up the satisfaction with boss scale are shown in Table D-7. This scale is a measure of the manager's satisfaction with his boss as a boss. The inter-scale correlational pattern is consistent and the inter-item correlation shows three strong items and

Table D-3.-- Scale 503, Goal Relevance

Item	Description
7	Was the relative importance of your various objectives pointed out to you?
6	Were your objectives clearly stated with respect to results expected?
3	Did objectives set for you reflect the most serious, pressing needs of the company?
4	To what degree did the personal development objectives set for you reflect your personal development needs?
24	Which best describes the present difficulty your boss has in measuring your performance?
16	Objectives have been set for you for 1972 under MBO. How do they compare to last year?
38	Did your boss indicate any priorities for your personal development objectives?
48	Did your boss establish priorities for your performance goals?

Scale Intercorrelations and Loading Matrix

7	60	62	37	28	33	32	29	28	
6	62	44	41	27	31	26	16	15	
3	37	41	27	40	21	23	3	14	
4	26	27	40	20	11	16	22	14	
24	33	31	21	11	17	18	12	20	
16	32	26	23	16	18	16	16	9	
38	29	16	3	22	12	16	14	34	
48	26	15	14	14	20	9	34	14	
501	74	60	29	44	36	34	39	29	Objective Feedback
502	63	52	26	31	39	31	33	30	Interest in MBO
503	78	66	52	45	41	39	37	37	Goal Relevance
504	56	51	36	23	39	38	30	26	Boss Concern With Failure
505	46	40	23	23	19	13	9	12	Influence Upward
506	22	17	15	12	28	15	27	9	Need For Policy
507	46	42	16	20	32	13	20	26	Satisfaction With Boss
508	56	43	17	34	34	34	25	22	Boss Supportiveness
509	38	37	34	27	36	26	19	20	Orientation Toward MBO
510	24	4	-7	-1	10	17	38	26	Influence On Goals
511	35	24	40	50	16	38	24	17	Goal Difficulty
512	32	27	13	13	18	3	9	13	Job Satisfaction
513	26	24	0	16	13	36	6	1	Goal Success
514	38	38	24	33	31	22	20	22	Performance-Reward Association
515	35	41	33	34	34	35	20	15	Importance of Competence
516	22	21	29	40	-0	34	8	-12	Residual

Table D-4.-- Scale 504, Boss Concern With Failure

Item	Description
44	How concerned do you feel your boss would be if you failed to achieve established objectives?
45	What criticism would you receive from your boss if you failed to achieve established objectives?

Scale Intercorrelations and Loading Matrix

44	55	52	
45	52	55	
501	55	35	Objective Feedback
502	57	33	Interest in MBO
503	65	45	Goal Relevance
504	73	73	Boss Concern With Failure
505	32	11	Influence Upward
506	33	30	Need For Policy
507	49	19	Satisfaction With Boss
508	47	15	Boss Supportiveness
509	38	25	Orientation Toward MBO
510	20	22	Influence On Goals
511	29	31	Goal Difficulty
512	26	8	Job Satisfaction
513	20	17	Goal Success
514	36	17	Performance-Reward Association
515	40	25	Importance Of Competence
516	24	18	Residual

Table D-5.-- Scale 505, Influence Upward

Item	Description
28	Do you feel you can influence the decisions of your boss?
27	How often does your boss ask your opinion when a problem comes up that involves your work?
50	How satisfied are you with the amount of influence you have on the decisions of your boss that relate to your work?
8	To what extent do you feel you control the means of reaching your objective?

Scale Intercorrelations and Loading Matrix

28	59	59	59	22
27	59	57	55	26
50	59	55	57	25
8	22	26	25	11

501	28	37	36	37	Objective Feedback
502	28	42	39	35	Interest in MBO
503	23	31	28	38	Goal Relevance
504	14	18	19	25	Boss Concern With Failure
505	77	76	75	32	Influence Upward
506	-4	4	11	13	Need For Policy
507	49	59	61	34	Satisfaction With Boss
508	55	65	74	43	Boss Supportiveness
509	9	12	17	38	Orientation Toward MBO
510	-12	-7	-4	-14	Influence On Goals
511	7	10	1	8	Goal Difficulty
512	26	32	44	24	Job Satisfaction
513	16	11	19	46	Goal Success
514	23	29	29	33	Performance-Reward Association
515	21	17	22	35	Importance of Competence
516	16	16	10	28	Residual

Table D-6.-- Scale 506, Need For Policy

Item	Description
46	How important is it for you to know what your boss wants you to do?
47	How important is it to have definite policies and procedures to help you in performing your job?

Scale Intercorrelations and Loading Matrix

46	45	42
47	42	45

501	24	13	Objective Feedback
502	36	22	Interest in MBO
503	30	19	Goal Relevance
504	37	20	Boss Concern With Failure
505	13	-0	Influence Upward
506	66	66	Need For Policy
507	29	11	Satisfaction With Boss
508	23	8	Boss Supportiveness
509	32	23	Orientation Toward MBO
510	20	11	Influence On Goals
511	10	2	Goal Difficulty
512	13	9	Job Satisfaction
513	9	10	Goal Success
514	20	7	Performance-Reward Association
515	36	27	Importance Of Competence
516	14	-1	Residual

Table D-7.-- Scale 507, Satisfaction With Boss

Item	Description
29	How capable a manager is your boss?
30	How good is your boss in dealing with people?
31	How satisfied are you with your boss?
26	Which statement best describes the feedback you get from your boss about your performance?

Scale Intercorrelations and Loading Matrix

29	79	79	75	53
31	79	84	74	58
30	75	74	65	44
26	53	58	44	37

501	49	46	39	58	Objective Feedback
502	58	53	48	60	Interest in MBO
503	46	40	34	54	Goal Relevance
504	44	32	32	42	Boss Concern With Failure
505	61	69	56	65	Influence Upward
506	29	24	24	20	Need For Policy
507	89	92	80	60	Satisfaction With Boss
508	71	81	66	76	Boss Supportiveness
509	27	21	21	34	Orientation Toward MBO
510	4	-3	-3	8	Influence On Goals
511	18	14	14	16	Goal Difficulty
512	45	50	41	49	Job Satisfaction
513	20	16	16	11	Goal Success
514	36	33	32	40	Performance-Reward Association
515	25	26	28	33	Importance Of Competence
516	14	9	14	15	Residual

one weaker one. Item 26 is an indicator of how the manager may interpret the actions of his boss based on his feedback and interaction with the boss.

Boss Supportiveness

Table D-8 presents the four items which form the boss supportiveness cluster, their intercorrelations, and their correlations with the other clusters. The pattern of intercorrelations is weakly rank one; however it shows a consistent pattern of parallelism with other scales. The content of these items measures the manager's perception of how supportive his boss is in the working environment.

Orientation Toward MBO

The three items of the orientation toward MBO scale (Table D-9) concern the usefulness of MBO as a tool for helping the manager do his job. The intercorrelations show a rank one matrix and a strong-weak gradient. The pattern of the inter-scale correlations demonstrates that these items hold together quite well.

Influence on Goals

Table D-10 presents the two items which compose the influence on goals scale, their intercorrelations and correlations with other scales. The items concern the objective setting process and seek to ascertain if it is an authoritative or a participative process.

