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THE DETERMINANTS OF MANAGEMENT
ACCOUNTING SYSTEM DESIGN IN PROFIT CENTERS

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Management accounting research has focused considerable attention on the functioning and design of management accounting and control systems. Two distinctly different approaches to the conceptual formulation of the problems of management accounting and control system choice dominate the research literature. The information evaluation approach brings the analytical rigor of statistical decision theory and microeconomic optimization techniques to bear on the system's choice. The principal determinants of management accounting and control system choice in the information evaluation paradigm are the utility functions of the information evaluator and decision maker and their expectations of the probability distributions over future uncertain events. To use this approach in systems design requires that the information evaluator have knowledge of the decision maker's utility function. Hence, not only has the information evaluation approach spawned an extensive theory, it has also encouraged important parallel research in the growing behavioral literature which attempts to understand the ways in which human decision makers use and process management accounting information (Hilton, 1980; Libby, 1981). In contrast to the information evaluation approach, attempts to develop contingency theories of management accounting view management accounting and control systems as closely interwoven with organizational design. Since organizational design depends on effective responses to organizational variables such as size and technology, and environmental variables such as competition and dynamism, effective design of management accounting and control systems must also depend on such contingent variables.

The research reported in this article consists of empirical tests of the reasonableness of the information evaluation approach versus the contingency theory approach conducted with the top management of 44 profit centers from

five large U.S. corporations. Briefly, the results indicate that management's style associates more closely with management accounting and control system design than the profit center's contingency variables. However, the joint effect of management style and contingency variables overwhelms the effect of either management style or contingency variables alone.

The remainder of this paper presents the theory underlying the main research hypotheses, as well as the resulting hypotheses, in greater detail; explains the research methodology adopted to empirically collect evidence related to these hypotheses; examines the results of the statistical tests used in the data analysis; and draws some conclusions concerning the dominant research paradigms in management accounting and their complementarity.

I. Theory

Information Evaluation in an Organizational Setting

The theory of information evaluation (Demski, 1972, 1980; Feltham, 1972; Demski and Feltham, 1976) specifies a closed set of items which must be known to the person choosing an information system. The role of the management accountant (information evaluator) under this theory is to choose the optimal information system, conditioned and his/her knowledge, which maximizes expected utility. More precisely, the management accountant chooses a specific information system (η) from a set of possible alternative systems (H), conditioned on predictions (1) of the signals ($y \in Y$) which the alternative systems will generate, (2) of the actions ($a \in A$) which the decision maker will choose upon receipt of the signals, and (3) of the future states of nature ($s \in S$) which will occur. Each combination of η , y , a , and s generates an expected utility measure for the management accountant, and he/she chooses the information system, η^* , which maximizes his/her expected utility. A formal

utility. A formal representation of this choice process is

$$E(U|\eta^*) = \max_{\eta \in H} \sum_{y \in Y} \sum_{a \in A} \sum_{s \in S} U(s, a, y, \eta) \phi(s|y, \eta) \phi(a|y, \eta) \phi(y|\eta). \quad (1)$$

Under this theory, then, the management accountant must assess these probability functions:

- (1) $\phi(s|y, \eta)$ = the probability that state s will occur, given that signal y is produced by information system η ;
- (2) $\phi(a|y, \eta)$ = the probability that the decision maker will choose action a once he/she has received signal y from information system η ;
- (3) $\phi(y|\eta)$ = the probability that information system η will produce signal y .

The first probability assessment by the management accountant depends on his/her knowledge of the world, and the third on his/her knowledge of the technical nature of the information system. The second probability assessment, however, depends on actions taken by a decision maker outside the control of the management accountant. In the simplified two-person world in which the theory of information evaluation has developed, the management accountant's degree of knowledge of the decision maker's decision model has important implications for the probability that a given signal from a given information system will generate a given response. If the management accountant has perfect knowledge of the decision maker's model for choosing actions, then $\phi(a|y, \eta)$ will be either 1 or 0 for every $a \in A$, given $y \in Y$ and $\eta \in H$ (Ashton, 1981). As Demski points out (1972, pp. 111-12), additional imperfect knowledge of the decision maker's choice model can reduce uncertainty in the management accountant's assessment of which information system to provide. In the information evaluation approach to information system choice, then, the management accountant can enhance management accounting and control system choice by learning about the decision maker's decision processes (Uecker, 1978).

While the theory of information evaluation has focused on situations where there is a single information evaluator and a single decision maker, extension of the basic results into more realistic organizational settings requires the conceptualization of decision style as characteristic of a management group in an organizational unit rather than as a personal characteristic. Although the mathematical elegance of the theory is sacrificed in an organizational setting because of the inability of expected utility theory to aggregate utility functions, characterization of management decision makers in terms of the dominant management style of the decision makers within the organization approximates the characterization of the decision maker as conceived in the theory. That is, if the theory of information evaluation accurately portrays the role played by management accountants within organizations, then their choices of information systems will depend (among other things) on the dominant management style of decision makers within the organizational unit. More formally, management accountants within a particular organization set the level of their services according to some function of their perception and understanding of the management style within that organization:

$$L(\text{MACS}) = f(\text{MS}), \quad (2)$$

where

$L(\text{MACS}) \equiv$ level of management accounting and control system functioning,

$\text{MS} \equiv$ management style, and f is a function mapping MS into $L(\text{MACS})$.

As an example, an organization with a participative management style will require management accounting functions which support the mutual participation of a large number of interested parties from different functional backgrounds. The demand for management accounting information in this type of organization

will include specific recognition of the divergent tasks and purposes to which the information will be put while, at the same time, striving to serve as a focus for organizational interdependence. An organization with a nonparticipative management may put fewer strains on the provision of management accounting functions, because their design will have to take into account the tasks and purposes of only one (or a few) managers.

In summary, the theory of information evaluation emphasizes the need for the management accountant to know about the decision processes of the organizational decision maker(s) prior to choosing (designing) the management accounting and control system. Although first-order representation of organizational decision makers' processes is not possible (Arrow, 1953), second-order representations, based on characteristics of the dominant management style, may be useful substitutes for utility functions in real organizational settings. Such characteristics of management style that have appeared in the management literature include management's attitude towards risk taking, optimization, participation, authority, and flexibility (Khandwalla, 1972, Chapter 11). Accordingly, an expanded version of the dependence of management accounting functions on management style treats the level of management accounting within an organization as an increasing function of the degree of sophistication of management style:

$$L(\text{MACS}) = f(R, O, P, A, F) \quad (3)$$

where

$$\frac{\partial f(R)}{\partial L}, \frac{\partial f(O)}{\partial L}, \frac{\partial f(P)}{\partial L}, \frac{\partial f(F)}{\partial L} > 0, \quad (3.1)$$

$$\frac{\partial f(A)}{\partial L} < 0, \quad (3.2)$$

and

R = extent of risk-taking behavior,

O = extent of optimizing behavior,

P = extent of participative behavior,

A = extent of authoritative behavior,

F = extent of flexible behavior, and

L(MAS) = the level of management accounting functions.

The first hypothesis under investigation in this research relates the level of management accounting and control functions to the decision styles of the managers who are users of these functions:

H₁: The contribution made by management accounting to management functions of an organizational unit is an increasing function of the sophistication of the unit's management style.

Contingency Theories in Management Accounting

In contrast, recent research developing contingency theories of management accounting (Bruns and Waterhouse, 1975; Watson, 1975; Hayes and Watson, 1976; Gordon and Miller, 1976; Hayes, 1977; Waterhouse and Tiessen 1978; and Otley, 1980) views the effective design of the management accounting and control system as highly interdependent with organizational design. Both organization design and management accounting and control system design are contingent on a set of organizational and environmental variables, including size, technology, competition, dynamism, homogeneity, hostility, and interdependence. The basic premise of these contingency theories is the proposition that although there may be numerous effective designs that fit the contingency variables, not all designs are necessarily equally effective (Ford and Slocum, 1977).

The contingency theories of management accounting emphasize organizational and environmental variables as determining the management accounting functions

(Gordon and Miller, 1976; Waterhouse and Tiessen, 1978; San Miguel, 1977).

Thus, in designing a management accounting and information system for an organization, the salient aspects of organizational life are those that exist at the level of organizational context rather than at the level of management style. Indeed, a strict contingency theory view would treat management style as depending on organizational context. That is, given a certain organizational context as described by the contingency variables, a distinctive management style will develop to deal effectively with that organizational context. Contingency theory focuses on the relationship between the current state of the organization's context and future probable states.

The following is a more formal statement of the contingency theories:

$$L(\text{MACS}) = f(S, T, H, C, G, I, D), \quad (4)$$

where

$$\frac{\partial f(S)}{\partial L}, \frac{\partial f(T)}{\partial L}, \frac{\partial f(H)}{\partial L}, \frac{\partial f(C)}{\partial L}, \frac{\partial f(I)}{\partial L}, \frac{\partial f(D)}{\partial L} > 0, \quad (4.1)$$

$$\frac{\partial f(G)}{\partial L} < 0, \quad (4.2)$$

and

S = size,

T = technological complexity,

H = hostility,

C = competition,

G = homogeneity,

I = interdependence, and

D = dynamism.

This statement emphasizes the dependence of the level of an organization's management accounting and control functions on the increasing complexity of organizational (S, T) and environmental (H, C, G, I, D) variables.

For example, both Khandwalla (1972) and Otley (1978) examined the effects of competition in the operating environment on the use of management controls. Khandwalla found that the intensity of competition faced by the firm increased the sophistication of the accounting and control systems used by the firm. In addition, price competition affected accounting controls differently than product competition in manufacturing firms. Otley distinguished between two types of operating environments--one in which it was easy to show accounting profits and one in which it was difficult--and found that senior managers used budgeting information differently when evaluating managerial performance in the two situations.

