ABSTRACT

EFFECTS OF COMPANY ORGANIZATION STRUCTURE ON THE ACCOUNTING SYSTEM

By

Kenneth Yale Rosenzweig

A fundamental assumption of accountants and accounting authors is that internal accounting systems must be designed in accord with the organization structures of their companies. Another fundamental assumption is that an important role of internal accounting systems is providing information for the control of their operations. Yet surprisingly, these assumtpions have not been extensively examined. In fact, little research has been done on the structure of accounting systems themselves or their links to the organization structures of their companies. Moreover, hardly any research has been done on how the control function of accounting relates to other company control systems. Thus much needs to be learned about whether characteristics of accounting systems relate to those of organization structure or other control systems. Furthermore, the nature and strength of these relationships should be studied.

The purpose of this dissertation is to investigate the association of properties of the accounting system and those of the overall company organization. In order to guide the inquiry, a basic model is constructed which incorporates some suppositions as to the effects of different types or levels of organizational characteristics on the accounting system. These levels are structural complexity, control systems (other than the accounting system), and process. Structural complexity refers

to the extent to which an organization is divided into parts on various dimensions. For instance, one dimension of structural complexity is the number of departments at various levels of the organization. Control systems include structures of an organization, other than its accounting system, which help control and coordinate the organization's operations. An example is standardized procedures by which management controls operations by establishing authorized ways of doing things. Process refers to the level of technology of the production operations of the organization.

The directions, positive or negative, of effects on the accounting system of the three levels of organizational variables are predicted in the model. These predictions are incorporated in three hypotheses which are as follows:

1. Structurally complex organizations tend to have more fully developed accounting systems to contribute to the resolution of greater control and coordination problems.
2. The stage of development of the accounting system is negatively related to that of other control systems since control systems are partial substitutes for one another.
3. The more sophisticated the production process of an organization, the more developed must be the accounting system to provide more and better information for management decisions.

The objectives of the research are: (a) to test the three hypotheses and thereby substantiate the model; (b) to determine the strength and direction of influence of characteristics of process, structural complexity, and control systems on the accounting system; (c) to determine how much the overall organization influences different accounting system characteristics; (d) to determine if accounting systems can be conveniently classified into types on the basis of their properties and accounting-related organizational properties.

Kenneth Yale Rosenzweig

In this field study, a sample of eighteen small manufacturing companies was selected. The controllers or chief financial officers of the companies were interviewed about their accounting systems, structural complexity, control systems, and process. Over one hundred measurements were collected for each company. Since the basic model included about twenty organizational variables and about ten accounting system variables, there were several measurements for each. The multiple measurements of each variable were combined into a single measurement with the statistical technique *principal components analysis.*

The relationships between each of the accounting system variables and those of the overall organization were calculated with the statistical technique *stepwise multiple regression analysis.* This technique finds subsets of the organizational variables which best explain each variable of the accounting system. For example, the technique may find three or four of the twenty organizational variables which, taken together, are most associated with accounting system size.

The output of the regression analysis was used to calculate the measures "explanatory power" and "explainability," which were developed in the course of this dissertation. Explanatory power is defined as the ability of each organizational variable to explain accounting system variables, taken together. Explainability is defined as the ability of each accounting system variable to be explained by organizational variables, taken together.

Another measure developed in the course of this dissertation was "consistency with the hypotheses." This is defined as the extent to which found relationships conform to the directions, positive or negative,

predicted in the three hypotheses. Consistency with the hypotheses was calculated for accounting system variables and for organizational variables. For example, a structural complexity variable such as number of departments is predicted by hypothesis one to have positive relationships to accounting system variables. Consistency with hypothesis one for number of departments is the extent that any such relationships that are found are positive. In addition to the consistency measures for variables, tests of the overall conformity of the research findings with each of the three hypotheses are performed.

The basic model and the three hypotheses were revised in accord with the research findings of the types discussed in the preceding three paragraphs. In the course of the model revision, the respective roles of the three organizational levels with respect to the development of the accounting system were refined. Furthermore, many of the variables within the three levels were reinterpreted. Similarly, the accounting system variables were reinterpreted with respect to the extent and manner they are explained by organizational variables.

The important findings of this dissertation are as follows. Structurally complex organizations do have more fully developed accounting systems, as predicted by hypothesis one. Process is even more important in determining the stage of development of the accounting system. Companies with more sophisticated processes have much more fully developed accounting systems, as predicted by hypothesis three. The stage of development of the accounting system is negatively related to that of some control systems, as predicted by hypothesis two. However, it is positively related to the stage of development of other control systems.

These positive relationships have been interpreted as resulting from complementarity: information produced by the accounting system helps these control systems function better.

The research findings apply to the accounting system as follows. Overall organization variables primarily influence the output of accounting systems (the nature of reports and where they are sent in the organization). They do not have as much influence on the structure of accounting systems. The only key feature of accounting system organization structure is the distinction between centralized and divisionalized accounting systems. In sum, the research findings show that it is impossible to design a new accounting system or even to adapt an existing one without understanding the organization of which it forms a part.

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By

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I dedicate this dissertation to my parents, Morris and Freda Rosenzweig. Without their guidance and support through the years, this dissertation would not have been possible.

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The eclectic nature of this dissertation, spanning three fields of study (accounting, organizational sociology, and statistical research design), created significant problems of integration of the diverse subject matter. My dissertation committee provided knowledgeable, understanding, and cooperative support during the development of the dissertation proposal and its implementation. Harold Sollenberger, chairman of the committee, helped assemble the dissertation sample. Furthermore, he was the primary impetus for organizing and clarifying early drafts of the dissertation. Harry Perlstadt, committee member from the Sociology Department, contributed much to the development of the interview questions and to the tie-in of the dissertation with sociological literature. Maryellen McSweeney, committee member from the Department of Counseling, Personnel Services, and Educational Psychology, assisted greatly in the selection and use of statistical methods and the development of the overall research design. I would also like to express my appreciation to Doug Johnson, my colleague at Arizona State University. He provided valuable suggestions for handling various problems with the research design.

I am grateful for the patience and understanding of my wife Bonnie during the trying time when my dissertation was in progress.

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Chapter 1

OVERVIEW OF THE STUDY

A fundamental assumption of accountants and accounting authors is that internal accounting systems must be designed in accord with the organization structures of their companies. Another fundamental assumpton is that an important role of internal accounting systems is providing information for the control of their operations.[1] Yet surprisingly, these assumptions have not been extensively examined. In fact, little research has been done on the structure of accounting systems themselves or their links to the organization structures of their companies. Moreover, hardly any research has been done on how the control function of accounting relates to other company control systems. Thus, much needs to be learned about whether characteristics of accounting systems relate to those of organization structure or other control systems. Furthermore, the nature and strength of these relationships should be studied.

PURPOSE

The basic thesis of the dissertation is that the nature of the accounting system is a result of the influence of the overall company

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[1] These assumptions may be inferred from the general tone of the discussion in Charles T. Horngren, *Cost Accounting, A Managerial Emphasis* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), specifically pp. 157-58 on the first assumption, and pp. 5 and 157-59 on the second.

organization. The purpose of the dissertation is to investigate this influence. In order to guide the inquiry, a basic model is constructed which incorporates some suppositions as to the effects of different types or levels of organizational characteristics on the accounting system. These levels are structural complexity, control systems (other than the accounting system), and process. "Structural complexity" refers to the extent to which an organization is divided into parts on various dimensions. For instance, one dimension of structural complexity is the number of departments at various levels of the organization. "Control systems" include structures of an organization, other than its accounting system, which help control and coordinate the organization's operations. An example is standardized procedures by which management controls operations by establishing authorized ways of doing things. "Process" refers to the level of technology of the production operations of the organization.

The directions, positive or negative,[1] of effects on the accounting system of the three levels of organizational variables are predicted in the model. These predictions are incorporated in three hypotheses which are as follows:

1. Structurally complex organizations tend to have more fully developed accounting systems to contribute to the resolution of greater control and coordination problems.

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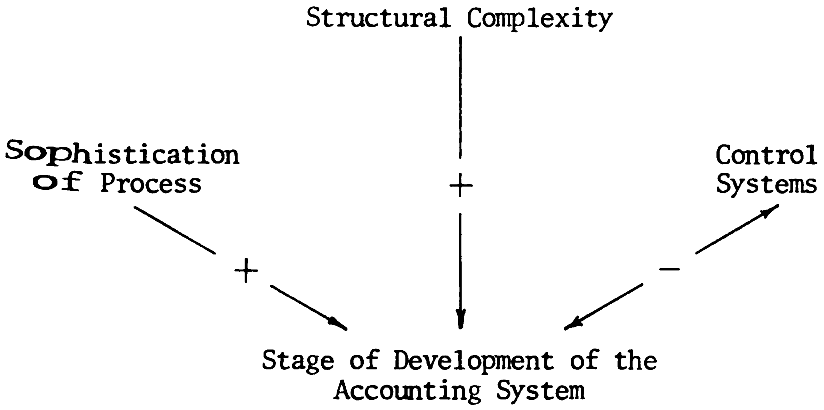
[1] "Positive direction" means that, when the stage of development of the organizational level is high, that of the accounting system tends to be high. "Negative direction" means that, when the stage of development of the organizational level is high, that of the accounting system tends to be low.

2. The stage of development of the accounting system is negatively related to that of other control systems, since control systems are partial substitutes for one another.

3. The more sophisticated the production process of an organization, the more developed must be the accounting system to provide more and better information for management decisions.

This is a diagram of the predictions in these hypotheses:



OBJECTIVES

The objectives of the research are:

1. To test the three hypotheses and thereby substantiate the model.

2. To determine the strength and direction of influence of characteristics of process, structural complexity, and control systems on the accounting system.

3. To determine how much the overall organization influences different accounting system characteristics.

4. To determine if accounting systems can be conveniently classified into types on the basis of their properties and accounting-related organizational properties.

RESEARCH DESIGN

In this field study, a sample of eighteen small manufacturing companies was selected. The controllers or chief financial officers of the companies were interviewed about their accounting systems, structural complexity, control systems, and process. Over one hundred measurements were collected for each company. Since the basic model included about twenty organizational variables and about ten accounting system variables, there were several measurements for each. The multiple measurements of each variable were combined into a single measurement with the statistical technique *principal components analysis.*

The relationships between each of the accounting system variables and those of the overall organization were calculated with the statistical technique *stepwise multiple regression analysis.* This technique finds subsets of the organizational variables which best explain each variable of the accounting system. For example, the technique may find three or four of the twenty organizational variables which, taken together, are most associated with accounting system size.

The output of the regression analysis was used to calculate the measures "explanatory power" and "explainability," which were developed in the course of this dissertation. "Explanatory power" is defined as the ability of each organizational variable to explain accounting system variables, taken together. "Explainability" is defined as the ability of each accounting system variable to be explained by organizational variables, taken together. These definitions of terms are used consistently throughout this dissertation.

Another measure developed in the course of this dissertation was "consistency with the hypotheses." This is defined as the extent to which found relationships conform to the directions, positive or negative, predicted in the three hypotheses. Consistency with the hypotheses was calculated for accounting system variables and for organizational variables. For example, a structural complexity variable such as "number of departments" is predicted by hypothesis one to have positive relationships to accounting system variables. Consistency with hypothesis one for "number of departments" is the extent that any such relationships that are found are positive. In addition to the consistency measures for variables, tests of the overall conformity of the research findings with each of the three hypotheses are performed.

REVISION OF MODEL

The basic model and the three hypotheses were revised in accord with the research findings of the types discussed in the preceding three paragraphs. In the course of the model revision, the respective roles of the three organizational levels with respect to the development of the accounting system were refined. Furthermore, many of the variables within the three levels were reinterpreted. Similarly, the accounting system variables were reinterpreted with respect to the extent and manner they are explained by organizational variables.

FINDINGS

The important findings of this dissertation are as follows. Structurally complex organizations do have more fully developed accounting systems, as predicted by hypothesis one. Process is even more important in determining the stage of development of the accounting system. Companies with more sophisticated processes have much more fully developed accounting systems, as predicted by hypothesis three. The stage of development of the accounting system is negatively related to that of some control systems, as predicted by hypothesis two. However, it is positively related to the stage of development of other control systems. These positive relationships have been interpreted as resulting from complementarity; information produced by the accounting system helps these control systems function better.

The research findings apply to the accounting system as follows. Overall organization variables primarily influence the output of accounting systems (the nature of reports and where they are sent in the organization). They do not have as much influence on the structure of accounting systems. The only key feature of accounting system organization structure is the distinction between centralized and divisionalized accounting systems.[1] In sum, the research findings show that it is impossible to design a new accounting system or even to adapt an existing one without understanding the organization of which it forms a part.

ORGANIZATION OF THE DISSERTATION

The first chapter is a brief nontechnical outline of the dissertation. Literature relevant to the topic of this dissertation is

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[1] Centralized accounting systems have a single accounting office at the company headquarters, while divisionalized accounting systems also have accounting offices at division headquarters.

examined in Chapter 2. From this examination emerged ideas for the basic model and hypotheses which are developed in the latter part of Chapter 2. The research design is elaborated in a step-by-step manner in Chapter 3. The statistical techniques are described using simple examples from the analysis of this dissertation's data. The emphasis is on the way data are manipulated rather than mathematical complexities.

The detailed findings of the study are in Chapter 4. These are of two types: the interrelations among accounting system variables and the relationships of organizational to accounting system variables. Chapter 5 attempts to integrate the detailed research findings of Chapter 4. A revised model is developed which incorporates the expected and unexpected findings. The steps of the inquiry and the important findings are reviewed in Chapter 6. Also, implications for company accountants and managers are suggested. Finally, follow-up research is proposed.

Chapter 2

REVIEW OF LITERATURE AND DEVELOPMENT OF BASIC MODEL

The purpose of this chapter is to review the literature in both management accounting and the branch of sociology devoted to the study of organization structure which was instrumental to the development of the research design of this dissertation and to formulate the basic model utilized in this dissertation. In Chapter 3, the research design for testing this basic model will be elaborated.

In the first section of the chapter, three studies from the accounting literature are reviewed which were vital to the development of the basic thesis of this dissertation. This thesis is that the nature of the accounting system is a result of the influence of the overall organization. Golembiewski formulated this thesis, but his arguments for it were defective in many respects.[1] Though Simon *et al.* were more concerned with the accounting system than the overall organization, their study suggested the idea of measuring the structural characteristics of the accounting system for the purpose of relating

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[1] Robert T. Golembiewski, "Organization Structure and the New Accountancy: One Avenue of Revolution," *The Quarterly Review of Economics and Business*, III (Summer, 1963), 29-40; Robert T. Golembiewski, "Accountancy as a Function of Organization Theory," *The Accounting Review*, XXXIX (April, 1964), 333-41.

them to characteristics of the overall organization.[1] Caplan was concerned with another influence of the overall organization on the accounting system—that of the attitudes of managers (both accountants and nonaccountants) about how organizations operate. Caplan's study provided some important concepts that were used in developing the basic model.[2]

In the second section of the chapter, two empirical sociological studies of samples of organizations are reviewed. These studies were essential to the development of both the research design and the basic model. Though neither study involved the accounting system, the primary contribution of the two studies was the idea that an empirical study of a sample of organizations could provide evidence of the validity of the basic thesis that the nature of the accounting system is a result of the influence of the overall organization. Moreover, the two studies furnished some indispensable methodological and conceptual ideas to the dissertation, the most important of which follow. The Pugh *et al.* studies concentrated on levels of variables instead of individual variables and applied data-combining techniques to organizational variables.[3] The

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[1] Herbert A. Simon, George Kozmetsky, Harold Guetzkow, and Gordon Tyndall, *Centralization vs. Decentralization in Organizing the Controller's Department* (New York: Controllership Foundation, Inc., 1954), pp. 1-10.

[2] Edwin H. Caplan, "Behavioral Assumptions of Management Accounting," *The Accounting Review*, XLI (July, 1966), 496-509; Edwin H. Caplan, "Management Accounting and the Behavioral Sciences," *Management Accounting*, L (June, 1969), 41-45; Edwin H. Caplan, *Management Accounting and Behavioral Science* (Reading, Mass.: Addison-Wesley Publishing Company, 1971), pp. 7-46.

[3] D. S. Pugh, D. J. Hickson, C. R. Hinings, K. M. Macdonald, C. Turner, and T. Lupton, "A Conceptual Scheme for Organizational Analysis,"

Blau and Schoenherr study developed the concept of structural complexity and helped refine the concept of control. These concepts were vital to the completion of the basic model.[1]

The basic model is developed in the third section of the chapter. It is composed of an accounting system level of variables and three levels of organizational variables. The nature of the relationships between the accounting system level and the three organizational levels is proposed in the model. Furthermore, the variables to be included in the four levels are developed and defined. Finally, three hypotheses are proposed for testing.

ACCOUNTING LITERATURE

The three studies in this section[2] deal with various ways in which the overall organization relates to the accounting system. Fundamental ideas for the development of this dissertation came from the Simon *et al.* study and the Golembiewski work. The Caplan work furnished some concepts which were useful in developing the basic model.

Administrative Science Quarterly, VIII (December, 1963), 289-315; D. S. Pugh, D. J. Hickson, C. R. Hinings, and C. Turner, "Dimensions of Organization Structure," *Administrative Science Quarterly*, XIII (June, 1968), 65-105; D. S. Pugh, D. J. Hickson, C. R. Hinings, and C. Turner, "The Context of Organization Structures," *Administrative Science Quarterly*, XIV (March, 1969), 91-114.

[1] Peter M. Blau and Richard A. Schoenherr, *The Structure of Organizations* (New York: Basic Books, Inc., 1971).

[2] Though most of the authors whose research is reviewed in this section are behavioral scientists, they are included because their work was published in accounting-oriented publications and concerns the accounting system explicitly. The only accounting researcher is Caplan.

Simon *et al.* investigated the structure of the accounting system and tried to relate it to accounting system effectiveness. They contributed to this dissertation the idea of measuring structural characteristics of accounting systems as well as several specific measures of those characteristics.

Golembiewski explored the relationship between the overall organization structure of a company and the role of its accounting system. He discussed the effect of alternative organization structures on the degree that the accounting system is a field of conflict within organizations. He furnished this dissertation with the idea that the nature of the accounting system may be determined by the overall organization in which it operates.

Caplan examined another way that the overall organization impacts on the accounting system. He considered the effects of the attitudes of executives and accountants about how organizations operate on the measurements produced by the accounting system. He classified those attitudes into two models of the firm: the traditional management accounting model of the firm and the modern organization theory model of the firm. Though Caplan's work did not contribute a fundamental idea for the dissertation, it suggested some important supportive concepts which were used in the model development section of this chapter.

Simon et al.

In the early 1950's, The Controllership Foundation (now the Financial Executives Institute) sponsored a groundbreaking study of the organization of controllers' departments in seven relatively large and complex companies. The study was undertaken by four behavioral scientists: Simon, Kozmetsky, Guetzkow, and Tyndall. They investigated the relationship between the structure of the controllers' departments, along five dimensions of centralization and decentralization, and the controller's department effectiveness, as measured by three performance measures.[1] The effectiveness measures were:

1. Providing information services of high quality.
2. Performing services at minimum cost.
3. Facilitating the long-range development of competent accounting and operating executives.

The five dimensions of decentralization were:

1. The structure of accounts and reports.
2. The geographical location of accounting functions.
3. Formal authority relations.
4. Loyalties.
5. Channels of communication.

Decentralization of the account structure has to do with whether financial information is developed for subordinate units of the company. Geographical decentralization means locating controllership personnel within operating locations away from the home office. Decentralization of formal authority relations has to do with whether accounting units are attached to operating units (as opposed to being responsible only to the controller). Decentralization of loyalties has to do with whether accounting personnel regard themselves as part of the operating team at

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[1] Simon *et al.*, pp. v-ix, 1-10.

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[1] Simon *et al.*, pp. v-ix, 1-10.

their respective locations. Decentralization of communication channels means the extent of horizontal communication between accountants and operating personnel on a given level.

Some comments on the measures of decentralization are appropriate here. First, none of the dimensions is directly involved with the internal organization of the controllership function, though some have implications for internal organization. Instead, all of the dimensions have to do with the relations to or attachment to operating units of controllership personnel. Second, none of the five dimensions has to do explicitly with the classic definition of decentralization-authority to make decisions at lower company levels. The only tie-in with the classic definition is that decentralization of the controllership function along all these dimensions can facilitate lower-level operating decision-making. In other words, if information and support are not provided to lower-level operating personnel by the controllership department, it is unlikely they will be able to make decisions. On the other hand, the fact that the information and support is provided does not assure that decentralize decisions will be made by operating employees. That could be influenced by company policies and other factors.

In light of the above, Simon *et al.* might better have labeled their variable "dispersion of accounting services and resources" rather than decentralization. In spite of the poor labeling, the Simon *et al.* study contributed significantly to the development of this dissertation in two ways. It suggested the idea of measuring the structural characteristics of accounting systems. In addition, their dimensions of decentralization suggested three accounting system variables used in this dissertation. These were decentralization of accounts and reports, decentralization of geographical locations, and decentralization of formal authority relations.[1]

The research design of the Simon *et al.* study was relatively unsystematic. Much qualitative as well as quantitative information was collected from company officials in loosely structured interviews. The effectiveness measures are quite vague, and the authors did not describe the statistical methods they used to relate them to the centralization measures. Consequently, the authors' opinions about the companies were difficult to distinguish from their research findings. The research really boils down to an extensive case study of the seven companies.

The "findings" of Simon *et al.* have to do with the separation of and the appropriate degree of centralization of three basic functions of controllership. These functions are:

1. Recordkeeping and preparation of accounting reports.
2. Assistance to operating departments in analysis of accounting information.
3. Participation in special studies to solve problems in operating departments.

The authors advocate the separation of these functions so they can each be placed at the appropriate organizational level. The assistance function must be completely decentralized to the operating departments. In that way, accountants can be located near operating officials in order to develop their trust by communicating regularly with them. The

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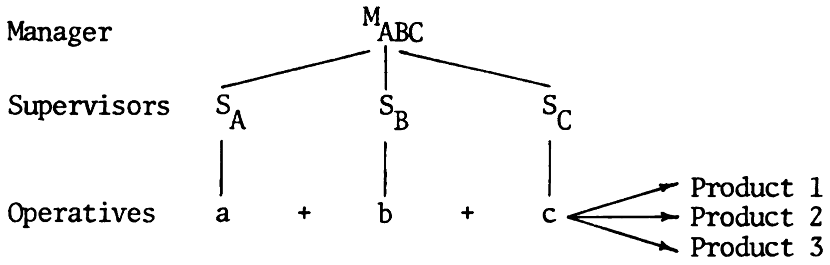
[1] The relationships of these variables to the model for this study are discussed below on pages 54-56.

special studies function should be at a high level since it involves recruiting specialists from different disciplines to attack a problem on a team basis. The recordkeeping function should be at some intermediate level depending on the strength of two countervailing influences. A decentralized location near the operating departments where documents are produced promotes reliability of the system and allows access to the documents where it is needed. A more centralized location facilitates clerical specialization and mechanization which reduce the cost of recordkeeping.

Golembiewski

The basic thesis of my dissertation (see above, page 1) was suggested in the early 1960's by Golembiewski. He maintained that the task and problems of management accounting were determined, to a great extent, by the organization structure of the productive sector of an organization. He based this conclusion on analysis of two alternative organization structures rather than empirical research.[1]

He called one of these the traditional theory of organization, and diagrammed it as follows:



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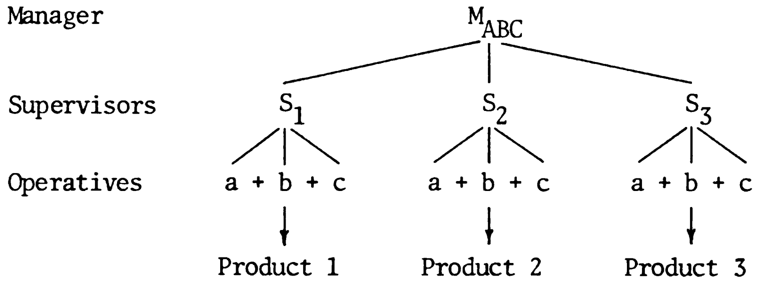
[1] Golembiewski, "Organization Structure and the New Accountancy," pp. 29-40; Golembiewski, "Accountancy as a Function of Organization Theory," pp. 333-41.

There are three production departments, each headed by a supervisor (S_A, S_B, and S_C). Three production processes are required to make each product, and the three processes are assigned, respectively, to the three production departments. Thus each production department has only one (or possibly a few) type of operative (production worker).

He called the alternative organization structure the emerging theory of organization, and diagrammed it as follows:



All three productive processes and their respective types of production workers are in each department. The departments may produce the same or different products.

Note that little integration of the activities of the departments is required with the emerging theory since the departments produce products independently, while extensive integration (scheduling, etc.) is required with the traditional theory since the output of one department is input to the next. Golembiewski maintains that the accounting function must play a dominant role in forcing integration of the activities in the traditional structure and is thus on the "firing line." In addition, there are no natural standards of performance for the process departments since each contributes only partially to the production of a product.

Thus arbitrary standards and arbitrary allocations of the costs of integration (i.e., idle time in one department caused by a slowdown in another department) are necessary. The accounting function suffers because it must force integration with necessarily imperfect instruments. This is alleviated by the emerging theory of organization where forced integration is not necessary. In this system, the accountant, relieved of his forced integration role, can concentrate on providing helpful information to managers.

Golembiewski's arguments about the superiority of the emerging theory over the traditional theory are defective in two respects. First, they cannot be proved without empirical verification. It is hoped that this dissertation may contribute in this area. Second, they are defective analytically. The two organization structures are not economically viable alternatives for most organizations. Economies of scale with respect to processes determine how much they must be concentrated in a single organizational unit. For example, if process A (under supervisor A) were an automated assembly line, it would be impossible to break it up between three product departments. Admittedly the emerging theory structure poses less coordination problems for the accountant and for management in general. But the accountant must work with whatever organization structure is mandated by the company's technology (i.e., economies of scale). Furthermore, much modern manufacturing enterprise is highly integrated and technologically sophisticated. It would be impossible to break up such enterprises into product units so that partial contributions to the production of the product need not be measured. In a high-technology environment, a primary challenge to accountants is to learn to measure such partial contributions rather than avoiding the problem by insisting on a simpler organization structure and thus a simpler level of technology.

Though the actual relationship between the organization structure and the accounting system may be much more complex than the oversimplistic and naive model that Golembiewski proposed, his postulation of it was a key steppingstone in the development of the idea for this dissertation.

Caplan

In the late 1960's, Caplan considered, from a different perspective, the effects of the organization on the nature of management accounting. Specifically, he considered the effect of various assumptions by management and accountants about the way organizations operate on what is measured by the management accounting system. Caplan developed two models which he maintained represent the mainstreams of management thought. These were the traditional management accounting model of the firm and the modern organization theory model of the firm. For each model, Caplan developed assumptions about organization goals, the behavior of participants (employees), the behavior of management, and the role of management accounting. He hypothesized that adherence to one of the models by management and accountants determines what accounting measurements are produced for management.[1]

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[1] Caplan, *Management Accounting and Behavioral Science*, pp. 7-46. The material in this reference was extracted by Caplan from two prior journal articles: Caplan, "Behavioral Assumptions of Management Accounting,"

The traditional management accounting model of the firm is oriented chiefly around the exclusive organization goal of profit maximization. The roles of both management and management accounting are to maximize profits. The chief function of management accounting is to subdivide the overall profit goal into subgoals, assign responsibility for the subgoals to managers (departmental budgets), and hold the managers responsible for accomplishment of the subgoals (departmental performance reports).

The modern organization theory model is oriented to decision-making at various levels of the organization and is based primarily upon the writings of Barnard and Simon. Its assumptions attempt to describe how organizations actually operate. The key aspect of the modern model is taking into account human limitations: limited rationality, limited cognitive ability, limited knowledge, and limited commitment to the organization.

Caplan suggested that the acceptance by accountants of the traditional model has greatly restricted the ability of accounting systems to respond to the actual needs of management. He recommended empirical research to determine the relative effects of acceptance of the two models by company accountants on company accounting measurements and on company functioning.

In contrast to Golembiewski, Caplan's analysis seems conceptually sound. He avoids postulating relationships which must be subject to

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pp. 496-509; and Caplan, "Management Accounting and the Behavioral Sciences," pp. 41-45.

empirical verification. The influence of the basic assumptions of accountants (and of course management) on the nature of accounting measurements, though subject to empirical verification, seems logical.

But Caplan's models omit consideration of a vital factor: organization structure. The management of organizations would be an impossible task were it not for relatively permanent structures created to channel organizational activities. Some of these structures are located within the accounting system. A key role of management, in addition to directly controlling operations, is creating such structures which foster effective and efficient operations, facilitate the control of operations, and thus allow management to pursue other activities such as planning.