Goal Difficulty

The four items which constitute the goal difficulty scale measure the challenge of the goals being sought by the manager. A response for

Table D-8.-- Scale 508, Boss Supportiveness

Item	Description
25	Which statement best describes the concern of your boss for your career?
23	Which best describes the manner in which your boss helps you in performing your job?
13	How do relations with your boss now compare to your relations with him during previous years?
43	Which statement best describes amount of praise you received from your boss about your performance last year?

Scale Intercorrelations and Loading Matrix

25	49	45	28	22	
23	45	38	25	17	
13	28	25	17	12	
43	22	17	12	9	
501	59	38	33	15	Objective Feedback
502	60	46	34	16	Interest in MBO
503	54	35	34	13	Goal Relevance
504	42	22	24	-2	Boss Concern With Failure
505	55	44	35	51	Influence Upward
506	22	17	16	-7	Need For Policy
507	64	50	34	37	Satisfaction With Boss
508	71	62	40	30	Boss Supportiveness
509	37	14	22	5	Orientation Toward MBO
510	16	-1	4	-15	Influence On Goals
511	20	4	16	-4	Goal Difficulty
512	37	33	18	21	Job Satisfaction
513	30	6	19	22	Goal Success
514	44	23	22	18	Performance-Reward Association
515	31	12	25	13	Importance of Competence
516	25	-1	37	10	Residual

Table D-9.-- Scale 509, Orientation Toward MBO

Item	Description
40	How applicable do you think the MBO system is to your job?
41	How helpful has the MBO system been to you in performing the duties of your job?
39	How well do you like the MBO system?

Scale Intercorrelations and Loading Matrix

40	78	75	68	
41	76	72	54	
39	68	64	50	
501	41	49	25	Objective Feedback
502	52	55	44	Interest in MBO
503	57	55	35	Goal Relevance
504	42	39	27	Boss Concern With Failure
505	28	23	23	Influence Upward
506	34	39	31	Need For Policy
507	28	29	22	Satisfaction With Boss
508	32	37	28	Boss Supportiveness
509	89	85	77	Orientation Toward MBO
510	8	13	2	Influence On Goals
511	11	19	-7	Goal Difficulty
512	27	29	26	Job Satisfaction
513	27	33	25	Goal Success
514	44	43	30	Performance-Reward Association
515	42	47	34	Importance Of Competence
516	27	28	28	Residual

this scale records a measure of the intrinsic worth of the manager's performance. Although the scale as shown in Table D-11 is a weak rank one matrix, the items show consistent internal and external patterns of relationships.

Job Satisfaction

Table D-12 presents the two items which make up the job satisfaction scale. The items are strongly related and consistent in their behavior with other scales. A response to this scale is an indication of the satisfaction of the manager with his monetary reward for effort expended and skill level possessed.

Goal Success

The three items of the goal success scale seek responses as to how probable was success in attaining goals as well as how was success perceived by the respondent. The item intercorrelations shown in Table D-13 form a rank one matrix and a strong-weak gradient along the diagonals. Additionally, the items have a similar pattern of correlations with other scales.

Performance-Reward Association

Table D-14 displays the two items which measure the perceived relationship between effort expended by the manager and future salary levels and promotions. These items are homogenous in content and hold together very well internally and externally.

Table D-10.-- Scale 510, Influence On Goals

Item	Description
37	Who had the most influence on setting personal development objectives for you?
18	Who had the most influence on setting the objectives for you?

Scale Intercorrelations and Loading Matrix

37	55	52
18	52	55

501	26	17	Objective Feedback
502	19	15	Interest in MBO
503	19	21	Goal Relevance
504	21	22	Boss Concern With Failure
505	-7	-14	Influence Upward
506	18	16	Need For Policy
507	2	1	Satisfaction With Boss
508	1	2	Boss Supportiveness
509	8	5	Orientation Toward MBO
510	73	73	Influence On Goals
511	16	22	Goal Difficulty
512	-1	-0	Job Satisfaction
513	-10	-13	Goal Success
514	9	12	Performance-Reward Association
515	11	12	Importance Of Competence
516	-18	-7	Residual

Table D-11.-- Scale 511, Goal Difficulty

Item	Description
2	What was the level of difficulty of the personal development objectives set for you?
1	What was the level of difficulty of the objectives set for your position?
10	Do you feel you had too many objectives?
17	New personal development objectives have been set. How does the the difficulty of these objectives compare to those of last year?

Scale Intercorrelations and Loading Matrix

2	40	37	25	21
1	37	27	28	9
10	25	28	24	17
17	21	9	17	9

501	31	20	24	31	Objective Feedback
502	18	12	18	20	Interest in MBO
503	36	39	20	25	Goal Relevance
504	14	28	15	23	Boss Concern With Failure
505	6	4	4	6	Influence Upward
506	2	1	-2	16	Need For Policy
507	11	9	7	10	Satisfaction With Boss
508	13	-5	8	19	Boss Supportiveness
509	9	5	-5	9	Orientation Toward MBO
510	10	11	13	16	Influence On Goals
511	64	52	49	29	Goal Difficulty
512	7	6	3	2	Job Satisfaction
513	-3	-22	-12	24	Goal Success
514	12	14	-3	15	Performance-Reward Association
515	12	5	1	17	Importance Of Competence
516	13	18	6	18	Residual

Table D-12.-- Scale 512, Job Satisfaction

Item	Description
32	Considering your skills and effort, how satisfied are you with the pay?
33	If you had a chance for a better paying job in this area, how would you feel about changing?

Scale Intercorrelations and Loading Matrix

32	45	42	
33	42	45	
501	22	30	Objective Feedback
502	28	35	Interest in MBO
503	19	23	Goal Relevance
504	14	17	Boss Concern With Failure
505	33	31	Influence Upward
506	13	10	Need For Policy
507	36	39	Satisfaction With Boss
508	29	35	Boss Supportiveness
509	20	23	Orientation Toward MBO
510	-3	2	Influence On Goals
511	2	10	Goal Difficulty
512	66	66	Job Satisfaction
513	2	7	Goal Success
514	32	33	Performance-Reward Association
515	12	18	Importance Of Competence
516	-18	6	Residual

Table D-13.--Scale 513, Goal Success

Item	Description
14	How successful were you in attaining the objectives set for you under MBO?
49	When your performance goals were established, what did you feel about the probability of attainment?
15	How successful were you in attaining personal development objectives last year?

Scale Intercorrelations and Loading Matrix

14	47	37	33	
49	37	28	22	
15	33	22	22	
501	12	23	23	Objective Feedback
502	10	18	14	Interest in MBO
503	18	17	17	Goal Relevance
504	16	15	12	Boss Concern With Failure
505	16	31	13	Influence Upward
506	8	4	12	Need For Policy
507	7	19	6	Satisfaction With Boss
508	22	27	13	Boss Supportiveness
509	21	25	12	Orientation Toward MBO
510	-11	-15	-1	Influence On Goals
511	-2	-16	7	Goal Difficulty
512	-4	10	9	Job Satisfaction
513	70	52	46	Goal Success
514	8	23	11	Performance-Reward Association
515	26	31	10	Importance Of Competence
516	27	17	24	Residual

Table D-14.-- Scale 514, Performance-Reward Association

Item	Description
34	To what extent will your actual job performance affect your future salary increases?
35	To what extent will your actual job performance now affect your future promotions?
8	Do you feel you control the means of reaching your objectives?