In addition, Hayes (1977) studied the implications of three major contingent variables for organizational subunit performance evaluation. He hypothesized that organizational performance depends on subunit interdependence, environmental relationships, and instrumental variables strictly internal to the subunit. Thompson's (1967) categories of pooled, sequential, and reciprocal interdependence serve as the basis of his subunit interdependence variable. He structures environmental relationships according to stable-dynamic and homogeneous-heterogeneous dimensions. Instrumental variables focus on the nature of tasks, types of people, and the quantifiability of subunit functions. Hayes's independent variables correspond closely to the organizational variables (technology and size) and environmental variables (homogeneity, interdependence, competition, hostility, and dynamism) common to contingency theories. Although his conclusions have been debated on methodological grounds (Tiessen

and Waterhouse, 1978; and Hayes, 1978), his data appear to support the hypothesis that the effectiveness of organization subunits is explained by combinations of the contingent variables which differ considerably in their complexity. In his discussion, Hayes suggests that these differences in organizational contextual complexity should lead to differences in the ways performance is measured and evaluated. In a responsibility accounting context, more complex subunits will require a larger number of independent performance evaluation criteria in order to capture the complexity.

The second hypothesis investigated in this research relates the level of management accounting and control functions to the technological and environmental context in which they exist:

- H₂: The contribution made by management accounting to management functions of an organizational unit is an increasing function of the complexity of the unit's operating context.

Theories of Management Style and Operating Context Interaction in Management Accounting

Some contingency theorists have included both elements of management style and operating context in their conceptual frameworks. Bobbitt and Ford's (1980) review of the organizational literature and possible alternative developments from this combined perspective covers a wide range of organizational relationships between management style and operating context, though they appear to prefer an approach in which the management style of the decision maker is seen as limiting the possible structural responses in a given organizational operating context. In the management accounting and control system literature on contingency theories, Gordon and Miller (1976) specifically consider management style as one of the variables on which the MACs depends. In a more recent review article, however, Otley (1981) does not explicitly

consider the possibility that management accounting may be a joint function of operating context and management style variables. Indeed, not only has there been little theoretical concern for the possibility that such a joint relationship between management style and operating context determines the management accounting functions, there has also been little empirical investigation into this possibility.

Following Bobbitt and Ford (1980), three distinctly different possibilities arise as to the relationship of management style and operating context considered together as a determinant of management accounting. To appreciate these different possibilities, consider the potential time series relationships among operating context complexity (OC), management style sophistication (MS), and the level of the management accounting and control system (MACS) from the point of view of organizational evolution (Weick, 1969). The organizational evolution perspective views the organization as adapting to its environment as it progresses through time. In the context of MACs, then, there are three different time series relating OC and MS to MACS:

$$OC_1 \longrightarrow MS_2 \longrightarrow MACS_3, \quad (5.1)$$

$$MS_1 \longrightarrow OC_2 \longrightarrow MACS_3, \text{ and} \quad (5.2)$$

$$(MS_1 \longleftrightarrow OC_1) \longrightarrow MACS_2, \quad (5.3)$$

where the subscripts refer to time periods and the arrows refer to the direction of causality. The first time series indicates that the internal adaptation in MACS lags behind the internal adaptation in MS, which, in turn, lags changes in the operating context. The first time series depicts management in a reactive mode with respect to operating context. The second time series projects management as being proactive with respect to the operating context,

such that changes in this internal MS cause changes in the OC, which, in turn, lead to changes in the MACS. The third time series stipulates a simultaneous interaction change effects between MS and OC, that together lead to changes in the MACS as the MACS adapts to changes in the joint effects of MS and OC.

Note that the three time series are meant to generate insight into the potential organizational process determining MACS rather than to indicate literal truth. For example, there are probably feedback effects going counter to the causation sign in both (5.1) and (5.2), but the theory only attempts to point to the causal direction with the greater importance. Hence, although management may be proactive on managing one or more dimensions of the operating context, in time series (5.1) the relative importance of these dimensions is low as compared to others. Time series (5.2) and (5.3) may be interpreted similarly.

Also note that all three time series may be perfectly viable general strategic alternatives within the context of contingency theory, but they should not necessarily be substitutable for each other in a given organization if contingency theory has falsifiable content.

Given these two notes and the time series relationships, some inferences concerning the association between MACS and OC, MACS and MS, and MS jointly with OC and MACS are possible. In (5.1), MS should associate more closely with MACS than OC, since it is closer in time to the adaptations in MACS. In (5.2), OC should associate more closely with MACS than MS since it is closer in time to the adaptation in MACS. In (5.3), OC and MS should associate equally with MACS since they adapt to each other in two-way feedback (Ashton, 1979) at the same point in time.

Although a fourth possibility--that MACS causes MS and OC--does exist, such a relationship would be difficult to imagine, in that management

accounting usually plays informational roles within organizations, reacting to management needs. In spite of this, it is conceivable that the MACS may play fundamentally different attention-directing roles in the three different time series. In time series (5.1), the informational role would emphasize managerial coordination, control, and decision making with respect to management information requirements. On the other hand, the MACS in time series (5.2) would direct management attention to the management of concerns and people outside of their own organization. Demands on the MACS in times series (5.3) would be balanced between an internal and an external orientation in the MACS. Understanding the appropriate time series relationship between MS and OC could lead to important differences in designing the MACS for a particular organization.

Considering OC and MS as being composed as in previous sections of the paper, then the level of MACS may be expressed as

$$L(\text{MACS}) = f_1(g_1(\text{OC}, \text{MS}), \text{OC}), \quad (6.1)$$

$$L(\text{MACS}) = f_2(g_2(\text{OC}, \text{MS}), \text{MS}), \quad (6.2)$$

$$L(\text{MACS}) = f_3(\text{OC}, \text{MS}), \quad (6.3)$$

which correspond respectively to (5.1), (5.2), and (5.3). Maintaining the convention that OC stands for operating context complexity and that MS stands for management style sophistication, g_1 is a function specifying the dependence of MS on OC and g_2 is a function specifying the dependence of OC on MS; then,

$$\frac{\partial f_1(g_1(\text{OC}, \text{MS}))}{\partial L}, \frac{\partial f_1(\text{OC})}{\partial L} > 0, \quad (6.1_a)$$

$$\frac{\partial f_2(g_2(\text{OC}, \text{MS}))}{\partial L}, \frac{\partial f_2(\text{MS})}{\partial L} > 0, \quad (6.2_a)$$

$$\frac{\partial f_3(\text{OC}, \text{MS})}{\partial L} > 0. \quad (6.3_a)$$

The third hypothesis under investigation in this research relates the level of management accounting and control functions to the interaction of the decision styles of the managers who use these functions and of the operating context within which the organization under consideration exists. Because of the potential interactive relationships among the variables, there are three competing hypotheses:

- H_{3a}: The contribution made by management accounting to management functions of an organizational unit is an increasing function of the interaction of the sophistication of the unit's management style with the complexity of the unit's operating context and an increasing function of the unit's operating context complexity.
- H_{3b}: The contribution made by management accounting to management functions of an organizational unit is an increasing function of the interaction of the sophistication of the units management style with the complexity of the units operating context and an increasing function of the unit's management style sophistication.
- H_{3c}: The contribution made by management accounting to management functions of an organizational unit is an increasing function of the interaction of the sophistication of the unit's management style with the complexity of the unit's operating context.

Theoretical Summary

The five hypotheses in the preceding sections relate management accounting to the dominant research paradigms of information evaluation and contingency theory. Functional notation points out that the theoretical content pertains principally to the first derivatives of the function relating MACS to MS and OC. The implication of the theory suggests that the range of the level of MACS functioning within an organizational unit is a strictly increasing function over the domains of MS and OC. Although one purpose of the research reported here is to differentiate among the relative merits of the five

hypotheses, a second purpose of equal importance is to understand more about the shapes of these functions. More precisely, are there points of inflection where the first derivative of the L(MACS) function is 0? Is this function stable across organizational units, or does it depend on the characteristics of the organizational unit?

The research methodology used to investigate the relative merits of the five hypotheses and its results are reported in the next sections of the paper, along with some tentative responses to the questions posed above. These responses are tentative in that they have been derived from the data collected. At this point, they require further refinement and research testing.