SOCIOLOGY LITERATURE

The two organization structure research studies reviewed in this section heavily influenced the conceptual foundations and the research design of this dissertation. The idea that relationships between the accounting system and the overall organization ought to be examined evolved from the studies dealing with the accounting system in the last section. But none of the three studies made effective use of empirical research techniques to document their conclusions. Only the Simon *et al.* study used a sample of companies. But the way they generalized from the data collected was not clear.

Though the two empirical organization structure studies in this section did not address the subject of the accounting system, their use of empirical research techniques suggested the idea of applying those techniques to a study involving the accounting system. More specifically, their use of the statistical technique *multiple regression analysis* to isolate relationships between variables was duplicated in this dissertation. Moreover, the studies suggested important implications of organization structure for the accounting system.

Both Pugh *et al.* and Blau and Schoenherr were interested in the relationships among characteristics of the context (environment and unchangeable aspects of the organization), organization structure, and functioning of organizations. Though Blau and Schoenherr were concerned with relationships among individual variables, Pugh *et al.* emphasized relationships among levels of variables, specifically the relationship between the context level and the organization structure and functioning level.[1] The levels approach was adopted in this dissertation. Pugh *et al.* also contributed to this dissertation the idea of combining measurements into a single measurement of a variable by means of such techniques as principal components analysis.

Hence, the greatest contribution of Pugh *et al.* was in methodological areas. In contrast, the most significant contribution of Blau and Schoenherr was in conceptional areas. They were very concerned with building a theory that explains how organizations develop. Consequently, they carefully defined concepts and tried to explain how relationships found among those concepts came about. A vital concept in their study was differentiation of organization parts which leads to complexity of

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[1] The rationale for the levels approach is that variables within the levels have a common influence on other levels of variables.

the organization structure. They also dealt with the problems of control and coordination in organizations. Each of these concepts contributed to establishing a role for the accounting system and thereby an explanation of the processes which may cause accounting systems to develop. These matters are discussed in the model development section of this chapter.

Pugh et al.

Much of the research design of this dissertation was suggested by the study by D. S. Pugh and his colleagues of forty-six organizations in the English Midlands during the late 1960's.[1] Rather than emphasizing the relationships among individual variables, they explored the relationships among different levels of variables in organizations, specifically the levels of contextual variables and organizational structure and functioning variables. The contextual level includes relatively unchangeable factors such as the history of the organization, the nature of its ownership and control, its size, its mission, its technology, its geographical dispersion, and its dependence on other organizations. The organizational structure and functioning level includes such factors as specialization, standardization, formalization, centralization, and configuration. Pugh *et al.* hypothesized that the contextual variables were prime determinants of the organizational structure and functioning variables and

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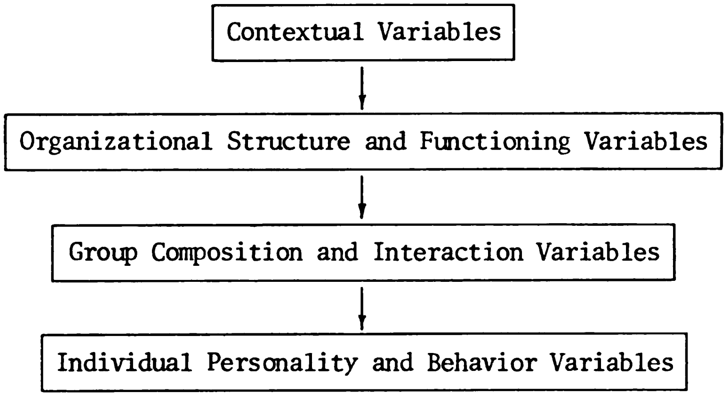
[1] Pugh *et al.*, "The Context of Organization Structure," pp. 91-114; Pugh *et al.*, "Dimensions of Organization Structure," pp. 65-105.

investigated that relationship.[1] They planned to investigate, in turn, whether these two levels of variables may be prime determinants of two other levels: group composition and interaction, and individual personality and behavior.[2]

Thus the Pugh *et al.* model might be diagrammed as follows:



Pugh and his colleagues hypothesize that the contextual variables influence the development of organizational structure and functioning. In turn, organizational structure and functioning variables influence the development of group composition and interaction variables, and these, in turn, influence the development of individual personality and behavior. Pugh and his colleagues recognize that the hypothesized direction of causation (as indicated by the arrows) may be reversed in some

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[1] Pugh *et al.*, "The Context of Organization Structure," pp. 91-114.

[2] Pugh *et al.*, "A Conceptual Scheme for Organizational Analysis," pp. 289-315.

cases.[1] For example, specializing of roles (a structural variable) may require more people (a contextual variable).

Pugh and his colleagues also deal extensively with the problem of aggregation of measurements. They make a clear distinction between measurements and concepts and use data-reduction techniques (principal components and item analysis) to merge different measurements felt to be associated with a concept into a single measurement of the concept.[2] The principal components technique of merging measurements was incorporated into this dissertation and is discussed below on pages 72-88. Pugh *et al.* recognize the cost of such aggregation in lost individual relationships but feel that the greater conceptual clarity outweighs the cost.[3]

Using the data-reduction techniques indicated in the prior paragraph, Pugh *et al.* consolidated their multitudinous contextual measures to eight dimensions, and their organization structure and functioning measures to three dimensions. Their dimensions of context were: age of the organization, size of the organization, size of the parent organization, operating variability, operating diversity, workflow integration, number of operating sites, and dependence.[4] Their organization structure

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[1] Pugh *et al.*, "The Context of Organization Structure," p. 112.

[2] Pugh *et al.*, "Dimensions of Organization Structure," p. 70; Pugh *et al.*, "The Context of Organization Structures," p. 93.

[3] *Ibid.*, p. 98.

[4] Size of the parent organization, for an agency of government, is the size of the government of which it is a part. For an independent business organization, it is the same as organization size. For a subsidiary, it is the size of the parent company. Operating variability is the extent to which the organization does not produce a standardized good or service. Operating diversity is the number of different outputs

and functioning dimensions were: structuring of activities, concentration of authority, and line control of workflow.[1]

Pugh *et al.* used stepwise regression to explain the dimensions of organization structure and functioning with the dimensions of context. They found that a large proportion of the variance of each of the three organization structure and functioning dimensions could be accounted for by respectively one or two contextual dimensions and that further contextual dimensions added nothing significant to the explanation.[2] From the Pugh *et al.* study came the idea of using stepwise regression in this dissertation. The stepwise technique, as applied to the dissertation, is discussed below on pages 90-100.

The most important conclusion of Pugh *et al.* is that context is a key determinant of organization structure and functioning. Their specific findings were that organization size and workflow integration were key determinants of structuring of activities; dependence and

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(i.e., products) produced by the organization. Workflow integration is the rigidity and integration of production operations. Dependency is the degree to which the organization is constrained by other organizations in its environment such as labor unions, suppliers, customers, parent companies, governments, etc. Three of these dimensions were incorporated into this dissertation; these are size of the organization, operating diversity, and number of operating sites. They are discussed below, respectively, on pages 49, 52, and 48. See Pugh *et al.*, "The Context of Organization Structures," pp. 94-109.

[1] Structuring of activities is a combination of measures of the extent the organization is bureaucratic; i.e., has standardized procedures, specialized roles, etc. Concentration of authority is roughly centralization of authority. Line control of workflow is the extent the organization is not dominated by a staff superstructure. See Pugh *et al.*, "Dimensions of Organization Structure," pp. 85-88.

[2] Pugh *et al.*, "The Context of Organization Structure," pp. 109-11.

number of operating sites were key determinants of concentration of authority; and operating variability was the key determinant of line control of workflow.[1]

Blau and Schoenherr

A study by Blau and Schoenherr of fifty-three state employment security agencies, published in 1971, exerted a predominant influence on the research design of this dissertation.[2] Their extremely well documented study influenced significantly the conceptual foundations, the statistical research design, and the measurement techniques of this dissertation.

The employment security agencies administer unemployment insurance programs and provide employment services to the public. Blau and Schoenherr collected a vast amount of data on each of the fifty-three state employment security agencies (fifty states, the District of Columbia, and two territorial possessions) by means of interviews with agency officials and documents supplied by the agencies. Most of the information involved structural characteristics of the agencies, and much of it was obtained from agency organization charts. The authors examined the interrelations among these agency characteristics to determine if significant patterns were observable.

The conceptual foundations of this dissertation are rooted in concepts developed in the Blau and Schoenherr study. Structure was

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[1] *Ibid.*

[2] Blau and Schoenherr, *op. cit.*

defined in their study, per the dictionary, as something composed of parts.[1] I would add two clarifying aspects to the definition. Structure is composed of "interrelated" parts.[2] The second clarifying aspect is not in the dictionary definition but, to my mind, is an essential aspect of organization structure: Structure is something composed of interrelated parts which persist with relative permanence; i.e., they do not have to be re-established constantly.

It follows that a key aspect of organization structure is the subdivision of the overall objectives of the organization into roles or areas of responsibility which individuals, departments, or levels of the organization can accomplish. Often these roles and areas of responsibility are different from one another. The general process of developing new parts of the organization which are often different from the old ones is referred to by Blau and Schoenherr as "differentiation." As organizations differentiate more and more parts, they become more complex. Differentiation can occur along several dimensions, but there are two basic types: horizontal and vertical. Vertical differentiation is the number of authority levels in the organization structure (between the chief executive officer and the lowest-level employees). Horizontal differentiation includes several other variables involving number of organization parts: number of different jobs, average number of departments

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[1] *Ibid.*, p. 300.

[2] *Webster's Third New International Dictionary of the English Language, Unabridged* (Chicago: Encyclopaedia Britannica, Inc., 1971), p. 2267.

under a given level of managers, average span of control of managers on a given level, and number of local offices.

The overall conclusion of the Blau and Schoenherr study is that organizations differentiate more and more parts, along all dimensions, as they become larger in size. Large organizations have more levels, more departments, more jobs, etc. However, the rate they differentiate new parts with increases in size levels off. Large organizations differentiate less new parts for a given increase in size than smaller organizations.

A key point made by Blau and Schoenherr and incorporated in this dissertation is that organization structure can be studied apart from the behavior of humans within the structure. It is obvious that humans (managers) create the structure and it is also obvious that humans are affected by the structure. Nevertheless, Blau and Schoenherr maintain that, given the scope of the organization's responsibilities, structural conditions exert constraints on the decisions of managers such that they tend to create structures with certain regularities and thus assessing the behavioral inclinations of managers is not necessary.[1] For example, the Appollo spacecraft could not have been constructed in someone's backyard, regardless of the amount of money invested in it. An organization structure (governmental and industrial) of a minimum degree of complexity was necessary to marshall the resources to get the job done.[2]

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[1] Blau and Schoenherr, p. 300.

[2] This is my own illustration.

Blau and Schoenherr also emphasize the importance of control and coordination of activities in complex organizations. They interpret many of their research findings in terms of control and coordination. For example, they explain why the rate of differentiation of organization parts with increases in size levels off by citing the additional coordination that is required in large organizations. For example, the number of departments in an organization increases with increases in company size. However, when the organization becomes large, coordination of the activities of the numerous departments becomes difficult. Consequently, pressure builds up to resist further differentiation. This pressure slows down the rate of differentiation of departments.

Furthermore, Blau and Schoenherr recognize that operations are controlled by "impersonal mechanisms of control." Personal control or supervision is the oldest form of control in organizations. Most other control mechanisms are impersonal to some degree. Impersonal mechanisms of control include automation and standardization of procedures, both of which control operations without human (or personal) intervention. For example, automation in the form of an assembly line controls the actions of workers by forcing them to adhere to the pace of the assembly line.[1]

The statistical research design of this dissertation was heavily influenced by the Blau and Schoenherr study. Theirs was a cross-sectional study of the interrelations of organization characteristics at a single point in time. Yet their explanations of the relationships were developmental. They were not satisfied with saying that one characteristic

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[1] Blau and Schoenherr, pp. 300-26.

happened to be associated with another. They suggested why the associations might have come about. The cross-sectional research design is not adequate to verify such explanations. Yet proposing the explanations is necessary for theory development.[1] Like Pugh *et al.* and this dissertation, Blau and Schoenherr used multiple regression analysis to determine the effects of variables on each other.[2]

The measurement techniques of this dissertation were based to a large extent on those used by Blau and Schoenherr. They described the specific measures they used for variables in appendices to their book.[3] These measures were used extensively in developing the interview questionnaire for this study. The specific uses of their measures will be noted later.

DEVELOPMENT OF BASIC MODEL

In order to direct the attempt to discern relationships between the structure and the accounting systems of organizations, a model is developed in this section. The model focuses attention on the key overall relationships and provides a means of classifying variables of the accounting system and those of the overall organization which influence the accounting system. This model incorporates many of the concepts of the studies that were discussed in the prior section.

The first step in developing the model is to set out the desirable features that it should have. Second, the broad concepts of the

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[1] *Ibid.*, pp. 326-29.

[2] *Ibid.*, pp. 23-27.

[3] *Ibid.*, pp. 373-407, 422-35.

model which are represented by levels of variables are defined. At the same time, the conjectured relationships between the levels are elaborated. Next, the variables which are to be included in each level are designated and defined. Finally the hypotheses which incorporate the assumed relationships among the levels of the basic model are formulated.

Desirable Features of the Model

The model must have certain characteristics in order to be useful. The major features that are strived for in the model development are simplicity, causality, and intuitive meaning for the major parts of the model (levels).

First of all, the model must be simple. Why should a model that is designed to explain highly complex relationships among multitudinous variables be simple? Because, otherwise, the human mind is unable to deal with it. Simplicity requires that relationships among only a few (no more than five) basic elements be examined at any one time. Consequently it is necessary to classify the numerous variables that must be considered in a study involving the structure of organizations into a few basic levels.[1] The cost of this simplification is that attention is diverted from many interesting and important individual relationships between variables. The advantage is the conceptual clarity gained. In

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[1] The idea for the levels approach came from the previously cited works of Pugh *et al.* See above, pages 22-23. Their distinction between the contextual level of variables and the organizational structure and functioning level was incorporated in the basic model of this dissertation. See the discussion of context below on pages 37-41.

fact, the "art" of theory building in any field is the simplification of highly complex relationships.

A second characteristic necessary to make the model useful (and a basis for distinctions among levels) is that it be causal. The levels should be related logically to each other. It seems obvious that such logical relationships among the levels would appear over time, and so a time dimension is a necessary element of the explanation. For instance, both Blau and Schoenherr and Pugh *et al.* have concluded that contextual level variables "cause" the development of various characteristics of organization structure.

Blau and Schoenherr discussed the issue of whether theories should explain why associations develop logically or merely predict that in certain circumstances they do appear. They concluded, as I have, that the usefulness of a theory is greatly enhanced by an explanation of the logical connections that explain the relationships that develop in organizations.[1] Consequently, causal relationships are described between the levels in this dissertation. The status of variables in the higher level necessitates that variables in the lower level take on a certain pattern.

A third characteristic necessary for the model to be useful is that the levels have intuitive meaning. If levels include seemingly random collections of variables, it is difficult either to establish the meaning of the level or to explain the logical relationships among the levels. Consequently, the variables in each level should have

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[1] Blau and Schoenherr, pp. 328-29.

some common characteristics which determine the meaning of the level as a whole.

The Levels and Their Interrelations

In this section, the four levels of the basic model and the theorized relationships among those levels are introduced. The four levels are the accounting system, the control system, structural complexity, and context. In the first subsection, the expected positive relationship between structural complexity and the stage of development of the accounting system is developed. In addition, the expected negative relationship between the stage of development of the accounting system and that of the control system is advanced. In the second subsection, the expected positive relationship between the stage of development of the accounting system and that of context is elaborated.

Structural Complexity and Control System

The Blau and Schoenherr study suggested one common characteristic that can define a set of variables in organization structure analysis: structural complexity. As was discussed above on page 27, structural complexity is the degree the organization is divided into (usually different) parts along various dimensions. Not only does structural complexity have conceptual clarity, but it suggests some important logical relationships to the accounting system that should be tested. Since accounting has often been considered to be focused on control and coordination in companies,[1] the question naturally arises whether an organization with greater structural complexity needs a more developed accounting system to force goal congruence.[2]

But is accounting the only control and coordination system in organizations? In small organizations there may be no accounting or any other observable control system. Yet all organizations must control their operations. Blau and Schoenherr refer to supervision as the traditional form of control in work organizations with the threat of punishment or termination of employment as the support for it. They point out that modern organizations do not rely as much on supervision. Instead, they use less offensive control systems, such as standardization of procedures and qualified personnel. Standardization of regulations and procedures limits the discretion of employees. The technical knowledge and self-discipline of certain employees is a control mechanism in that such employees need less supervision, procedures to guide them, and other forms of control.[3] This variable will be called "personnel quality" in this dissertation.

Another form of control is the retention in the hands of top management of the authority to make key decisions. If lower-level

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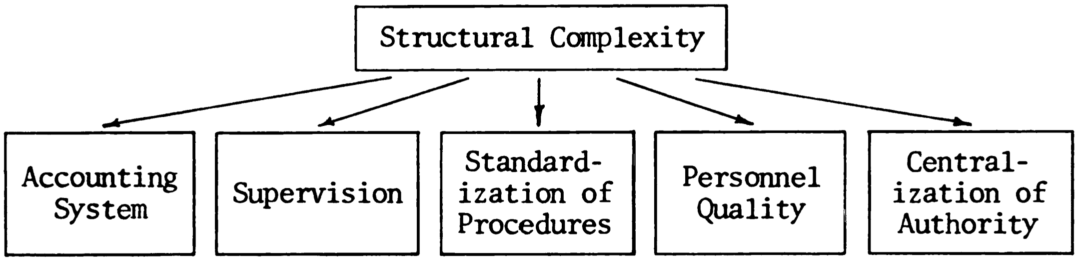
[1] Caplan's traditional management accounting model of the firm clearly views the role of management accounting as primarily a control device. Its chief functions are to assign responsibility for performance to managers by means of budgets and hold them responsible for accomplishment by means of performance reports. Caplan implies that the traditional model is widely accepted among accountants. See above, page 19 for a description of Caplan's traditional management accounting model.

[2] This question was initially raised by Golembiewski; see above, page 15.

[3] Blau and Schoenherr, pp. 348-50.

managers do not have such authority, they do not have the power to disrupt company operations. This retention of authority is referred to in this dissertation as centralization of authority (as opposed to decentralization of authority). The development of each of these control systems, like the development of the accounting system, may respond to increasing structural complexity. These relationships can be diagrammed as follows:



If control systems are related positively to structural complexity, how are they related to each other? A supposition of this dissertation is that they are negatively related to each other. The logic behind this supposition is presented in the following paragraph.

Blau and Schoenherr asserted that automation (or mechanization) acted as a control system. It took the form of the extent of computer usage in employment security agencies. Blau and Schoenherr felt that computers exert a constraining influence on employees since their performance must conform to the computer setup.[1] But of more importance for this dissertation, they found an interesting interaction effect

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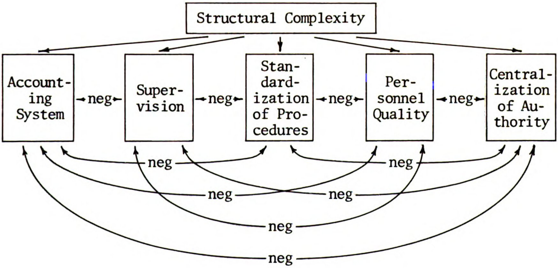
[1] *Ibid.*, p. 126.

between computerization and centralization of authority. Increasing organization size created pressures to decentralize operations in order to decrease the decision-making load of top management. But such decentralization tended to take place only in the presence of computerization. Apparently computerization restrained operations to the extent that top management felt more comfortable about decentralizing decision-making.[1] This finding suggested the possibility of similar interaction effects between other control systems. Is it possible that, in general, as one control system develops (i.e., automation), another (i.e., centralization) need not develop as far? If so, negative associations between the stages of development of the control systems can be expected. The two basic relationships discussed so far can be diagrammed as follows:



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[1] *Ibid.*, pp. 321-22.

The above diagram presents the core of the model used in this dissertation. Though structural complexity will be broken into different dimensions and other control systems will be added, it incorporates the primary relationships that are examined: the positive relationship between structural complexity and the accounting system, and the negative relationships among the control systems (particularly the negative relationships between the accounting system and other control systems). All the variables taken together constitute organization structure, the persistent aspects of the organization.[1]

Context

Though the model proposed so far includes the key relationships to be examined in this dissertation, it is advisable to expand it somewhat for two reasons. First, it is necessary to control for some factors which may affect the relationships between overall structural complexity and the control system. Second, an alternative explanation of the development of the accounting system is possible.

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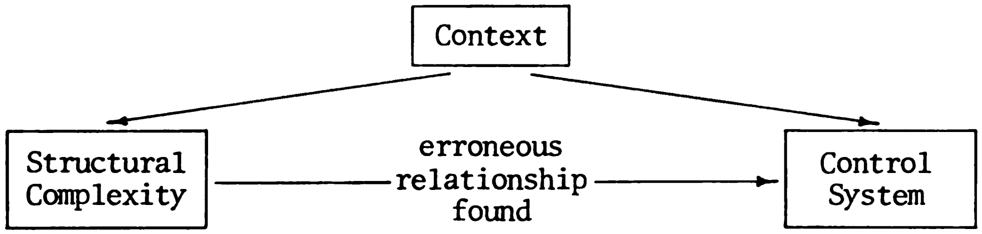
[1] Neither Pugh *et al.* nor Blau and Schoenherr subdivide organization structure between structural complexity and control systems as this dissertation has. They were not compelled to make such a subdivision because their primary objective was to explain organization structure in terms of context. If context induces the development of structural complexity and structural complexity induces the development of control systems, then positive relationships will be found between context and both structural complexity and control systems. In contrast to Pugh *et al.* and Blau and Schoenherr, the primary objective of this dissertation is to explain a single control system—the accounting system—in terms of organization structure. The subdivision of organization structure is necessary because negative relationships are expected between the accounting system and other control systems, while positive relationships are expected between the accounting system and structural complexity. See the discussion of the definition of structure above, page 27.

Though the context of the organization has been left out of the model so far, it is important to include it for several reasons. Many organization researchers, including Pugh *et al.* and Blau and Schoenherr, have examined (and documented) the ways that context, the relatively unchangeable aspects of the organization, induces the development of organization structure.[1] To ignore that relationship would leave open the possibility that any relationships found within the organization structure are accountable solely by the common influence of context. For example, context may influence the development of the control system and structural complexity, as follows:



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[1] Both Pugh *et al.* and Blau and Schoenherr distinguish variables that are given (context) from those which can be altered. Given variables cannot be changed by the current management of the organization. Blau and Schoenherr split the given variables between environmental and parameter variables (characteristics of the organization itself which cannot be changed). On the other hand, Pugh *et al.* create one group called contextual variables, which includes both environmental and parameter variables. Pugh *et al.* include in the contextual group such variables as size of the organization, its mission, and its technology (nature of its productive operations). Blau and Schoenherr include such variables as size of the organization and extent of civil service regulations governing the organization (employment security agency) in the parameter classification and characteristics of the local population in the environmental classification. See above, pages 22 and 24.

If context were not included in the study, structural complexity would be found to be positively related to the control system due to the common influence on the two by context. That relationship would be erroneous, since there is no causal connection between the two. Consequently, the context of the organization is included in the model as a control on this possible relationship.

A second reason for the inclusion of context in the model is that context, rather than structural complexity, may actually be the primary determinant of the development of the accounting system. The logic behind this alternative explanation is the additional decision-making information that may be required for companies with involved contexts.

A significant body of accounting thought in recent years has assumed that the primary function of both management and financial accounting is the provision of information for decision-making. For example, Charles T. Horngren, in his widely used and respected cost accounting textbook, asserts that providing information for managerial decision-making is the basic reason for management accounting.[1] Caplan adopts a decision-making orientation in his modern organization theory model and contrasts this with the primarily control orientation of the traditional accounting model.[2] If providing information for decision-making were actually the primary function of management accounting in

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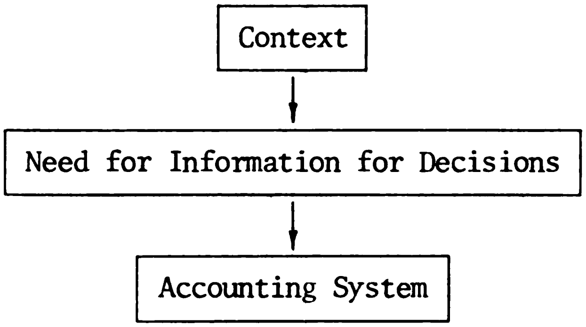
[1] Charles T. Horngren, *Cost Accounting, A Managerial Emphasis* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), pp. 2-3.

[2] A discussion of Caplan's alternative model appears above, page 19.

organizations, then it might be expected that the stage of development of the accounting system would be closely related to the demands placed on the organization by its context. It seems logical that companies facing a changing and intricate environment would need more and better information for decision-making. This relationship could be diagrammed as follows:



As was discussed on page 38, the relationship between context and organization structure has been extensively examined by organization researchers. A direct, probably causal, relationship between context and organization structure has been verified by these researchers.[1] In a general sense, it is evident that a changing and intricate environment as well as a sophisticated technology and other aspects of context necessitate the development of a complex organization structure. This general relationship is assumed to be true in this dissertation and is not tested. Context is added to the model on page 36 as follows:

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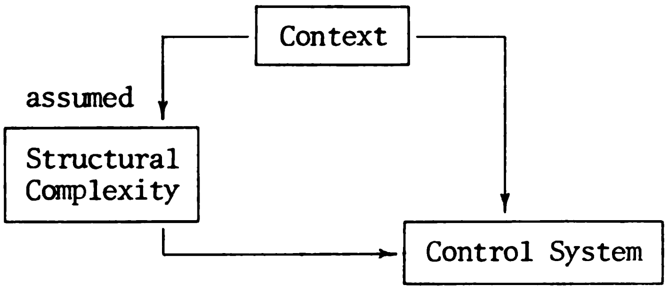
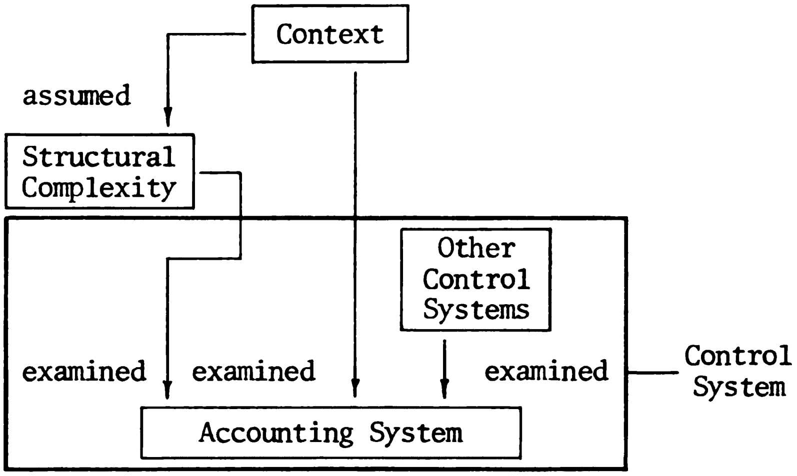
[1] The specific variables of context and organization structure that are found to be related are not always the same.



To this point, the control system as a whole has been presented as the bottom level of the model. The model suggested the desirability of examining the relationship of the control system to two higher levels of variables in the model: structural complexity and context. But since the concern of this dissertation is the accounting system rather than the control system as a whole, it is desirable to elaborate the model somewhat further. The control system can be divided into two parts: the accounting system and other control systems. Furthermore, the relationships, indicated by arrows, from structural complexity and context are redirected to the accounting system. This elaboration is diagrammed as follows:



The accounting system is now on the bottom level and thus subject to explanation by three higher levels of variables: other control systems, structural complexity, and context. But the relationship of the accounting system to other control systems is quite different than the relationships to the other two levels. The accounting system is to be explained by other control systems because it is the central focus of the research, not because the other control systems cause the accounting system to be developed. Hence the relationship to other control systems is reciprocal rather than causal.

In summary, the model includes three levels of variables which are possible determinants of the state of development of the accounting system. This dissertation will examine these relationships in a sample of companies. The relative strength and direction (positive or negative) of the relationships to the three levels will suggest implications as to the nature of the processes[1] which cause the accounting system to be developed. For instance, if the complexity of the organization structure is found to have a strong positive relationship with the stage of development of the accounting system, when the effects of context and other control systems are held constant, then support is provided for the thesis that management accounting is primarily control-oriented and must develop in response to the differentiation of the organization into parts along various dimensions. If, in addition, the stage of development of the accounting system is found to be negatively related to the

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[1] "Process" is used here in the general sense, not as the organizational level.

stage of development of the other control systems, when the effect of context and structural complexity are held constant, then support is provided for the thesis that control systems are at least partially substitutes in contributing to the resolution of control and coordination problems created by structural complexity. If, on the other hand, the stage of development of the accounting system is found to be more strongly related to context than to structural complexity, when the other levels are held constant, then support is provided for an alternative thesis that the accounting system is primarily decision-oriented rather than control-oriented and that the quantity and quality of information needed by management for decision-making is dependent on the intricacy of the context facing the organization.