Scale Intercorrelations and Loading Matrix

34	64	61	
35	61	64	
501	38	39	Objective Feedback
502	44	36	Interest in MBO
503	43	48	Goal Relevance
504	31	27	Boss Concern With Failure
505	38	31	Influence Upward
506	18	16	Need For Policy
507	41	29	Satisfaction With Boss
508	46	38	Boss Supportiveness
509	32	40	Orientation Toward MBO
510	11	12	Influence On Goals
511	18	13	Goal Difficulty
512	49	29	Job Satisfaction
513	18	21	Goal Success
514	79	79	Performance-Reward Association
515	44	40	Importance Of Competence
516	23	47	Residual

Importance of Competence

The three items which compose the importance of competence scale (Table D-15) measure the manager's need to achieve a certain level of expertise or reward for successful job performance. The items form a flat rank one matrix and have a consistent pattern of correlational relationships with the other scales.

Residual

This scale (D-16) is composed of those items which did not meet the criteria for inclusion in any of the above described scales.

The Revised Seven Scale Research Model

In an attempt to improve the internal scale reliabilities for the research model, the fifteen scales were condensed into a seven scale model. The cluster analyses of the scales for that model are presented in the following sub-sections.

Importance of Goals

Table D-17 presents the ten items which make up the Importance of Goals scale. This macro scale has two scales which were defined in the fifteen scale model as Goal Relevance (Scale 503) and Boss Concern with Failure (Scale 504). The items of this scale demonstrate a consistent pattern of correlational relationships with the other scales of the system.

Goal Setting Behavior

This scale consists of two subscales--Influence on Goals and Goal Difficulty--which together total six items. In Table D-18 the existence

Table D-15.-- Scale 515, Importance of Competence

Item	Description
51	How important is it to you that you do a better job than other people who have had your job?
52	To what extent will effort increases by you lead to increases in your job performance?
53	Do you experience a feeling of personal accomplishment and satisfaction in fully completing your goal assignments?

Scale Intercorrelations and Loading Matrix

51	33	33	32	
52	33	33	32	
53	32	32	32	
501	14	36	24	Objective Feedback
502	16	23	32	Interest in MBO
503	25	41	40	Goal Relevance
504	24	21	32	Boss Concern With Failure
505	10	28	25	Influence Upward
506	36	21	26	Need For Policy
507	14	21	23	Satisfaction With Boss
508	14	30	25	Boss Supportiveness
509	15	28	40	Orientation Toward MBO
510	8	12	7	Influence On Goals
511	18	5	7	Goal Difficulty
512	4	13	22	Job Satisfaction
513	18	27	23	Goal Success
514	25	41	26	Performance-Reward Association
515	57	57	56	Importance of Competence
516	42	29	47	Residual

Table D-16.-- Scale 516, Residual

Item	Description
12	How did the amount of effort you put into your job compare with previous years?
19	The amount of change associated with my job is:
20	The number of contacts with persons outside my department are:
42	How interesting is the work in your present job?
55	Given your present situation, how important are future promotions to you?

Scale Intercorrelations and Loading Matrix

12	16	8	7	21	15	
19	8	8	11	9	11	
20	7	11	11	12	14	
42	21	9	12	12	3	
61	15	11	14	3	10	
501	18	6	-2	16	9	Objective Feedback
502	17	1	-4	17	6	Interest in MBO
503	23	8	-6	19	16	Goal Relevance
504	18	9	-6	16	11	Boss Concern With Failure
505	10	-6	5	35	1	Influence Upward
506	19	-7	-11	10	6	Need For Policy
507	12	-6	3	20	-2	Satisfaction With Boss
508	20	2	9	16	12	Boss Supportiveness
509	16	4	-4	26	14	Orientation Toward MBO
510	1	-4	-17	-7	-2	Influence On Goals
511	27	18	-0	2	1	Goal Difficulty
512	1	-13	-8	33	-29	Job Satisfaction
513	13	7	12	19	16	Goal Success
514	14	3	3	25	28	Performance-Reward Association
515	28	10	10	34	32	Importance Of Competence
516	41	28	33	35	32	Residual

Table D-17.-- Scale 501, Importance Of Goals

Item	Description
7	Was the relative importance of your various objectives pointed out to you?
6	Were your objectives clearly stated with respect to results expected?
3	Did objectives set for you reflect most serious, pressing needs of the company?
24	Which best describes the difficulty your boss has in measuring your performance?
16	Objectives have been set for 1972 under MBO. How do they compare to last year?
48	Did your boss establish priorities for your performance goals?
38	Did your boss indicate priorities for your personal development objectives?
44	How concerned do you feel your boss would be if you failed to achieve established objectives?
45	What criticism would you receive from your boss if you failed to achieve established objectives?

Scale Intercorrelations and Loading Matrix

	7	5	3	4	24	16	48	38	44	45
7	58	62	37	28	33	32	28	29	51	31
5	62	43	41	27	31	26	15	16	47	28
3	37	41	25	40	21	23	14	3	32	20
4	28	27	40	17	11	16	14	22	20	14
24	33	31	21	11	19	18	20	12	32	26
16	32	25	23	16	18	17	9	16	29	27
48	28	15	14	14	20	9	13	34	23	15
38	29	15	3	22	12	16	34	14	24	20
44	51	47	32	20	32	29	23	24	49	52
45	31	28	20	14	26	27	15	20	52	25
501	76	65	50	41	43	42	36	37	70	50
502	41	21	27	38	18	39	28	41	34	37
503	51	44	20	26	30	20	21	19	45	16
504	67	55	35	39	45	36	30	38	60	39
505	35	41	33	34	34	35	15	20	40	25
506	32	27	13	13	18	3	13	9	26	8
507	44	43	15	34	30	40	16	18	39	24
508	22	21	29	40	-0	34	-12	8	24	18

Table D-18.-- Scale 502, Goal Setting Behavior

Item	Description
37	Who had the most influence on setting personal development objectives for you?
18	Who had the most influence on setting the objectives for you?
2	What was the level of difficulty of personal development objectives set for you?
1	What was the level of difficulty of objectives set for your position?
10	Do you feel you had too many objectives?
17	New personal development objectives have been set. How does the difficulty of these objectives compare to those of last year?

Scale Intercorrelations and Loading Matrix

18	21	52	9	9	12	13	
37	52	15	7	6	8	10	
1	9	7	18	37	28	9	
2	9	6	37	23	25	21	
10	12	8	28	25	19	17	
17	13	10	9	21	17	11	
501	23	21	38	32	20	26	Importance of Goals
502	46	39	43	48	43	33	Goal Setting Behavior
503	-4	-1	4	10	6	12	Superior-Subordinate Relationship
504	16	22	14	21	12	24	Utility of MBO
505	12	11	5	12	1	17	Importance of Competence
506	-0	-1	6	7	3	2	Job Satisfaction
507	-1	-1	-6	6	-11	28	Performance-Reward Association
508	-7	-18	18	13	6	18	Residual

of a rank two matrix is very evident. However, when viewed collectively the macro scale has a consistent pattern of correlations with the other scales. The content of the influence subscale requires the respondent to assess who had the most influence in setting both his performance and personal development goals. For the goal difficulty subscale, the manager's response indicates whether goal setting is accomplished only as a technique for expanding or developing the manager's potential for effectiveness.