II. Methodology

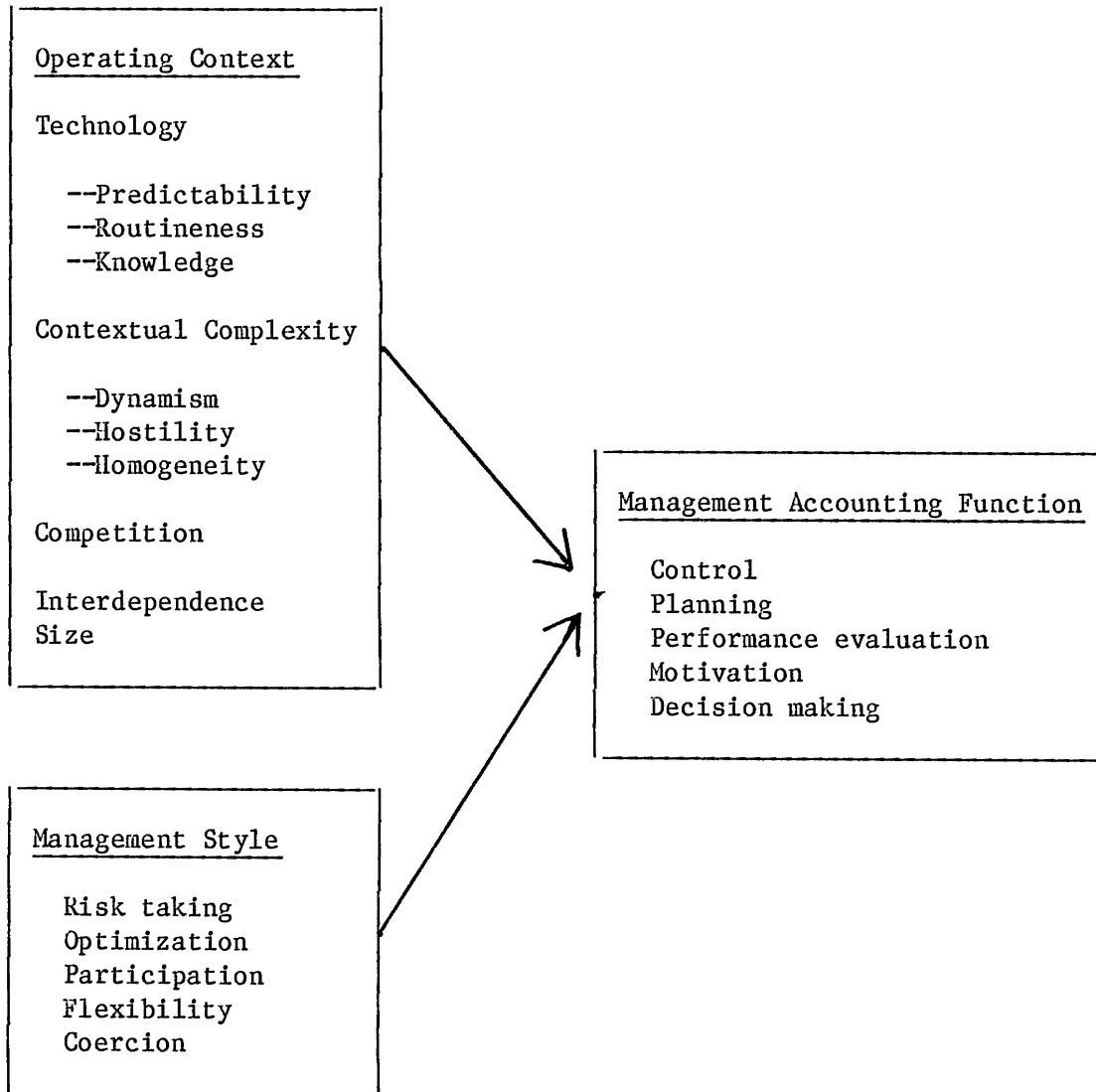
Conceptual Framework

The conceptual framework derived from the literature and discussed in the preceding sections is presented in Figure 1. The basic tenet of the conceptual framework posits that management accounting is a joint function of operating context and management style. The components of management style include managerial dispositions toward risk taking, optimization, participative management, flexibility in decision making, and coercion in the use of authority. The operating context variable consists of aspects of technology, contextual complexity, competition, interdependence, and size. The management accounting variable depicts the degree to which management accounting information is used to assist management with their organizational tasks of planning, control, performance evaluation, motivation, and decision making.

Consistent with equations (3), (3.1), and (3.2), management style is scaled according to increasing sophistication, so that higher scores on the

FIGURE 1

Conceptual Framework



index of the underlying components imply higher degrees of sophistication than lower scores. Likewise, operating context is scaled to capture increasing complexity according to the signs of the first derivations in equations (4.1) and (4.2). Since at this time there is no general theory specifying the relationships of the components to each other in constructing the overall indices of management style and operating context, a linear additive relationship has been assumed in operationalizing the tests that follows.

The Unit of Analysis

The logical development of the conceptual framework imposes restrictions on the organizational units which should be considered in exploring the hypothesized relationships. First, the organizational units must possess enough autonomy within their companies' management hierarchy to legitimately possess a differential operating context and management style. Second, these units should be small enough so that their operating context and management style are reasonably homogeneous throughout the organizational unit. Attempts to measure the operating context and management style of a conglomerate would very likely reveal information about the headquarter's staff but not about the operating contexts and management styles of the conglomerate's operating divisions, which may vary drastically from each other as well as from those of the headquarter's staff. Third, since the conceptual framework relates management accounting to management style and operating context within an organizational unit, the organizational units included in the study should also possess management accounting departments with enough autonomy to adapt to characteristics of the organizational unit. Fourth, due to the implicit assumption in the conceptual framework that the actual configuration of management accounting functions represents some form of effective and efficient alignment of

management accounting with respect to operating context and management style, organizational units in the study should come from reasonably successful companies with an espoused commitment to management accounting functions. These four conditions guided the selection of the organizational units included in the study.

To satisfy the first three conditions, organizational units from the participating companies had to qualify as profit centers in their companies. In choosing the profit centers for the study, contacts from the participating companies assisted in the interpretation of the term "profit center" for application to their companies because "profit center" refers to different types of organizational units in different companies. Use of a specific definition and careful selection of the profit centers increases the probability that the organizational units studied are comparable on the basis of the first three conditions. Specifically, all the organizational units were chosen because they were among the companies' smallest units with a distinguishable management style and operating context. They had autonomous managements and differentiated business tasks within the companies, as well as management accounting groups which were functionally able to adapt to the informational demands of the profit centers.

Satisfaction of the fourth condition requires companies that have been successful in their business operations. To satisfy this requirement, companies supplying profit centers for the study were drawn from large, publicly traded companies which have operated viably for a number of years. The five companies¹ providing profit centers consisted of a major conglomerate, a

¹The companies participating in the research requested that they not be identified by name in the written report. Four are from the top Fortune 100 firms. The fifth is the largest firm of its kind in Ohio.

major diversified steel-maker, a major chemical producer, a major agricultural supplier, and a major oil company. These companies provided profit centers engaged in light and heavy manufacturing, marketing, insurance, aerospace technology, industrial production, consumer production, farm supply, and administration.

Scales and Questionnaire Design

This section analyzes and discusses the development of the scales and questionnaire statements used to collect the cognitive perceptions of expert judges about the characteristics of operating context, management style, and management accounting in their profit centers. The relationship between the questionnaire items and the conceptual categories and a discussion of validity and reliability issues constitute the substance of this discussion. Appendix A consists of a copy of the questionnaire used in the study.

The scale used to measure the dependent variable, the contribution of management accounting to management functions, was defined for the respondents in the questionnaire itself. A definition of each point on the scale accompanied the questionnaire items in order to anchor the scale for the respondents. The response sheet for the questionnaire restricted responses to the five points in the scale, enhancing the interval nature of the scale. The underlying conceptual scale runs continuously from 1 to 4, with higher ratings indicating more involvement in the management function by management accounting and lower ratings indicating less involvement.

Stratification of the principal conceptual constructs of management accounting contributions to the functions of profit center management into performance valuation, motivation, planning, decision making, and control components strengthens the validity of the questionnaire. The construction of

individual items within the five components considers both the differentiation among various aspects of the components and the collection of multiple responses to the same item statement. Differentiation among various aspects of the components increases the validity of the questionnaire insofar as it enables fuller investigation of the domain of the conceptual construct. Requiring the respondents to rate the same (or similar) aspect more than once creates the basis for conducting post hoc reliability tests, where reliability refers to the internal consistency of the respondents from each profit center. In addition, multiple questionnaires from each profit center should increase the validity of the measurements by averaging of the questionnaires' responses and should, at a higher level, provide insight into the reliability of the responses. If the questionnaire actually measures what it purports to measure, then one would expect different respondents from the same profit center to respond similarly. Relatively small within-profit-centers variances for questionnaire items would indicate that the respondents rate the characteristics in a similar manner.

The segments of the questionnaire related to operating context reflect the content and form of questionnaires used by previous researchers, particularly Lawrence and Lorsch (1967), Lorsch and Allen (1973), Lynch (1974), Van de Ven and Delbecq (1974), Khandwalla (1977), and Vancil (1979). The questionnaire segments relating to management style reflect adaptations of questionnaires used by Khandwalla (1977) and Rahman and McCosh (1976).

Like the scales used for measuring the dependent variables, the scales for the independent variables are anchored at each point by common English modifiers that should carry similar meanings to different respondents. Restricting the responses to one of the integers represented also aids in

constructing a weak interval scale (Upshaw, 1968, p. 76). Stratification of the conceptual constructs of operating context and management style into components, and further stratification of the components into specific aspects of the components, strengthens the questionnaire's validity. Requiring responses to the same items more than once generates the data necessary to conduct post hoc reliability tests. Multiple responses from the profit centers, as in the case of the dependent variable, increases the validity and provides a higher level test of reliability.

In the development of the questionnaire items and formats, executives from one of the companies participated in a pretest, which led to revising the wording of some items in order to clarify them and to put them into words more familiar to managers. The pretest also led to the format of the final questionnaire (see Appendix A). The executives participating in the pretest believed the questionnaire items flowed most logically and naturally in the order presented in the final questionnaire. At least one executive from the other four companies also reviewed the questionnaire prior to its distribution to the respondents. These further reviews generated no further changes in the questionnaire format or wording. Individual questionnaire items appear in random order within scale categories, except in cases where the semantics of the items require consecutive placement for clarity.

Questionnaire Returns

The companies' executive contacts specifically identified respondents from each participating profit center. These respondents received questionnaires from the researcher and returned them directly to the researcher, using a self-addressed, stamped envelope provided as part of the questionnaire package.

Table 1 summarizes the responses to the questionnaire by the five companies. Identification of the companies appears by number across the top of the table. The number of questionnaires returned by the profit centers appears in the first column. The numbers within the matrix represent the number of profit centers in the companies returning the specified number of questionnaires. In total, 45 profit centers agreed to participate in the study. Of the 45, 44 returned questionnaires, for a 97.78 percent response rate. Participating profit centers agreed to return two or more questionnaires completed by different individuals. Of the 119 questionnaires sent, 103 were returned, for a questionnaire response rate of 86.55 percent. The high response rates indicate that the research questionnaire generated interest on the part of the procedures for choosing profit centers and respondents were effective.