Variables within the Levels

Though some of the variables of the control system level were developed in the previous section in order to describe the relationship between the structural complexity level and the control system level, the purpose of this section is to fill out the levels with variables which are to be their respective elements. In order that the reader may have a guide to follow as various variables are discussed, the basic model used in this study is presented at this point with variables included.

Figure 1 illustrates the basic model. The three major groupings of variables—process (a condensation of context discussed on pages 52-53), overall structural complexity, and control system—are in the three outer boxes. Within each box are variables or subgroups of variables of

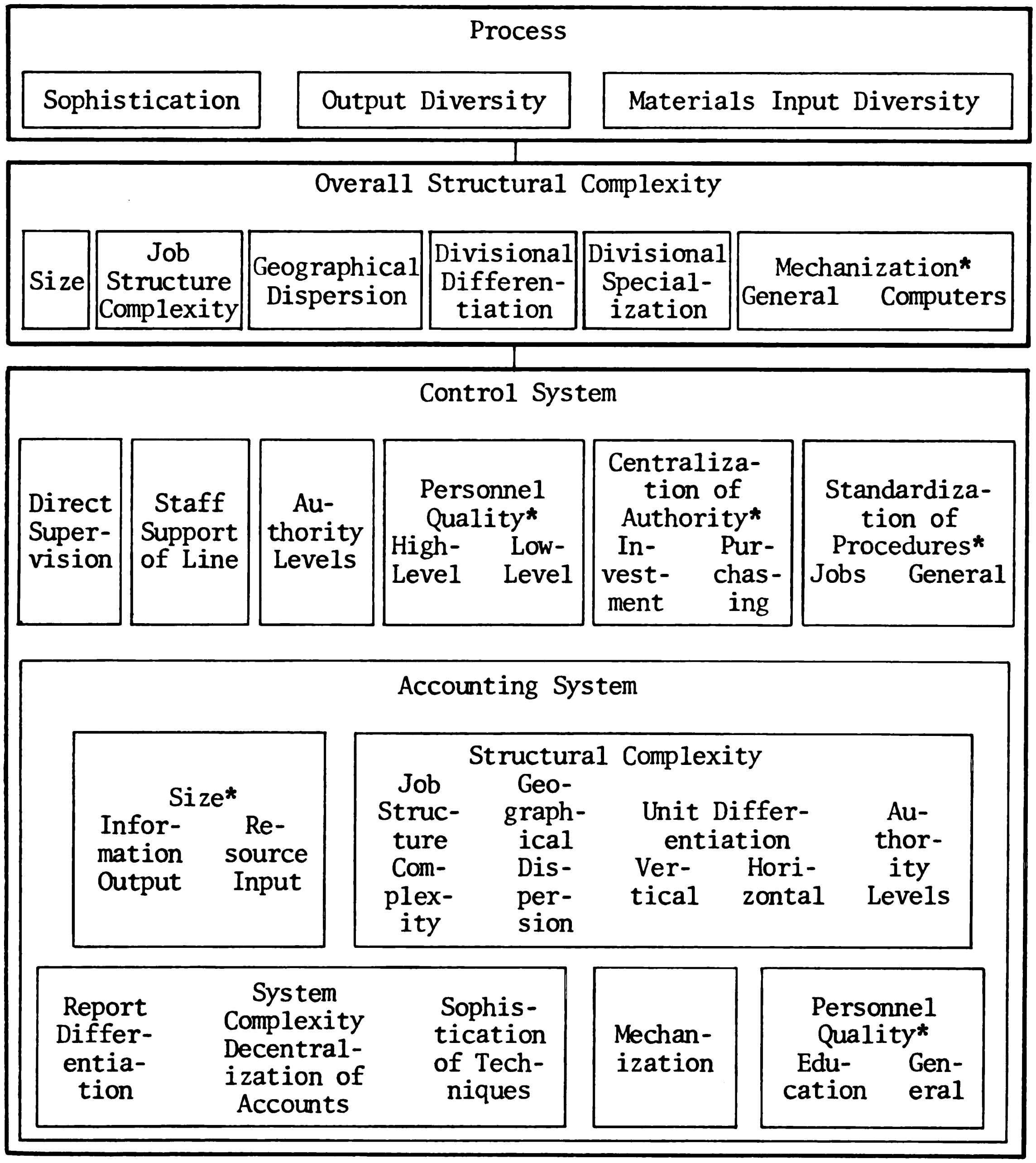

Figure 1. The Basic Model

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*These six variables were respectively split into the two variables indicated in the data refinement stage (below, pages 81-88). In this chapter on model development, they are discussed as a single variable.

the respective groupings. For example, "sophistication," "output diversity," and "materials input diversity" are variables of process. "Direct supervision" and "staff support of line" are variables of the control system. The accounting system, a subgroup of variables within the control system, is itself broken down into four variables and two subgroups of variables. The two subgroups of variables within the accounting system are labeled "structural complexity" and "system complexity."

There are four levels of variables in the basic model. Since the focus of interest of the study is on characteristics of the accounting system, the variables included in that box are considered criterion (dependent) variables and, taken together, constitute the first level of variables in the basic model. The rest of the levels in the model are composed of explainer (independent) variables which are frequently referred to in this dissertation as organizational variables. The rest of the variables in the control system box, taken together, constitute the second level of variables. The overall structural complexity and process variables respectively constitute the third and fourth level of variables.

In the first subsection, variables are assigned to the structural complexity and control system levels. In the second subsection, the technology of the production process is set forth as the only aspect of context that it is necessary to measure for the sample of companies examined in this dissertation. Consequently, the context level is renamed "process" and three variables of process are elaborated. In the third subsection, the variables of the accounting system are developed.

Structural Complexity and Control System Variables

In this section, variables are assigned to the structural complexity and control system levels. The first step is to incorporate into the control system level four control systems that were developed to demonstrate the nature of the control system level (above, page 34). Then the variables of differentiation are allocated between the structural complexity and control system levels. Finally, "size" and "mechanization" are ascribed to the structural complexity level, and "staff support of line" to the control system level.

The four control systems (other than the accounting system) origiinally discussed above on page 34 are recapitulated and redefined formally for this study here. "Direct supervision" is the extent to which activities of employees are controlled through the issuance of directives by a supervisor. "Standardization of procedures" is the proportion of organizational situations for which there are explicit rules and regulations to govern employee actions. "Personnel quality" is the extent of technical knowledge and self-discipline among employees which alleviate the necessity of having other control systems. "Centralization of authority" is the prevention of deviation from top management plans by restricting the authority to make key decisions to high-level executives. Each of these control systems is incorporated in the control system level of Figure 1.

Like the concept of structural complexity itself, many of the variables which are elements of the structural complexity level were derived from Blau and Schoenherr. As was discussed above on page 27, differentiation, the developing of new parts of the organization, is the process which creates structural complexity. Blau and Schoenherr divide differentiation into two types: horizontal and vertical. Vertical differentiation is the number of authority levels in the organization structure (between the chief executive officer and the lowest-level employees). Horizonal differentiation includes all the other variables involving number of organization parts. These include job structure complexity, geographical dispersion, and divisional differentiation.

All of these variables of differentiation were incorporated in the model in some way. "Authority levels" was included as a control system, while the other differentiation variables were included as structural complexity variables. The reasoning for not including "authority levels" in structural complexity follows. Blau and Schoenherr found that the number of authority levels in an agency is inversely related to the number of divisions, a measure of horizontal differentiation. They speculated that increasing agency size leads initially to horizontal differentiation, specifically more divisions. But the increasing number of divisions overburdens top management with administrative work (controlling the divisions). This forces top management to create a new level of superdivisions between itself and the old divisions. This decreases top management's administrative load but increases the number of authority levels.[1] The implication is that vertical differentiation (authority levels) is a pressure-relief mechanism rather than a control-problem-producing aspect of differentiation.

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[1] Blau and Schoenherr, p. 321.

Vertical differentiation (authority levels) has to do with the administrative superstructure above the operating level. It is developed to manage the operating level and enable it to perform its function. For example, a greater number of authority levels permits more first-level supervisors to be in the organization structure and thus more operatives to be controlled without increasing the span of control of the first-level supervisors. Rather than contributing to structural complexity and its consequent problems, it alleviates those problems. Thus it is classified as a control system in the basic model.

The horizontal differentiation variables were assigned to the structural complexity level because they were perceived to increase control and coordination problems. "Job structure complexity" is defined for this dissertation as the subdivision of the process into tasks which individual employees can accomplish. It is roughly the number of different jobs or types of work in the organization.[1] "Geographical dispersion" is the degree to which the organization is divided into separate locational units and the degree these units are spread out.[2] "Divisional differentiation" is the number of company divisions.

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[1] This variable was suggested by Blau and Schoenherr's variable, "number of different jobs." A secondary aspect that was incorporated into the variable was the distribution of employees among jobs. This has to do with whether most employees are in a few jobs or the employees are uniformly dispersed among the jobs. The idea for this came from James L. Price, *Handbook of Organizational Measurement* (Lexington, Mass.: D. C. Heath and Company, 1972), pp. 70-71.

[2] It was suggested by the Blau and Schoenherr variable, "number of local offices" (see above, page 28), and the Pugh *et al.* variable, "number of operating sites" (see above, page 24).

In addition to divisional differentiation, divisional specialization was included in the structural complexity level. "Divisional specialization" is the degree the responsibilities of divisions are different from one another. For example, a company with three divisions—manufacturing, sales, and administration—is highly specialized since the responsibilities of the divisions are completely different. Another company with three divisions—West Coast, East Coast, and South—is very unspecialized since the three divisions have the same responsibilities. In general, differences among the parts of an organization can be assumed to increase the complexity of the organization structure and thereby control and coordination problems. In other words, given the number of divisions is the same, differing division responsibilities make the job of coordinating their activities more difficult.

The definition of "organization size" in this dissertation is the quantity of resources at the disposal of the organization. The most important resource for most organizations is employees, and thus the number of employees is considered the major aspect of organization size.

Even though organization size is not a dimension of structural complexity as has been defined (differentiation of parts), "size" is assigned to the structural complexity level in this dissertation.[1] Two criteria have been used for assigning variables to the structural complexity level. First, the variable must develop in response to some

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[1] The operational definition of "structural complexity" has thus been broadened.

aspect(s) of context. Second, the variable must icnrease control and coordination problems of the company. "Size" qualifies on both criteria. It is obvious that quantities of resources, especially employees, enable an organization to cope with its context. For example, manufacturing companies must hire employees to accomplish their primary objective which is to manufacture product. Furthermore, it is clear that large quantities of resources create control and coordination problems for organizations.[1]

"Mechanization" is defined for this dissertation as the utilization of sophisticated machinery and equipment, and is assigned to the structural complexity level. It should be noted that the "mechanization" variable in this dissertation is much broader than that of Blau and Schoenherr, since it includes "automation of production" (assembly lines, etc.) as well as "data automation" (computerization). On page 36 above, it was indicated that Blau and Schoenherr considered automation in general, and specifically data automation (computerization), to be control devices.[2]

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[1] Both Pugh *et al.* and Blau and Schoenherr assigned "organization size" to the context level. The rationale was that organization size is mandated by the scope of the organization's responsibilities, and not controlled by current management. For example, employment security agencies must have a certain number of employees to accomplish the responsibilities laid on them by state and federal laws. In contrast, the business organizations in the sample selected for this dissertation are free to expand or reduce the scope of their operations and make tradeoffs between human and nonhuman (machinery and automation) resources which management perceives will maximize the accomplishment of company goals. Thus a key difference between this dissertation and the studies of Blau and Schoenherr and Pugh *et al.* is that "organization size" is a variable that is under managerial control.

[2] In fact, the basic idea of negative relationships among control systems came from Blau and Schoenherr's discussion of the interaction between centralization of authority and computerization.

Though the control impact of computers is apparent in certain circumstances, the traditionally accepted role of computers is an aid to decision-making rather than a control device. For example, computers can efficiently produce detailed sales information which is vital for decisions on pricing and development of new product lines. Thus the computer enables the company to respond effectively to a volatile marketing environment which is one aspect of context. Similarly, automation of the production line enables a company to efficiently produce goods for the market. In general, mechanization, like company size, enables an organization to satisfy requirements of its context. Furthermore, companies can trade off other aspects of structural complexity for mechanization. For example, computerization can reduce the numbers of employees involved in clerical activities, thereby decreasing company size. In addition, the organizational arrangements necessary in a computerized operation (data processing department, systems analysis staff, etc.) can create control and coordination problems themselves. In view of the above, the "mechanization" variable is assigned to the structural complexity level.

"Staff support of line," as measured by proportion of staff personnel, was assigned to the control system level.[1] Supervisors in modern organizations face exceedingly complex control and other responsibilities. Support personnel may be necessary to accumulate information and perform routine functions for supervisors. Without such

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[1] Blau and Schoenherr used "staff support" in their study, but it had little impact on the theory they attempted to develop. See Blau and Schoenherr, pp. 86-87.

support, supervisors may do a poor job of controlling and other control systems may have to take up the slack. It is expected that, to the extent the staff component is developed, control systems (particularly the accounting system) need not be as highly developed.

Context Variables

As was discussed above on page 38, context includes characteristics of the environment (local community, etc.) which affect the organization as well as committed characteristics of the organization itself. Contextual characteristics are not under the control of current management. Since the key interest of this writer was in the relation of organization structure to the accounting system, a conscious effort was made to minimize the importance of context, though some characteristics of context did have to be included. The importance of context was minimized primarily by selecting a sample of organizations with similar contexts; i.e., small manufacturing companies in small Michigan communities (see below, page 61, for a description of the sample characteristics). It was felt that the context of these companies differed chiefly in the technology of their productive operations. Due to the control by sample selection, no other aspects of context are measured in this study. The contextual level is consequently renamed the "process level" to indicate that variables of the technology of the productive process are included.

Even the characteristics of process can be extremely complex. This study has taken a very rudimentary approach to the measurement of process. One of the variables was derived from Pugh *et al.*: "diversity of output," or the number of different products or services produced by the organization.[1] Other factors being equal, the greater the number of outputs (products), the greater is the difficulty of producing them (the process). Pugh *et al.*'s "diversity of outputs" suggested the idea of "diversity of inputs" (different types of raw material or components purchased) as a variable of process. It seems logical that, other factors being equal, the greater the number of materials inputs, the more highly developed must be the process in order to assemble them. The third variable, "sophistication of the process," is just a convenient label for a variety of measures suggested by various people who read the dissertation proposal. These measures included such characteristics of the companies as length of the operating cycle, proportion of expenses which are for research and product development, and average value added (sales price minus materials costs).

Accounting System Variables

In this section, variables of the stage of development of the accounting system are elaborated. Many of these variables are mirrors of variables for the organization as a whole.[2] In the first part of the section, variables of the structural complexity of the accounting system are developed. Then size of the accounting system is defined. Next, a set of nonorganizational variables, having to do with the nature of the

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[1] Pugh *et al.*, "The Context of Organization Structures," p. 103. Also see above, page 24.

[2] The Simon *et al.* study suggested to me the idea of measuring the structural characteristics of the accounting system, but more of the specific accounting system variables were influenced by the Blau and Schoenherr study than by any other source. See above, pages 11-15 and 26-30.

output (reports, etc.) of the accounting system, are developed. Finally, three further aspects of the accounting organization are described. These are personnel quality, mechanization, and centralization of authority.

The entire set of accounting system structural complexity variables is mirrored after variables of the same name for differentiation of various types. "Accounting system structural complexity" is thus defined as the degree the accounting system is divided into parts on various dimensions. "Job structure complexity" is the extent of subdivision of the accounting system function into employee tasks (see above, page 48). "Authority levels" is the difference between the authority level of the top-level controllership executive and the authority level of the lowest-level controllership employees.[1] "Geographical dispersion" is the number of different sites at which controllership employees are located.[2]

The variable "size of the accounting system" was suggested by the previously discussed variable "size of the organization as a whole." "Size of the accounting system" is defined as the quantity of organization resources (primarily personnel) allocated to accounting activities.

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[1] Though the variable "authority levels" was distinguished from the other forms of differentiation as a control system for the overall organization (see above, page 47), no such distinction is made for the accounting system. Whether accounting system authority levels help to create or alleviate control problems within the accounting system is not important for this study. The question is whether they change in response to other levels of variables.

[2] Simon *et al.* used an almost identical variable which they called "decentralization of geographical locations" (see above, page 12).

Since accounting resources are allocated out of total organization resources, the variable should perhaps be called "proportion of organization resources allocated to accounting activities," and some of its measures reflect this proportional interpretation.

"Decentralization of accounts" is defined as the extent to which accounting reports are prepared for and presented to lower-level departments.[1] Stated another way, it is the depth in the organization structure for which departmental accounting reports are developed and thus the extent the data are collected in detail for lower-level departments.

"Decentralization of accounts" suggested the idea of measuring other nonorganizational aspects of the development of the accounting system. These characteristics, along with "decentralization of accounts," were subsumed under the label "system complexity," to distinguish them from structural complexity. Both were suggested by accounting faculty who read and commented upon the dissertation proposal. "Report differentiation" is the elaboration of different types of accounting reports for different purposes. "Sophistication of techniques," which could perhaps have been called accounting technology, is the use of advanced accounting tools such as standard cost, break-even analysis, etc.

"Personnel quality" of the accounting system is defined in the same way as personnel quality of the organization as a whole (see above, page 46): the technical knowledge and self-discipline of accounting employees. However, the function it serves for this dissertation is

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[1] Simon *et al.* developed the variable, and it is used in much the same way in this dissertation as it was in their study. See above, page 12.

somewhat different for the accounting system than for the organization as a whole. For the overall organization, it is assumed to alleviate the necessity of other control systems. For the accounting system, it is assumed to be a measure of the human technology of the system; i.e., the more qualified the accounting personnel, the more effective the output of the system, other things being equal. Thus it is a variable of the stage of development of the accounting system.[1]

"Accounting system mechanization" is defined as the utilization of equipment to perform accounting functions. Though there was some question whether mechanization of the overall organization creates control problems or alleviates them (above, page 51), it seems logical that mechanization of the accounting system contributes to the control function of accounting. Naturally, mechanization of the accounting system involves data processing equipment, including computers, and not production processing equipment.

The accounting system "centralization of authority" variable was derived from the Simon *et al.* study. As was mentioned on page 13, their "centralization of authority" variable does not have anything to do with the classic definition of centralization of authority: the restriction of

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[1] Of course, "personnel quality" probably serves both functions for both the accounting system and the overall organization. "Personnel quality of the overall organization," like the variables of "overall structural complexity," furthers directly the accomplishment of the organization's goals, and "personnel quality of the accounting system" helps to alleviate control problems within the accounting system. However, this study hypothesizes that the predominant effect of "personnel quality of the overall organization" is as a control system, and the predominant effect of "personnel quality of the accounting system" is as a dimension of the stage of development of the accounting system.

the right to make decisions at lower organization levels. Instead, it involves the extent the company has accounting units which are attached to operating units and not to the central controller's department. A very centralized accounting function would have all lower-level accounting units and accounting personnel in a direct authority line to the controller and none reporting to operating officials. A decentralized accounting function would have numerous accounting personnel and units attached to various operating departments with no reporting responsibility to the controller. The Simon *et al.* definition was adopted for this study.

Hypotheses as Incorporated in the Basic Model

Though the basic theses to be tested in this dissertation have been stated at various points in the preceding sections and at various stages of development of the basic model, it is advisable to recapitulate them here in their final form. The three hypotheses to be tested in this dissertation are:

1. Structurally complex organizations tend to have more fully developed accounting systems to contribute to the resolution of greater control and coordination problems, given the process and stage of development of other control systems is held constant.

2. The stage of development of the accounting system is inversely related to that of other control systems, when process and structural complexity are held constant, since control systems are partial substitutes for one another.

3. The more sophisticated is the production process of the organization, the more the accounting system must be developed since it must provide more and better information for management decisions.

The meaningfulness of hypothesis two is dependent on the validity of hypothesis one. If organizations do not have control problems, it is not meaningful to speak of substitution of control systems. However, hypothesis two could be false even if hypothesis one is true. One implication of this would be that accounting is the only control system in organizations. It is possible that both hypothesis one and hypothesis three could be true. The stage of development of the accounting system could depend partly on the control needs induced by structural complexity and partly on the decision needs induced by the process.

Chapter 3

RESEARCH DESIGN

The purpose of this chapter is to lay out a program for testing the basic model developed in Chapter 2 and for determining specific relationships between characteristics of an accounting system and characteristics of the organization in which it operates. Techniques for processing the data up to the point of interpretation are described in this chapter so that the research findings chapter is not cluttered with research design material. The research findings are not interpreted in this research design chapter. However, most of the data used for the interpretation of the research findings are developed and presented in this chapter. Those data are summarized and often used in a different order in the research findings chapter. The order of presentation in this chapter is by steps in data development. The order of presentation in the research findings chapter is that which facilitates interpretation of the research data.

The three sections of this chapter are Source of the Research Data, Refining the Data, and Analyzing the Data. Source of the Research Data comprises the determination of the sample of companies and characteristics of the company employees who provided the information for this dissertation. Refining the Data covers basically principal components analysis which was used to reduce a larger number of measurements to a limited number of variables of the accounting system and the overall organization. Analyzing the Data includes multiple regression analysis which was used to determine the relationships between the accounting system variables and organizational variables. It also covers techniques of using the multiple regression data to determine the strength and direction of influence of organizational variables and levels of variables on the accounting system. Techniques for determining the influenceability of accounting system variables by organizational variables are also discussed.

The two parts of the research findings chapter analyze, respectively, relationships among the characteristics of the accounting system and relationships between accounting system characteristics and overall organization characteristics. The same research design techniques were used for each of these sets of relationships; specifically, multiple regression, explanatory power, and explainability.[1] In order to keep the discussion of these techniques in this research design chapter simple, only data for the relationships between the accounting system characteristics and those of the overall organization are presented and discussed.

SOURCE OF THE RESEARCH DATA

In this section, the factors which were considered in determining what type of sample of organizations to select and the general

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[1] The technique "consistency with the hypotheses" only applies to relationships between accounting system characteristics and characteristics of the overall organization.

characteristics of the sample companies are examined. Then the characteristics of the individuals within the companies who were interviewed to obtain the research data are discussed.

The Sample

The objective of the sample selection process was to get a relatively homogeneous sample of companies which would not differ significantly due to environmental factors. Little environmental information was formally collected in the study, and thus it was impossible to explicitly control for environmental factors. Using a homogeneous sample means that the conclusions of the study cannot be generalized beyond companies of the same type. It must be left to other studies to determine if the conclusions of this study apply to other types of organizations. Table 1 lists some characteristics of the sample companies.

It was decided that the entire sample would be composed of profit-making organizations. The study is a new application of comparative organization structure research to accounting systems. Such a new research application should first be applied to traditional subjects. Accounting systems are most highly developed in profit-making organizations, and thus relationships with the overall organization structure might be stronger than in nonprofit organizations.

The sample was restricted to manufacturing companies without significant selling operations. This restriction helped satisfy the homogeneous sample objective stated above. Also, numerous manufacturing companies were available within reasonable travel distance of the researcher's home base, Lansing, Michigan. A further justification for

Table 1

Characteristics of Sample Companies

Company No.	City	No. of Employees	Line of Business
1	Jackson	210	Motor vehicle parts
2	Albion	650	Welded wire and sheet metal
3	Lansing	245	Tools, dies, jigs, fixtures
4	Kalamazoo	385	Pumps, compressors
5	Jackson	525	Surgical, orthopedic appliances
6	Battle Creek	810	Paperboard
7	Kalamazoo	500	Machine tools
8	Grand Rapids	1,302	Hardware
9	Grand Rapids	700	Paint
10	Grand Rapids	730	Wire products
11	Grand Rapids	800	fabric finishing
12	Grand Rapids	869	Hardware
13	Jackson	105	Games and toys
14	Grand Rapids	305	Aluminum processing
15	Saginaw	600	Sugar refining
16	Jackson	600	Motor vehicle parts
17	Lansing	186	Machine tools
18	Jackson	1,041	Automobile service tools
	Average	587	

this restriction was that selling operations tend to have quite different organization structures from manufacturing operations, and it would have been difficult to control for this variability. Also, manufacturing operations are likely to have more mature accounting information systems and thus the role of the accounting systems within the control system might be clearer than for selling operations.

The researcher intended for all the companies to be autonomous. All companies which were subsidiaries of other companies were excluded from the sample except one company which was discovered to be a subsidiary only after the interview was completed. This company was retained in the sample since it was managed separately from the parent company, a conglomerate. The reason for excluding subsidiaries was that it was felt that only autonomous companies would have complete sets of control systems. Subsidiaries might be controlled in part by control systems in the parent organization, such as parent company internal audit staffs, interchange of executive personnel between parent and subsidiary, and imposed charts of accounts and standardized reports. Second, the primary interest was in control systems that were spontaneously developed as the result of the condition of the company. Subsidiaries might have control systems which were imposed by the parent company rather than spontaneously developed.

As Table 1 indicates, the companies ranged in size from about 100 to about 1,300 employees. Several factors influenced the decision as to the size of companies to be included in the sample. First, it was felt that companies must reach a certain size before their control systems were mature enough to develop patterns required by the company's complexity. For example, a small family-controlled business might need few control structures apart from the family grouping. Only when the company reached a size that the family could not control the business directly would significant control structures develop. Consequently, a floor should be placed on the size of companies permitted in the sample. Second, a ceiling was placed on the size of companies in the sample by the fact that few central offices of large companies were within practical driving distance of Lansing. Third, large companies would often require the participation of numerous respondents within the company. Such contacts with several employees of a company would have been time-consuming and not consistent with the data-collection design. Another factor restricted the range of size of companies to be included in the sample. Though variability in size was desired to explicitly measure the effect of size on the control systems of companies, the measurement of characteristics of companies of vastly different sizes on the same scale might have been extremely difficult. The control systems of very large companies might be so different from those of small companies that a completely different interview instrument would have been necessary. Though such comparisons of large and small companies would be a valid research study, they were considered outside the scope of this new research application. For all of the above reasons, it was decided to concentrate on small to medium-sized companies of at least 100 employees.

An important characteristic of most of the companies in the sample is that they are suppliers of the large automobile manufacturers. This was inevitable due to the dominance of the auto industry in southern

Michigan. Even though all but one of the companies were not owned by another company, most were heavily dependent on the automobile manufacturers for business. The effect of this dependence on the control systems of the companies could not be measured in this study but should be considered in interpreting the conclusions.

Identification of most of the candidates for inclusion in the sample was made from *The Directory of Michigan Manufacturers* listings for cities whose metropolitan areas had populations of from 100,000 to 500,000 within about 100 miles of Lansing, Michigan.[1] Detroit-area companies were purposely excluded as possibly being significantly different from the companies in the smaller cities and thus introducing variability into the sample that could not be controlled. The following Michigan cities were selected by the above criterion: Jackson, Lansing, Kalamazoo, Battle Creek, Grand Rapids, and Saginaw. A few of the candidates were identified from Chamber of Commerce directories for those cities. Table 2 lists the cities from which sample companies were selected.

A letter requesting participation in the study was sent to the top financial executive of each of the companies (below, page 273). An attempt was made to select companies that had top financial executives who were members of the local chapters of the National Association of Accountants, as indicated by their listings in the NAA chapter directories for the respective cities. It was thought that NAA membership would

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[1] *The Directory of Michigan Manufacturers* (Detroit: Manufacturer Publishing Co., 1971).

Table 2

Populations of Cities from Which Sample Companies Were Selected[a]

City	Population	
	Within City Limits	Metropolitan Area
Jackson	44,500	132,500
Albion	12,112[b]	20,000
Lansing	133,000	311,000
Kalamazoo	86,000	214,000
Battle Creek	38,200	110,700
Grand Rapids	196,500	455,000
Saginaw	91,000	184,500

[a] *Britannica Atlas* (Chicago: Encyclopaedia Britannica, Inc., 1972), pp. I22-I23.

[b] *The Official Associated Press Almanac 1975* (Maplewood, N.J.: Hammond Almanac, Inc., 1975), p. 774.

increase the probability of agreement to the interview and active cooperation with the interviewer. One company from the smaller town of Albion, Michigan, was selected for the sample exclusively on the basis of a personal contact through NAA.

The sample is a selective one and therefore no conclusions can be drawn statistically from the research results about companies other than those in the sample. Nevertheless, various tests of significance are performed throughout the data analysis. These can be justified in two ways. First, the test of significance is a convenient and objective criterion to distinguish large associations, worthy of attention, from small associations, not worthy of attention. Second, according to the Cornfield-Tukey argument for inference, the statistical results derived from a selective sample can be generalized to a population from which the sample might have been drawn (similar to the sample). The characteristics of the sample should be described and the reader of the research report can judge whether the universe of similar companies is of interest to him.[1]

The Respondents

Information was collected by means of interviews with the controllers, treasurers, or other financial personnel of the sample companies. For fourteen of the companies there was only one respondent, but for the other four companies two persons shared the answering of the

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[1] Jerome Cornfield and John W. Tukey, "Average Values of Mean Squares in Factorials," *The Annals of Mathematical Statistics*, XXVII (1956), 912-13.

questions. For eleven of the companies the chief respondent was the top official in the finance and accounting function. For six of the companies the chief respondent was on the level below the top official in the finance and accounting function. For one company the president was the respondent. Table 3 lists the titles of the respondents.