Superior-Subordinate Relationship

The twelve items which comprise the superior-subordinate relationship scale are shown in Table D-19. This scale has three subscales--Boss Supportiveness - items 25, 23, 13, 43; Influence Upward - items 8, 28, 27, 50; and Satisfaction with Boss - items 29, 30, 31, 26. All three subscales assess the manager's feelings about his interaction and influence with his boss.

Utility of MBO

Table D-20 contains the eleven items which form the utility of MBO scale. It is actually composed of four subscales. The first subscale (items 46, 47) is described as need for policy which could also be called need for structure. The second subscale (items 39, 40, 31) is concerned with a specific technique (MBO) which may satisfy the need for structure or policy.

The next three items (21, 22, 26) appraise the "higher level" interest of the boss and the organization in MBO as a useful tool. The remaining three items (5, 9, 11) evaluate the amount of results

Table D-19.-- Scale 503, Superior-Subordinate Relationship

Item	Description
25	Which best describes the concern of your boss for your career?
23	Which best describes the manner in which your boss helps you in performing your job?
13	How do relations with your boss now compare to your relations with him previously?
43	Which best describes the amount of praise you received from your boss about your performance last year?
8	To what extent do you feel you control the means of reaching your objective?
28	Do you feel you can influence the decisions of your boss?
27	How often does your boss ask your opinion about a problem that involves your work?
50	How satisfied are you with the amount of influence you have on decisions of your boss that relate to your job?
29	How capable a manager is your boss?
30	How good is your boss in dealing with people?
31	How satisfied are you with your boss?
26	Which best describes the feedback you get from your boss about your performance?

Scale Intercorrelations and Loading Matrix

24	43	45	28	22	28	35	39	42	50	44	51	60
23	45	28	25	17	19	21	35	39	40	35	46	40
13	28	25	14	12	22	20	19	29	28	25	32	25
43	22	17	12	19	18	36	37	41	26	29	35	30
8	28	19	22	18	15	22	26	25	25	25	27	33
28	35	21	20	36	22	36	59	59	39	35	45	40
27	39	35	19	37	26	59	47	55	47	41	50	51
50	42	39	29	41	25	59	55	53	48	44	59	46
29	50	40	28	26	25	39	47	48	59	75	79	53
30	44	35	25	29	25	35	41	44	75	49	74	64
31	51	46	32	35	27	45	50	59	79	74	72	58
26	60	40	25	30	33	40	51	46	53	44	58	61
501	53	33	33	9	37	22	29	28	48	36	40	54
502	24	3	15	-12	-2	-1	4	-2	16	9	9	17
503	66	53	38	43	38	60	68	73	76	70	85	72
504	60	38	35	11	42	22	33	35	53	42	47	58
505	31	12	25	13	35	21	17	22	25	28	26	33
506	37	23	18	21	24	26	32	44	45	41	50	49
507	51	20	28	28	55	27	27	33	39	33	33	35
508	25	-1	37	10	28	16	16	10	14	14	9	15

Table D-20.-- Scale 504, Utility of MBO

Item	Description
36	How much time did your boss devote to the MBO system in 1970?
22	How much of an interest do you think your boss has in the MBO system?
21	How much of an interest do you think the company has in the MBO system?
46	How important is it for you to know what your boss wants you to do?
47	How important is it to have definite policies and procedures to help you in performing your job?
40	How applicable do you think the MBO system is to your job?
41	How helpful has the MBO system been in performing the duties of your job?
39	How well do you like the MBO system?
9	How often were you given feedback on your progress on personal development objectives?
5	How often were you given feedback on your progress on your objectives?
11	How much emphasis did your boss put on attaining your personal development objectives?

Scale Intercorrelations and Loading Matrix

45	17	42	26	29	26	25	31	26	17	21	20
47	42	8	15	15	25	17	16	17	6	9	16
39	26	15	29	53	54	38	33	29	22	22	16
40	28	16	68	45	76	40	39	38	38	34	27
41	26	25	64	75	53	41	42	43	43	42	33
21	25	17	38	43	41	38	58	48	38	39	32
22	31	16	33	39	42	58	55	67	52	53	51
35	26	17	29	38	43	48	67	56	60	62	56
5	17	6	22	33	43	38	52	60	45	80	51
9	21	9	22	34	42	39	53	62	80	50	61
11	20	16	16	27	33	32	51	56	51	61	35
501	34	20	35	55	55	47	63	67	74	67	63
502	19	7	-4	13	22	20	35	37	41	49	55
503	23	7	25	31	31	46	55	60	51	53	50
504	42	28	54	67	73	62	74	75	67	70	59
505	36	27	34	42	47	30	31	34	33	37	33
506	13	9	26	27	29	40	34	36	31	33	31
507	20	12	38	43	51	39	38	42	44	50	48
508	14	-1	28	27	28	24	12	15	23	27	18

oriented feedback from the boss regarding performance toward performance and personal development goals.

Importance of Competence

Table D-21 presents the three items which make up this scale, their inter-correlations, and their correlations with the other scales. These items demonstrate a flat rank one correlation matrix and are parallel across the other scales. All three have the idea of competence or mastery of the job in common.

Job Satisfaction

The two items which make up this scale are shown in Table D-22 along with their intercorrelations and their correlations with other scales. Both items evaluate the manager's satisfaction with his pay compared to his input (skills and effort) and his next best alternative job. The items are very similar in content and correlation with other scales. They form a flat rank one matrix of intercorrelations.

Performance-Reward Association

Table D-23 presents the five items which comprise this scale. It is evident that there are two subscales in this macro scale. The first three items (14, 49, 15) concern the manager's feeling of goal accomplishment. The other two items (34, 35) assess the subject's perception of the relationship between actual performance on the job and future increases in pay and promotion opportunity.

Residual

Table D-24 displays the five residual items, their intercorrelations and their correlations with other scales.

Table D-21.-- Scale 505, Importance of Competence

Item	Description
51	How important is it to you that you do a better job than other people who have had your job?
52	To what extent will effort increases by you lead to increases in job performance?
53	Do you expect a feeling of personal accomplishment and satisfaction in fully completing your goal assignments?

Scale Intercorrelations and Loading Matrix

51	33	33	32	
52	33	33	32	
53	32	32	32	
501	26	38	40	Importance of Goals
502	18	11	10	Goal Setting Behavior
503	13	27	26	Superior-Subordinate Relationship
504	23	35	40	Utility of MBO
505	57	57	56	Importance of Competence
506	4	13	22	Job Satisfaction
507	30	47	34	Performance-Reward Association
508	42	29	47	Residual

Table D-22.-- Scale 506, Job Satisfaction

Item	Description
32	Considering your skills and effort, how satisfied are you with the pay?
33	If you had a chance for a better paying job in this area, how would you feel about changing?