Since the questionnaire task involved the respondents' cognitive perception of aspects of operating context, management style, and management accounting functions, several steps were taken to ensure that respondents qualified as expert judges with respect to their profit centers. In the research context, a respondent had to satisfy two conditions to qualify as an expert judge. First, the respondent had to be a member of the controller's department or of one of the other management groups within the profit center. Second, the respondent had to have been a member of the profit center's management for at least six months in order to ensure an informed perception of the profit center's characteristics.

Questionnaire item 122, which relates directly to the expert judge issue, asked the respondent to indicate the length of his service in the profit center. Table 2 summarizes the responses to this item.

TABLE 1

Summary of Questionnaire Responses

Note: The numbers in the body of the table show the number of profit centers responding with a given number of questionnaires for a given company.

<u>Number of Questionnaires</u>	Company					<u>Totals</u>	
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>Profit Centers</u>	<u>Questionnaires</u>
0	-	1	-	-	-	1	0
1	1	2	-	3	1	7	7
2	4	2	6	10	-	22	44
3	3	5	1	-	-	9	27
4	4	-	-	1	-	5	20
5	<u>1</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>5</u>
Profit Centers	<u>13</u>	<u>10</u>	<u>7</u>	<u>14</u>	<u>1</u>	<u>45</u>	<u>103</u>
% Profit Centers Responding	<u>100</u>	<u>90</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>97.78</u>	
% Questionnaires Returned	<u>89</u>	<u>70</u>	<u>100</u>	<u>93</u>	<u>100</u>	<u>86.55</u>	

TABLE 2

Response to Item 122
(years of service)

	1 <u>Less than</u> <u>1 year</u>	2 <u>1-2 years</u>	3 <u>2-3 years</u>	4 <u>3-5 years</u>	5 <u>More than</u> <u>5 years</u>	<u>Total</u>
Number	14	16	12	8	51	101
Percent	13.86	15.84	11.88	7.92	50.50	100

Mean of item 122 = 3.65
Standard deviation = 1.54

Analysis of the response to item 122 indicates that 86.14 percent of the respondents had worked in their profit centers more than one year. Significantly, 50 percent of the respondents had worked in their profit centers more than five years, indicating that a fairly large proportion of the respondents were extremely familiar with their profit centers.

All responses to item 121 indicated adequate management position. Thus the respondents to the questionnaire satisfy both conditions: that they be high enough in management and employed long enough in their profit centers to be knowledgeable about its management style, operating context, and management accounting functions.

Item 123 investigated the ease of difficulty experienced by the respondents in identifying the organizational unit to which the items applied. If respondents experienced difficulty in bounding their profit centers, then there would be a serious question about the suitability of the respondents' organizational unit for the purposes of this research. Table 3 summarizes the responses to item 123.

TABLE 3

Ease in Identifying Organizational Unit

	1	2	3	4	5	
	<u>Very Easy</u>	<u>Easy</u>	<u>Neither Easy nor Difficult</u>	<u>Difficult</u>	<u>Very Difficult</u>	<u>Total</u>
Number	27	35	30	7	2	101
Percent	26.73	34.66	29.70	6.93	1.98	100

Mean of item 123 = 2.22
Standard deviation = .96

Analysis of the responses to item 123 reveals that 91.09 percent of the respondents experienced no appreciable difficulty in identifying the organizational unit about which they were responding. The care taken in identifying the participating profit centers was effective, in that managers familiar with the profit centers found the questionnaire items to be applicable to their profit centers. This result also constitutes reassurance from a content validity perspective, because the respondents have affirmed that the questionnaire items constitute legitimate questions or statements about their profit centers.

Aggregation Methods

The data aggregation led to an average value for each profit center on 17 variables. The 17 variables include five each for management accounting and management style and seven for operating context. Figure 2 list these variables and the number of questionnaire items for each of them.

FIGURE 2

Operational Variables in the Study

<u>Management Accounting</u>	<u>Management Style</u>	<u>Operating Context</u>
1. Motivation (5)	1. Optimization (5)	1. Interdependence (3)
2. Planning (11)	2. Coercion (5)	2. Hostility (7)
3. Control (9)	3. Risk taking (5)	3. Dynamism (10)
4. Decision making (11)	4. Flexibility (7)	4. Homogeneity (4)
5. Performance evaluation (19)	5. Participation (4)	5. Competition (5)
		6. Technology (9)
		7. Size (1)

The steps leading to the average values consisted of:

1. Scaling all questionnaire items within variables consistently from low to high; the one exception was coercion, which was scaled with low values corresponding to high coercion and high values corresponding to low coercion.
2. Finding the means and standard deviations of each variable by each respondent. Missing values were omitted from the denominator in calculating these descriptive statistics under the assumption that the absence of a response to an item implied that the item was not applicable to the profit center in the respondent's opinion.
3. Finding the means and standard deviations of each variable by aggregating across respondents within a profit center. The same procedure as in point 2 was followed with regard to missing values.

The reason for using the aggregated mean as the variable index is that it summarizes the pertinent information in the data. Since the design of the questionnaire items specifically considered different aspects of the variables, the inclusion of all items in the final summary statistics for the dependent and independent variables captures all the information in the data. Averaging over a number of items related to the same variable also enhances the interpretation of differences, in that the summary statistic should have less random error associated with respondents' different perceptions of the variables' indices.

Cluster Analysis by the Independent Variables

The next step in the data analysis was the use of cluster analysis to group the 44 profit centers into similar classes according to management style and operating context. Although the creation of a priori groups according to specified cut-off scores on the management style and operating context variables is theoretically possible, this approach is inherently arbitrary and potentially misleading, because the groups may bear no relationship to the characteristics of the underlying data. An alternative data-based approach to classifying profit centers is to form groups on the basis of clustering techniques. (For complete discussions of cluster analysis see Anderberg [1973], Hartigan [1975], Duran and Odell [1974], and Everitt [1974].) These heuristic algorithms partition objects into optimally homogeneous groups on the basis of the empirical similarity among the objects as expressed in the responses.

Cluster analysis techniques are useful tools for data analysis in situations where there is a large set of multivariate data and no strong a priori reasons to group the data in any given way. The cluster analysis techniques search for natural groupings of the data so that all objects or individuals assigned to the same cluster are similar, while those objects or individuals assigned to different clusters are different. The various techniques for cluster analysis strive to optimize distance functions, which differ from technique to technique. Thus, the choice of the technique used to achieve the cluster analysis is an important issue.

Milligan (1980) evaluated hierarchical and nonhierarchical methods of clustering according to how they reconstructed known clusters in a geometric space which exhibited the properties of internal cohesion and external isolation. The addition of outlier points, error perturbation of the distances,

addition of random noise dimensions, use of non-Euclidean distance measures, and standardization of the dimensions were ways Milligan hid the true cluster structure. His results showed that the hierarchical methods respond differently to the type of error introduced and that the nonhierarchical methods perform poorly in recovering the true clusters when random seed points start the methods. However, he found two alternative starting procedures for nonhierarchical methods which enhanced their performance. Milligan concluded that the most robust approach with respect to the types of errors examined is to use a K-means algorithm with starting centroids generated by a hierarchical method. Accordingly, the approach adopted by this research is to generate starting centroids using a hierarchical method and to use these centroids as seeds to start the Jancey nonhierarchical algorithm.

The hierarchical methods define the distance between groups as a Euclidean measure of distance. At each step in the grouping procedure, the methods fuse individuals or groups of individuals which are closest to each other until the desired number of clusters is obtained. Once an observation becomes a member of a group, there is no provision for relocating that observation later in the algorithm.

Jancey's method partitions the objects or individuals into clusters by optimizing a predefined criterion function. It differs from the hierarchical methods in that it allows the relocation of objects or individuals during the course of the clustering, so that poor early partitions can be corrected at a later stage. Following the Milligan results, the centroids generated from a hierarchical method will initiate the clusters. The Jancey method minimizes the trace of the pooled within-groups matrix of sums of squares and cross products. Intuitively, the method relocates objects or individuals in groups

until all the objects or individuals are closer to their own cluster centroid than to the centroid of any other clusters. Jancey's method uses a Euclidean distance measure to quantify the distance between objects or individuals.

The procedure outlined above, using a hierarchical method to generate centroids for the Jancey nonhierarchical method, was followed in arriving at the clusters. Since there are numerous different hierarchical cluster analysis techniques, the profit centers' means were run through several techniques. Ultimately, the technique with the highest point biserial goodness of fit coefficient was used to generate the centroids for the Jancey method.

The complete linkage method generated a three-cluster solution to the cluster analysis of operating context, with a point biserial goodness of fit coefficient of .412. This coefficient was compared to the means of a random distribution of 44 objects with seven variables each; the random nature of this distribution means it has no discernible cluster structure. The null hypothesis of no difference between the point biserial goodness of fit statistic for the three-cluster solution and the point biserial goodness of fit statistic for a random distribution can be rejected at the .10 level. This means that the three-cluster solution generates clusters which are statistically distinct from each other. The centroids for the three clusters became seed points for starting the Jancey algorithm on the operating context data. The three-cluster solution using the Jancey algorithm gave a point biserial goodness of fit statistic of .497, which is higher than the same statistic for the complete linkage method. The two-stage approach to the cluster analysis resulted in some improvement in the cluster structures. Since the point biserial goodness of fit statistic is higher with the Jancey algorithm, the rejection level for the null hypothesis of no difference between the generated

cluster structure and a purely random distribution is lower. Since the .10 level attained by the hierarchical method is acceptable, the lower level attained by the Jancey method would also be acceptable.

Table 4 presents the means of the three clusters for each of the variables along with the cluster ranks for these means. Differences among the rankings of the operating context variables are the basis for describing the qualitative characteristics of the three clusters.

The context variables--interdependence, hostility, dynamism, homogeneity, and competition--for cluster 1 rank highest, except for dynamism which ranks second. Cluster 2's context variables rank lowest, except for hostility which ranks second. Cluster 3's context variables rank second, except for hostility which ranks lowest and dynamism which ranks highest. In general, cluster 1 profit centers face the most complex operating environments, and cluster 3 profit centers face an operating environment which is intermediate in complexity.