REFINING THE DATA

The essential elements of the statistical research design are principal components analysis for reducing a voluminous set of measurements to a manageable set of variables, and multiple regression analysis for analyzing the relationships among the variables.[1] Multiple regression analysis is discussed in the next section. This section is concerned essentially with principal components analysis. But first the questions addressed to the respondents are examined, various manipulations of the answers to those questions are outlined, and the assembly of the measurements which are the raw data for the principal components procedures is described. The important features of principal components analysis are conveyed in a nontechnical manner by means of two illustrations, one of the combination of measurements into a component and the other of

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[1] The idea for the combination of principal components and multiple regression analysis came from Green and Tull. They suggested that principal components analysis can be used to reduce the number of explainer variables (while retaining as much as possible of the original information) and also to reduce the multicollinearity among the explainer variables. Both of these factors facilitate the interpretation of multiple regressions. See Paul E. Green and Donald S. Tull, *Research for Marketing Decisions* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970), pp.424-26.

Table 3

Titles of Respondents

Company No.	Titles	No. of Persons	Position in Finance Function
1	Treasurer	1	1
2	Controller; Accounting Manager	2	1
3	Treasurer	1	1
4	VP-Finance	1	1
5	Sec/Treas; Asst Treasurer	2	1
6	Controller/Secretary	1	2
7	Credit Manager	1	2
8	Mgr of Finance; Gen Acct Mgr	2	1
9	Accounting Manager	1	2
10	Head of Finance	1	1
11	Controller	1	2
12	Controller	1	1
13	President	1	0
14	VP-Finance	1	1
15	Controller/Asst Treas; Asst Gen Fact Mgr	2	2
16	Financial Manager	1	1
17	Secretary/Treasurer	1	1
18	Controller (Tool Div)	1	2

rotation of components. Then the output of the principal components procedures, the component scores, are characterized.

Collection and Disposition of Measurements

One hundred thirty-eight questions were directed to the respondents. These questions are listed in the central column of Appendix A (pages 212-38), along with the measurement rules used to interpret the responses to questions. Since 16 of the 138 questions were multiple-part questions, the total number of measurements was 166.[1] The measurements were recorded on an SPSS[2] system tape file for use in further processing. The SPSS calculation capabilities were used to calculate 117 new measurements by mathematical combinations of the original measurements. These new measurements were usually calculated by subtracting one measurement from another, dividing one measurement by another, multiplying one measurement by another, or adding one measurement to another. In some cases more than two measurements were combined to form the new measurement and more than one of the above mathematical functions were used in the calculation. The 117 new measurements were added to the SPSS system tape

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[1] One of these measurements, question 33, was dropped from the analysis at this point since seven of its responses were missing and the rest exhibited no variability. Three of the questions (R1, R2, and R3) pertained to requests for general information from the respondents, such as organization charts, financial statements, and personnel lists. The answers to these questions, though coded on the SPSS system tape file, were not used in the subsequent analysis.

[2] All of the data manipulation and statistical data processing in this dissertation were performed with SPSS, which is a very versatile statistical program prackage. See Norman H. Nie, C. Hadlai Hull, Jean G. Jenkins, Karin Steinbrenner, and Dale H. Bent, *Statistical Package for the Social Sciences* (San Francisco: McGraw-Hill Book Company, 1975).

file.[1] At this point, the total number of measurements on the SPSS system tape file was 284 (including the responses to the original questions [166], the calculated measurements [117], and company interview order). These measurements are listed on Table 19, pages 274-92. The numbers in measurement names correspond to question numbers in Appendix A, pages 212-38. The names of original measurements begin with an R (for raw), and calculated measurements begin with a C. The formula used to calculate the new measurements is listed under the caption "Description and Calculation."

One hundred two of the raw (uncalculated) measurements were discarded once they were used to calculate a new measurement, since the calculated measurement was more clearly related to a variable in the basic model. Several of the measurements collected for the eighteen companies had missing responses.[2] These missing responses, when used in calculating the new measurements, resulted in missing responses for them also. Measurements with more than three missing responses were dropped from the analysis, and one measurement was dropped with two missing responses. A total of ten measurements were dropped due to having too few responses.

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[1] One additional measurement, "company interview order," was added to the SPSS system tape file for possible later tests to determine if there was drift in the interviewer's interpretation of responses to questions.

[2] Missing responses were due in only one case to the respondent claiming the information was confidential or proprietary. In that case, executive salary information was not obtained. Most missing responses were due to the inaccessibility of the data to the respondent or the inapplicability of the measurement to the company.

Principal Components Analysis

One hundred sixty-four measurements remained after all of the eliminations described in the previous section. These were grouped by the twenty-six variables from the basic model shown in Figure 1, page 44. Table 20, pages 293-99, lists the groups of measurements in the two right-hand columns. Each group contains measurements which the researcher felt would be associated with a particular variable from the basic model. Such groups were assembled for twenty-five of the twenty-six variables in the basic model. The remaining variable, "materials input diversity," is represented by a single measurement, R11.

The focus of interest of this study was on the twenty-six variables developed for the basic model illustrated on page 44. Each of these variables was represented by from one to eighteen measurements. Statistical techniques which are described on pages 89-127 will be used to determine the influence of the twenty-six variables on each other. But a necessary first step is to derive a single measure of each of the variables.

The measures of the variables were derived using principal components analysis performed with a statistical program package known as SPSS.[1] Principal components is a form of factor analysis, and its

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[1] Nie *et al.*, pp. 468-514. An excellent nontechnical description of principal components analysis can be found in Green and Tull, pp. 402-22. The idea of using principal components analysis to combine organizational measures came from the Pugh *et al.* studies; for a specific application, see D. S. Pugh, D. J. Hickson, C. R. Hinings, and C. Turner, "The Context of Organization Structures," *Administrative Science Quarterly*, XIV (March, 1969), p. 100.

application to this study is described on the following pages. The combined measures of the variables (to be called components) are listed in Table 4 along with some information about them which will also be explained in the following pages. For nineteen of the variables, a single component was derived, as indicated by a one in the column of Table 4 headed "Number Components." For six of the variables, two components were derived, as indicated by a two in the column.

Example of Derivation and Interpretation of First Component

As an example of combining measurements, consider the three measurements that are grouped under staff support:[1]

Company No.	C48 Staff Ratio	R49 Staff Functions	C50 Clerical Ratio
1	-0.0202985	0.6352100	-0.4951830
2	0.1707500	0.0337000	0.7957610
3	-1.0770100	-0.5682990	-0.4759200
4	1.0364200	0.0334600	2.3757200
5	-1.9068700	0.6352100	0.4874800
6	-0.7426870	-0.5682990	-0.8227360
7	0.6483580	-0.5682990	-0.8034680
8	0.3976120	1.8387300	0.0828516
9	1.9200000	0.0337000	-0.1868980
10	0.4274630	0.0337000	-0.8612720
11	-0.2411940	0.0337000	1.1811200
12	0.3259700	0.0337000	-0.3795760
13	-0.9038810	-1.1700600	0.4104050
14	0.7916420	-1.1700600	-0.7263970
15	1.3468700	-1.1700600	-0.4951830
16	-0.1695520	-1.1700600	-0.9768790
17	-1.5844800	0.6352100	-0.9961460
18	-0.4203000	2-4404900	1.8554900

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[1] Note that these scores are standardized to mean zero and standard deviation one. C48, R49, and C50 indicate measurement numbers (see Table 19, page 274.

Table 4

Component Description

Component Name	No. of Measurements[a]	No. of Components	Eigenvalue	Percent Variance Explained
Process				
Sophistication	7	1	3.5	50.5
Output diversity	2	1	1.3	65.2
Overall structural complexity				
Size	6	1	5.6	93.9
Job structure complexity	3	1	2.1	71.4
Geographical dispersion	4	1	2.8	69.4
Divisional differentiation	6	1	3.8	63.6
Divisional specialization	4	1	2.4	60.3
Mechanization-general & mechanization-computers	14	2	7.9	56.8
Control system				
Direct supervision	3	1	2.0	67.2
Staff support	3	1	1.5	48.6
Authority levels	2	1	1.7	86.2
Personnel quality-high level & personnel quality-low level ...	15	2	7.0	47.0
Centralization-investment & centralization-purchasing	18	2	8.9	49.5
Standardization-jobs & standardization-general	20	2	10.5	52.5
Accounting system				
Size-information output & size-resource input	7	2	3.7	53.4
Job structure complexity	4	1	2.0	50.8
Geographical dispersion	6	1	3.4	56.3
Unit differentiation-vertical ...	2	1	2.0	97.8
Unit differentiation-horizontal .	3	1	1.6	54.4
Authority levels	4	1	3.0	73.9
Report differentiation	7	1	4.3	61.5
Decentralization of accounts	3	1	1.7	56.3
Sophistication of techniques	6	1	3.3	55.2
Mechanization	3	1	2.4	79.7
Personnel quality-education & personnel quality-general	8	2	3.3	41.8
Average			3.0[b]	62.5[c]

[a] See Table 20, pages 293-99, for listings of the measurements combined into each component.

[b] For the 31 components.

[c] For the 25 groups.

One method of combining the measurements in a group into a single measurement would be to add the three measurements for each company. This method would not take into account the differing importance of the measurements to the variable.[1]

A simple and general method of combining measurements is known as a linear combination. In this method, the combined measurement for a given company is calculated by multiplying each measurement by a coefficient and summing the products. For example, the coefficients for staff ratio, staff functions, and clerical ratio might be 2, 0.5, and 8, respectively. The combined score for staff support for company number five would be:

$$\left(\begin{array}{c}\text{Staff}\\ \text{ratio}\\ \text{coeffi-}\\ \text{cient}\end{array} \times \begin{array}{c}\text{Staff}\\ \text{ratio}\\ \text{score}\end{array}\right) + \left(\begin{array}{c}\text{Staff}\\ \text{functions}\\ \text{coeffi-}\\ \text{cient}\end{array} \times \begin{array}{c}\text{Staff}\\ \text{func-}\\ \text{tions}\\ \text{score}\end{array}\right) + \left(\begin{array}{c}\text{Clerical}\\ \text{ratio}\\ \text{coeffi-}\\ \text{cient}\end{array} \times \begin{array}{c}\text{Clerical}\\ \text{ratio}\\ \text{score}\end{array}\right) =$$

$$(2 \times -1.90687) + (0.5 \times 0.63521) + (8 \times 0.48748) =$$

Combined score, company five = 0.40371.

The scores for the other seventeen companies can be calculated in the same way. Note that the coefficients determine which measurements have the greatest influence on the combined score. The larger the coefficient, the greater the influence of the corresponding measurement.[2]

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[1] It also does not take into account the different scales of the measurements. Measurements with a larger variance would influence the combined measurement more than other measurements.

[2] Green and Tull, p. 405.

What are the appropriate coefficients? The grouping of the three measurements together presumed that each measurement had something to do with the variable, but the exact way that the measurement related to the variable was not known. It seems logical that the variable represents something that is common to all three measurements. The first component extracted by principal components analysis is a linear combination of the measurements which accounts for more of what is common to the three measurements than any other possible linear combination.

Principal components procedures compute coefficients which can be used to calculate component scores for each company in the sample. The component coefficients for the three measurements are, respectively, -0.18578, 0.59188, and 0.54846.[1] These can be used to calculate the component score for company five, as follows:

$$\left(\begin{matrix}\text{Staff}\\ \text{ratio}\\ \text{coeffi-}\\ \text{cient}\end{matrix} \times \begin{matrix}\text{Staff}\\ \text{ratio}\\ \text{score}\end{matrix}\right) + \left(\begin{matrix}\text{Staff}\\ \text{functions}\\ \text{coeffi-}\\ \text{cient}\end{matrix} \times \begin{matrix}\text{Staff}\\ \text{func-}\\ \text{tions}\\ \text{score}\end{matrix}\right) + \left(\begin{matrix}\text{Clerical}\\ \text{ratio}\\ \text{coeffi-}\\ \text{cient}\end{matrix} \times \begin{matrix}\text{Clerical}\\ \text{ratio}\\ \text{score}\end{matrix}\right) =$$

$$(-0.18578 \times -1.90687) + (0.59188 \times 0.63521) + (0.54846 \times 0.48748) =$$

Component score, staff support, company five = 0.99759.

The component scores for the other seventeen companies are calculated in the same way.

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[1] The coefficients are for the first (unrotated) component. The derivation of subsequent components is discussed below, on page 81.

Company No.	Staff Support Component Score
1	0.104944
2	0.428329
3	-0.397638
4	1.133827
5	0.997563[1]
6	-0.650715
7	-0.896963
8	1.063812
9	-0.435986
10	-0.534300
11	0.711681
12	-0.247952
13	-0.297102
14	-1.235087
15	-1.210088
16	-1.193071
17	0.119369
18	2.539277

The staff support component scores were used as a new measurement of the variable staff support, and the three old measurements were discarded. A unitary measure of staff support has been obtained, but some of the information in the original three measurements has been lost since one measurement can seldom convey as much information as three measurements. For assessing the adequacy of the component scores, the relative amount of the information contained in the three discarded measurements that is retained in the component must be determined.

The information value of a score can be thought of as the degree it varies from the mean of the scores on that measurement. For example,

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[1] The component scores were calculated by an SPSS procedure and are more accurate than hand-calculated figures since more significant digits are carried through the calculations. This accounts for the difference between company five's component score as calculated in this text and the component score as calculated by the program.

the score for company nine on "staff ratio" is 1.92.[1] This indicates that company nine had an above-average staff ratio since the mean of the scores is zero. But how much above average? The average deviation of these scores from the mean, known as the standard deviation, is one. Consequently, it can be said that company nine had a staff ratio which was significantly above average; i.e., almost twice the average deviation.

If each of the three measurements has a standard deviation of 1,[2] the total variation of the three measurements is three. "Eigenvalue" is defined as the variance of the component scores[3] but can best be interpreted as the equivalent number of measurements which the component explains. For example, the eigenvalue of the staff support component is 1.458. The staff support component is thus about 50 percent better than any one of the original measurements in explaining the total variation of the three components. In general, components with eigenvalues near one are poor explainers since they explain little more than an original measurement. The maximum possible eigenvalue is the number of measurements times one (the average variation of each measurement). This would occur only if all the variables were perfectly correlated.

Eigenvalue can be used to calculate a second measure of the adequacy of the component "percent variance explained":

$$\text{Percent variance explained} = 100\left(\frac{\text{eigenvalue}}{\text{total variation original measurements}}\right)$$

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[1] See above, page 73.

[2] Standard scores must always have a standard deviation of one.

[3] "Variance" is the square of the standard deviation.

For staff support, the calculation would be:

$$100(1.458/3) = 48.6\%.$$

Staff support explained 48.6 percent of the variation of the original three measurements.

Though eigenvalue and "percent variance explained" indicate how much of the total variance of the three measurements is explained by the component, they do not indicate how much of the variance of each individual measurement is explained by the component. Information about the explanation of individual measurements comes from component loadings. These are the simple correlations of the component scores with the original measurements. For staff support, the component scores on page 77 are correlated with the original measurement scores on page 73 to obtain the following component loadings:

C48, staff ratio	-0.27
R49, staff functions	0.86
C50, clerical ratio	0.80

The range of a simple correlation is from -1 to 1. The closer a loading is to 1 or -1, the greater the degree of association between the component and the original measurement. The closer a loading is to zero, the less the degree of association between the component and the original measurement. Measurements are said to load highly on a component when their loadings are near 1 or -1. Thus "staff functions" loads highly on the component while "staff ratio" loads only weakly on the component. A positive loading indicates that when the component score for a company is large the original measurement score for that company tends to be large. A negative loading indicates that when the component score for a company is large the original measurement score for the company tends to be small. The lack of any association between a component and an original measurement is indicated by a zero loading.

The three original measurements were selected because they were believed to measure aspects of the variable "staff support." Why then did "staff ratio" load only weakly on the "staff support" component? Also why did it have a negative loading on the "staff support" component? While the answers to these questions can only be surmised, it is important to note that "staff functions" and "clerical ratio" are highly correlated with each other, while "staff ratio" is only weakly correlated with either "staff functions" or "clerical ratio." In order to explain the most possible variance, the component explained the common aspect of "staff functions" and "clerical ratio" but it was not able to explain much of "staff ratio" because "staff ratio" shared little with the other two measurements.

The meaning of a component is determined by the measurements which load highly on it. Thus when a measurement which was originally assigned to measure a variable loads weakly on the component derived to measure that variable or has a loading with the wrong sign, a somewhat different meaning may be applied to the component than was intended for the variable. For example, see below, pages 242-46, for the interpretation of the four overall structural complexity components: "job structure complexity," "geographical dispersion," "divisional differentiation," and "divisional specialization." In the case of "staff ratio," the reason for the weak and inconsistent loading was assumed to be due to a poor measurement (see below, page 249). Thus the meaning of the component was not changed from that intended for the variable "staff support."

A rough indication of the strong positive association of the "staff functions" scores (above, page 73) and the "staff support" component scores (above, page 77) can be obtained by comparing these scores. Note that, for fifteen of the eighteen companies, the component score has the same sign as the "staff functions" score. The weak negative association of the "staff ratio" scores and the "staff support" component scores is indicated by the fact that, for eleven of the eighteen companies, the component score has the opposite sign of the "staff ratio" score.

Derivation of Second Component for Some Variables

A single component was extracted for nineteen of the twenty-six variables in the basic model (see Table 4, page 74). These components were analyzed and interpreted in the manner described on the preceding pages. Though some information was lost by discarding the original measurements for these nineteen variables, this disadvantage was outweighed by the advantage of reducing the number of measurements. For eighteen variables, the percent variance explained by the component was greater than 50 percent, and for "staff support" it was very close to 50 percent. Thus it was felt that the components for these nineteen variables must measure at least an important aspect of the respective variables.

For the other six variables, the level of explanation of the original measurements in terms of percent variance explained by the component was not considered adequate:

Component Name	Pct. Variance Explained by First Component
Overall structural complexity	
Mechanization	31.2
Control system	
Personnel quality	25.3
Centralization	33.6
Standardization	37.1
Accounting system	
Size	33.3
Personnel quality	23.4

The reason for these poor levels of explanation is that the general degree of correlation among the original measurements for the respective variables is low. As was implied for the "staff support" component on page 80, correlation among the original measurements facilitates the explanation of those measurements by a component.

For any group of measurements, several components (no more than the number of measurements) can be calculated with principal components analysis. Each component is a linear combination of the original measurements similar to that illustrated on page 76, but with different coefficients. The first of these components, which has been illustrated, accounts for more of the variance of the original measurements than any other possible linear combination. The second component accounts for more of the variance that has not been accounted for by the first component than any other possible linear combination. However, the second component must be uncorrelated with the first component. In other words, the component scores on the second component must have zero correlation with the component scores on the first component. Subsequent components follow the same pattern: greatest explanation of variance yet unexplained and uncorrelated with all prior components.

In order to achieve an adequate level of explanation of the original measurements of the six variables for which the first component was inadequate, components had to be added. However, for the sake of minimizing the number of components whose interrelationships must later be analyzed, it was decided to limit the number of components for any group of measurements to two. The addition of the second component increased the percent variance of the original measurements explained as follows:

	Percent Variance Explained by:		
Component Name	First Component	Second Component	Total[1]
Overall structural complexity			
Mechanization	31.2	25.6	56.8
Control system			
Personnel quality	25.3	21.7	47.0
Centralization	33.6	15.9	49.5
Standardization	37.1	15.4	52.5
Accounting system			
Size	33.3	20.1	53.4
Personnel quality	23.4	18.4	41.8

The level of explanation of the original measurements by two components was considered adequate for all but the two personnel quality variables,

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[1] From Table 4, page 74.

control system and accounting system. Essentially 50 percent of the variance of the measurements of the other four variables was explained by respectively two components[1]

The inadequate level of explanation of the two personnel quality variables was due to two factors. First, both variables had a lot of measurements—fifteen for control system and eight for accounting system. Second, the measurements were of a very diverse nature: various aspects of the education level, seniority, and salary levels of employees.

Rotation of First and Second Components

The two components isolated for each of the six variables were rotated before being used in the analysis of interrelationships among variables. In order to describe the nature of rotation, it is valuable to examine one variable in detail, "accounting system size," which included seven measurements. To review what has occurred up to the point of rotation, the principal components procedure has calculated coefficients for a first component which explains more of the variance of the seven measurements than any other possible linear combination. Using these coefficients in a linear combination of the original measurements such as that illustrated above on page 76, it calculated component scores for the eighteen companies (such as those on page 77 above). Then the procedure calculated the coefficients for a second component which explains more of the variance of the seven measurements left unexplained

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[1] "Centralization" was shy by only 0.5 percent.

by the first component than any other possible linear combination. The second component scores are calculated using the coefficients in a linear combination of the original measurements. Then the procedure calculated the correlations of the two component scores with each of the seven original measurement scores.[1] These are the component loadings and are as follows:

	Accounting Size	
	Component 1	Component 2
Proportion controllership employees	-0.77	0.41
Proportion employees receiving reports	-0.61	-0.37
Number data centers	-0.47	-0.61
Data center elaboration	-0.44	-0.36
Average report frequency	-0.21	0.33
Proportion controllership expenses	-0.65	0.63
Controllership expense emphasis	0.72	0.17

Two components representing accounting system size have been derived which account in total for 53.4 percent of the variance of the original measurements (see above, page 83). At a later stage in the study, the relationships of these components to other components might be investigated. How will these relationships be interpreted? Which component is "accounting system size"? What would be the interpretation if only one of the two components related to another component?

Observe the loadings. Note that many of the measurements load fairly highly on both component 1 and component 2. Thus there is little opportunity to distinguish the meaning of component 1 from component 2.

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[1] The description and ordering of mathematical steps in this text are convenient for exposition. The computer program mathematics are quite different.

All that can be said is that these two components represent accounting system size, are uncorrelated with one another, and cannot be distinguished in meaning.

A solution to this problem is produced by rotation of the two components. Rotation produces two rotated components which are linear combinations of the old components:

$$\begin{matrix}\text{Rotated}\\ \text{component 1}\\ \text{score}\end{matrix} = \begin{pmatrix}\text{Coefficient}\\ \text{old}\\ \text{component 1}\\ \text{for rotated}\\ \text{component 1}\end{pmatrix}\begin{pmatrix}\text{Old}\\ \text{component 1}\\ \text{score}\end{pmatrix} + \begin{pmatrix}\text{Coefficient}\\ \text{old}\\ \text{component 2}\\ \text{for rotated}\\ \text{component 1}\end{pmatrix}\begin{pmatrix}\text{Old}\\ \text{component 2}\\ \text{score}\end{pmatrix}$$

$$\begin{matrix}\text{Rotated}\\ \text{component 2}\\ \text{score}\end{matrix} = \begin{pmatrix}\text{Coefficient}\\ \text{old}\\ \text{component 1}\\ \text{for rotated}\\ \text{component 2}\end{pmatrix}\begin{pmatrix}\text{Old}\\ \text{component 1}\\ \text{score}\end{pmatrix} + \begin{pmatrix}\text{Coefficient}\\ \text{old}\\ \text{component 2}\\ \text{for rotated}\\ \text{component 2}\end{pmatrix}\begin{pmatrix}\text{Old}\\ \text{component 2}\\ \text{score}\end{pmatrix}$$

Note that each rotated component has a portion of both old component 1 and old component 2 in it. Since any two variables can always be fully explained as linear combinations of any two other variables, there is no loss of information due to the rotation.[1] But why do it?

The purpose of rotation is to find rotated components such that the loadings on the original measurements are as close to 1, 0, or -1 as possible. In other words, the original measurements should load highly on components or not at all. This facilitates the differentiation of the meaning of the two components, because measurements will tend to be loaded highly on one component and weakly on the other. Thus the

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[1] In other words, the percent variance explained by the two rotated components is still 53.4 percent.

original measurements that load highly on one component can be inspected to see what distinguishes them from the measurements which load highly on the other component.

The loadings of the original measurements on the varimax rotated components[1] are as follows:

	Accounting Size Rotated Component 1	Accounting Size Rotated Component 2
Proportion controllership employees	0.26	0.84
Proportion employees receiving reports	0.72	0.09
Number data centers	0.75	-0.13
Data center elaboration	0.58	0.01
Average report frequency	-0.10	0.42
Proportion controllership expenses	0.08	0.88
Controllership expense emphasis	-0.64	-0.38

Note that all of the original measurements load strongly on one rotated component and almost not at all on the other.[2] Thus the meaning of the two rotated components can be readily distinguished.[3] The meaning of component 1 is determined by the high-loading measurements "proportion employees receiving reports," "number data centers," and "controllership expense emphasis." The high loading on "controllership

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[1] See below, page 258, for the specific analysis of the loadings of accounting size components. Varimax rotation was selected from among several available rotation methods because it is the most commonly used method. Varimax rotation produces rotated components which have zero correlation with each other. See Green and Tull, pp. 418-21.

[2] Controllership expense emphasis is a possible exception, since it loads modestly on rotated component two.

[3] The two accounting components are interpreted in much more detail below, on pages 258-60. This paragraph is intended merely to suggest how the meaning of components can be differentiated.

expense emphasis" was assumed to be due to a measurement error. The other two high-loading measurements have to do primarily with the information output of the accounting system, and so rotated component 1 was interpreted as size of the information output of the accounting system. The high-loading measurements on rotated component 2 are "proportion controllership employees" and "proportion controllership expenses." Employees and expenses are company resources allocated to the accounting system, so rotated component 2 was interpreted as size of the resource input of the accounting system.

The two components extracted for each of the other five variables listed on page 83 above were varimax-rotated in the same manner as those for accounting size. The meaning of these components was interpreted, along with the single-component variables, on pages 239-72 below. These interpretations were used to assign different component names to the two components for each of the six variables. These different names are listed in Table 4, page 74.

Component Scores

It is important to review the output of the data-refinement stage of this dissertation. Thirty-one new measurements, called components, have been derived by means of principal components analysis. These are listed in Table 4, page 74. For each component, there are eighteen component scores, one for each company. All of the original measurements have been discarded except for one, "materials input diversity," which will be retained along with the thirty-one components to make a total of thirty-two measurements. These thirty-two measurements correspond to the twenty-six variables in Figure 1, page 44. Since two components are included in six of the variables, these variables are split to form two variables. There are now thirty-two measurements measuring thirty-two variables, as indicated in Figure 1.

ANALYZING THE DATA

The output of the prior section on refining the data is a set of accounting system variables and a set of organizational variables of three types: process, overall structural complexity, and control system. The basic statistical technique used in this section, multiple regression, is applied to the problem of relating the accounting variables to the organizational variables. One of the multiple regressions used in the study is illustrated in this section as a means of communicating the essential aspects of multiple regression in a nontechnical manner. Then techniques of combining the multiple regression results to answer the questions addressed by this dissertation are described. These questions are classified as explanatory power, explainability, and consistency with the hypotheses. The "Explanatory Power and Explainability" subsection develops measures of the strength of influence of the organizational variables and the levels of organizational variables on the accounting system. It also develops measures of the influenceability of accounting variables by organizational variables. The "Consistency with the Hypotheses" subsection assesses the direction of influence of the organizational variables on the accounting variables as compared with the direction predicted in the hypotheses. The "Analyzing the Data" section concludes with a discussion of the limitations of the research design of the dissertation.

Stepwise Multiple Regression

As has been implied at various points in Chapters 2 and 3, a key objective of the dissertation is to explain accounting system variables with organizational variables. Thirteen of the thirty-two variables developed in the data-refinement section (above, pages 68-88) are accounting system variables. The other nineteen variables are organizational variables of three types—process (three variables), overall structural complexity (seven variables), and control system (nine variables)—which are to be used to explain the accounting variables. An SPSS stepwise linear multiple regression procedure was used to analyze the relationships between the organizational and the accounting system variables.[1] On the following pages, one of the regression procedures calculated in connection with this dissertation is used to illustrate the nature of stepwise multiple regression and to develop some of the terminology that will be used in subsequent analysis.

Linear multiple regression is a very common technique of explaining a single variable with a set of other variables.[2] Essentially, linear multiple regression attempts to find a linear combination of a set

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[1] Nie *et al.*, pp. 320-67.

[2] An excellent intuitive description of linear regression can be found in Green and Tull, pp. 343-64. For a rigorous, extensive, more mathematical treatment, see N. R. Draper and H. Smith, *Applied Regression Analysis* (New York: John Wiley & Sons, Inc., 1966), pp. 1-35, 163-77.

of explainer variables which is most highly associated with the single variable (called criterion variable in this dissertation).[1] As applied to this study, the single variable is any one of the thirteen accounting system components, and the set of explainer variables is any set of the nineteen organizational components.