Scale Intercorrelations and Loading Matrix

32	45	42	
33	42	45	
501	19	23	Importance of Goals
502	-0	9	Goal Setting Behavior
503	35	37	Superior-Subordinate Relationship
504	28	33	Utility of MBO
505	12	18	Importance of Competence
506	66	66	Job Satisfaction
507	23	27	Performance-Reward Association
508	-18	6	Residual

Table D-23.— Scale 507, Performance-Reward Association

Item	Description
14	How successful were you in attaining the objectives set for you under MBO?
49	When your performance goals were established, what did you feel about the probability of their attainment?
15	How successful were you in attaining personal development objectives last year?
34	To what extent will your actual job performance affect your future salary increases?
35	To what extent will your actual job performance now affect your future promotions?

Scale Intercorrelations and Loading Matrix

14	19	37	33	7	5	
49	37	27	22	16	20	
15	33	22	13	6	10	
34	7	16	6	24	61	
35	5	20	10	61	29	
501	15	17	16	42	45	Importance of Goals
502	-8	-22	5	20	17	Goal Setting Behavior
503	15	27	11	44	33	Superior-Subordinate Relationship
504	18	25	20	44	44	Utility of MBO
505	26	31	10	44	40	Importance of Competence
506	-4	10	5	49	29	Job Satisfaction
507	43	52	36	49	54	Performance-Reward Association
508	27	17	24	23	47	Residual

Table D-24.-- Scale 508, Residual

Item	Description
12	How did the amount of effort you put into your job compare to previous years?
19	The amount of change associated with my job is:
20	The number of contacts with persons outside my department are:
42	How interesting is the work in your present job?
55	Given your present situation, how important are future promotions to you?

Scale Intercorrelations and Loading Matrix

12	16	8	7	21	15	
19	8	8	11	9	11	
20	7	11	11	12	14	
42	21	9	12	12	3	
61	15	11	14	3	10	
501	23	8	-6	19	16	Importance of Goals
502	21	12	-10	-3	-0	Goal Setting Behavior
503	14	-4	5	25	3	Superior-Subordinate Relationship
504	22	2	-6	23	12	Utility of MBO
505	26	10	10	34	32	Importance of Competence
506	1	-13	-8	33	-29	Job Satisfaction
507	19	7	11	31	30	Performance-Reward Association
508	41	28	33	35	32	Residual

APPENDIX E

OTHER FINDINGS IN THE FIRM B MBO STUDY

Note: The data from two administrations of the MBO questionnaire to the managers of Firm B were used in this analysis.

APPENDIX E

OTHER FINDINGS IN THE FIRM B MBO STUDY

This appendix presents the development of a revised research model for the managerial attitude system using the responses to two administrations of the fifty-five item MBO study questionnaire by the one hundred seventeen (117) managers of Firm B. To do this the first section describes a fifteen variable model developed from a multiple group cluster analysis of the data. This section also contains a description of the scale content, the inter-scale correlations, and the change score reliabilities. The second section is a presentation of a condensed model of these fifteen scales and representative statistics about each of the new scales. The third section contains an effects diagram for the condensed model for Firm B managers.

Fifteen Scale Model

The strategy employed for the analysis of the Firm B data was to revise the original fourteen scale model developed by Chesser using the additional data available (items 48-55) for Firm B. The first step was to perform a fourteen scale multiple group analysis and carefully examine the factor loadings of those items in the residual. The residual in this case included all items not in the Chesser fourteen scale model plus the new items available. After examination of the resultant clusters, a new scale of three items which measured the importance of competence to the manager was discovered. The scale consisted of the following items:

51. How important is it that you do a better job than other people who have had your job?

52. To what extent will effort increases by you lead to increases in job performance?

53. Do you experience a feeling of personal accomplishment, satisfaction in full completion of goals?

It also was evident that some of the items in the residual belonged in established clusters. Several different combinations of items within and between clusters were tried before a decision was made that further manipulations would only blur important content considerations.

During these various studies the same three criteria were applied to the analysis of the scales. They were:

1. Items within a scale should be internally consistent (that is, they should correlate with one another).

2. Items within a scale should be "externally" consistent (that is, they should have a similar pattern of correlations with other scales).

3. The scales should have reasonably similar content.

Table E-1 presents a description of the scales for the fifteen scale model for the managers of Firm B. Table E-2 displays the means and standard deviations for each scale in the model.

In the development of the original model, a minimum threshold for internal reliability was set at .50 (r_{11} = .50). Using this same criteria, the internal scale reliabilities shown in Table E-3 are all .50 or greater with the exception of scale eleven--Goal Difficulty--for the first administration of the questionnaire.

The problem of low change score reliabilities for several of the scales is present in the revised scales as it was in the Chesser research. Scales 4, 6, 11, 12, 13, and 15 all have change score reliabilities less than .25. The strategy for improving these low change

Table E-1 .-- Fifteen Scale Research Model

Scales	Questionnaire Item Numbers
1. Objective Feedback	9,5,11
2. Interest in MBO	36,22,21
3. Goal Relevance	7,6,3,4,24,16,38,48
4. Boss Concern with Failure	44,45
5. Influence Upward	8,28,27,50
6. Need for Policy	46,47
7. Satisfaction with Boss	29,31,30,26
8. Boss Supportiveness	25,23,13,43
9. Orientation Toward MBO	40,41,39
10. Influence on Goals	37,18
11. Goal Difficulty	2,1,10,17
12. Job Satisfaction	32,33
13. Goal Success	14,49,15
14. Performance-Reward Association	34,35
15. Importance of Competence	51,52,53
16. Residual	12,19,20,42,61

Table E-2.-- Means and Standard Deviations for Fifteen Scale Model

Scale	Description	Means Time 1	Means Time 2	Standard Deviations Time 1	Standard Deviations Time 2
501	Objective Feedback	2.89	3.01	0.79	0.77
502	Interest in MBO	3.82	3.77	.84	.72
503	Goal Relevance	3.00	3.04	.48	.43
504	Boss Concern With Failure	3.39	3.33	.79	.76
505	Influence Upward	3.33	3.40	.71	.77
506	Need for Policy	4.29	4.16	.68	.76
507	Satisfaction With Boss	3.50	3.56	.59	.53
508	Boss Supportiveness	2.92	1.98	.52	.54
509	Orientation Toward MBO	3.73	3.51	.89	.92
510	Influence on Goals	2.25	2.36	.69	.67
511	Goal Difficulty	2.98	2.99	.43	.49
512	Job Satisfaction	3.30	3.34	.89	.88
513	Goal Success	3.08	2.98	.74	.79
514	Performance-Reward Association	3.64	3.47	.84	.82
515	Importance of Competence	4.36	4.30	0.54	0.55

Table E-3.-- Internal Scale Reliabilities and Change Score Reliabilities for Fifteen Scale Model

Scale	Internal Reliability		Time 1-Time 2 Correlation	Change Score Reliability
	Time 1 (r_{11})	Time 2 (r_{22})	r_{12}	r_{dd}
1	.83	.84	.53	.61
2	.72	.80	.47	.55
3	.70	.72	.39	.52
4	.56	.68	.50	.24
5	.75	.74	.33	.63
6	.59	.59	.55	.09
7	.88	.88	.34	.82
8	.67	.57	.25	.50
9	.85	.87	.66	.61
10	.69	.68	.35	.52
11	.37	.54	.41	.10
12	.56	.59	.52	.13
13	.58	.57	.52	.13
14	.77	.76	.56	.48
15	.49	.59	.56	.00

score reliabilities was to condense these scales into seven macro scales.