Cluster 3 ranks highest on the technology variable and cluster 2 ranks lowest. Cluster 3 profit centers run the most sophisticated technologies in the sense that required knowledge, variability, and search behavior rate higher for them than for cluster 1 and cluster 2 profit centers.

The rank order from highest to lowest of the three clusters on the size variable is cluster 2, cluster 1, and cluster 3. Cluster 2 profit centers are large related to other profit centers in the firm, cluster 1 profit centers are of average size, and cluster 3 profit centers are small.

Table 5 summarizes the operating context description of the three clusters in terms of the underlying index scales for the variables. Classifications as to high, average, or low are based on the distance of the index rating from

TABLE 4

Cluster Means for Operating Context Variables¹

<u>Variable</u>	<u>Cluster 1</u> <u>Mean</u>	<u>Cluster 2</u> <u>Mean</u>	<u>Cluster 3</u> <u>Mean</u>
Interdependence	3.89050 (3)	2.62927 (1)	2.80111 (2)
Hostility	3.02512 (3)	3.01272 (2)	2.96629 (1)
Dynamism	3.13831 (2)	2.94827 (1)	3.20982 (3)
Homogeneity ²	3.06644 (3)	2.76891 (1)	2.93141 (2)
Competition	3.68499 (3)	3.33636 (1)	3.34023 (2)
Technology	3.17400 (2)	3.09918 (1)	3.26870 (3)
Size	3.13337 (2)	4.01518 (3)	2.32353 (1)

¹Ranks from low to high appear in parentheses below the means.

²Low scores indicate homogeneous environments while high scores indicate heterogeneous environments.

TABLE 5

Summary of Cluster Description by Operating Context

<u>Variable</u>	<u>Cluster 1</u>	<u>Cluster 2</u>	<u>Cluster 3</u>
Interdependence	high	average-low	average
Hostility	average	average	average-low
Dynamism	average	average-low	average-high
Homogeneity ¹	average-high	average-low	average
Competition	high	average	average
Technology	average	average-low	average-high
Size	average	large	small

¹The homogeneity scale runs from least complex to most complex. High scores on the homogeneity scale indicate a heterogeneous environment.

the mean. Any index rating greater than one standard deviation from the mean received a classification of high or low, depending on the direction. Clusters with profit centers characterized by a range of index scores on a particular variable received a classification indicating that range. For example, cluster 2 has profit centers ranging from average to low on the interdependence variable, while cluster 1 has only profit centers with high ratings on that dimension.

Table 6 presents the means and ranks of the profit centers in the three clusters for the management style variable. This cluster analysis resulted from using the Jancey algorithm with seed centroids from the group average method. The point biserial goodness of fit statistic for the three-cluster solution is .448. The null hypothesis, that this point biserial goodness of

TABLE 6

Cluster Means for Management Style Variables¹

<u>Variable</u>	<u>Cluster 1</u>	<u>Cluster 2</u>	<u>Cluster 3</u>
Optimization	2.89245 (2)	2.69687 (1)	3.20833 (3)
Coercion ²	3.69227 (2)	3.38537 (1)	3.85000 (3)
Risk taking	2.34604 (1)	2.60525 (2)	3.22833 (3)
Flexibility	3.29540 (1)	3.35337 (2)	3.39283 (3)
Participation	3.60236 (2)	2.94669 (1)	3.76050 (3)

¹Ranks appear in parentheses below the cluster means. Ranks are from low to high.

²The scale for coercion runs from coercive at the low end to noncoercive at the high end.

fit statistic equals one drawn from a random distribution of observations with no cluster structure, is rejected at the .07 level. Therefore, the three-cluster solution distinguishes among three distinct groups with the 44 observations on the basis of management style.

Cluster 3 profit centers rank highest on all management style subvariables, indicating that these profit centers have the most sophisticated management styles. Cluster 2 profit centers rank lowest on optimization, coercion, and participation, and second on the risk taking and flexibility subvariables. Cluster 1 profit centers rank lowest on risk taking and flexibility, and second on the optimization, coercion, and participation subvariables. Managements

of the profit centers in cluster 1 use more sophisticated management tools than those in cluster 2, as reflected in the higher ratings on the optimization, coercion, and participation subvariables. However, the managements of profit centers in cluster 1 prefer more structured organizations and less risk taking than those in cluster 2.

Table 7 describes qualitatively the relative characteristics of the three clusters in terms of high, average, and low. These three classifications reflect the distance of the individual subvariable cluster mean from the mean for the subvariable across clusters as well as the underlying index scale.

TABLE 7

Qualitative Description of Management Style Clusters

<u>Variable</u>	<u>Cluster 1</u>	<u>Cluster 2</u>	<u>Cluster 3</u>
Optimization	average	low	high
Coercion ¹	average-high	average	high
Risk taking	low	average	high
Flexibility	average-low	average	average-high
Participation	average-high	average-low	average-high

¹High scores on the coercion index indicate noncoercive style.

General characterizations of the profit centers' operating contexts are identifiable from Table 5. Cluster 1 profit centers are average in size, technologies of average sophistication, and face environments that are high and average-high in complexity. Cluster 2 profit centers are large in size, have less sophisticated technologies and operate in environments that are

average and low-average in complexity. Cluster 3 profit centers are small in size, have the most highly sophisticated technologies, and face operating environments characterized by an average amount of complexity relative to clusters 1 and 2.

Identification of general characteristics of the profit centers' management style can be derived from an analysis of Table 7. The managements of cluster 1 profit centers make use of sophisticated quantitative and motivational management techniques but take fewer risks and prefer more rigid organizational structures than do cluster 2 and 3 profit center managements. Cluster 2 profit center managements use less sophisticated management techniques than cluster 1 or cluster 3 profit center managements, but are willing to take more risks and tolerate more ambiguous organizational structures than cluster 1 profit center managements. Cluster 3 profit center managements employ more sophisticated management techniques, take more risks, and design more flexible organizational structure than either cluster 1 or cluster 2 profit center managements. Cluster 3 profit center managements exhibit the most sophisticated management styles, followed by cluster 1 and, finally, cluster 2 profit center managements.

Research Design

Using the three management style classes and the three operating context classes as the independent variables, and the management accounting variable indices as the dependent variable, the following two-way analysis of variance with interaction model was used to empirically investigate the five hypotheses from section 1:

$$Y_{ijk} = \mu_{..} + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk},$$

where

Y_{ijk} is the index of each of 5 management accounting variables for profit center k at the i th level of the management style factor and the j th level of the operating context factor;

$\mu..$ is the overall mean;

α_i is the main effect for the management style factor at the i th level subject to $\sum_i \alpha_i = 0$;

β_j is the main effect for the operating context factor at j th level subject to $\sum_j \beta_j = 0$;

$(\alpha\beta)_{ij}$ is the interaction effect when the management style factor is at the i th level and the operating context factor is at the j th level subject to $\sum_i (\alpha\beta)_{ij} = 0$ and

$$\sum_j (\alpha\beta)_{ij} = 0;$$

ϵ_{ijk} are independent $N(0, \sigma^2)$; and

$i = 1, 2, 3; j = 1, 2, 3; k = 1, \dots, 218.$

Since the ANOVA cell frequencies are neither equal nor proportionate, the main and interaction effects are not orthogonal. For this reason, a weighted means solution to the analysis of variance, in which the sums of squares for the main effects are adjusted for the other main effect only and the interaction effect sums of squares are adjusted for both main effects, was used.

In addition, since there are five observations of the management accounting variable for each profit center according to the management function involved, the total number of potential observations for assignment to the ANOVA cells is 220. However, in two profit centers, management believed that management accounting was not applicable with respect to motivating people. Hence,

there are 218 observations of the dependent variable assignable to nine cells in the design.

Table 8 reports the weighted means solution to the analysis of variance and will be used in analyzing the research hypotheses.

TABLE 8

Two-Way Analysis of Variance with Interaction Term

<u>Source of Variation</u>	<u>Degrees of Freedom</u>	<u>Sum of Squares</u>	<u>Mean Square</u>	<u>F Value</u>
Model	8	9.00695981	1.12586998	3.96
Error	209	68.09281920	0.32580246	
Corrected Total	217	77.09977901		

Probability > F = .0009

<u>Source of Variation</u>	<u>Degrees of Freedom</u>	<u>Sum of Squares</u>	<u>F Value</u>	<u>Probability > F</u>
Management Style	2	2.09453530	3.21	0.0422
Operating Context	2	1.11808678	1.72	0.1823
Interaction	4	6.023925584	4.62	0.0013

Data Analysis

Since the model posits interaction effects, analysis of these interactions is the logical starting point for the analysis. The interaction effects relate to research hypothesis 3c. A formal statistical test of hypothesis 3c consists of

$$H_{03c}: (\alpha\beta)_{ij} = 0$$

versus

$$H_{13c}: (\alpha\beta)_{ij} \neq 0.$$

On the basis of the data from Table 8, the null hypothesis is rejected at the .0013 level. This confirms the hypothesis that the interaction of management style and operating context has a significant effect on management accounting's contribution to profit center management.

The theoretical development of hypotheses (1), (2), and (3) set up management style, operating context, and their interaction as competing, mutually exclusive determinants of the contribution made by management accounting to the management functions of profit centers. Rejection of the null hypothesis of no interaction constitutes evidence of significant interaction effects, which implies that hypothesis (3) dominates both hypotheses (1) and (2). That is, the interaction of management style and operating context explains more of the variance across profit center clusters of the management accounting dependent variables than do the main effects alone. This result suggests the complementary nature of the relationship between management style and operating context in determining management accounting.