Example of Multiple Regression

As an example of linear combination of explainer components to explain a criterion component, take the regression of the criterion component "accounting size-information output" on the four explainer components: "process-sophistication," "job structure complexity," "direct supervision," and "personnel quality-low level."[2] The component scores on these five variables are as follows:

	Criterion Component	Explainer Components			
Company No.	Accounting Size-Information Output	Process Sophistication	Job Structure Complexity	Direct Supervision	Personnel Quality-Low Level
1	-0.602657	-0.296721	0.010537	-0.606413	0.009474
2	1.124027	-0.398268	-1.602391	0.458668	0.472895
3	1.340012	1.390160	-1.114058	-2.317780	1.995165
4	-0.395408	-0.138480	1.552997	0.452153	0.882082
5	-1.126679	-0.203618	0.126531	-0.382799	-2.454819
6	0.777250	-0.416430	0.332067	0.335229	1.142752
7	-0.432310	-0.200983	1.519192	0.169600	-1.013620

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[1] Criterion variables often are referred to as dependent variables, and explainer variables as independent variables.

[2] These particular explainer components were selected by the stepwise regression procedure that is described below on pages 98-100. The discussion at this point is facilitated by treating the example as straight multiple regression.

	Criterion Component	Explainer Components			
Company No.	Accounting Size-Information Output	Process Sophistication	Job Structure Complexity	Direct Supervision	Personnel Quality-Low Level
8	2.324751	2.473550	-1.661982	1.661989	0.379315
9	-0.824774	-0.919824	1.276731	1.138866	0.104121
10	-0.176136	-0.412887	0.176635	-0.884163	0.448130
11	-0.127615	-0.596342	-0.624720	1.107347	0.058178
12	-0.745879	-0.325225	-0.178166	-0.599827	-0.628232
13	0.098104	-0.529910	-1.646463	-0.328273	-1.378594
14	-1.062548	-0.266749	0.174330	-0.796742	0.281690
15	-0.429995	-0.625398	0.491589	1.343424	0.212429
16	-0.875054	-0.598388	0.366133	-1.195680	-0.059280
17	1.490802	2.395775	0.576389	0.056460	-0.086073
18	-0.355890	-0.330261	0.224648	0.387938	-0.365613

The first step of the multiple regression analysis is to find a set of four coefficients which, when multiplied by the four explainer component scores and summed, will produce an estimate of the "accounting size-information output" score, as follows:

$$\begin{array}{c}\text{Estimated}\\\text{accounting}\\\text{size-infor-}\\\text{mation out-}\\\text{put score}\end{array} = \left(\begin{array}{c}\text{Process}\\\text{sophis-}\\\text{tication}\\\text{coefficient}\end{array} \times \begin{array}{c}\text{Process}\\\text{sophis-}\\\text{tication}\\\text{score}\end{array}\right) + \left(\begin{array}{c}\text{Job}\\\text{structure}\\\text{complexity}\\\text{coefficient}\end{array} \times \begin{array}{c}\text{Job}\\\text{structure}\\\text{complexity}\\\text{score}\end{array}\right)$$

$$+ \left(\begin{array}{c}\text{Direct}\\\text{supervision}\\\text{coefficient}\end{array} \times \begin{array}{c}\text{Direct}\\\text{supervision}\\\text{score}\end{array}\right) + \left(\begin{array}{c}\text{Personnel}\\\text{quality-}\\\text{low level}\\\text{coefficient}\end{array} \times \begin{array}{c}\text{Personnel}\\\text{quality-}\\\text{low level}\\\text{score}\end{array}\right)$$

The coefficients determined by the SPSS procedure are, respectively, 0.59857 for "process sophistication," -0.37317 for "job structure complexity," 0.23679 for "direct supervision," and 0.32078 for "personnel quality-low level." For company number five, the scores on the four components would be combined as follows:

$$(0.59857 \times -0.203618) \quad + \quad (-0.37317 \times 0.126531)$$

$$+ \quad (0.23679 \times -0.382799) \quad + \quad (0.32078 \times -2.454819)$$

$$\begin{array}{c}\text{Accounting size-information output}\\ \text{estimated score for company five}\end{array} = -1.0472.$$

The estimated scores for the other seventeen companies are calculated in the same manner. These are listed here along with the actual scores:

Company No.	Accounting Size-Information Output Estimated Score	 Actual Score
1	-0.322090	-0.602657
2	0.619880	1.124027
3	1.339020	1.340012
4	-0.272410	-0.395408
5	-1.047200	-1.126679
6	0.072770	0.777250
7	-0.972210	-0.432310
8	2.616010	2.324751
9	-0.723950	-0.824774
10	-0.378670	-0.176136
11	0.157050	-0.127615
12	-0.471730	-0.745879
13	-0.222730	0.098104
14	-0.323030	-1.062548
15	-0.171550	-0.429995
16	-0.796960	-0.875054
17	1.204710	1.490802
18	-0.306930	-0.355890

Note that the estimated scores are reasonably close to the actual scores, indicating the correlation between the two sets is fairly high. The sign of the estimated score is correct for sixteen of the eighteen companies.[1] Not only are the estimates good, they are the best that

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[1] The other two companies have scores near the mean of zero, which considerably increases the chance of opposite signs.

could be obtained with these four explainers in a linear combination. In other words, the correlation of the estimates with the actual scores is higher for this set of coefficients than for any other possible set of coefficients applied to the four explainer components.

This linear combination of explainer components is analogous to the linear combination of measurements which produced the components.[1] However, the objective of the linear combination is different. The coefficients of the linear combination of measurements (principal components analysis) were chosen so that the correlations of the component scores with the measurements would be as high as possible. The component thus represents the common aspect of the measurements. The coefficients of the linear combination of explainer components (linear multiple regression) are chosen so that the combination scores (or predicted scores) are most highly correlated with the criterion component, not with the explainer components themselves. Thus the combination scores incorporate the portions of the components which are most associated with the criterion, not the common aspect of the explainer components themselves.

The regression estimates are good, but how good are they? R square is a measure of the explaining power of a regression. An explanation of its meaning follows. For a particular company, the quantity that the four explainer components should try to predict can be thought of as the deviation of the "accounting size-information output" score from the mean of the accounting size scores (mean is zero). For example, company five had an actual score of -1.126679, which is also its deviation

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[1] See above, page 76.

from the mean of the "accounting size-information output" scores, zero. The total variation for the eighteen companies that the four explainer components should try to predict is the total of the deviations from the mean for the eighteen companies. However, since some deviations are positive and some are negative, the total of the deviations is always zero. A mathematical solution to the problem of totaling the deviations from the mean is to square each one, which makes it positive, and then sum the squares. Thus the total variation for the eighteen companies that the four explainer components must try to explain is the sum of the squared deviations from the mean. Since the actual scores for "accounting size-information output" are already deviations from the mean, they can be squared as is:

$$(-0.602657)^2 + (1.124027)^2 + \dots + (-0.355890)^2$$

$$\begin{array}{c}\text{Sum of squared deviations of} \\ \text{actual scores from the mean}\end{array} = 16.7658.$$

For a particular company, the quantity that the four explainer components actually did predict is the deviation of the estimated score from the mean.[1] For the eighteen companies, the total variation actually predicted is equal to the sum of the squared deviations of the estimated scores from the mean, as follows:

$$(-0.32209)^2 + (0.61988)^2 + \dots + (-0.30693)^2$$

$$\begin{array}{c}\text{Sum of squared deviations of} \\ \text{estimated scores from the mean}\end{array} = 14.5246.$$

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[1] Like the actual scores, the estimated scores are deviations from the mean of zero.

R square is a measure of the ability of a set of explainer components to predict the values of a criterion component. R square is computed as follows:

$$\text{R square} = \frac{\text{Sum of squared deviations of estimated scores from the mean}}{\text{Sum of squared deviations of actual scores from the mean}}$$

For the regression of "accounting size-information output" on the four explainer components, R square is as follows:

$$\text{R square} = \frac{14.5246}{16.7658} = 0.866.$$

In other words, about 87 percent of what was available to be explained was explained by the four explainer components.

The regression coefficients are used as measures of the relative importance of the four explainer components to the prediction of the criterion component. Ordinarily the maximum value of a regression coefficient is 1, and the minimum value is -1. Regression coefficients near 1 or -1 are vital to the prediction, while regression coefficients near 0 have little importance to the prediction.[1] As listed above on page 92, the four regression coefficients are:

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[1] Since all the scores on the components are normalized to mean 0 and standard deviation 1, the coefficients using them are standardized regression coefficients. Standardized coefficients can be compared with one another since both the criterion component and the explainer components are on the same scale. One measurement, "materials input diversity," which was not normalized since it is not a component, was used as an explainer in some regressions. Wherever a regression coefficient for materials input diversity is presented in this dissertation, it is the standardized regression coefficient. This coefficient is the same one that would be obtained if materials input diversity had been normalized.

Process sophistication	0.59857
Job structure complexity	-0.37317[1]
Direct supervision	0.23679
Personnel quality-low level	0.32078

"Process sophistication" is the most important variable to the prediction, while "direct supervision" is the least important.

The regression coefficients also indicate the direction, positive or negative, of the relationship between the criterion component and a given explainer component when the effect of the other explainer components is held constant. For example, the fact that the coefficient of "process sophistication" is positive indicates that, the more sophisticated is a company's process, the more its accounting system size increases in terms of information output when the effect of "job structure complexity," "direct supervision," and "personnel quality-low level" are held constant. A negative relationship would be indicated by a negative coefficient and can be interpreted as follows: The greater the amount of the explainer variable, the less tends to be the amount of the criterion variable when the effects of other explainer variables are held constant.

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[1] This coefficient is negative because the job structure complexity component has negative direction, as interpreted below, on page 243. This means that, as the component score increases, the amount of job structure complexity decreases. The relationship between the "variable" job structure complexity and accounting size-information output is thus positive. In subsequent presentations of regression coefficients, the coefficient signs are adjusted for the direction of the criterion and explainer components. When the criterion component has negative direction, all coefficient signs for that regression are reversed. When any explainer component has negative direction, its coefficient sign is reversed. See below, page 239, for a more extensive discussion of the direction of components.

The Stepwise Procedure

For two reasons, the number of the nineteen explainer (organizational) components allowed to explain each criterion (accounting system) component in a multiple regression was restricted. It is generally recommended in statistical procedures that the sample size be at least twice the number of variables. Since the sample size is eighteen, the number of variables in any multiple regression should be no more than nine and the number of explainers should be no more than eight. Even eight explainers of each accounting component was considered too many since it would be difficult to conceptualize the relationship of that many explainers to a criterion variable. The number of explainers was restricted generally to about five.

Which of the nineteen potential explainers should be used to explain each accounting component? It seems logical that only those explainers most associated with the different accounting criterion components should be included in the respective regressions. A systematic procedure is needed to select those "most associated" explainers. That procedure is *stepwise regression.* The SPSS stepwise regression procedure used in this study sequentially adds explainer variables that contribute most to improving the prediction scores of the criterion component until it determines that further variables do not contribute significantly to improving the prediction scores.

The four explainer components that were used to estimate "accounting size-information output" were selected by the stepwise regression procedure. In the first step, the procedure examined all the simple correlations of the nineteen potential explainer components with "accounting size-information output" and selected "process sophistication" as having the highest correlation. It then performed an *F* test[1] of the significance of "process sophistication" as a predictor of "accounting size-information output" and found that "process sophistication" was a significant predictor. The procedure calculated the regression of the criterion "accounting size-information output" on the single explainer "process sophistication." An R square of 62 percent was calculated for this regression.

Next the procedure examined the partial correlations of "accounting size-information output" with each of the eighteen explainers not in the regression (all but "process sophistication"). The partial correlation is a measure of the association of "accounting size-information output" with one of the eighteen explainers after the effect of "process sophistication" has been removed from each. The procedure selects the

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[1] The statistical nature of the *F* test is beyond the scope of this dissertation. See Draper and Smith, pp. 24-26, 67-69, 169-71. A mechanical and intuitive discussion of the use of the *F* test in this dissertation follows. As each potential explainer is considered for addition to the regression, an *F* statistic is calculated. The calculated *F* is compared with a critical *F* value which is set by the researcher. When the calculated *F* is greater than the critical *F*, the explainer is admitted to the regression. When the calculated *F* is less than the critical *F*, the explainer is not admitted. The critical *F* value is derived from an *F* table in which three items must be stipulated by the researcher: confidence level, numerator degrees of freedom, and denominator degrees of freedom. The confidence level was set at 90 percent. The numerator degrees of freedom for the addition of a single variable is always set at one. The denominator degrees of freedom is calculated as the sample size (eighteen) minus the number of variables in the regression after the admission of the explainer (estimated at five) minus one. The denominator degrees of freedom was thus eighteen minus five minus one, equals twelve. The critical *F* value for the stepwise regressions was determined to be 3.0 from an *F* table at the 90 percent confidence level, with numerator degrees of freedom of one and denominator degrees of freedom of twelve.

explainer with the highest partial correlation which is "job structure complexity" and performs an *F* test of the significance of "job structure complexity" to the regression. Almost any second variable will increase the accuracy of the predicted scores, and thus the R square, since two explainers are better than one. The *F* test determines if the increase in R square is more than would be expected from the addition of a worthless variable. "Job structure complexity" was determined by the *F* test to be significant, and a new regression was calculated of the criterion "accounting size-information output" on the explainers "process sophistication" and "job structure complexity." This regression had an R square of 73 percent, an increase of 11 percent over the regression with just "process sophistication." The final two explainer components, "personnel quality-low level" and "direct supervision," were added to the regression in two subsequent steps similar to those already described.

Twelve other stepwise regression procedures similar to the "accounting size-information output" regression were calculated with the other twelve accounting system components, respectively, as criterion components, and the nineteen organizational components as potential explainers. Table 5 lists the coefficients of the explainer components that were admitted, respectively, to the thirteen regressions.

Explanatory Power and Explainability

A key purpose of this dissertation is to determine whether organizational variables influence the development of the accounting system and what types of organizational variables have the greatest

Table 5

Regression Coefficients for the Stepwise Regressions of the Thirteen Accounting System Components on Nineteen Potential Organizational Explainer Components[a]

Organizational Explainer Component	Accounting System Component[b]						
	A	B	C	D	E	F	G
Process							
Sophistication	0.6	•	•	0.2	-0.4	•	•
Output diversity	•	0.5	•	•	•	•	•
Materials input diversity ...	•	•	•	•	0.3	•	•
Overall Structural Complexity							
Size	•	•	•	-0.8	0.3	•	•
Job structure complexity	0.4	•	•	•	•	•	•
Geographical dispersion	•	•	•	•	•	•	•
Divisional differentiation ..	•	•	•	0.6	•	•	•
Divisional specialization ...	•	•	•	•	•	-0.4	•
Mechanization-general	•	•	•	•	•	•	•
Mechanization-computers	•	•	0.5	•	•	•	•
Control System							
Direct supervision	0.2	•	•	1.0	•	•	0.6
Staff support	•	•	•	•	•	•	•
Authority levels	•	•	•	0.4	•	•	•
Personnel quality-high	•	•	•	0.5	•	•	•
Personnel quality-low	0.3	•	-0.4	•	•	•	-0.4
Cent. of authority-invest ...	•	•	•	•	0.3	•	•
Centr. of authority-purchase.	•	•	•	•	•	•	•
Standardization-jobs	•	-0.5	•	•	-0.8	•	•
Standardization-general	•	•	•	-0.8	•	•	•

[a] Coefficient signs are adjusted to the direction of components. The thirteen columns of accounting system components represent different regressions; each column includes the coefficients for the explainer components which were added to the regressions of the accounting system component for the column identified.

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels.

Table 5 (Cont'd.)

Organizational Explainer Component	Accounting System Component[c]					
	H	I	J	K	L	M
Process						
Sophistication	0.7	•	•	•	•	•
Output diversity	•	•	•	•	•	•
Materials input diversity	•	•	-0.5	•	•	•
Overall Structural Complexity						
Size	•	•	-0.3	•	•	•
Job structure complexity	•	0.4	•	•	•	•
Geographical dispersion	•	•	•	•	•	•
Divisional differentiation	•	•	•	•	•	•
Divisional specialization	•	•	•	•	•	•
Mechanization-general	•	•	•	•	•	•
Mechanization-computers	•	•	•	0.5	•	•
Control System						
Direct supervision	•	0.4	•	•	•	•
Staff support	•	•	•	•	-0.4	•
Authority levels	•	•	•	•	•	•
Personnel quality-high	•	-0.2	•	•	•	•
Personnel quality-low	•	0.3	0.4	•	•	•
Centr. of authority-invest	0.6	-0.5	•	•	•	•
Centr. of authority-purchase	•	•	•	•	•	•
Standardization-jobs	•	•	•	•	•	•
Standardization-general	-0.4	0.3	•	•	•	•

[c] *Accounting System Components*: (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

influence on the accounting system. A secondary purpose is to determine what aspects of the accounting system are most influenced by organizational variables and what aspects are most insulated from the influence of organizational variables.

In order to address these purposes, the terms "explanatory power" and "explainability" must be defined. "Explanatory power" is the ability of a variable or set of variables to contribute to the explanation or prediction of another variable or set of variables. As discussed above on page 97, "process sophistication" is an important variable to the prediction of "accounting size-information output." It thus has considerable explanatory power. Groups of variables can be determined to have much explanatory power. For example, the four explainers of "accounting size-information output," taken together, were determined to have an R square of 87 percent and thus explain 87 percent of what was available to be explained of "accounting size-information output." An R square of 87 percent is considerably higher than the average (about 52 percent)[1] for the thirteen regressions of accounting components on organizational components, and thus the four explainers have a great deal of explanatory power with respect to "accounting size-information output."

"Explainability" is the ability of a variable or set of variables to be predicted or explained by another variable or set of variables. It thus refers to criterion variables rather than explainer variables. For example, the above-average R square of 87 percent for the regression of

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[1] See below, page 112.

"accounting size-information output" indicates that it is very explainable by organizational variables.

A basic interest of the dissertation is the relative explanatory power of the three levels of explainer variables ("process," "overall structural complexity," and "control system") with respect to the accounting system variables. Though the hypotheses on page 57 above did not predict which levels would have greatest explanatory power, the focus of the dissertation is on "overall structural complexity" as an explainer of the accounting system. The expectation is that "overall structural complexity" will have a lot of explanatory power. "Control system" should also have much explanatory power because of the hypothesized interrelationships within the control system. "Process" was included in the basic model mostly as a control, and the expectation is that its explanatory power will be minimal.

A more specific interest of the dissertation is the relative explanatory power of the organizational variables within the different levels of explainers. Which of the variables within the respective levels are important representatives of the level in explaining the accounting system, and which of the variables are unimportant? The answer to this question can draw attention to important explainers that should be studied more intensively or to poor explainers that might be removed from the basic model.

Another specific interest of the dissertation is the relative explainability of the accounting system variables by the organizational variables. Which of the accounting system variables are most related to organizational variables, and which are least related?

Description of Frequencies and R Square Increase Methods

Explanatory power and explainability are both assessed in this dissertation by two methods: frequencies of coefficients and R square increase. Table 6 accumulates the information for the frequencies method, and Table 7 accumulates the information for the R square increase method. Table 6 is an extension of Table 5 (page 101), in that the number of coefficients is summed and cross summed. Table 7 substitutes for the coefficients the R square increase as each component was added to a regression. The R square increases are summed and cross summed.

The frequencies method assesses the explanatory power of a given explainer component by the number of the thirteen regressions for which the explainer component was incorporated in the regression. For example, "process sophistication" was used as an explainer in four of the thirteen regressions. Consequently there is a *4* in the *f* column for "process sophistication" in Table 6. The frequencies method assesses the explanatory power of a level by the number of times explainers within the level were used in the thirteen regressions. For example, "process level" components were used seven times as explainers in the thirteen regressions, and there is a *7* in the *f* column for "total process." Explainability of an accounting system component is assessed by means of the number of explainer components that were incorporated in its respective regression. For example, "accounting size-information output" was explained by four explainer components. There is a *4* in the "total frequency" row for "accounting size-information output."

Table 6

Frequencies of Regression Coefficients of Accounting System Components on Organizational Explainer Components[a]

Organizational Explainer Component	Accounting System Component[b]							
	A	B	C	D	E	F	G	H
			Process					
Sophistication	0.6	•	•	0.2	-0.4	•	•	0.7
Output diversity	•	0.5	•	•	•	•	•	•
Materials inp. div.	•	•	•	•	0.3	•	•	•
f	1	1	0	1	2	0	0	1
Explainability f/Ef[c]	1.9	1.9	0	1.9	3.7	0	0	1.9
			Overall Structural Complexity					
Size	•	•	•	-0.8	0.3	•	•	•
Job struct. compl.	0.4	•	•	•	•	•	•	•
Geog. dispersion	•	•	•	•	•	•	•	•
Divisional diff.	•	•	•	0.6	•	•	•	•
Divisional special.	•	•	•	•	•	-0.4	•	•
Mechan.-general	•	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.5	•	•	•	•	•
f	1	0	1	2	1	1	0	0
Explainability f/Ef	1.4	0	1.4	2.9	1.4	1.4	0	0
			Control System					
Direct supervision	0.2	•	•	1.0	•	•	0.6	•
Staff support	•	•	•	•	•	•	•	•
Authority levels	•	•	•	0.4	•	•	•	•
Personnel-high	•	•	•	0.5	•	•	•	•
Personnel-low	0.3	•	-0.4	•	•	•	-0.4	•
Cen. auth.-invest	•	•	•	•	0.3	•	•	0.6
Cen. auth.-purchase	•	•	•	•	•	•	•	•
Standard.-jobs	•	-0.5	•	(d)	-0.8	•	•	•
Standard.-general	•	•	•	-0.8	•	•	•	-0.4
f	2	1	1	4	2	0	2	2
Explainability f/Ef	1.2	0.6	0.6	2.5	1.2	0	1.2	1.2
			Total					
f	4	2	2	7	5	1	2	3
Explainability f/Ef	1.4	0.7	0.7	2.5	1.8	0.4	0.7	1.1

[a] Coefficient signs are adjusted for the direction of components. This table is an extension of Table 5, page 101.

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

[c] *Explainability*: Expected frequencies (Ef): process components, 7/3 = 2.33333; total process, 37 × 3/19 = 5.84211; structural complexity

Table 6 (Cont'd.)

Organizational Explainer Component	Accounting System Component^{b}					f	f/Ef^{c}
	I	J	K	L	M		
Process							
Sophistication	•	•	•	•	•	4	1.7
Output diversity	•	•	•	•	•	1	0.4
Materials inp. div.	•	-0.5	•	•	•	2	0.9
f	0	1	0	0	0	7	•
Explainability f/Ef	0	1.9	0	0	0	•	1.2
Overall Structural Complexity							
Size	•	-0.4	•	•	•	3	2.3
Job struct. compl.	0.4	•	•	•	•	2	1.6
Geog. dispersion	•	•	•	•	•	0	0
Divisional diff.	•	•	•	•	•	1	0.8
Divisional special.	•	•	•	•	•	1	0.8
Mechan.-general	•	•	•	•	•	0	0
Mechan.-computers	•	•	0.5	•	•	2	1.6
f	1	1	1	0	0	9	•
Explainability f/Ef	1.4	1.4	1.4	0	0	•	0.7
Control System							
Direct supervision	0.4	•	•	•	•	4	1.7
Staff support	•	•	-0.4	•	1	0.4	
Authority levels	•	•	•	•	•	1	0.4
Personnel-high	-0.2	•	•	•	•	2	0.9
Personnel-low	0.3	0.4	•	•	•	5	2.1
Cen. auth.-invest	-0.5	•	•	•	•	3	1.3
Cen. auth.-purchase	•	•	•	•	•	0	0
Standard.-jobs	•	•	•	•	•	2	0.9
Standard.-general	0.3	•	•	•	•	3	1.3
f	5	1	0	1	0	21	•
Explainability f/Ef	3.1	0.6	0	0.6	0	•	1.2
Total							
f	6	3	1	1	0	37	•
Explainability f/Ef	2.1	1.1	0.4	0.4	0	•	•

components, 9/7 = 1.28571; total structural complexity, 37 × 7/19 = 13.63160; control components, 21/9 = 2.33333; total control, 37 × 9/19 = 17.52630; accounting components, 37/13 = 2.84615; accounting process, 7/13 = 0.53846; accounting structural complexity, 9/13 = 0.69231; accounting control, 21/13 = 1.61538.

[d] Though "standard-jobs" was the first component to be added to the regression of accounting geographical dispersion, it was no longer a significant explainer after the other explainers were added (i.e., its calculated F to remove was under the critical F of 3.0). The regression was recalculated without "standard-jobs." The coefficients for that recalculated regression are shown here.

Table 7

R Square Increase of Organizational Components Admitted to Regression^{a}

Organizational Explainer Component	Accounting System Component^{b}							
	A	B	C	D	E	F	G	H
	Process							
Sophistication	0.62	•	•	0.01	0.18	•	•	0.30
Output diversity	•	0.22	•	•	•	•	•	•
Materials inp. div. ...	•	•	•	•	0.06	•	•	•
Σ	0.62	0.22	0	0.01	0.24	0	0	0.30
Explainability Σ/EΣ^{c} ..	4.8	1.7	0	0.1	1.9	0	0	2.3
	Overall Structural Complexity							
Size	•	•	•	0.05	0.19	•	•	•
Job struct. compl.	0.11	•	•	•	•	•	•	•
Geog. dispersion	•	•	•	•	•	•	•	•
Divisional diff.	•	•	•	0.06	•	•	•	•
Divisional special. ...	•	•	•	•	•	0.17	•	•
Mechan.-general	•	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.23	•	•	•	•	•
Σ	0.11	0	0.23	0.11	0.19	0.17	0	0
Explainability Σ/EΣ ...	1.1	0	2.3	1.1	1.9	1.7	0	0
	Control System							
Direct supervision	0.06	•	•	0.20	•	•	0.35	•
Staff support	•	•	•	•	•	•	•	•
Authority levels	•	•	•	0.05	•	•	•	•
Personnel-high	•	•	•	0.04	•	•	•	•
Personnel-low	0.08	•	0.16	•	•	•	0.16	•
Cen. auth.-invest	•	•	•	•	0.05	•	•	0.20
Cen. auth.-purchase ...	•	•	•	•	•	•	•	•
Standard.-jobs	•	0.26	•	0.39^{d}	0.34	•	•	•
Standard.-general	•	•	•	0.16	•	•	•	0.14
Σ	0.14	0.26	0.16	0.84	0.39	0	0.51	0.34
Explainability Σ/EΣ ...	0.5	0.9	0.6	2.9	1.3	0	1.8	1.2
Total Σ (R square)	0.87	0.48	0.39	0.96	0.82	0.17	0.51	0.64
Total Expl. Σ/EΣ	1.7	0.9	0.8	1.8	1.6	0.3	1.0	1.2

[a] The thirteen columns headed by accounting system components represent the thirteen regressions whose coefficients are listed in Table 5, page 101. The R square increases listed in this table occurred at the step that the given explainer component was added to the regression of the criterion component. Absence of entry indicates that the explainer component was not added to the regression in that column.

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

Table 7 (Cont'd.)

Organizational Explainer Component	Accounting System Component[b]					Σ	Σ/EΣ[c]
	I	J	K	L	M		
Process							
Sophistication	•	•	•	•	•	1.11	2.0
Output diversity	•	•	•	•	•	0.22	0.4
Materials inp. div.	•	0.27	•	•	•	0.33	0.6
Σ	0	0.27	0	0	0	1.66	•
Explainability Σ/EΣ	0	2.1	0	0	0	•	1.6
Overall Structural Complexity							
Size	•	0.11	•	•	•	0.35	1.9
Job struct. compl.	0.10	•	•	•	•	0.21	1.1
Geog. dispersion	•	•	•	•	•	0	0
Divisional diff.	•	•	•	•	•	0.06	0.3
Divisional special.	•	•	•	•	•	0.17	0.9
Mechan.-general	•	•	•	•	•	0	0
Mechan.-computers	•	•	0.30	•	•	0.53	2.8
Σ	0.10	0.11	0.30	0	0	1.32	•
Explainability Σ/EΣ	1.0	1.1	3.0	0	0	•	0.5
Control System							
Direct supervision	0.09	•	•	•	•	0.70	1.7
Staff support	•	•	•	0.18	•	0.18	0.4
Authority levels	•	•	•	•	•	0.05	0.1
Personnel-high	0.05	•	•	•	•	0.09	0.2
Personnel-low	0.09	0.15	•	•	•	0.64	1.5
Cen. auth.-invest	0.16	•	•	•	•	0.41	1.0
Cen. auth.-purchase	•	•	•	•	•	0	0
Standard.-jobs	•	•	•	•	•	0.99	2.4
Standard.-general	0.41	•	•	•	•	0.71	1.7
Σ	0.80	0.15	0	0.18	0	3.77	•
Explainability Σ/EΣ	2.8	0.5	0	0.6	0	•	1.2
Total Σ (R square)	0.90	0.53	0.30	0.18	0	6.75	•
Total Expl. Σ/EΣ	1.7	1.0	0.6	0.3	0	•	•

[c] *Explainability*. Expected sums (EΣ): process components, 1.66/3 = 0.55333; total process, 6.75 × 3/19 = 1.06579; structural complexity components, 1.32/7 = 0.18857; total structural complexity, 6.75 × 7/19 = 2.48684; control components, 3.77/9 = 0.41889; total control, 6.75 × 9/19 = 3.19737; accounting components, 6.75/13 = 0.51923; accounting process, 1.66/13 = 0.12769; accounting structural complexity, 1.32/13 = 0.10154; accounting control, 3.77/13 = 0.29000. Σ = column or row sum.