Seven Scale Model

From the analysis of the reliability of the change scores for the fifteen scale model, it was decided that further scale condensation was necessary in order to improve the internal reliability of the scales. Wherever it was feasible, recognizing content and correlational patterns, the scales of the fifteen scale model were collapsed into macro measures. The resulting improved seven scale research model is shown in Table E-4. See Appendix D for the cluster analysis of these scales.

Development of Effects Diagram

In this section, the data from the Firm B managers will be used to construct an effects diagram of the behavioral system. The methodology for this development will be the same as that used in Appendix C.

Table E-5 is a matrix of raw and corrected correlation coefficients between change scores for the improved model. There are sixteen pairs of variables in the model which possess a significant relationship ($p < .05$). These will be indicated in the effects diagram by a solid line connecting the related pair of variables. Table E-6 is a matrix of differences between cross-lagged panel correlations for the total sample of Firm B managers. These differences are calculated using the formula:

$$\Delta r = r_{x_1 y_2} - r_{y_1 x_2}$$

where: $r_{x_1 y_2}$ = the correlation between a variable x at Time 1 with a variable y at Time 2

$r_{y_1 x_2}$ = the correlation between a variable y at Time 1 with a variable y at Time 2

Differences found to be significant are indicative of an asymmetrical or causal relationship. There are seven significant relationships ($p < .20$)

Table E-4.-- Revised Seven Scale Research Model

Scale	Description	Questionnaire Item Numbers
1.	Importance of Goals	7,6,3,4,24,16 48,38,44,45
2.	Goal Setting Behavior	37,18,2,1,10,17
3.	Superior-Subordinate Relationship	25,23,13,43,28,27 50,29,30,31,26
4.	Utility of MBO	36,22,21,46,47 40,41,39,9,5,11
5.	Importance of Competence	51,52,53
6.	Job Satisfaction	32,33
7.	Performance-Reward Association	14,49,15,34,35

Table E-5.-- Matrix of Raw and Corrected Correlation Coefficients Between Change Scores for Revised Model

Variable	Raw and Corrected Change Score Correlation Coefficients													
	1		2		3		4		5		6		7	
1. Importance of Goals	1.0	1.0												
2. Goal Setting Behavior	.41	.36	1.0	1.0										
3. Superior-Subordinate Relationship	.27	.21	.13	.06	1.0	1.0								
4. Utility of MBO	.54	.57	.30	.25	.40	.39	1.0	1.0						
5. Importance of Competence	.22	.27	.18	.12	.23	.22	.22	.25	1.0	1.0				
6. Job Satisfaction	.15	.18	.06	.00	.34	.31	.31	.34	.15	.16	1.0	1.0		
7. Performance-Reward Association	.19	.40	-.08	.01	.34	.37	.27	.41	.22	.39	.18	.25	1.0	1.0

Significant values of r:

.05 level = .18
.01 level = .24

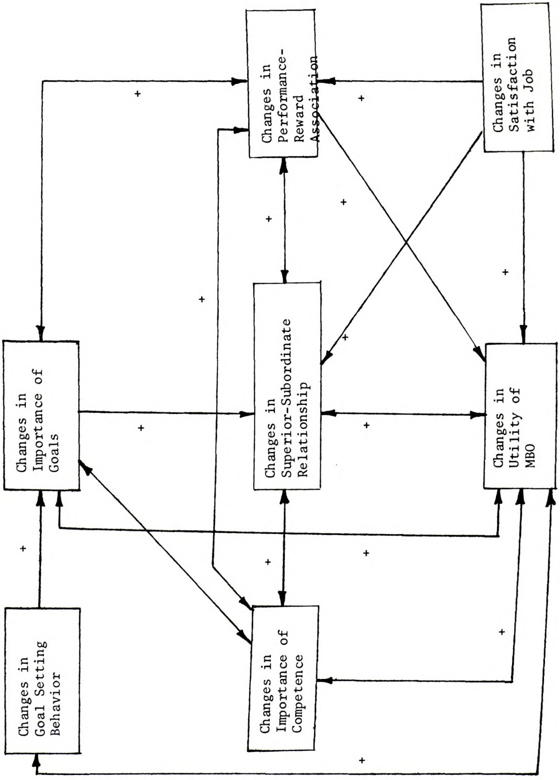
between the variables in the model. By combining the analysis of these tables with that of the previous table which contained the significant dynamic (corrected) correlations, the effects diagram for the total sample of Firm B managers has been constructed (Figure E-1). There are five of the seven asymmetrical cross-lagged panel correlations which are identified for significant dynamic correlations.

Changes in satisfaction with the job is the variable which assumes the role of the "driver" variable in this diagram. This variable is a member of three of the five causal relationships that were found and in each case is the causal factor in changes of the other variables. One implication is that Job Satisfaction is affected by forces outside the system under study. Personal pressures, economic pressures, and pressures from other relevant persons could all form a part or a total explanation for the important influence of this variable. Another possibility is the "halo" effect or the importance (as perceived by the manager) of participating in a research program of this nature.

There are four variables which are mutually reinforcing and form the "center" of the attitudinal system. These variables--Changes in Superior-Subordinate Relationship, Performance-Reward Association, Utility of MBO, and Importance of Competence--all share a positive relationship which indicates that as any one of them increases, the others will follow. The Importance of Goals scale is one of the factors which directly influences this center core of the model. As the Importance of Goals increases, the Superior-Subordinate relationship increases and its positive relationship with the other core variable is influenced.

The Importance of Goals variable is itself influenced by another variable, Changes in Goal Setting Behavior. For example, if Goal

Figure E-1.--Revised Model of Change Relationships in MBO Behavioral System



Setting Behavior (the goal setting process as perceived by the subordinate) became more autocratic than consultative, this change would be positively related to changes in the importance (relevance, clarity, priority) of goals.

The effects diagram for the total sample suggests that as there are changes in job satisfaction these changes bring about changes in the core of the system. These changes in the core variables influence and bring about changes in the goal setting process and the importance of goals.

APPENDIX F

MODERATED CHANGE RELATIONSHIPS IN THE MBO SYSTEM

Note: 1. Firm B "High Cool" Managers (n = 58)

2. Firm B "Low Cool" Managers (n = 59)

APPENDIX F

MODERATED CHANGE RELATIONSHIPS IN THE MBO SYSTEM

The Ghiselli Self Description Inventory was administered to the managers of both organizations concomitant with the first administration of the MBO Study Questionnaire. A computer search was conducted to determine if the Ghiselli dimensions moderated the change relationships found in the seven scale model. Chesser found four highly correlated dimensions which moderated these relationships. They were perceived occupational level, initiative, self assurance, and intelligence (Chesser, p. 80). Those managers who rated themselves high on these dimensions are called the "high cool" managers while those who rated themselves low on these dimensions are called "low cool" managers.