An implication of hypotheses (1) and (2) is a nonsignificant interaction effect in the analysis of variance for the collected data. The significant interaction effect result forms a basis for a general conclusion in favor of hypothesis (3) over hypotheses (1) and (2). Thus, the empirical results suggest that neither management style nor operating context alone constitutes an adequate explanation of management accounting functions.

In the context of the ANOVA design reported here some tentative conclusions concerning the appropriateness of hypotheses 3a and 3b are also possible, in that they have different implications for the significance of the main effects given that the interaction effect is significant. More precisely, hypothesis (3a) implies a significant main effect for operating context and a

nonsignificant main effect for management style, while hypothesis (3b) implies a significant main effect for management style and a nonsignificant main effect for operating context. These implications are based on the potential time series relationship between the independent variables and constitute extreme cases for the analysis. In the spirit of the type of inference drawn from this data, the main effect with the higher significance level has, in theory, a closer time relationship with management accounting than does the other main effect.

Turning to the main effects of management style and operating context, analysis of the following hypotheses results from Table 8:

$$H_{03b}: \alpha_i = 0$$

versus

$$H_{13b}: \alpha_i \neq 0;$$

and

$$H_{03a}: \beta_i = 0$$

versus

$$H_{13a}: \beta_i \neq 0.$$

The null hypothesis H_{03a} is rejected only at the .1823 level, while the null hypothesis H_{03b} can be rejected at the .0422 level of significance. These results lead to the conclusions that operating context does not have a significant effect on management accounting's contribution to the profit center's management functions, while the management styles of the profit centers do have a significant effect on management accounting's contribution.

Table 9 contains the means of the main effects for management style groups according to the management style sophistication. Bonferroni multiple contrasts at an experiment-wise significance level of .10 for the family of contrasts indicate that profit centers with average management style sophistication differ significantly from profit centers with highly sophisticated management styles. Management accounting makes greater contributions to the management of profit centers with average sophistication of management style than to those with highly sophisticated management styles. At the .10 level, there are no differences between the low-average and low-high contrasts.

TABLE 9

Management Style Main Effect Means

<u>Management Style Sophistication</u>	<u>N</u>	<u>Mean</u>
low	79	2.217
average	110	2.342
high	29	2.076

If the interaction effects and their interpretation are found important, investigating them depends on the classification of profit centers into management style groups with low, average, and high relative management sophistication and into operating context groups with low, average, and high relative operating complexity. Table 10 details the means of the interaction effects. The graphs in Figure 3 showing the interaction cell means indicate important interaction effects because the interaction cell means are nonparallel. Inspection of the graphs in Figure 3 shows that the interaction means differ the most when operating context is of average complexity. Bonferroni multiple contrasts of the differences between the interaction means, when operating

TABLE 10

The Interaction Effects Means and Analysis

<u>Management Style</u>	<u>Operating Context</u>	<u>N</u>	<u>Mean</u>
low	low	15	2.345
low	average	29	2.154
low	high	35	2.125
average	low	30	2.174
average	average	40	2.640
average	high	40	2.171
high	low	10	2.295
high	average	14	1.865
high	high	5	2.229

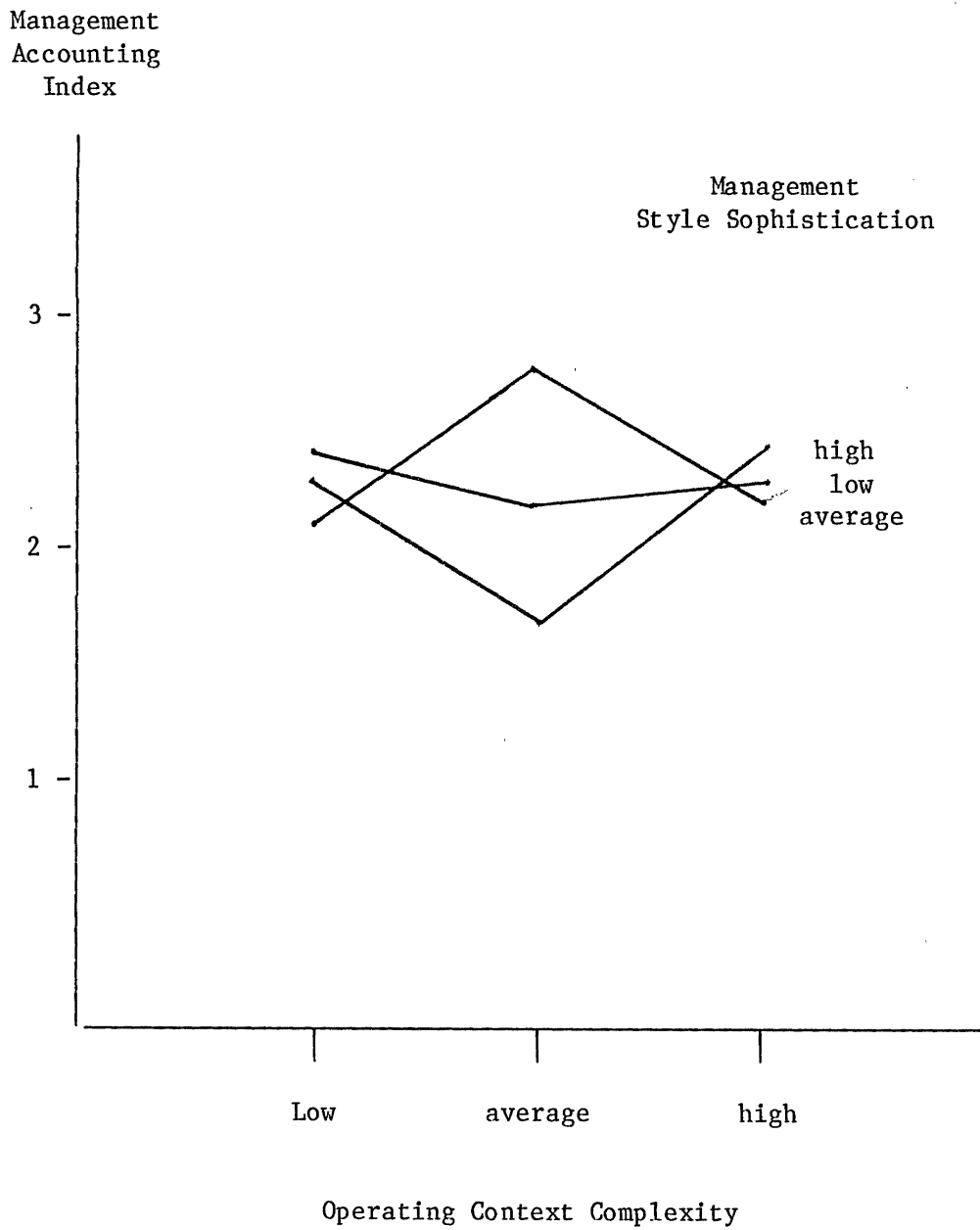
Operating Context Complexity

	low	average	high	Row mean	
low	2.345	2.154	2.215	2.238	+ .006
average	2.174	2.640	2.171	2.328	+ .096
high	2.295	1.865	2.229	2.130	- .102
Column mean	2.272	2.220	2.206	2.232	
	+ .040	- .012	- .028		

Management Style Sophistication

FIGURE 3

Graphs of the Interaction Means



context is held constant at average complexity and management style varies according to the level of sophistication, confirm that these three means differ significantly at the .05 level for the family of comparisons. When profit center operating context is of average complexity, the contribution of management accounting to profit center management is significantly higher in profit centers with management styles of average sophistication than in profit centers with either low or high management style sophistication. Likewise, the contribution of management accounting is greater in low management style sophistication profit centers than in profit centers with highly sophisticated management styles. The interaction means when operating context is at either a high or a low level of sophistication do not differ significantly from each other.

Using the aggregated scores for the management accounting dependent variables yielded significant interaction and management style effects and nonsignificant operating context effects. Bonferroni multiple contrasts indicated that the interaction effects are significant only in treatments where operating context is held constant at average sophistication and the management style effect is significant only for a contrast between average and high sophistication in profit center management styles.

A second purpose of this research has to do with the form(s) associated with L(MACS) as a function of OC and MS. The received theory has implications only for the first derivatives of the function. Some evidence for points of inflexion may be inferred from the data collected in this research.

Table 9 details the means for the management accounting index according to management style sophistication. Figure 5 graphs these means. Table 11 gives the management accounting index means for the operating context

TABLE 11

Operating Context Main Effect Means

<u>Operating Context Complexity</u>	<u>N</u>	<u>Mean</u>
low	55	2.243
average	83	2.339
high	80	2.194