[d] Though "standard-jobs" was the first component added to the regression of accounting geographical dispersion, it was no longer a significant explainer after the other explainers were added (i.e., its calculated *F* to remove was under the critical *F* of 3.0). An R square increase is shown here because "standard-jobs" increased R square at the step entered. However, the regression was recalculated without "standard-jobs." Coefficients for that regression are shown in Table 6.

In order that a given frequency may be evaluated as to whether it indicates high or low explanatory power or explainability, it must be compared with an expected frequency. For an explainer component within a level, the expected frequency is the average frequency of coefficients for the variables within the level. For example, since process components were used seven times as explainers and there are three process components, the expected frequency for each process component is 7 divided by 3 equals 2.3. For a level, the expected frequency is the proportion of the total number of coefficients that would be expected based on the number of explainer components in the level compared to the total number of explainer components. For example, the explainers are used a total of thirty-seven times in the thirteen regressions. Since explainer components might be expected to be used the same number of times, the proportion of the thirty-seven components that is expected for "process" is based on the proportionate number of "process" explainers. Three of the nineteen explainer components are "process" components. Consequently the expected frequency of components used as explainers for "process" is:

$$\frac{3 \text{ "process" components}}{19 \text{ total explainer components}} \times 37 \text{ total frequency}$$

expected frequency total "process" = 5.8

For an accounting component, the expected frequency is the average number of explainer components per regression. For example, explainer components were used a total of thirty-seven times in the thirteen regressions. The average number of explainer components per regression is 37 divided by 13 equals 2.8.

In the right column and the bottom row of Table 6, the actual frequencies are divided by the expected frequencies to obtain measures respectively of explanatory power and explainability. For example, the actual frequency for "process sophistication," 4, is divided by the expected frequency, 2.3, to obtain a measure of the explanatory power of "process sophistication," 1.7. "Process sophistication" was used as an explainer 70 percent more than might be expected. The total frequency for "process," 7, is divided by the expected frequency for "process," 5.8, to obtain a measure of the explanatory power of "process," 1.2. "Process" components, taken together, are used as explainers 20 percent more than might be expected. The total frequency for "accounting size-information output," 4, is divided by the expected frequency, 2.8, to obtain a measure of the explainability of "accounting size-information output," 1.4. "Accounting size-information output" is 40 percent more explainable than might be expected.

The R square increase method assesses the explanatory power of a given explainer component by the total of the R square increases for each of the thirteen regressions into which the component was incorporated. For example, the Σ (meaning summation) column for "process sophistication," 1.11, is just the total of the R square increases for the four regressions into which "process sophistication" was incorporated as an explainer. The R square increase method assesses the explanatory power of a level by the sum of all the R square increases of all the explainer components in the level that were incorporated in any of the thirteen regressions. For example, the Σ column for total "process," 1.66, is the total of the R square increases for all the "process" components that were incorporated into any of the thirteen regressions. Explainability of an accounting component is assessed by means of the total R square for the regression of that component on the organizational components. For example, the Σ row for "accounting size-information output" (whose explainability was discussed above on page 103) is 0.87, which is the total of the R square increases as each explainer was added to the regression. By definition, the total of the R square increases is the total R square for the regression. The total R squares for the thirteen regressions can be compared with their average, about 52 percent.

In order that a given summation (Σ) may be evaluated as to whether it indicates high or low explanatory power or explainability, it must be compared with an expected summation (EΣ). The expected summations are modeled after the expected frequencies for the frequencies method. For an explainer component within a level, the expected summation is equal to the total summation for the level divided by the number of components in the level. For individual "process" components, the expected summation is equal to the total summation for "process," 1.66, divided by the number of components, 3, equals 0.55. For a level, the expected summation is the proportion of the total summation for all regressions that is expected based on the number of explainer components in the level compared to the total number of explainer components. For example, the expected summation for the "process" level is:

$$\frac{\text{3 "process" components}}{\text{19 total explainer components}} \times \text{6.75 total summation}$$

expected summation total "process" = 1.07

For an accounting component, the expected summation is equal to the average R square for the thirteen regressions, which is 6.75 divided by 13 equals 0.52.

Like the frequencies method, the actual summations are divided by the expected summations to obtain measures of explanatory power and explainability. For example, the actual summation for "process sophistication," 1.11, is divided by the expected summation, 0.55, to obtain a measure of the explanatory power of "process sophistication," 2.0. "Process sophistication" has twice as much explanatory power in terms of R square increase than might be expected. The total summation for the "process" level, 1.66, is divided by the expected summation, 1.07, to obtain a measure of the explanatory power of the "process" level, 1.6. The "process" level has 60 percent more explanatory power than might be expected in terms of R square increase. The total R square for "accounting size-information output," 0.87, is divided by the expected total R square for accounting components, 0.52, to obtain a measure of the explainability of "accounting size-information output," 1.7. "Accounting size-information output" is 70 percent more explainable than might be expected.

Comparison of Frequencies and R Square Increase Methods

A key advantage of both the frequencies and the R square increase methods is that they permit the calculation of the explanatory power of individual explainer components and levels of explainer components in terms of proportions of the total aspects of the accounting system that are explained. The frequencies method does this by means of proportions of the total number of times explainer components were used for the thirteen regressions. For example, "process sophistication" was used four times and thus explains 4 divided by 37 equals 11 percent of the explained aspect of the accounting system. The "process" level explains 7 divided by 37 equals 19 percent of the explained aspect of the accounting system.

The R square increase method permits the calculation of the proportional explanation of the total of the R squares for the thirteen regressions by individual explainer components and levels of explainer components. In Table 7, the R square increases of individual regressions (the columns under the accounting system components) must, by definition, add up to the total R square for the regression. For example, consider the regression of "accounting size-information output":

$$\underbrace{0.62 + 0.11 + 0.06 + 0.08}_{\text{R square increases}} = \underset{\text{total R square}}{0.87}$$

The total R squares and the R square changes for individual explainers and levels of explainers can be cross added. In Table 7, the total R squares cross add to 6.75. The R square increases for total "process" cross add to 1.66. The "process" level accounts for 1.66 divided by 6.75 equals 25 percent of the influence of explainer components on the predictions of accounting components. "Process sophistication" accounts for 1.11 divided by 6.75 equals 16 percent of the influence of explainer components on the predictions of accounting components. Then the proportional influence of an individual explainer or a level of explainers is just the summation of the R square changes divided by the total of the R squares.

The chief difference between the two approaches is that the frequencies approach ignores the strength of a particular association. A 1.0 coefficient counts the same as a 0.1 coefficient. The R square increase approach considers the strength of the associations but is biased toward explainers which are added in the early steps of the stepwise regressions. In other words, early-added explainers are credited with too little. The reason for this bias is that the explainers in a particular regression are almost always correlated with one another to a certain extent. The first explainer added is credited with the full effect it has on the prediction in terms of R square increase. The second explainer added (assumed to be correlated with the first) is credited only with its unique contribution to the prediction in terms of R square increase, apart from the contribution of the first explainer. The part of the second explainer that is common to the first explainer has already been credited to the first explainer. The later-added variables are credited with less and less R square increase partly because the early-added variables have already accounted for much of the commonality between the explainers. The early-added variables deserve to be credited with more R square increase than later-added variables. Otherwise they would not have been added early. But, as indicated above, they are credited with too much R square increase.

Both methods have deficiencies, but their deficiencies are different for the two methods. Consequently, in the analysis of the research findings in Chapter 4, the measurements for each method are compared with one another in assessing the explanatory power of explainer components and levels and the explainability of accounting system components.

Consistency with the Hypotheses

In addition to determining the strength of influence of organizational variables on the development of the accounting system (explanatory power as discussed in the previous section), a key purpose of the dissertation is determining the direction of influence, positive or negative, of organizational variables on the development of the accounting system. Which organizational variables and groups of organizational variables lead to the further development of the accounting system (positive influence) and which tend to suppress the development of the accounting system (negative influence)?

Frequencies Method

In order to address this purpose, consistency with the hypotheses must be defined. Defining consistency will be easier if Table 8 is presented and partially interpreted at this point. Table 8 contains all

Table 8

Frequencies of Coefficients Consistent with Hypotheses[a]

Organizational Explainer Component	Accounting System Component[b]							
	A	B	C	D	E	F	G	H
				Process				
Sophistication	0.6	•	•	0.2	-0.4*	•	•	0.7
Output diversity	•	0.5	•	•	•	•	•	•
Materials inp. div. ...	•	•	•	•	0.3	•	•	•
Number consistent	1	1	•	1	1	•	•	1
Proportion consistent .	1	1	•	1	0.50	•	•	1
				Overall Structural Complexity				
Size	•	•	•	-0.8*	0.3	•	•	•
Job struct. compl.	0.4	•	•	•	•	•	•	•
Geog. dispersion	•	•	•	•	•	•	•	•
Divisional diff.	•	•	•	0.6	•	•	•	•
Divisional special. ...	•	•	•	•	•	-0.4*	•	•
Mechan.-general	•	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.5	•	•	•	•	•
Number consistent	1	•	1	1	1	0	•	•
Proportion consistent .	1	•	1	0.50	1	0	•	•
				Control System				
Direct supervision	0.2*	•	•	1.0*	•	•	0.6*	•
Staff support	•	•	•	•	•	•	•	•
Authority levels	•	•	•	0.4*	•	•	•	•
Personnel-high	•	•	•	0.5*	•	•	•	•
Personnel-low	0.3*	•	-0.4	•	•	•	-0.4	•
Cen. auth.-invest	•	•	•	•	0.3*	•	•	0.6*
Cen. auth.-purchase ...	•	•	•	•	•	•	•	•
Standard.-jobs	•	-0.5	•	•	-0.8	•	•	•
Standard.-general	•	•	•	-0.8	•	•	•	-0.4
Number consistent	0	1	1	1	1	•	1	1
Proportion consistent .	0	1	1	0.25	0.50	•	0.50	0.50
				Total				
Number consistent	2	2	2	3	3	0	1	2
Proportion consistent .	0.50	1	1	0.43	0.60	0	0.50	0.67

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[a] Coefficient signs are adjusted for the direction of components. This table is an extension of Table 5, page 101. Asterisk (*) = coefficient has a sign which is inconsistent with one of the hypotheses.

Table 8 (Cont'd.)

Organizational Explainer Component	Accounting System Component[b]					No. Consist.	Propor. Con.
	I	J	K	L	M		
	Process						
Sophistication	•	•	•	•	•	3	0.75
Output diversity	•	•	•	•	•	1	1
Materials inp. div.	•	0.5*	•	•	•	1	0.50
Number consistent	•	0	•	•	•	5	•
Proportion consistent	•	0	•	•	•	•	0.71
	Overall Structural Complexity						
Size	•	-0.4*	•	•	•	1	0.33
Job struct. compl.	0.4	•	•	•	•	2	1
Geog. dispersion	•	•	•	•	•	•	•
Divisional diff.	•	•	•	•	•	1	1
Divisional special.	•	•	•	•	•	0	0
Mechan.-general	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.5	•	•	2	1
Number consistent	1	0	1	•	•	6	•
Proportion consistent	1	0	1	•	•	•	0.67
	Control System						
Direct supervision	0.4*	•	•	•	•	0	0
Staff support	•	•	•	-0.4	•	1	1
Authority levels	•	•	•	•	•	0	0
Personnel-high	-0.2	•	•	•	•	1	0.50
Personnel-low	0.3*	0.4*	•	•	•	2	0.40
Cen. auth.-invest	-0.5	•	•	•	•	1	0.33
Cen. auth.-purchase	•	•	•	•	•	•	•
Standard.-jobs	•	•	•	•	•	2	1
Standard.-general	0.3*	•	•	•	•	2	0.67
Number consistent	2	0	•	1•	•	9	•
Proportion consistent	0.40	0	•	1	•	•	0.43
	Total						
Number consistent	3	0	1	1	•	20	•
Proportion consistent	0.50	0	1	1	•	•	0.54

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

of the regression coefficients for the regressions of the accounting system components on the organizational components which were presented in Table 5 (page 101). Some additional information is interspersed through the table. Note that some of the coefficients are singled out by an asterisk (*) which indicates that the sign of the coefficient is inconsistent with one of the hypotheses. The numbers of consistent coefficients (ones without an asterisk) are summed and cross summed similar to the way the total number of coefficients was summed and cross summed in Table 6 (page 106). Then the numbers of consistent coefficients in the respective groupings are divided by the total numbers of coefficients to get the proportion consistent.

The three hypotheses listed above on page 57 postulate some relationships between levels of organizational variables and the accounting system. For instance, hypothesis one suggests that structurally complex organizations tend to have more fully developed accounting systems. If a single measure of structural complexity of the eighteen companies and a single measure of accounting system development were available, testing this hypothesis would be simple: a positive relationship would be looked for as an indication of the validity of the hypothesis. In other words, the companies with high scores on "structural complexity" should tend to have high scores on "accounting system development" and vice versa.

Unfortunately, single measures of either structural complexity or accounting system development have not been developed, and it is necessary to work with multiple measures. In this dissertation, there are seven structural complexity and thirteen accounting system variables.

There are thus 7 times 13 equals 91 potential relationships between structural complexity variables and accounting system variables. These ninety-one potential relationships are represented by the ninety-one spaces in Table 8 in the thirteen "Accounting System Variable" columns of the "Overall Structural Complexity" section. Not all of these relationships were found to exist. Those spaces with coefficients indicate relationships that were found. Spaces containing single dots indicate relationships that were not found.

How will the relationships that are found be evaluated as to the extent they confirm hypothesis one? They are evaluated by their direction, positive or negative. Positive direction means that when one variable has a high value the other variable tends to have a high value. Negative direction means that when one variable has a high value the other variable tends to have a low value. Positive-direction relationships tend to confirm hypothesis one, and negative-direction relationships tend to disconfirm hypothesis one, given the following conditions are true:

1. The structural complexity variables are valid aspects of structural complexity, and high scores on them constitute greater structural complexity of the company, other things being equal.
2. The accounting system variables are valid aspects of the development of the accounting system, and high scores on them constitute greater development of the accounting system.

Therefore, in order to confirm hypothesis one, many of the relationships found between structural variables and accounting system variables should be positive and few should be negative. In general, confirmation of one of the three hypotheses depends upon the extent that the relationships found between the variables of the two levels have the direction, positive or negative, which is indicated by the respective hypothesis. A measure of the degree of confirmation of a given hypothesis is the proportion of the relationships found which have the direction, positive or negative, that is suggested by the hypothesis. As discussed above on page 120, relationships are indicated by regression coefficients. Thus the measure of confirmation is the proportion of the regression coefficients of accounting system variables with the variables in one of the explainer levels which have the sign that is suggested by the respective hypothesis.

For hypothesis one, the measure of confirmation is the proportion of the regression coefficients of accounting system components on structural complexity components which are positive. Table 8 indicates that there are six positive coefficients within the section, indicated by the absence of an asterisk, out of nine. Therefore, the proportion of consistent coefficients is:

$$\frac{\text{6 consistent structural complexity coefficients}}{\text{9 total structural complexity coefficients}} =$$

proportion consistent structural complexity coefficients =

0.67.

For hypothesis two, postulating the inverse relationship between the stage of development of the accounting system and other control systems, the measure of confirmation is the proportion of the regression coefficients of accounting system components on control system components which are negative. Table 8 indicates that nine of the twenty-one coefficients are negative, and thus the proportion consistent is 9 divided by 21 equals 0.43. For hypothesis three, postulating the positive relationship between "process" and accounting system development, the measure of confirmation is the proportion of the regression coefficients of accounting system components on "process" components which are positive. Table 8 indicates that five of the seven coefficients are consistent, and thus the proportion consistent is 0.71.

Consistency of Individual Components

Testing the hypotheses thus involves determining if the relationships between the accounting system level and the three organizational levels tend to have prevailing directions, positive or negative. Though testing the hypotheses is the major goal of the dissertation, it is desirable to have more specific information on the effects of each of the organizational components on the accounting system and the response of individual accounting system components to the organizational variables. The explanatory power of the organizational variables and the explainability of the accounting variables was discussed in the prior section (above, pages 100-116). In this section, techniques are developed for assessing the direction of influence, positive or negative, of individual explainer variables and the direction of increase of accounting system variables in response to changes in organizational variables.

Consistency with the hypotheses must be defined separately for accounting variables and for organizational variables. For an organizational variable (explainer), consistency with a hypothesis is the extent that any relationships found between the organizational variable and the accounting system variables have the direction, positive or negative, that is suggested by the hypothesis that applies to the level in which the explainer is located. Consistency with a hypothesis is measured by the proportion of coefficients for the regressions into which the explainer was incorporated that have the appropriate sign. For example, the consistency of "process sophistication" with hypothesis three (the only hypothesis applicable to "process" variables) is the extent that any relationships between "process sophistication" and accounting system variables are positive. Table 8 indicates that three out of the four coefficients for the regressions into which "process sophistication" was incorporated have positive signs. Consequently, the consistency of "process sophistication," measured by proportion of coefficients, is 0.75.

For an accounting variable (criterion), consistency with the hypotheses is the extent that any relationships found between the accounting variable and organizational variables have the direction, positive or negative, that is suggested by the hypotheses that apply to the levels in which the respective explainers are located. Consistency of an accounting component is measured by the proportion of the coefficients of the explainers used to explain the accounting component which have the appropriate sign. For example, the consistency of "accounting size-information output" is the extent that the coefficients of any "process" explainers used to explain "accounting size-information output" have positive signs per hypothesis three, the coefficients of any structural complexity component have positive signs per hypothesis one, and the coefficients of any control system components have negative signs per hypothesis two. Table 8 indicates that accounting size has four explainers: "process sophistication," whose positive coefficient is consistent with hypothesis three; "job structure complexity," whose positive coefficient is consistent with hypothesis one; and "direct supervision" and "personnel quality-low level," both of whose positive coefficients are inconsistent with hypothesis two. Thus the consistency of "accounting size-information output" is 2 consistent coefficients divided by 4 total coefficients equals 0.50.

R Square Increase Method

Just like the frequencies method for explanatory power, the frequencies method for consistency with the hypotheses ignores the strength of particular associations. An inconsistent 0.1 coefficient counts the same as an inconsistent 1.0 coefficient. This defect is overcome by the R square increase method for consistency with the hypotheses. Table 9 includes the same R square increases as Table 7 (page 108). The R square increases are tagged with an asterisk whenever the coefficient for the respective explainer has a sign which is inconsistent with one of the hypotheses, as indicated by an asterisk in Table 8. The R square increases which are consistent are summed and cross summed just as the R square increases were summed and cross summed in Table 7. The consistent R square increase sums (Σ_C) are divided by the total R square increase sums (Σ) to obtain the proportion of R square increase consistent with the hypotheses for individual

Table 9

Proportion of R Square Consistent with the Hypotheses[a]

Organizational Explainer Component	Accounting System Component[b]							
	A	B	C	D	E	F	G	H
Process								
Sophistication	0.62	•	•	0.01	0.18*	•	•	0.30
Output diversity	•	0.22	•	•	•	•	•	•
Materials inp. div.	•	•	•	•	0.06	•	•	•
Σ_c	0.62	0.22	•	0.01	0.06	•	•	0.30
Consistency Σ_c/Σ	1	1	•	1	0.25	•	•	1
Overall Structural Complexity								
Size	•	•	•	0.05*	0.19	•	•	•
Job struct. compl.	0.11	•	•	•	•	•	•	•
Geog. dispersion	•	•	•	•	•	•	•	•
Divisional diff.	•	•	•	0.06	•	•	•	•
Divisional special.	•	•	•	•	•	0.17*	•	•
Mechan.-general	•	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.23	•	•	•	•	•
Σ_c	0.11	•	0.23	0.06	0.19	0	•	•
Consistency Σ_c/Σ	1	•	1	0.55	1	0	•	•
Control System								
Direct supervision	0.06*	•	•	0.20*	•	•	0.35*	•
Staff support	•	•	•	•	•	•	•	•
Authority levels	•	•	•	0.05*	•	•	•	•
Personnel-high	•	•	•	0.04*	•	•	•	•
Personnel-low	0.08*	•	0.16	•	•	•	0.16	•
Cen. auth.-invest	•	•	•	•	0.05*	•	•	0.20*
Cen. auth.-purchase	•	•	•	•	•	•	•	•
Standard.-jobs	•	0.26	•	0.39	0.34	•	•	•
Standard.-general	•	•	•	0.16	•	•	•	0.14
Σ_c	0	0.26	0.16	0.55	0.34	•	0.16	0.14
Consistency Σ_c/Σ	0	1	1	0.65	0.87	•	0.31	0.41
Total								
Σ_c	0.73	0.48	0.39	0.62	0.59	0	0.16	0.44
Consistency Σ_c/Σ	0.84	1	1	0.65	0.72	0	0.31	0.69

[a] This table is a modification of Table 7, page 108; the R square increases are the same, but the summations are different. Asterisk (*) = the explainer component whose addition to the regression resulted in this R square increase (per Table 7) has a sign which is inconsistent with one of the hypotheses (per Table 8). Σ_c = sum of R square increases consistent with hypotheses. Σ = sum of R square increases.

Table 9 (Cont'd.)

Organizational Explainer Component	Accounting System Component[b]					Σ_c	Σ_c/Σ
	I	J	K	L	M		
	Process						
Sophistication	•	•	•	•	•	0.93	0.84
Output diversity	•	•	•	•	•	0.22	1
Materials inp. div.	•	0.27*	•	•	•	0.06	0.18
Σ_c	•	0	•	•	•	1.21	•
Consistency Σ_c/Σ	•	0	•	•	•	•	0.73
	Overall Structural Complexity						
Size	•	0.11*	•	•	•	0.19	0.54
Job struct. compl.	0.10	•	•	•	•	0.21	1
Geog. dispersion	•	•	•	•	•	•	•
Divisional diff.	•	•	•	•	•	0.06	1
Divisional special.	•	•	•	•	•	0	0
Mechan.-general	•	•	•	•	•	•	•
Mechan.-computers	•	•	0.30	•	•	0.53	1
Σ_c	0.10	0	0.30	•	•	0.99	•
Consistency Σ_c/Σ	1	0	1	•	•	•	0.75
	Control System						
Direct Supervision	0.09*	•	•	•	•	0	0
Staff support	•	•	•	0.18	•	0.18	1
Authority levels	•	•	•	•	•	0	0
Personnel-high	0.05	•	•	•	•	0.05	0.56
Personnel-low	0.09*	0.15*	•	•	•	0.32	0.50
Cen. auth.-invest	0.16	•	•	•	•	0.16	0.39
Cen. auth.-purchase	•	•	•	•	•	•	•
Standard.-jobs	•	•	•	•	•	0.99	1
Standard.-general	0.41*	•	•	•	•	0.30	0.42
Σ_c	0.21	0	•	0.18	•	2.00	•
Consistency Σ_c/Σ	0.26	0	•	1	•	•	0.53
	Total						
Σ_c	0.31	0	0.30	0.18	•	4.20	•
Consistency Σ_c/Σ	0.34	0	1	1	•	•	0.62

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

explainer components, levels of explainer components, and accounting system components.

Though the R square increase method for consistency with the hypotheses does consider the strength of particular associations, it has the same bias toward early-added explainers as the R square increase method for explanatory power (see above, page 115). Like the use of the two methods for explanatory power, the results of the two methods for consistency with the hypotheses will be compared with one another in assessing the consistency of explainer components, levels of explainer components, and accounting system components with the hypotheses.

Limitations

In this section several restrictions on the applicability of the conclusions of the study are discussed. These restrictions are necessitated by the nature of the research design. The restrictions include: generalization of the findings, techniques of organizational measurement, the reliability of information provided by the respondents, the feasibility of demonstrating causality, the incompleteness of the basic model, the effects of the small sample size on the research design, and multicollinearity.

The most basic restriction is the result of the selective sample. As was discussed on page 67, no statistical generalization of the findings to a population of organizations other than the sample is permissible. However, it is natural to want to apply the findings to other organizations. When doing so, it must be kept in mind that particular characteristics of this sample may account for the findings.

The techniques of organizational measurement are generally in a very early stage of development. Since there is little standardization of the measurements of various organizational concepts, the results of different studies often are not comparable.[1] Where possible, measurements that had been used in other organizational studies are used in this dissertation, but many of the concepts of this dissertation are new and new measurements had to be developed.[2] The conclusions of the study are thus subject to the validity of the measurements.

A second measurement problem is the reliability of the information provided by the respondents. Most respondents were cooperative and seemed knowledgeable, but it is difficult to know if their responses were inaccurate or biased. Inaccuracy of the responses would probably lead to the inability to find relationships which do exist. Bias of the responses may lead to the discovery of relationships which do not exist. Obviously, bias is the greater problem. The conclusions of the study are subject to the reliability of the information provided by the respondents.

All of the hypotheses are stated in a causal way since the basic model concerns how control systems develop in organizations. This cross-sectional field study is not capable of demonstrating any causal

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[1] James L. Price, *Handbook of Organizational Measurement* (Lexington, Mass.: D. C. Heath and Company, 1972), pp. 1-2.

[2] See below, pages 239-72.

relationships, including the causal aspect of the hypotheses, for two reasons. First, all measurements were taken at a single point in time so there is no time period for changes to occur. Second, even if sequential measurements had been taken, there are multitudinous variables not incorporated in the analysis which may cause spurious relationships to appear among the variables in the model or obscure relationships such that they do not appear. Only associations among the variables can be demonstrated. These associations will be examined in this dissertation as to whether they appear to be causal. It is hoped that future longitudinal studies may shed more light on the causal nature of the associations found in this dissertation.

The basic model is very likely incomplete in the sense that important explainers of the accounting system and important measures of the accounting system are left out. The basic model could be incomplete in two ways. First, variables could be missing within the levels. For example, the process level may not include all the important aspects of "process" or the accounting system level may not include all the important aspects of the accounting system. The second type of incompleteness is that the model may not include other levels of components which might be significant determinants of the accounting system. For example, a level of environmental variables might have been included. As was mentioned on page 61 above, an attempt was made to control for environmental factors by sample selection. But environmental factors could influence simultaneously the four levels of variables in the study, resulting in spurious associations among the variables in those levels. It is hoped that the control over levels of variables not included in the basic model is sufficient and that there are enough significant variables within the levels so that tentative conclusions can be drawn about the relationships among the levels.

Though justified by the great volume of measurements collected for each company, the restricted sample size of eighteen had pervasive effects on the way the data were analyzed. First, since the number of variables analyzed, thirty-two, was much greater than the sample size of eighteen, no single statistical procedure was possible to test simultaneously all the relationships among the variables. This led to the separate statistical procedures (multiple regressions) for each of the thirteen accounting system variables. It also led to the restriction of the number of the nineteen explainers allowed into the regressions by means of the stepwise multiple regression procedure.

The separate regressions for the thirteen accounting system variables means that the interrelations among the accounting system variables are ignored by the analysis.[1] However, sums and averages are calculated across separate regressions in order to obtain measures of explanatory power and consistency with the hypotheses. In interpreting these measures, it is important to keep in mind that they ignore the interrelations of the accounting system components.

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[1] Ideally, such interrelations of criterion accounting system variables should have been taken into account by means of a procedure such as canonical correlation, which finds the highest correlation between a linear combination of explainers and a linear combination of criterions. In fact, multiple canonical correlation would have been desirable since there are three levels of explainers. Canonical correlation was impossible for the small sample size of eighteen and the large number of variables, thirty-two.

The restricted sample size also prevented the validation of the multiple regression equations on a holdout sample of companies. In interpreting the findings, the lack of validation must be considered.

A frequently encountered problem in studies of organizations is the generally strong association among explainer variables, known as multicollinearity. This restricts the ability of the researcher to determine the explanatory power of individual explainer variables. Fortunately, multicollinearity was not a great problem in this dissertation. The average intercorrelation of the organizational components admitted to the thirteen regressions was only 10 percent.[1] The highest for any regression was only 28 percent. These intercorrelations are indicated in Table 10.

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[1] The low degree of intercorrelation of organizational explainer variables in this dissertation is partly due to stepwise regression. Stepwise regression tends to minimize the intercorrelation of the explainer variables admitted to the regressions. At each step after the first explainer is admitted, explainers are admitted that explain most of the remaining variance of the criterion variable. Consequently, explainers that are minimally correlated with the explainers already admitted will tend to be selected. These are more likely to have "new information" about the criterion.