For the replication of the original research model development using the Firm B data, these "moderators" were used to sort the total sample of one hundred seventeen managers into two subgroups. These two subgroups, the "high cool" managers (n=58) and the "low cool" managers (n=59) are intended to be homogeneous with respect to the four Ghiselli personality dimensions.

Table F-1 and Table F-2 present the inter-scale correlation coefficients or the cross-lagged panel correlations between the first and second administrations of the questionnaire for the Firm B "high cool" and "low cool" managers, respectively. The two samples do have several distinct differences when the dynamic (corrected) correlations are calculated and analyzed (Table F-3 and Table F-4). There are ten of these

Table F- 1.-- Inter-Scale Correlation Coefficients Between First and Second Administrations of the Questionnaire - Firm B "High Cool" Managers (n=58)

First Administration	Second Administration						
	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	.47[a]	.19	.42	.35	-.15	.10	.32
2. Goal Clarity and Relevance	.42	.41	.35	.26	-.22	.09	.27
3. Orientation Toward MBO	.60	.48	.66	.48	.05	.30	.35
4. Performance-Reward Association	.36	.35	.38	.46	.11	.21	.10
5. Subordinate's Influence	.12	.16	.00	.13	.49	-.12	-.04
6. Satisfaction With Job	.29	.34	.32	.37	.04	.56	.26
7. Perceived Success	.12	.23	.23	.08	-.24	-.02	.45

[a]The diagonal entries are correlations between a variable measured at time 1 and time 2. Off-diagonal entries are correlations between a variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .26
.01 level = .33

Table F-2 .-- Inter-Scale Correlation Coefficients Between First and Second Administrations of the Questionnaire - Firm B "Low Cool" Managers (n=59)

	Second Administration						
First Administration	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	.40[a]	.27	.35	.23	-.14	-.02	.18
2. Goal Clarity and Relevance	.29	.51	.15	.16	-.18	-.17	.03
3. Orientation Toward MBO	.10	.27	.67	.19	-.13	-.06	.13
4. Performance-Reward Association	.38	.31	.37	.69	.04	.20	.05
5. Subordinate's Influence	-.07	-.02	-.09	-.12	.21	.08	-.04
6. Satisfaction With Job	.30	.00	.25	.34	.03	.44	.09
7. Perceived Success	.31	.29	.01	.11	-.08	.14	.57

[a]The diagonal entries are correlations between a variable measured at time 1 and time 2. Off-diagonal entries are correlations between a variable measured at time 1 and a second variable measured at time 2.

Significant value of r:

.05 level = .26
.01 level = .33

Table F-3 .-- Matrix of Dynamic (Corrected) Correlation Coefficients for Firm B "High Cool" Managers

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	1.00						
2. Goal Clarity and Relevance	.54	1.00					
3. Orientation Toward MBO	.29	.21	1.00				
4. Performance-Reward Association	.46	.36	.32	1.00			
5. Subordinate's Influence	.13	.28	-.06	.18	1.00		
6. Satisfaction With Job	.43	.27	.17	.41	.04	1.00	
7. Perceived Success	.25	.07	.16	.19	.24	-.06	1.00

Significant value of r:

.05 level = .26
.01 level = .33

Table F-4 .-- Matrix of Dynamic (Corrected) Correlation Coefficients for Firm B "Low Cool" Managers

	Second Administration						
First Administration	1	2	3	4	5	6	7
1. Superior-Subordinate Relationship	1.00						
2. Goal Clarity and Relevance	.41	1.00					
3. Orientation Toward MBO	.24	.28	1.00				
4. Performance-Reward Association	.42	.10	.14	1.00			
5. Subordinate's Influence	.01	.00	-.15	-.05	1.00		
6. Satisfaction With Job	.18	.06	.08	.23	.05	1.00	
7. Perceived Success	.24	.12	.19	.25	-.05	-.13	1.00

Significant value of r: .05 level = .26
.01 level = .33

dynamic (corrected correlations) which are significant at the .05 level for the high cool managers and there are seven for the low cool managers. The methodology for the inference of causality is the same as that of Appendices C and E. To locate the significant asymmetrical relationships between the cross-lagged panel correlations, a matrix of differences is set up for each sample (Table F-5 and Table F-6). The most efficient mechanism for discussing these differences is the effects diagram for each of the samples.

Effects Diagram - "High Cool" Managers

The relationships between the seven system variables for the Firm B "high cool" managers is shown in Figure F-1. For each of the significant dynamic (corrected) correlations (at the .05 level) a solid line is used to connect the two change variables in the diagram. A dotted line shows that a dynamic (corrected) correlation is significant at the .10 level or better. The inference of causal priority suggests three asymmetrical relationships among the cross-lagged panel correlations for the high cool managers at the .10 level or better. These are shown in effects diagram as unidirectional arrows.

The relationship between changes in goal clarity and relevance and changes in superior-subordinate relationship is different for the high cool managers than for the total sample. For the sample of high cool managers, increases in the clarity and relevance of goals leads to increases in the relationship between the manager and his superior.

A comparison of the effects diagram developed here with the effects diagram for the Firm A "high cool" managers (Chesser, p. 112) shows even greater differences. The most obvious difference is that the

Table F-5 .-- Matrix of Differences Between Cross-Lagged Panel Correlations for Firm B "High Cool" Managers

First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship		-.23	-.18	-.01	-.27	-.19	.20
2. Goal Clarity and Relevance			-.13	-.09	-.38	-.25	.04
3. Orientation Toward MBO				.10	.05	-.02	.12
4. Performance-Reward Association					-.02	-.16	.02
5. Subordinate's Influence						-.16	.20
6. Satisfaction With Job							.28
7. Perceived Success							

Notes: 1) These differences are calculated as the correlation for a First Administration Variable (X_1) with a Second Administration Variable (Y_2) minus the correlation of the First Administration Variable (Y_1) with the Second Administration Variable (X_2) or $r_{X_1Y_2} - r_{X_2Y_1}$

2) $r_{z_2-z_1} = .19$

3) Significant Difference (Δr) at
.20 level = .24
.10 level = .31
.05 level = .37
.01 level = .44

Table F-6 .-- Matrix of Differences Between Cross-Lagged Panel Correlations for Firm B "Low Cool" Managers