Figure 4

Graph of Operating Context Means

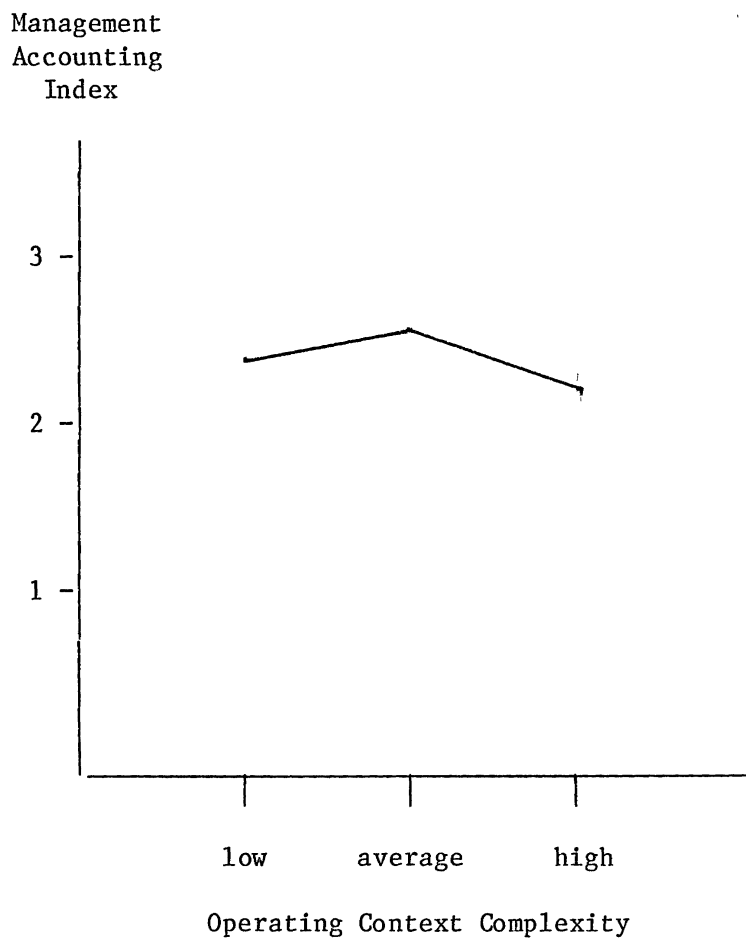
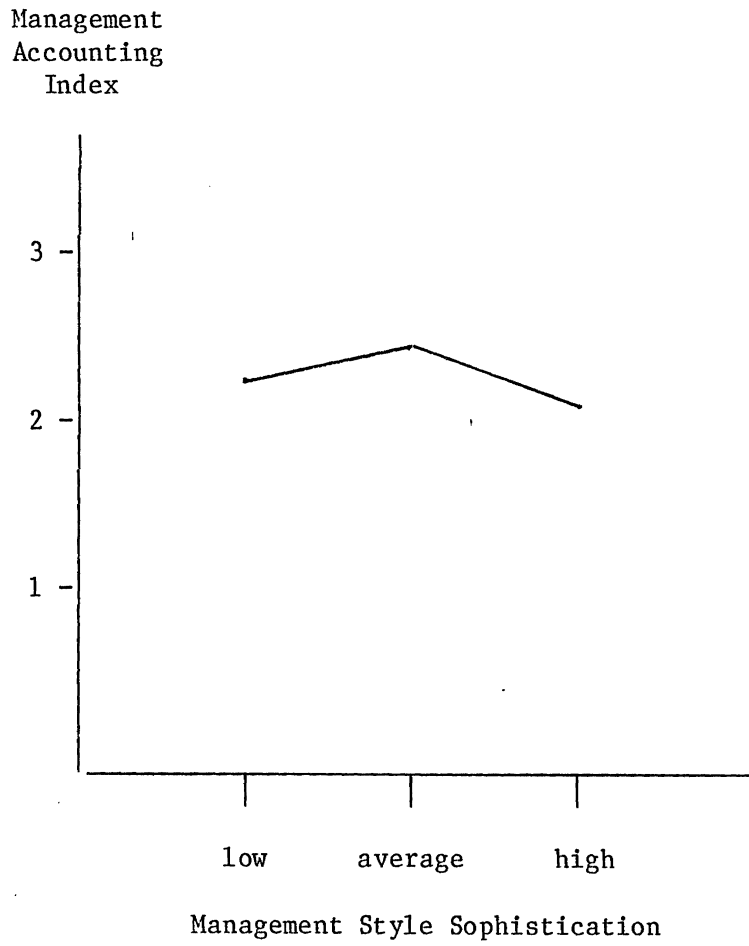


Figure 5

Graph of Management Style Means



complexity main effect, while Figure 4 graphs these means. Table 10 presents the interaction effect means for the management accounting index and Figure 3 presents their graphs.

In all three cases, it appears that the management accounting index variable increases as the independent variable moves from low sophistication (complexity) to an average level, and decreases as it moves from that point to the high level. This implies that management accounting is not a strictly increasing function over the domains of management style sophistication and operating context complexity. Indeed, management accounting reaches a point of inflexion where its highest level is at the group of profit centers with average levels of management style sophistication and operating context complexity. The evidence for points of inflexion in the L(MACS) function is strongest for the interaction effect as indicated by the multiple contrasts reported above. The L(MACS) function exhibits constant behavior over the low-average management style sophistication group of profit centers and decreases as it moves from the average to the high group. There is no apparent change in the L(MACS) function across different levels of operating context.

III. Discussion of Results

The results from the data analysis indicate that management accounting has important dependencies on both management style and operating context characteristics. In the context of MACS design, it is important for the information evaluator to understand the implications of managements' decision styles as well as the dimensions of the organization's operating context. Operating context complexity alone appears to have little impact on the level of management accounting in the profit centers. Regardless of the general complexity of the environment in which the profit center operates, the perceived

usefulness of management accounting information for management functions does not vary. However, this situation changes when management accounting functions are considered in relation to management style sophistication. The level of contribution of management accounting to management functions is significantly higher for profit centers with average levels of management style sophistication than for profit centers with highly sophisticated management styles. There is no difference, however, between low management style sophistication profit centers and high management style sophistication profit centers.

The analysis of the interaction effect means disclosed a similar result. Profit centers with average management style sophistication and average operating context complexity had significantly higher management accounting indices than profit centers with low and high management styles with average operating contexts. Profit centers with low, average, and high management style sophistication and low and high operating context complexity were indistinguishable in terms of their use of management accounting functions.

Although there is no formal theory to explain the results of the data analysis, there are intuitive explanations. Management accounting exists within organizations in its own right, supplying a base level of usefulness to management which depends principally on its own technology. In some organizations, there is little need to expand these services beyond the base level, either because the complexity of the situation does not require expansion or because the ability of management does not allow them to profit from the additional services. Likewise, in other organizations there is little need to expand management accounting beyond some base level because the operating context is so complex that additional management accounting information does not

appreciably aid management in their functions, or because management itself is so sophisticated that it prefers an alternative form of internal information to that normally generated through management accounting. However, at the average level of complexity, unsophisticated managements do not require much management accounting information because of their inability to use it. Highly sophisticated managements require more, but not as much as managements with average sophistication, because they deal with the functions with which management accounting could assist by means of their management styles instead.

The results from this study are limited in ways typical of field research. Although care was exercised in designing the questionnaire and the aggregation methods to adequately capture the concepts of interest, there is no external measure of the study's validity. Ex post reliability tests indicated that within-respondent variability on retest questions and within-profit-center variability on variable indices were small. Tests for equality of the ANOVA treatment group variances indicate some relatively small differences. In addition, analysis of the standardized residuals found that 69.7 percent fall between ± 1 , 89.4 percent fall between ± 1.695 , and 95.4 percent fall between ± 2 , indicating that the error terms are approximately normal. Even though care was taken to enhance the internal validity and reliability of the study, clear-cut interpretation of the results is nonetheless clouded by potential measurement and analytical error.

An element of the study contributing positively to its internal validity was the careful choice of the organizational units used in the study. Restricting the organization units to those fitting a well-specified concept of profit center also restricts the external validity of the study. That is, the group of profit centers studied was a nonrandom sample which could be

representative only of profit centers from their own companies. The cluster analytic techniques for classifying profit centers by management style and operating context characteristics were conceived to provide more general descriptions of the organizational units under study. The results for these clusters are generalizable to other profit centers only to the extent one believes those other centers to be characterized by low, average, and high degrees of management style sophistication and operating context complexity.

Although some evidence was found for a general form of contingency theory as applied to management accounting functions, there remains a high degree of imprecision in the details. The data support a framework suggesting management accounting's joint dependence on management style and operating context, but available methods of conceiving and thinking about these joint effects are weak. For example, what should we call a business organization characterized by high management sophistication and low operating context? Why would we find such a combination of operating and managerial attributes? Does this constitute an "acceptable" organizational response, or is this type of organization one that will fail? What normative response should management accountants take in designing their functions for different profit centers? How does the management accounting response affect the success of the profit centers? Answers to these and many other questions about the operation of management accounting functions within managerial hierarchies await further research and inquiry.

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Appendix A

The questionnaire used to collect the data from profit center respondents is reproduced in this appendix. The items relate to the conceptual framework according to the following schedules.

Management Accounting Functions

<u>Control</u>	<u>Decision Making</u>	<u>Planning</u>	<u>Motivation</u>	<u>Performance Evaluation</u>
25	18	20	31	22
37	19	21	33	23
38	27	30	52	24
46	29	36	59	26
49	41	40	62	28
50	44	56		32
51	58	57		34
65	61	60		35
72	64	67		39
	69	68		42
	70	71		43
				45
				47
				48
				53
				54
				55
				63
				66

Operating Context Dimensions

<u>Dynamism</u>	<u>Competition</u>	<u>Hostility</u>	<u>Homogeneity</u>	<u>Technology</u>	<u>Interdependence</u>
1	3	2	10	5	11
8	15	7	99	6	12
9	16	81	106	74	120
13	17	82	116	97	
14	73	90		4	
84		101		105	
112		111		117	
113				85	
114				118	
115					

Management Style Dimensions

<u>Flexibility</u>	<u>Coercion</u>	<u>Optimization</u>	<u>Participation</u>	<u>Risk</u>
80	83	78	75	77
91	89	86	76	79
92	98	88	87	93
94	107	96	100	103
95	110	102		109
104				
108				

This questionnaire is part of a research project designed to identify and to measure the effects of operating context and management style on management accounting. Your responses to the questionnaire items will form the basis of an evaluation of the impact of organizational characteristics on the contribution of management accounting to the management of organizational units with different operating contexts and management styles. The research results will measure the degree to which management accounting contributes to management functions of organizational units with different operating contexts and management styles.

The questionnaire items refer to the "profit center" as the organizational unit of interest. Since the term "profit center" has different meanings in different companies, the organizational unit for which you are responding may not be called a profit center in your company. For the purpose of completing this questionnaire, interpret "profit center" as the organizational unit for which you work. Your knowledge of the operating context, management style and management accounting activities in this profit center is the reason for your selection as a respondent.