Table 10

Intercorrelations of Organizational Explainers

Regression of Accounting System Variable	No. of Organizational Explainers	Average Intercorrelation of Explainers
Size-information output	4	0.13
Size-resource input	2	0.06
Job structure complexity	2	0.01
Geographical dispersion	7	0.26
Unit differentiation-vertical	5	0.16
Unit differentiation-horizontal	1	•
Authority levels	2	0.10
Report differentiation	3	0.28
Decentralization of accounts	6	0.15
Sophistication of techniques	3	0.21
Mechanization	1	•
Personnel quality-education	1	•
Personnel quality-general	0	•
Average		0.10

Chapter 4

INTERPRETATION OF THE RESEARCH FINDINGS

The emphasis in this chapter is on analysis of the research findings. The preceding chapter developed the research data that are analyzed here, though some refinement and reassembly of the data are done in this chapter. The following chapter integrates the research findings of this chapter.

The purpose of this chapter is to examine the relationships between an organization and its accounting system and to examine the internal relationships among characteristics of its accounting system. The internal relationships are examined in the first section, while the relationships of the accounting system to the overall organization are examined in the second section. The dissertation is concerned with some general questions about these relationships:

1. How important is the overall organization to the determination of characteristics of its accounting system?
2. Do the hypotheses predict correctly the relationships of the three levels of organizational variables ("process," "overall structural complexity," and "control system") to the accounting system?
3. Which of the three levels of organizational variables is most important to the determination of characteristics of the accounting system and which is least important?
4. Which organizational variables are most important to the determination of characteristics of the accounting system and which are least important?

5. Do the organizational variables used in this dissertation influence the accounting system in the way expected if the hypotheses are true?

6. Which accounting variables are significantly influenced by organizational variables and which are not?

7. How are accounting variables related to one another?

The means of addressing these questions in this chapter are to analyze two sets of relationships: the relationships among the thirteen accounting system variables and the relationships between the thirteen accounting system variables and nineteen organizational variables. The first section of the chapter covers the relationships among the thirteen accounting system variables. The second section covers the relationships between the accounting system variables and the organizational variables. In both sections, the thirteen accounting system variables are treated as criterion variables (variables to be explained). In the first section, these accounting system criterion variables are explained by other accounting system variables. In the second section, the accounting system criterion variables are explained by organizational variables.

The statistical technique that was used to isolate these relationships is stepwise multiple regression, which was discussed in Chapter 3 on pages 90-102. This technique finds a subset of explainer variables which best explains each accounting variable. The two explainer sets are the twelve accounting variables other than the one that is being explained (the criterion) and the nineteen organizational variables. Different subsets of accounting and organizational explainer variables were selected by the multiple regression procedure for different accounting criterion variables. Thus two sets of regressions are analyzed in this chapter: the set of thirteen regressions of each accounting system variable on the other twelve accounting system variables, covered in the first section, and the set of thirteen regressions of each accounting system variable on the nineteen organizational variables, covered in the second section. The multiple regression technique also produces measures of the strength of relationship between each accounting variable and each of the subset of explainer variables used to explain it.

For each of the two sets of regressions, the measures of strength of relationship between individual accounting variables and each explainer variable are summarized by means of the techniques explanatory power and explainability, discussed above on pages 100-116. These techniques produce measures of the explanatory power of each explainer variable (organizational or accounitng) with regard to the respective sets of regressions. Furthermore, measures of the explainability of accounting system variables by respectively the set of other accounting system variables and the set of organizational variables are produced. Measures of the explanatory power of the levels of organizational explainer variables ("process," "overall structural complexity," and "control system") are also produced.

The extent that the set of regressions of accounting components on organizational components tend to confirm the three hypotheses stated on page 57 above are assessed by means of the technique "consistency with the hypotheses," developed on pages 116-26. Like explanatory power and explainability, this technique summarizes an aspect of the relationships between individual accounting and organizational variables. It produces measures of conformance of the research findings with the hypotheses for levels of organizational variables ("process," "overall structural complexity," and "control system"), for individual organizational variables, and for individual accounting variables.

RELATIONSHIPS WITHIN THE ACCOUNTING SYSTEM

The basic model proposed no explicit hypotheses as to relationships among the characteristics of the accounting system. Nevertheless, before attempting to explain accounting system characteristics with organization structure characteristics, it is necessary to examine the interrelationships within the accounting system.

The same statistical technique, stepwise multiple regression, is used to analyze the relationships among the accounting system components as is used to analyze the relationships between accounting system components and organizational components. Stepwise multiple regression is explained in detail for the organizational regressions on pages 90-100. The application of stepwise multiple regression to the accounting system regressions is described here only in a cursory fashion.

Each of the thirteen accounting system components was explained in terms of a linear combination of a subset of the other twelve accounting components. Thus there are thirteen regressions with the thirteen accounting components, respectively, as criterions. For a given criterion, the subset of explainer components used to explain the criterion was selected by the forward-stepping stepwise multiple regression procedure described above on pages 98-100.[1]

Table 11 shows the coefficients of the stepwise regressions of each accounting system component on all other accounting system components. The thirteen accounting system components, treated as criterion variables, are represented across the top. The potential accounting system component explainers are listed along the left margin. The explainers which were entered into the respective regressions have their standardized regression coefficients in the columns for those regressions. For the purpose of comparison, Table 21 (below, page 300) lists the zero-order Pearson correlations of the accounting components with each other.

Classification as Input and Output Components

The thirteen accounting system components can be divided into two groups, input and output components. Input components deal with the organizational and physical arrangements necessary to perform the functions of the accounting system, production and dissemination of information. Output components deal with the nature of that information and the places where it is sent. For example, "size-resource input" is an input component having to do with the quantity of human and financial resources applied to the accounting function. "Report differentiation" is an output component having to do with the elaboration of different types of

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[1] The critical F value for these regressions was determined to be 3.0, the same critical F value as that for the organizational regressions. See above, page 99, footnote 1.

Table 11

Regression Coefficients for the Stepwise Regressions of Each of the Thirteen Accounting Components on the Other Twelve Accounting Components[a]

Explainers[b]	Criterions[b]												
	A	B	C	D	E	F	G	H	I	J	K	L	M
A		•	•	•	•	•	•	•	0.9	•	•	•	•
B	•		•	•	•	•	•	•	•	•	•	•	•
C	•	0.5		•	•	•	0.6	•	•	•	•	-0.5	•
D	•	•	•		0.6	•	•	•	•	•	•	•	•
E	•	•	•	0.8		•	•	-0.4	•	-0.6	•	•	•
F	•	•	•	•	•		•	•	•	•	•	•	•
G	•	•	•	•	•	•		•	•	•	•	•	•
H	0.5	•	•	•	•	•	•		-0.5	•	•	-0.4	•
I	0.8	•	•	•	•	•	0.5	•		•	•	•	•
J	•	•	•	•	-0.4	0.4	•	•	•		•	•	•
K	•	•	•	•	•	•	•	•	•	0.3		•	•
L	•	•	-0.6	•	•	•	•	-0.6	•	•	•		•
M	•	•	•	-0.4	•	•	•	•	•	•	•	•	

[a] Coefficient signs are adjusted for the direction of components. The thirteen columns headed by criterion components represent different regressions. Each column includes the coefficients for the explainer components which were added to the regression of the criterion component that heads the column.

[b] *Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

accounting reports and the degree to which accounting reports are prepared for different parts of the company. An important aspect of the interrelationships of components within the accounting system is the nature of the associations of the input and output components. These are described below on pages 152-55.

Nine of the thirteen accounting system components are input components, and four are output components. The input components are:

1. Size-resource input
2. Job structure complexity
3. Geographical dispersion
4. Unit differentiation-vertical
5. Unit differentiation-horizontal
6. Authority levels
7. Mechanization
8. Personnel-education
9. Personnel-general

Accounting
structural
complexity
components

Five of the nine accounting input components can be identified as accounting structural complexity components. These are "job structure complexity," "geographical dispersion," "unit differentiation-vertical," "unit differentiation-horizontal," and "authority levels." These components have to do with the breakup of the accounting system along various dimensions.

The output components are:

1. Size-information output
2. Report differentiation

3. Decentralization of accounts
4. Sophistication of techniques

Explanatory Power and Explainability of Accounting Components

Two characteristics may be relevant for determining the relative importance of accounting system components:

1. Explanatory power: the ability of an accounting component to explain other accounting components
2. Explainability: the ability of an accounting component to be explained by other accounting components

Both explanatory power and explainability are measured by two methods—frequencies of coefficients and R square increase—which were discussed on pages 100-116. Table 12 calculates the total frequencies of coefficients (f) for the accounting components treated as explainers on the right margin and the total frequencies of coefficients (f) for accounting components treated as criterions on the bottom margin. Table 13 calculates the total R square increase (Σ) for accounting components treated as explainers on the right margin and the total R square (Σ) for accounting components treated as criterions on the bottom margin. As was explained on pages 110-13, the total frequencies and R square increases are divided by expected frequencies and R square increases to obtain measures of explanatory power and explainability.

Thus there are two measures of explanatory power of accounting components and two measures of explainability of accounting components. All these measures are assembled in Table 14 by the concepts explanatory power and explainability. Keep in mind that average explanatory power or explainability is indicated by a score of 1.0. Scores greater than one

Table 12

Frequencies of Regression Coefficients of Accounting Components on Each Other[a]

Explainers[b]	Criterions[b]													f	$\frac{f}{Ef}$[c]
	A	B	C	D	E	F	G	H	I	J	K	L	M		
A		•	•	•	•	•	•	•	0.9	•	•	•	•	1	0.7
B	•		•	•	•	•	•	•	•	•	•	•	•	0	0.0
C	•	0.5		•	•	•	0.6	•	•	•	•	-.5	•	3	2.1
D	•	•	•		0.6	•	•	•	•	•	•	•	•	1	0.7
E	•	•	•	0.8		•	•	-.4	•	-.6	•	•	•	3	2.1
F	•	•	•	•	•		•	•	•	•	•	•	•	0	0.0
G	•	•	•	•	•	•		•	•	•	•	•	•	0	0.0
H	0.5	•	•	•	•	•	•		-.5	•	•	-.4	•	3	2.1
I	0.8	•	•	•	•	•	0.5	•		•	•	•	•	2	1.4
J	•	•	•	•	-.4	0.4	•	•	•		•	•	•	2	1.4
K	•	•	•	•	•	•	•	•	•	0.3		•	•	1	0.7
L	•	•	-.6	•	•	•	•	-.6	•	•	•		•	2	1.4
M	•	•	•	-.4	•	•	•	•	•	•	•	•		1	0.7
f	2	1	1	2	2	1	2	2	2	2	0	2	0	19	•
f/Ef[c]	1.4	0.7	0.7	1.4	1.4	0.7	1.4	1.4	1.4	1.4	0	1.4	0	•	•

[a] This table is an extension of Table 10 (page 132). Coefficient signs are adjusted for the direction of components.

[b] *Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

[c] Expected frequency (Ef) = 19/13 = 1.46154.

Table 13

R Square Increase of Accounting Components Admitted to Regressions on Each Other[a]

Explainers[b]	Criterions[b]													Σ	$\frac{\Sigma^{c}}{E\Sigma}$
	A	B	C	D	E	F	G	H	I	J	K	L	M		
A		•	•	•	•	•	•	•	.48	•	•	•	•	0.48	1.2
B	•		•	•	•	•	•	•	•	•	•	•	•	0.00	0.0
C	•	.22		•	•	•	.19	•	•	•	•	.33	•	0.74	1.9
D	•	•	•		.51	•	•	•	•	•	•	•	•	0.51	1.3
E	•	•	•	.51		•	•	.15	•	.35	•	•	•	1.01	2.6
F	•	•	•	•	•		•	•	•	•	•	•	•	0.00	0.0
G	•	•	•	•	•	•		•	•	•	•	•	•	0.00	0.0
H	.25	•	•	•	•	•	•		.23	•	•	.13	•	0.61	1.5
I	.48	•	•	•	•	•	.20	•		•	•	•	•	0.68	1.7
J	•	•	•	•	.17	.16	•	•	•		•	•	•	0.33	0.8
K	•	•	•	•	•	•	•	•	•	.11		•	•	0.11	0.3
L	•	•	.33	•	•	•	•	.20	•	•	•		•	0.53	1.3
M	•	•	•	.12	•	•	•	•	•	•	•	•		0.12	0.3
Σ	.73	.22	.33	.63	.68	.16	.39	.35	.71	.46	.00	.46	.00	5.12	•
$\Sigma/E\Sigma^{c}$	1.9	0.6	0.8	1.6	1.7	0.4	1.0	0.9	1.8	1.2	0.0	1.2	0.0	•	•

[a] The thirteen columns headed by criterion components represent the thirteen regressions whose coefficients are listed in Table 10 (page 132). The R square increases listed in this table (other than the last two columns and rows) occurred at the step that the given explainer component was added to the regression of the criterion component. Single dots indicate that the explainer component was not added to the regression in the respective column.

[b] *Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

[c] Expected sum ($E\Sigma$) = 5.12/13 = 0.39385.

Table 14

Explanatory Power and Explainability of Accounting Components with Respect to Other Accounting Components

Accounting Component	Explanatory Power		Explainability	
	Frequency[a]	R Square[b]	Frequency[a]	R Square[b]
Size-information output	0.7	1.2	1.4	1.9
Size-resource input	0.0	0.0	0.7	0.6
Job structure complexity	2.1	1.9	0.7	0.8
Geographical dispersion	0.7	1.3	1.4	1.6
Unit differentiation-vertical ...	2.1	2.6	1.4	1.7
Unit differentiation-horizontal .	0.0	0.0	0.7	0.4
Authority levels	0.0	0.0	1.4	1.0
Report differentiation	2.1	1.5	1.4	0.9
Decentralization of accounts	1.4	1.7	1.4	1.8
Sophistication of techniques	1.4	0.8	1.4	1.2
Mechanization	0.7	0.3	0.0	0.0
Personnel quality-education	1.4	1.3	1.4	1.2
Personnel quality-general	0.7	0.3	0.0	0.0

[a] Table 12.

[b] Table 13.

indicate high explanatory power or explainability. Scores less than one indicate low explanatory power or explainability. Zero scores indicate no explanatory power or explainability.

An important initial question that must be asked is, "To what extent are the accounting components, as a group, interrelated?" A rough indication of this is provided by the average R square for the thirteen regressions which is 5.12 divided by 13 equals 0.39.[1] The average number of explainers per regression was 19 divided by 13 equals 1.5.[2] Thus an average of 39 percent of the variation in each accounting component was accounted for by a subset of one or two other accounting components.

The top three explainers were selected from the explanatory power column in Table 14 by finding the accounting components which have high scores on both frequency and R square. These are:

1. Unit differentiation-vertical
2. Job structure complexity
3. Report differentiation

Only one of these, "unit differentiation-vertical," has good explainability. The other two, "job structure complexity" and "report differentiation," have poor to fair explainability. Three components have zero explanatory power. These are:

1. Size-resource input
2. Unit differentiation-horizontal
3. Authority levels

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[1] From Table 13.

[2] From Table 12.

These zero-explanatory-power components are very poorly explained by other accounting components (though none has zero explainability).

The most explained four accounting components were selected from the explainability column in Table 14 by finding the components which have high scores on both R square and frequency. These are:

1. Size-information output
2. Geographical dispersion
3. Unit differentiation-vertical
4. Decentralization of accounts

Only "unit differentiation-vertical" and possibly "decentralization of accounts" also have good explanatory power. "Size-information output" and "geographical dispersion" have only fair explanatory power. Two components are not explained by any other accounting component. These are:

1. Mechanization
2. Personnel quality-general

These zero-explainability components were also poor as explainers of other accounting components.

Two components have not been mentioned as having exceptional explanatory power or explainability. These are:

1. Sophistication of accounting techniques
2. Personnel quality-education

Both have fairly average explanatory power and explainability.

Some generalizations can be drawn from these observations. Accounting components with low and medium explanatory power have the corresponding degrees of explainability and vice versa. But accounting components with high explanatory power do not necessarily have high explainability, and accounting components with high explainability do not necessarily have high explanatory power. The single exception is "unit differentiation-vertical," which has high explanatory power and high explainability.

The chief difference between explainability and explanatory power is that the interrelations of the components are taken into account for explainability since a single multiple regression is involved, while the interrelations of the components are not taken into account for explanatory power since the numbers of coefficients and the R square increases are summarized across regressions. Thus high explainability means a large association with the common variance of the accounting components. On the other hand, high explanatory power means a large amount of unique characteristics since it results from the component being used as an explainer in numerous regressions.

Path Analysis

Path analysis was used to map out the relationships indicated by the stepwise regressions. The components which were not used to explain any other components were put at one end of the paths and the components which were not explained by any other components were put at the other end of the paths. Then the intermediate components were filled in sequentially. Path analysis places the components which are closely related locationally close to one another and reveals clusters or groups of closely related components which could be treated as dimensions of the accounting system broader than any one accounting system variable.

The path analysis mapping developed in this dissertation is shown in Figure 2.

The three accounting system components not used to explain any other accounting system components (zero explanatory power) are "size-resource input," "authority levels," and "unit differentiation-horizontal." These three components were placed at the top of Figure 2. The two accounting system components not explained by any other accounting system component (zero explainability) are "personnel-general" and "mechanization." These two components were placed at the bottom of Figure 2. The chains of relationships indicated by regression coefficients were filled in between the components which do not explain any others and the components which are not explained by any others. First the components which explain the nonexplaining components are plotted. For example, "size-resource input" is explained by "job structure complexity," as is indicated by the regression coefficient of 0.5 in Table 11. The rest of the relationships are plotted in the same manner.

Note that the top component in all linkages is explained by the bottom component, as is indicated by ascending arrows. However, in some cases the regressions indicate both directions of relationships; i.e., two components both explain and are explained by each other. This is indicated by two-ended arrows on the same level. For example, "unit differentiation-vertical" and "sophistication of techniques" both explain and are explained by each other.

As was mentioned above on page 145, components which had poor explanatory power also had poor explainability, and vice versa. It follows that the nonexplaining and unexplained components in Figure 2

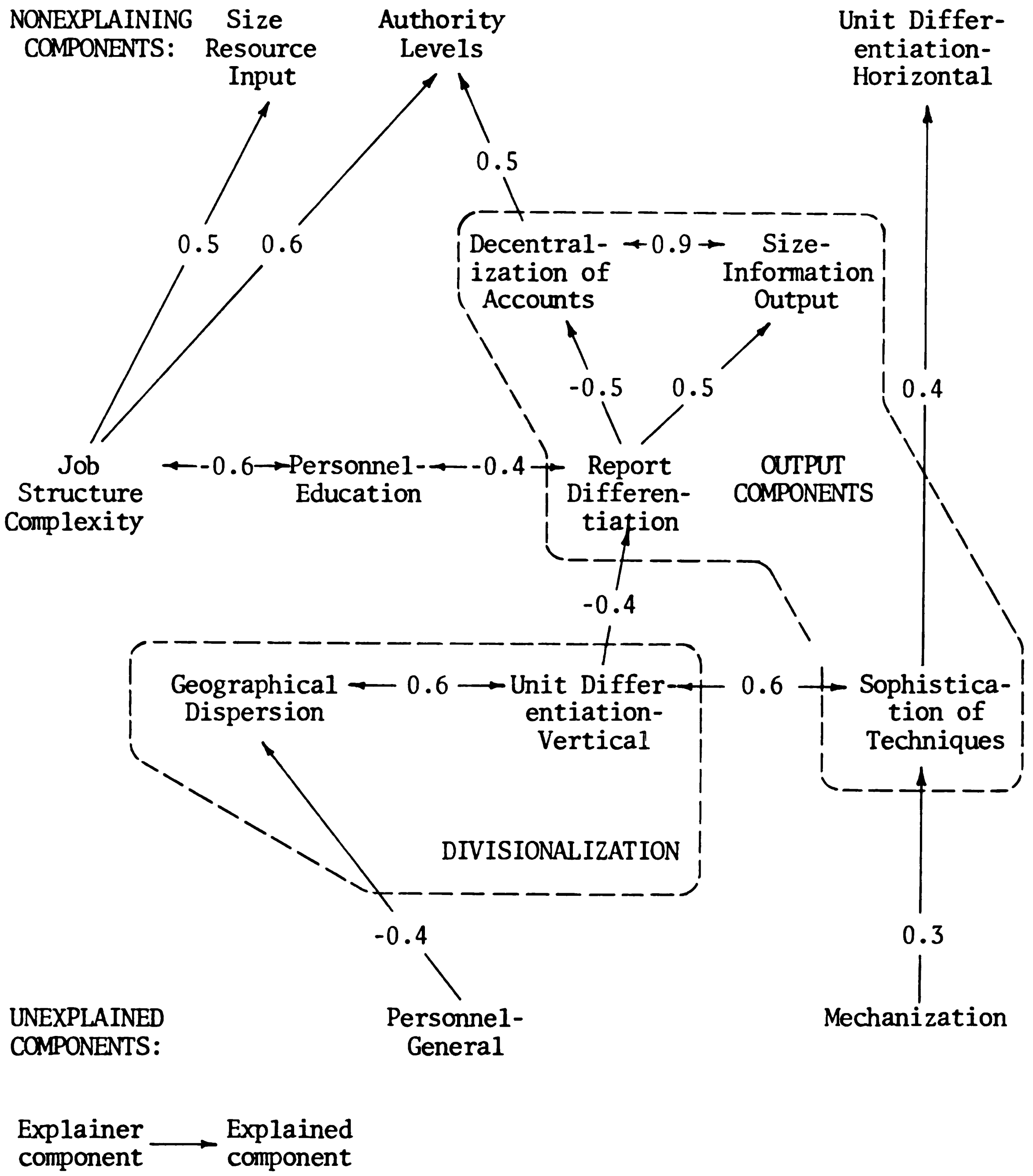

Figure 2

Path Analysis of Accounting System Interrelationships

have poor explanatory power and explainability. High-explanatory-power components and high-explainability components are located in the center of Figure 2.

Output Component Cluster

The output components are all in the middle of the structure in Figure 2. In other words, they both explain and are explained by the input components. The input components are thus separated into those which are explained, directly or indirectly, by output components (at the top of Figure 2) and those which explain, directly or indirectly, output components (at the bottom of Figure 2).

Three of the four output components form a very tight group: "decentralization of accounts," "size-information output," and "report differentiation." The fourth output component, "sophistication of techniques," is relatively close to the other three, with only "unit differentiation-vertical" separating them. This would suggest that the characteristics of the output of accounting systems might blend into a single dimension of accounting output.

The very strong positive association of "size-information output" and "decentralization of accounts" suggests logically that accounting systems tend to grow in size by presenting more information to lower company levels. The positive association of "size-information output" and "report differentiation" suggests that accounting systems also grow by presenting more different types of reports. The negative association of "decentralization of accounts" and "report differentiation" is more difficult to explain. Apparently, companies' accounting systems can develop in two alternative directions: the preparation of basic cost reports for lower levels of the company and the elaboration of more sophisticated types of reports for the higher levels. Consequently, decentralization of accounts and report differentiation are negatively related to each other since accounting systems which grow in terms of decentralization of accounts have little report differentiation and vice versa.

Relationships among Input Components

The relationships of the components at the top of Figure 2 go from the nonexplaining components—"size-resource input," "authority levels," and "unit differentiation-horizontal"—to the output component cluster. There are two groups of these components. "Accounting size-resource input" and "authority levels" are closely related by means of "job structure complexity," while "unit differentiation-horizontal" is independently related to the output component cluster.

It appears from Figure 2 that companies with larger accounting systems (in terms of resource input) tend to have more complex accounting job structures. Companies with greater numbers of authority levels within the accounting system also tend to have more complex accounting job structures. However, the companies with more complex job structures tend to have less-educated accounting personnel. This may indicate that, the higher the education level within the accounting system, the more of the total accounting task each employee can handle, and thus the less complex the job structure needs to be. This would suggest that education level and job structure complexity are substitutes for one another in accomplishing the accounting task. However, the negative association of "personnel-education" with the output component "report differentiation" would suggest that "personnel-education" does not contribute positively to the elaboration of different types of reports.

The relationships at the bottom of Figure 2 go from the output components to the components which are not explained by any other components. There are two groups of these: the accounting divisionalization group and the "mechanization" component.

The accounting divisionalization group has to do with the dispersal of accounting activities down and out to lower-level units (usually divisions) of the company. As a company grows, the accounting function, originally concentrated in a single unit, may have to be geographically and organizationally dispersed to the dispersed divisions of the company in order to make accounting information more accessible to and controllable by divisional personnel. This dispersal is reflected in the positively related two-component grouping of "unit differentiation-vertical," the development of lower-level (probably divisional) accounting departments, and "geographical dispersion," the development of accounting departments at different locations (probably divisions). Such dispersal may entail a lowering of the overall quality of accounting personnel, as is indicated by the negative regression coefficient of "geographical dispersion" on "personnel-general." Smaller-scale divisional accounting departments might have to concentrate more on routine data processing, whereas larger, centralized accounting departments, having economies of scale, might be able to retain more highly qualified specialists. The association of divisionalization of the accounting function with decline in personnel quality is consistent with the negative association of divisionalization with the output components "report differentiation" and "sophistication of accounting techniques." In general, the more dispersed is the accounting function, the less complex is the output of the system, at least partly due to a decline in the general quality of personnel.

Relationships between Input and Output Components

There are six associations between input and output components indicated in Figure 2—three positive and three negative. The positive associations are:

Authority levels—Decentralization of accounts
Unit differentiation-horizontal—Sophistication of techniques
Mechanization—Sophistication of techniques

The negative associations are:

Personnel-education—Report differentiation
Unit differentiation-vertical—Report differentiation
Unit differentiation-vertical—Sophistication of techniques

Though no explicit hypotheses were developed as to the interrelations of accounting system components, it seems logical that, as the quantity and complexity of inputs to the accounting system becomes greater, the quantity and complexity of the outputs from the system should also become greater. Just as overall structural complexity of the company provides for the production of products, the structural complexity (as measured by input components) of the accounting system provides for the production of reports (as measured by output components). This surmised relationship suggests that the relationships between input and output components should be positive if the respective components measure increasing elaboration of the accounting system.

The three positive associations seem to confirm the surmised relationship of input and output components. The positive association of authority levels and decentralization of accounts suggests logically that the development of the account structure down to the lower levels of the company is accompanied by the downward development of the accounting organization structure.

The positive association of "unit differentiation-horizontal" and "sophistication of techniques" also supports the surmised relationship. Note that "unit differentiation-horizontal" has to do with the breakup of the central accounting department, as opposed to divisional accounting departments. Thus it probably is associated with unit specialization within the accounting function since multiple units would probably be assigned different functions. Some of the techniques included in "sophistication of techniques" might even require separate units within the central accounting department. For example, a standard cost system might require a standard-setting department. Consequently, the association between "unit differentiation-horizontal" and "sophistication of techniques" seems highly reasonable.

The positive association of "mechanization" and "sophistication of techniques" also supports the surmised relationship. Apparently, mechanization is instituted to free accounting personnel of some of the burdens of routine data processing. This leaves them time to concentrate on implementing more sophisticated accounting techniques.

The three negative associations seem to disconfirm the surmised relationship. As was indicated on page 151, the negative association of "personnel-education" and "report differentiation" is very difficult to explain. Since "personnel-education" is negatively related to the three primary arrangement components—"size-resource input," "job structure complexity," and "authority levels"—and they in turn are related positively to the output component cluster by means of "authority levels" and "decentralization of accounts," perhaps "personnel-education" reflects only the absence of "job structure complexity" which, along with the other two primary arrangement components, is instrumental to sophisticated accounting output. Thus "personnel-education" would have no unique influence on output components. An alternative explanation is that "personnel-education" does contribute positively to some aspect of accounting system output not measured in this study, perhaps flexibility. Thus it is possible that accounting system structural complexity, measured by "job structure complexity" and "authority levels," can routinely produce complex accounting reports but educated personnel are required to cope with nonroutine situations; i.e., provision of problem-solving information. It is recommended that future studies measure flexibility as an aspect of accounting system output.

As was maintained on page 152, the more dispersed is the accounting function in terms of divisionalization, the less complex is the output of the system in terms of report differentiation and sophistication of techniques. These two negative associations would suggest that divisionalization has a negative effect on accounting output, at least in terms of the two output components "report differentiation" and "sophistication of techniques." The question might be asked: "Why disperse the accounting function if it damages output?" The answer is that divisional accounting departments may be more responsive to the needs of divisional operating personnel. Responsiveness was not measured in this study, but it is recommended that it be included in future studies.

Alternative Types of Accounting Systems

The inconsistent associations between input and output components suggest that all the aspects of accounting output may not develop in the same direction. In other words, one accounting system may emphasize one set of output characteristics while another may emphasize another set.