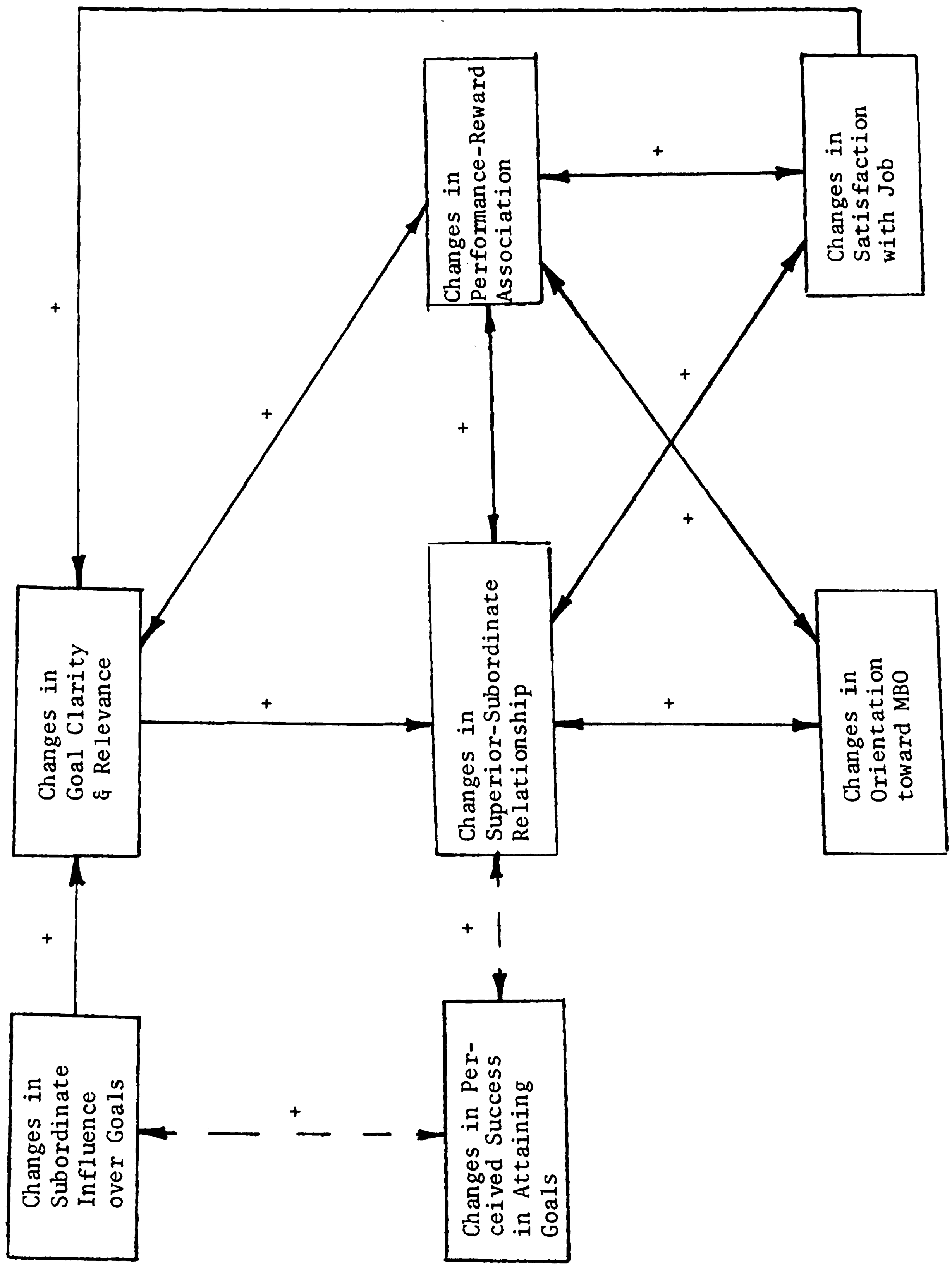
First Administration	Second Administration 1	2	3	4	5	6	7
1. Superior-Subordinate Relationship		-.02	.25	-.15	-.07	-.32	-.13
2. Goal Clarity and Relevance			-.12	-.15	-.16	-.17	-.26
3. Orientation Toward MBO				-.18	-.04	-.31	.12
4. Performance-Reward Association					.16	-.14	-.06
5. Subordinate's Influence						.05	.04
6. Satisfaction With Job							-.05
7. Perceived Success							

Notes: 1) These differences are calculated as the correlation for a First Administration Variable (X_1) with a Second Administration Variable (Y_2) minus the correlation of the First Administration Variable (Y_1) with the Second Administration Variable (X_2) or $r_{X_1Y_2} - r_{X_2Y_1}$

2) $r_{z_2-z_1} = .19$

3) Significant Difference (Δr) at
.20 level = .24
.10 level = .31
.05 level = .37
.01 level = .44

Figure F-1.-- Effects Diagram of Change Relationships in the MBO Behavioral System for Firm B "High Cool" Managers



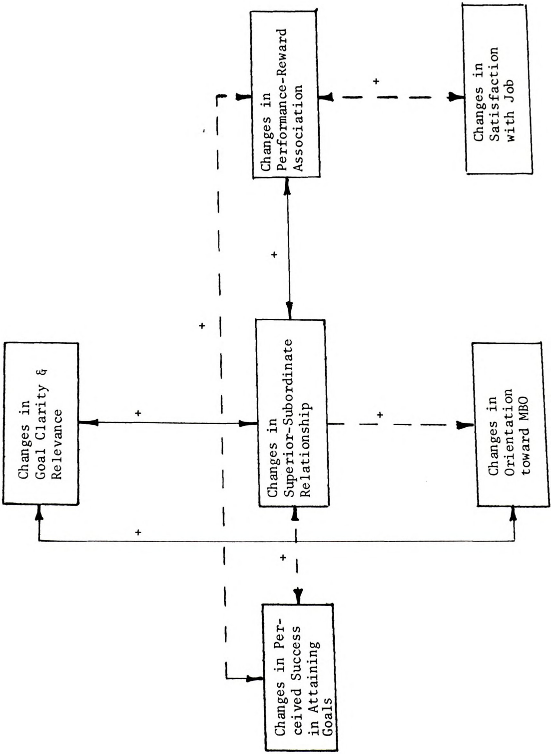
number of significant relationships between system variables is much less for the Firm A managers. A part of this difference is attributable to the larger sample size for the Firm B managers. It should be noted that two of the five significant relationships in the effects diagram for Firm A are negative, while all the relationships for Firm B are positive.

Another difference between the Firm A and Firm B managers is that of the "driver" variable. Clearly, for the Firm A managers, changes in Goal Clarity and Relevance cause changes in the Relationship between Superior and Subordinate. While this same causal relationship is found in the sample of Firm B managers, the Changes in Goal Clarity and Relevance variable is "driven" by the variables, Changes in Subordinate Influence over Goals and Changes in Satisfaction with the Job. The net result of these causal differences is that the driver and output variables have reversed themselves for the two samples of "high cool" managers.

Effects Diagram - "Low Cool" Managers

In the original study, the effects diagram for the Firm A managers who rated themselves as "low cool" on the Ghiselli dimensions was the same as the effects diagram for the total sample of Firm A managers. This is not the case for the Firm B "low cool" managers (Figure F-2). There are three significant dynamic (corrected) correlation coefficients at the .05 level with four additional coefficients significant at the .10 level or better. To assess causal priorities, it is required to search the matrix of differences between cross-lagged panel correlations at a significance level of .20. Since only one asymmetrical relationship is found at that level (variable 1 with

Figure F-2.-- Effects Diagram of Change Relationships in the MBO Behavioral System for Firm B "Low Cool" Managers



variable 3), it was determined that the relationships for the "low cool" managers were mutually reinforcing.

The relationships established in the effects diagrams for the managers of Firm B were found to be moderated by the Ghiselli dimensions--perceived occupational level, initiative, self assurance, and intelligence. This finding replicates a similar finding for the managers of Firm A.

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