Please use the answer sheet to respond to the questionnaire items. Fill in the box corresponding to your answer for each questionnaire item with a No. 2 pencil. For example, if you believe that the task in item 1 is "very easy," you would fill in the first box on the response sheet for item 1. Please make sure that the item number of the answer sheet corresponds to the item number for which you are responding in the questionnaire.

Please use the envelope enclosed with the questionnaire to return your completed answer sheet directly to the researcher.

Thank you for participating in the study.

Statements 1-7 investigate the ease or difficulty of achieving certain objectives. Please indicate your perception of the ease or difficulty of achieving these objectives using this measurement scale:

1	2	3	4	5
Very Easy	Easy	Neither Easy nor Difficult	Difficult	Very Difficult

1. The prediction of changes in the future state of this profit center's external environment is
2. Compliance with government regulation of this profit center is
3. Increasing this profit center's market share by 10 percent would be
4. The solution of problems in running this profit center's basic production or service activity is
5. The prediction of the results of this profit center's productions or service activity's work effort is
6. Planning day to day work schedules for the profit center's production or service activity is
7. Financial survival in the normal course of business for this profit center is

Statements 8-12 investigate the importance of certain characteristics for this profit center's success. Please indicate your perception of their importance using this measurement scale:

1	2	3	4	5
Very Unimportant	Unimportant	Neither Unimportant nor Important	Important	Very Important

8. The development of new products for success in this profit center's industry is
9. The modification of existing products for success in this profit center's industry is
10. The differentiation of products or services (a variety of products or services at different quality grades) for success in this profit center's industry is
11. The purchase of products or services from other profit centers in this company is
12. The sale of products or services to other profit centers in this company is

Statements 13 and 14 investigate the rate of change of certain characteristics of this profit center. Please indicate your perception of their rate of change using this measurement scale:

1	2	3	4	5
Very Slow	Slow	Neither Slow nor Rapid	Rapid	Very Rapid

13. The rate of innovation in the profit center's production or service technology is
14. The rate of change in the technical aspects of the profit center's products or services themselves is

* * *

Statements 15-17 investigate the intensity of competition facing this profit center. Please indicate your perception of competitive intensity using this measurement scale:

1	2	3	4	5
Very Weak	Weak	Neither Weak nor Intense	Intense	Very Intense

15. The competition for basic inputs (raw materials, labor, machiner, etc.) in this profit center's industry is
16. The competition for technical manpower (managers, engineers, scientists, accountants, computer experts, etc.) in this profit center's industry is
17. The marketing competition (advertising, promotion, distribution, etc.) in this profit center's industry is

* * *

Statements 18-72 describe functions of a profit center's management to which management accounting might contribute. Please indicate your perception of the contribution made by management accounting to the management functions using this measurement scale:

1	2	3	4	5
No Contribution	Indirect Contribution	Direct Contribution	Complete Contribution	Not Applicable

Use the following definitions to code your perceptions:

- 1 = No Contribution: Management accounting is not involved in any way in performing the particular management function.
- 2 = Indirect Contribution: Management accounting provides information for management's use in performing the particular management function.
- 3 = Direct Contribution: In addition to providing information, management accounting actively participates in performing the particular management function.
- 4 = Complete Contribution: Management accounting is the management group responsible for performing the particular management function.
- 5 = Not Applicable: The particular management function is not performed in the profit center. An example would be the evaluation of production personnel performance in a profit center which has only administrative personnel. Be careful not to indicate "not applicable" in cases where the management function is performed in the profit center but management accounting makes "no contribution."

Management accounting's contribution to...

18. Product-mix decisions
19. Evaluation of alternative courses of future action
20. Appraisal of the social environment of the profit center (morale, organizational structure, etc.)
21. Appraisal of the governmental environment of the profit center
22. Reporting the results of operations to middle management
23. Evaluation of the effectiveness of business policies
24. Interpreting the results of operations for upper management
25. Administration of budgets (setting formats, acting as a clearing house for data, etc.)
26. Measuring profit center financial performance
27. Make-buy-lease decisions
28. Determination of operational efficiency (optimum use of assets in reaching goals)
29. Product-line decisions
30. Formulation of investment opportunities
31. Providing incentives for top management
32. Interpreting the results of operations for lower management
33. Providing incentives for production workers
34. Explanation of financial statements to upper management
35. Evaluating manager performance for promotion purposes
36. Consulting about business policies
37. Educating managers about the accounting effects of their decisions
38. Coordination of operational control between line and staff personnel
39. Measuring the performance of managers within a profit center (department managers, plant managers, etc.)
40. Representing the profit center's position at headquarters
41. Price-setting decisions
42. Evaluating profit center financial performance after its measurement
43. Evaluation of the attainment of objectives
44. Special sales order decisions
45. Interpreting the results of operations for middle management
46. Preparation of budgets (determination of the contents of budgets)
47. Explanation of financial statements for lower management
48. Evaluation of the effectiveness of procedures
49. Testing the compliance of actual operations with standards, plans, or goals
50. Administration of control systems
51. Educating managers about the effects of transfer pricing on their decisions
52. Providing incentives for lower management
53. Explanation of financial statements to middle management
54. Reporting the results of operations to lower management
55. Measuring the profit center's manager's performance
56. Appraisal of the financial environment of the profit center
57. Design of internal information systems
58. Choice of future courses of action to be taken by the profit center
59. Providing incentives for office workers
60. Calculation of the financial effects of alternative investment opportunities
61. Expansion decisions
62. Providing incentives for middle management

63. Determination of operational effectiveness (meeting profit center goals)
64. Market entrance decisions
65. Enforcing approved budgets
66. Reporting the results of operations to upper management
67. Establishing plans for control
68. Determining business strategy
69. Market abandonment decisions
70. Disinvestment decisions
71. Setting business goals
72. Setting standards for costs

Statements 73-111 concern characteristics which might describe this profit center. Please indicate your degree of agreement or disagreement with each statement using this scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

73. Price competition is "cut-throat" in this profit center's industry.
74. There is a well understood sequence of steps to follow in performing the production or service activity of this profit center.
75. This profit center uses a participative approach to decision-making (specific courses of action are determined only after full discussion leading to a consensus of opinion).
76. This profit center encourages decision-makers to reach conclusions just using information supplied in reports.
77. This profit center emphasizes marketing already established products or services.
78. This profit center conducts market research prior to implementing new production or marketing plans.
79. This profit center prefers high risk, high return investment to low risk, moderate return investments.
80. In this profit center personnel always follow the established rules and procedures.
81. This profit center faces severe constraints (political social, or legal) in its external environment.
82. This profit center's markets are shrinking.
83. This profit center rewards employees for following directions without questions.
84. To be successful in this profit center's industry, you must be oriented toward research and development.
85. The work activity in this profit center's production or service technology is all routine.
86. This profit center emphasizes the use of Operations Research (linear programming, simulation, decision models, etc.) in making decisions.
87. When changes are made this profit center involves all those who are most likely to be affected in the planning and implementation of the changes.
88. This profit center emphasizes profit maximization to the exclusion of other objectives.

89. This profit center offers incentives in order to attain its objectives.
90. This profit center holds a dominant position in its industry (being able to control and manipulate the external environment to its advantage).
91. In this profit center formal controls are the rule.
92. This profit center requires management to go through a formal management training program.
93. This profit center favors a strategy of cooperative existence with rival firms (within the limits of the anti-trust laws) to a strategy of "cut-throat" competition.
94. In this profit center the expert in a given situation makes the decision even if it means bypassing the formal line of authority.
95. This profit center's communication channels are highly structured.
96. This profit center relies on personnel with experience and common sense in decision-making rather than on formal decision models.
97. There is a clearly defined body of knowledge or subject matter which guides the production or service activity in this profit center.
98. This profit center institutes changes without explaining or justifying them.
99. This profit center has a single customer market.
100. This profit center makes decisions using committees of those managers who are responsible for implementing the decisions.
101. This profit center has numerous investment opportunities.
102. This profit center makes important decisions without researching and quantifying all relevant costs and benefits.
103. This profit center emphasizes steady growth.
104. In this profit center financial and operating information flow freely to anyone who needs it.
105. There is always someone to go to for answers to specific problems encountered in the production of service technology of this profit center.
106. This profit center has a single product or service market.
107. This profit center uses formal conflict resolution procedures to handle serious disagreements.
108. In this profit center getting the work done depends on informal relationships and cooperation.
109. This profit center considers only opportunities with predictable outcomes.
110. This profit center uses solutions proposed by outside experts in dealing with problems.
111. This profit center has numerous marketing opportunities.

Statements 112-120 investigate the size of certain characteristics of this profit center. Please indicate your perception of each characteristic's size using this measurement scale:

1	2	3	4	5
Very Small	Small	Neither Small nor Large	Large	Very Large

For items 112 and 113 respond only to the one which applies, leaving the other blank.

- 112. The growth of this profit center over the past five years has been
- 113. The deterioration of this profit center over the past five years has been
- 114. The size of fluctuations around the long-term sales trend in this profit center has been
- 115. The size of this profit center's variability in financial performance from period to period has been
- 116. The amount of customized work demanded of the profit center by its customers has been
- 117. The amount of thinking time spent dealing with specific problems of this profit center's production or service activity has been
- 118. The number of new problems faced by the profit center in its production or service activity has been
- 119. Compared to other profit centers in this company, this profit center is
- 120. The number of demands on this profit center from headquarters has been

The following statements concern characteristics of the respondents. Please answer them according to the instruction with each statement.

- 121. If you work in the controller's department, fill in box 1; otherwise, fill in box 2.
- 122. How long have you worked in this profit center?

1	2	3	4	5
Less than Year	1-2 years	2-3 years	3-5 years	More than 5 years

- 123. The ease or difficulty which you experienced in determining the organizational unit to which the questionnaire items applied.

1	2	3	4	5
Very Easy	Easy	Neither Easy nor Difficult	Difficult	Very Difficult