One way of looking at the results of the accounting system regressions involves the following assumption. Accounting systems tend to fall on a dimension with the following polar extremes:

Polar Types of Accounting Systems

1	*2*
Sophisticated accounting techniques	Elementary accounting techniques
High-level reports	High and low level reports
Centralized	Divisionalized
Departmentalized	Undepartmentalized
Mechanized data processing	Manual data processing
High-quality personnel	Lower-quality personnel
Rigid and unresponsive to information needs of lower-level managers	Flexible and responsive to information needs of lower-level managers

Accounting systems can occur anywhere between the extremes. However, when an accounting system has one of the characteristics of one of the extremes, it tends to have the other characteristics.

Centralized accounting systems have a single accounting office for the entire company. This office may have many specialized departments. Divisionalized accounting systems have accounting offices at division headquarters. Centralized accounting systems tend to produce reports only for high-level management, utilize sophisticated accounting techniques, have high-quality personnel, and have mechanized data processing systems. Divisionalized accounting systems tend to produce reports for both high- and low-level management, utilize elementary accounting techniques, have lower-quality personnel, and utilize manual data processing systems. The final characteristics which distinguish the two types, flexibility and responsiveness, were not measured in this dissertation. It is the opinion of the author that some characteristics such as these must work to induce companies to divisionalize (more generally to decentralize) their accounting systems. Otherwise the advantages of centralization would prevent decentralization altogether.

Support for the association of characteristics illustrated on page 155 comes from a number of associations in Figure 2 (page 148). The negative association of "decentralization of accounts" and "report differentiation" discussed on page 149 suggests that accounting systems either concentrate on producing more reports for managers at lower company levels (as measured by "decentralization of accounts") or they concentrate on producing more sophisticated reports for the higher levels (as measured by "report differentiation").

What kind of accounting organizational arrangements (input components) are associated with these two alternative types? Accounting structural complexity (as measured by "authority levels" and "job structure complexity") is most associated with production of reports for lower company levels (as measured by "decentralization of accounts"). As might be expected, the provision of reports to lower company levels requires the development of more levels in the accounting organization structure. But divisionalization is negatively related to two measures of sophistication of high-level output: "report differentiation" and "sophistication of techniques." Why then do companies divisionalize their accounting systems? A possible reason for this strange finding is discussed in the following paragraph.

In this sample of small companies, it is likely that the major influence on the number of accounting authority levels is divisionalization of the accounting system. In other words, companies with accounting offices at division headquarters will almost invariably have more authority levels in their accounting systems than those with only a single accounting office. It may be speculated that divisionalization, along with authority levels, contributes to the production of more reports for lower company levels. The imperfections of measurement and research design may have obscured the (positive) relationship between divisionalization and decentralization of accounts.[1]

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[1] The two negative associations— "decentralization of accounts" with "report differentiation," and "unit differentiation-vertical" with "report differentiation"—may be combined to form a positive association between "decentralization of accounts" and "unit differentiation-vertical."

Two other associations in Figure 2 support the association of the characteristics of centralized accounting systems. The positive association of "mechanization" and "sophistication of techniques" suggests indirectly that centralized accounting systems which utilize sophisticated accounting techniques also tend to have more mechanized accounting data processing systems. The positive association of "unit differentiation-horizontal," a measure of the departmentalization of the central accounting office, and "sophistication of techniques" also suggests indirectly that centralized accounting systems which utilize sophisticated techniques tend to be departmentalized.

RELATIONSHIPS OF THE ACCOUNTING SYSTEM TO THE OVERALL ORGANIZATION

The central concern of the dissertation is the relationships between characteristics of an organization and characteristics of its accounting system. The multiple regression technique described in Chapter 3 (pages 90-100) was used to analyze the relationships between thirteen accounting system variables and nineteen organizational variables. There are thirteen regressions, one for each accounting variable. For each regression, a subset of the nineteen organizational variables was used to explain the accounting variable. The regression coefficients for these subsets are listed in Table 5 (page 101).

Two basic purposes of analyzing the relationships between accounting system variables and organizational variables are to determine the strength and direction, positive or negative, of influence of the organizational variables on the accounting system variables. A corollary purpose is to determine the influenceability of accounting system variables by organizational variables. Both strength of influence and influenceability are measured by two techniques, frequency and R square.[1] Both techniques involve, generally speaking, the number of regression coefficients for various categories of relationships between accounting and organizational variables. Strength of influence is evaluated with respect to the entire set of organizational variables, the three levels of organizational variables, and the individual organizational variables.

The direction of influence is assessed with respect to three hypotheses (stated above on page 57) which predict the direction, positive or negative, of the relationships of, respectively, the three levels of organizational variables to the accounting system variables. The measures of conformance of the research findings with the hypotheses are called "consistency with the hypotheses" and are of two types, frequency and R square.[2] Both types involve, generally speaking, the extent that various groupings of regression coefficients have the signs, positive or negative, that are expected if the hypotheses are true. Consistency with the hypotheses is evaluated with respect to the levels of organizational variables and the individual organizational variables.

The Extent of Influence of an Organization on Its Accounting System

The most basic question that can be asked in this study is, "How important are characteristics of an organization to the determination of

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[1] See above, pages 100-116.

[2] See above, pages 116-27.

the characteristics of its accounting system?" With respect to the components and the multiple regression approach used in this dissertation, the question becomes, "How much of the variation in the accounting components scores can be accounted for by linear combinations of the organizational components?" As was explained on pages 95-96, R square is a measure of the proportion of the variation in a criterion accounted for by a linear combination of explainers. The average R square for the thirteen regressions of accounting components on organizational components is thus a measure of the average ability of the organizational components to explain accounting components.

The average R square is 52 percent.[1] It should be noted that the average number of organizational components used as explainers in the thirteen regressions was 2.8. In other words, only three of the nineteen potential explainers were necessary to explain 52 percent of the variation in the accounting components. The average R square of 52 percent might be compared with the average R square for the regressions of the accounting components on other accounting components which was 39 percent.[2] It follows that accounting components were much more easily explained by organizational components than they were by each other. In general, it can be said that characteristics of an organization are vital to the determination of characteristics of its accounting system.

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[1] This is calculated as the average of the R squares in the second to the bottom row of Table 7, page 108.

[2] See above, page 144.

The Influence of the Explainer Levels on the Accounting System

There are three levels of explainer variables in this dissertation: process, overall structural complexity, and control system. The process level includes three variables, the overall structural complexity level includes seven variables, and the control system level includes nine variables. The concern of this section is the strength and direction of influence of each of these explainer levels on the accounting system level which includes thirteen variables. The strength of influence is measured by explanatory power, and the direction of influence is measured by consistency with the hypotheses. In order to keep perspective, it may be useful while reading this section to refer back to the basic model on page 44 and the regression coefficients for the thirteen regressions of accounting components on organizational components in Table 5 (page 101). In this section, the analysis concentrates on three groupings of coefficients shown as separate sections of Table 5.

Table 15 assembles measures of the explanatory power and consistency with the three hypotheses of the three levels of explainers. A brief discussion follows of the key aspects of the measures necessary to use them. Much of this discussion applies also to subsequent sections. For extensive treatments of the derivation of the measures, see pages 100-116 for explanatory power and pages 116-27 for consistency with the hypotheses.

Explanatory power of a level is the ability of the variables within that level to explain accounting variables. More specifically, it is the extent that variables in the level were chosen by the thirteen

Table 15

Explanatory Power and Consistency with the Hypotheses of Explainer Levels

Item	Explainer Level		
	Process	Overall Structural Complexity	Control System
Explanatory power compared to expected[a]			
Frequencies[b]	1.20	0.70	1.20
R square increase[c]	1.60	0.50	1.20
Proportion of total explained[d]			
Frequencies[b]	0.19	0.24	0.57
R square increase[c]	0.25	0.19	0.56
Consistency with hypotheses[e]			
Frequencies[f]	0.71	0.67	0.43
R square increase[g]	0.73	0.75	0.53
Number components	3	7	9

[a] Average explanatory power, compared to expected, is indicated by a score of 1.0. High explanatory power, compared to expected, is indicated by scores in excess of 1, while scores less than 1 indicate low explanatory power. Zero explanatory power would be indicated by a score of 0.

[b] Table 6, page 106.

[c] Table 7, page 108.

[d] The maximum proportion of total explained is 1.0, and the minimum is 0.

[e] Perfect consistency with the hypotheses is indicated by a score of 1.00. Perfect inconsistency is indicated by a score of 0.

[f] Table 8, page 117.

[g] Table 9, page 125.

stepwise regression procedures as explainers of the accounting variables. Explanatory power, compared to expected, includes measures of the extent that the individual explainer variables in the level, on the average, are used more or less as explainers than variables in other levels. Explanatory power, proportion of total explained, includes measures of the proportional influence of the variables in the level on the explanation of accounting variables, regardless of the number of variables in the level. Naturally, levels with more variables will explain more in terms of proportion of total explained. For example, the three individual process variables were chosen more often as explainers than variables in the overall structural complexity level, as indicated by the "compared to expected" measures. The nine control system variables, as a group, explained more of the variability of the accounting variables than the three process variables, as indicated by the "proportion of total explained" measures, because control system had more variables.

Two measures of each form of explanatory power, frequencies and R square increase, are presented because no faultless measure could be developed in Chapter 3. The frequencies measures ignore the size of associations indicated by regression coefficients, but the R square increase measures are biased toward explainers which were added early to regressions.

The focus of the dissertation has been on the three hypotheses incorporated in the basic model. These predict that the relationships between variables in the three explainer levels and accounting variables will have certain directions, positive or negative. For example, control system variables are predicted to have negative relationships with accounting variables, per hypothesis two (page 57). For the multiple regression research design of this dissertation, these relationships are regression coefficients, and the regression coefficients of accounting components on control system components are predicted to have negative signs. The two numbers under consistency with the hypotheses for control system are measures of the extent that any regression coefficients of accounting components on control system components are negative. Like those for explanatory power, the frequencies measure of consistency with the hypotheses ignores the size of particular associations, while the R square increase measure is biased toward early-added explainers.

The measurements of consistency with the hypotheses for process and overall structural complexity strongly support, respectively, hypotheses one and three (see page 57).[1] The frequencies measures indicate that 71 percent of the coefficients of accounting system components on process components were positive, the direction predicted by hypothesis three, and 67 percent of the coefficients of accounting system components on overall structural complexity components were positive, the direction predicted by hypothesis one. The even larger R square increase measures for process and overall structural complexity indicate that the large

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[1] Since it is not possible to generalize statistically from this selective sample of companies to a larger population of companies, about all that can be said about the confirmation of the hypotheses is that, for this sample, the preponderance of relationships is in the direction expected. It is also important to note that the rough nature of the measurements of accounting and organizational variables makes high proportions, near 1.0, very unlikely. It is the judgment of the author that these proportions are as high as could have been expected given the rough nature of the measurement process.

associations were even more consistent than the small associations. In light of these measurements, the following statements can be made:

1. When companies have high scores on their process variables, they tend to have high scores on their accounting system variables.
2. When companies have high scores on their overall structural complexity variables, they tend to have high scores on their accounting system variables.

The consistency with hypothesis two measures for the control system, 0.43 and 0.53, do not confirm or disconfirm hypothesis two. Only 43 percent of the coefficients of accounting system components on control system components were negative, as predicted by hypothesis two. But the larger associations, as measured by R square increases, were more consistent (negative) than the smaller associations. This caused the R square increase measure to be greater than 50 percent.[1]

As might be expected, control system components, as a group, explained a larger proportion of the variation in accounting system components, almost 60 percent, than any other level since there were more control system components. Also, the average control system

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[1] It is interesting to note that, for all three levels, consistency with the hypotheses is greater in terms of R square increase than in terms of frequencies. That is to say, explainers that were added early to the stepwise regressions tended to have coefficients with signs that were more consistent with the hypotheses. If the regressions had been more restrictive in admitting explainers (i.e., a critical *F* value greater than 3.0 had been set), the signs of coefficients would have been more consistent with the hypotheses. Apparently, the first explainers admitted to the regressions indicate significant relationships (i.e., high explanatory power and consistency with the hypotheses). Later explainers admitted may indicate more indirect and possibly spurious relationships between the explainers and one of the accounting variables. Such indirect relationships could have been caused by the simultaneous effect on the accounting variable and the organizational variable of a third variable.

component explained 20 percent more than the average of all organizational components. The control system level is an important determinant of the accounting system. The importance of the control system level is surprising in light of the fact that hypothesis two could not be confirmed. In general, it can be said that the control system level contains variables which have many strong positive and negative associations with accounting system variables.

The average component in the overall structural complexity level explained 30 to 50 percent less than the average of all organizational components. Even though there were more than twice as many components, the overall structural complexity level explained no more of the variation in accounting components than the process level, 20 to 25 percent. The overall structural complexity level, which was originally predicted to be an important explainer of the accounting system (see page 104), had unexpectedly poor explanatory power. This was surprising in light of the fact that hypothesis one was strongly confirmed. In general, it can be said that the overall structural complexity level has variables which have consistently positive but relatively weak associations with accounting system variables.

The process level was included in the basic model primarily as a control and was not expected to have much explanatory power. Yet the average process component explained from 20 to 60 percent more than the average of all organizational components. They were thus the strongest of the explainer components. Though the process level, with only a third of the components, could not explain as much as the control system level, it did explain as much as the overall structural complexity level.

Process was the only explainer level which had good explanatory power and was very consistent with its hypothesis (three). In general, it can be said that the process level has variables which have very strong and consistently positive associations with accounting system variables.

The Influence of the Explainer Variables on the Accounting System

The purpose of this section is to analyze the strength and direction of the relationships of each organizational variable to the entire set of accounting variables. It addresses two questions:

1. How much does the explainer component contribute to the linear combination estimates of the accounting component scores (explanatory power)?
2. Are the directions of the coefficients of the explainer component consistent with the hypothesis which applies to the explainer level of which the explainer component is a member (consistency with the hypothesis)?

In this section, the rows of Table 5 (page 101) are analyzed. For example, the first row in the table includes four coefficients. These are the coefficients of four accounting components on "process sophistication" for the four of the thirteen regressions into which "process sophistication" was admitted as an explainer. These four coefficients (and the associated R square increases) are assembled into measures which indicate whether "process sophistication" is an important explainer of the thirteen accounting system components and whether its coefficients tend to confirm hypothesis three.[1] The reader

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[1] See above, pages 100-116 and 116-27, respectively, for discussions of the techniques, explanatory power, and consistency with the hypotheses.

will find it useful to keep the text open to Table 5 as he reads this section.

Table 16 accumulates measures of the explanatory power and consistency with the hypotheses of each of the nineteen explainer components. Note that the explanatory power measures are centered on a score of 1, which indicates the component has average explanatory power for the explainer components within its level. A score of 0 indicates the component was not added to any of the thirteen regressions and thus has no explanatory power. Scores less than 1 indicate poor explanatory power, while scores in excess of 1 indicate good explanatory power. The consistency measures are proportions. Perfect consistency is indicated by a score of 1, while perfect inconsistency is indicated by a score of 0.

Once again, the two methods, frequencies and R square increase, are used to form separate measures of both explanatory power and consistency with the hypotheses. The frequencies method ignores the strength of associations indicated by regression coefficients, while the R square increase method is biased toward early-added explainers.

In this section, the individual explainer components are analyzed by levels of explainers. The main objective of the analysis is to separate variables which are good representatives of their explainer levels from variables which are poor representatives of their explainer levels. Good representatives have more explanatory power than other components within the explainer level and have coefficients whose signs are consistent with the hypothesis which applies to the respective explainer level. Poor representatives have poor explanatory power and/or

Table 16

Explanatory Power and Consistency with the Hypotheses of Explainer Components

Explainer Component	Explanatory Power[a]		Consistency with Hypotheses[b]	
	Frequency[c]	R Square[d]	Frequency[e]	R Square[f]
Process				
Sophistication	1.7	2.0	0.75	0.84
Output diversity	0.4	0.4	1.00	1.00
Materials input diversity	0.9	0.6	0.50	0.18
Overall structural complexity				
Size	2.3	1.9	0.33	0.54
Job structure complexity	1.6	1.1	1.00	1.00
Geographical dispersion	0.0	0.0	•	•
Divisional differentiation	0.8	0.3	1.00	1.00
Divisional specialization	0.8	0.9	0.00	0.00
Mechanization-general	0.0	0.0	•	•
Mechanization-computers	1.6	2.8	1.00	1.00
Control system				
Direct supervision	1.7	1.7	0.00	0.00
Staff support	0.4	0.4	1.00	1.00
Authority levels	0.4	0.1	0.00	0.00
Personnel quality-high	0.9	0.2	0.50	0.56
Personnel quality-low	2.1	1.5	0.40	0.50
Centr of authority-invest	1.3	1.0	0.33	0.39
Centr of authority-purchase	0.0	0.0	•	•
Standardization-jobs	0.9	2.4	1.00	1.00
Standardization-general	1.3	1.7	0.67	0.42

[a] Average explanatory power is indicated by a score of 1.0. High explanatory power is indicated by scores in excess of 1.0, while low explanatory power is indicated by scores less than 1.0.

[b] Perfect consistency with the hypotheses is indicated by a score of 1.00. Perfect inconsistency is indicated by a score of 0.00. Spaces containing a single dot indicate there were no coefficients for this explainer with which consistency with the hypotheses could be calculated.

[c] Table 6, page 106.

[d] Table 7, page 108.

[e] Table 8, page 117.

[f] Table 9, page 125.

consistency. The direction of their influence on the accounting system may not be consistent with the level of which they are a member, or they may have little influence on accounting system variables.

"Process sophistication" is clearly the most representative of the process level components. It has exceptional explanatory power and is fairly consistent with hypothesis three. "Materials input diversity" has somewhat lower than average explanatory power and is somewhat inconsistent with hypothesis three. "Output diversity" was admitted to only one of the thirteen regressions, and thus has low explanatory power, though the single coefficient is consistently positive. The lack of significant influence on the accounting system by the two variables "output diversity" and "materials input diversity," which were derived from the Pugh *et al.* studies, is notable. The only variable in this level with significant influence, "process sophistication," was the result of miscellaneous measurements assembled by this author.[1]

Two of the overall structural complexity components, "job structure complexity" and "mechanization-computers," are representative of overall structural complexity in that they have better than average explanatory power and are (perfectly) consistent with hypothesis one. The only other better than average explanatory power component is company size, but strangely it is somewhat inconsistent with hypothesis one. Two out of three of its coefficients are negative, but the coefficient represented by the largest R square increase ("unit differentiation-

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[1] See above, page 53.

vertical") is consistently positive,[1] making the R square measure of consistency greater than 0.50.

The relationships of company size to divisionalization of the accounting system, as represented by accounting "geographical dispersion" and "unit differentiation-vertical," is particularly interesting. Company size leads to the development of accounting departments at division headquarters and below. But company size is negatively related to geographical dispersion of the accounting system. It should be noted that most of the measurements which were incorporated into accounting "geographical dispersion" had the effect of overall company geographical dispersion and/or size removed.[2] Thus the interpretation of accounting "geographical dispersion" is the additional geographical dispersion of the accounting system beyond what is expected based on the geographical dispersion and size of the company. In contrast, "unit differentiation-vertical" did not have the overall company effect removed.[3] Therefore, an interpretation of these results is that company size leads to the development of accounting units away from the home office but at a rate less than the rate of increase in company size.

Two of the overall structural complexity components, "geographical dispersion" and "mechanization-general," were not used as explainers in any of the thirteen regressions and thus have no explanatory power. The two divisional components, differentiation and specialization, have poor explanatory power, each having been incorporated

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[1] See Table 9, page 125.

[2] See below, page 261.

[3] See below, page 267.

in only one of the thirteen regressions. The positive coefficient of accounting "geographical dispersion" on "divisional differentiation" is consistent with hypothesis one though it is explainable by the direct relationship between the two components. Divisions of companies are often at different locations. Only companies with multiple locations provide the opportunity for the accounting function to be geographically dispersed. Similarly, the negative coefficient of accounting "unit differentiation-horizontal" on "divisional specialization," though inconsistent with hypothesis one, is also explainable by a direct relationship between the two components. In small companies, the controllership departments may perform many nonaccounting staff functions, such as personnel or finance. To the extent that these staff functions are split off from controllership and put into separate divisions, the company has more different types of divisions (divisional specialization), but the controllership division does not have to be broken up into subunits (accounting "unit differentiation-horizontal").

The poor consistency of the control system level as a whole[1] limited the number of representative control system variables; i.e., those with good explanatory power and consistency. Most of the components with better than average explanatory power were inconsistent with hypothesis two. The only two representative components were the two standardization components. Both were better than average explainers. "Standardization-jobs" is perfectly consistent with hypothesis two, while "standardization-general" is moderately consistent.

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[1] See above, page 165.

"Direct supervision" was an important control system explainer, but its positive coefficients were totally inconsistent with hypothesis two. Thus the relationship of "direct supervision" to the accounting system is not in accord with hypothesis two, which predicts that control systems have negative relationships to one another.[1] A possible explanation of this finding is that direct supervision and the accounting system do act as control systems but they are complementary. To the extent that a company emphasizes direct supervision as a control system, it must provide accounting information to the supervisors so they can effectively control operations.

"Personnel quality-low level" was a very important explainer of the accounting system, but "personnel quality-high level" was not. Neither of the personnel quality components was particularly consistent or inconsistent with hypothesis two. A possible explanation of the lack of good consistency is that personnel quality, though it alleviates the need for other control systems,[2] also necessitates the provision of accounting information to make the personnel more effective. Like direct supervision, personnel quality may have a complementary relationship to the accounting system. Thus personnel quality may have a dual role: alleviating control problems and requiring the provision of more accounting information. The greater influence of the quality of lower-level personnel suggests that the degree of lower-level personnel quality creates an organizational environment which has a great influence on

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[1] See above, page 57.

[2] See above, page 57.

the development of the accounting system though the direction of influence on parts of the accounting system is mixed.

The "centralization of authority-purchasing" component was not used as an explainer in any of the thirteen regressions and thus had no explanatory power. The "centralization of authority-investment" component was only an average explainer. But more important, it was inconsistent with hypothesis two since two out of three of its coefficients were positive. The lack of much importance of the centralization variables as explainers was surprising as well as the inconsistent relationship to the accounting system.

The "authority levels" component was a poor explainer, having been added to only one of the thirteen regressions. The coefficient for this regression was positive, inconsistent with hypothesis two. This suggests that the split-off of authority levels from other forms of structural complexity as a control-problem-alleviating instead of control-problem-producing characteristic, described on page 47, may not have been appropriate. Apparently the number of authority levels contributes to the control problems created by structural complexity and thereby necessitates the development of the accounting system.

The "staff support" component was a poor explainer, having been added to only one of the thirteen regressions. However, its coefficient was consistent with hypothesis two. To a limited extent, then, the greater is the development of nonaccounting staff functions, the less needs to be the development of the accounting system.

The Influenceability of Accounting Variables by Organizational Variables

The purpose of this section is to analyze the strength and directions of influence of the organizational variables on each accounting variable. It addresses two questions:

1. To what extent is the accounting component explained by a linear combination of organizational components (explainability)?
2. Are the directions of the coefficients of the organizational components in the linear combination consistent with the hypotheses which apply to the level in which the respective organizational components are located (consistency with the hypotheses)?

In this section, the columns of Table 5 (page 101) are analyzed. For example, the first column, headed by accounting system "size-information output," includes four coefficients. These are the coefficients of the four organizational components which were used to explain accounting "size-information output." These four coefficients are assembled into measures which indicate to what extent accounting "size-information output" is explained by organizational components and whether the signs of the coefficients are consistent with the respective hypotheses.[1] The reader will find it useful to keep the text open to Table 5 as he reads this section.

Table 17 accumulates measures of the explainability and consistency with the hypotheses of each of the thirteen accounting components. The reader will find it easier to understand the table if he concentrates

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[1] See above, pages 100-116 and 116-27, respectively, for discussions of the techniques, explainability, and consistency with the hypotheses.

Table 17

Explainability and Consistency with the Hypotheses of Accounting System Components[a]

Accounting System Component	Process		Structural Complexity		Control System		Total	
	Freq	R Sq	Freq	R Sq	Freq	R Sq	Freq	R Sq
	Explainability[b]							
Size-infor output	1.90	4.80	1.40	1.10	1.20	0.50	1.40	1.70
Size-resource input ...	1.90	1.70	0.00	0.00	0.60	0.90	0.70	0.90
Job struct compl	0.00	0.00	1.40	2.30	0.60	0.60	0.70	0.80
Geog dispersion	1.90	0.10	2.90	1.10	2.50	2.90	2.50	1.80
Unit diff-vertical	3.70	1.90	1.40	1.90	1.20	1.30	1.80	1.60
Unit diff-horizontal ..	0.00	0.00	1.40	1.70	0.00	0.00	0.40	0.30
Authority levels	0.00	0.00	0.00	0.00	1.20	1.80	0.70	1.00
Report differen	1.90	2.30	0.00	0.00	1.20	1.20	1.10	1.20
Decen of accounts	0.00	0.00	1.40	1.00	3.10	2.80	2.10	1.70
Sophis of techniques ..	1.90	2.10	1.40	1.10	0.60	0.50	1.10	1.00
Mechanization	0.00	0.00	1.40	3.00	0.00	0.00	0.40	0.60
Personnel-education ...	0.00	0.00	0.00	0.00	0.60	0.60	0.40	0.30
Personnel-general	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Consistency with Hypotheses[c]							
Size-infor output	1.00	1.00	1.00	1.00	0.00	0.00	0.50	0.84
Size-resource input ...	1.00	1.00	•	•	1.00	1.00	1.00	1.00
Job struct compl	•	•	1.00	1.00	1.00	1.00	1.00	1.00
Geog dispersion	1.00	1.00	0.50	0.55	0.25	0.65	0.43	0.65
Unit diff-vertical	0.50	0.25	1.00	1.00	0.50	0.87	0.60	0.72
Unit diff-horizontal ..	•	•	0.00	0.00	•	•	0.00	0.00
Authority levels	•	•	•	•	0.50	0.31	0.50	0.31
Report differen	1.00	1.00	•	•	0.50	0.41	0.67	0.69
Decen of accounts	•	•	1.00	1.00	0.40	0.26	0.50	0.34
Sophis of techniques ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mechanization	•	•	1.00	1.00	•	•	1.00	1.00
Personnel-education ...	•	•	•	•	1.00	1.00	1.00	1.00
Personnel-general	•	•	•	•	•	•	•	•

[a] Frequency and R square data are taken from Tables 6 (page 106) and 8 (page 117), and Tables 7 (page 108) and 9 (page 125), respectively.

[b] Average explainability is indicated by a score of 1.00, high explainability is indicated by scores in excess of 1.00, and low explainability is indicated by scores less than 1.00.

[c] Perfect consistency with the hypotheses is indicated by a score of 1.00; perfect inconsistency is indicated by a score of 0.00. Spaces containing single dots indicate there were no coefficients for this category with which consistency with the hypotheses could be calculated.

at first on the columns denoting total explainability and total consistency with the hypotheses. Note that the explainability measures are centered on a score of 1.00, which indicates the accounting component is explained about as much as the average accounting component. A score of 0.00 indicates that no organizational components were used to explain the accounting component. In other words, given the tests for entry of components to regressions, no linear combination of any of the nineteen organizational components could be found to explain the accounting component. This was true of accounting "personnel quality-general." Scores less than 1.00 indicate poor explainability, while scores in excess of 1.00 indicate good explainability. The consistency measures are proportions. Perfect consistency is indicated by a score of 1.00, while perfect inconsistency is indicated by a score of 0.00.

Once again the two methods, frequencies and R square increase, are used to form separate measures of both explainability and consistency with the hypotheses. The frequencies method ignores the strength of associations indicated by regression coefficients, while the R square increase method is biased toward early-added explainers.

The explainability measures are broken into four groups: total, control system, structural complexity, and process. Total explainability is the extent that the accounting component is explained by a linear combination of the organizational components, as compared to the average explainability of the thirteen components. For example, the component "sophistication of accounting techniques" has a total explainability about average for the thirteen components. Explainability by a level is the extent that the component was explained by explainer components in that level, as compared to the average explainability of accounting components by explainer components in that level. For example, "sophistication of accounting techniques" is explained much more than average by process components, a little more than average by structural complexity components, and less than average by control system components.

The consistency measures are also broken into four groups: total, control system, structural complexity, and process. Total consistency is the extent that the coefficients of organizational components in a linear combination used to explain an accounting component have the signs that are expected if the hypotheses are true which apply to the levels in which they are located. For example, the total consistency of "size-information output" is 50 percent or better (0.50 or 0.84). An inspection of the first column in Table 5 shows that the positive coefficient on "process sophistication" is consistent with hypothesis three, the positive coefficient on "job structure complexity" is consistent with hypothesis one, and the two positive coefficients on "direct supervision" and "personnel quality-low level" are inconsistent with hypothesis two. Thus two out of four coefficients are consistent, and the frequency measure is 50 percent.[1] The control system measure of zero indicates the control system coefficients are all inconsistent, while the structural complexity and process measures of one indicate their coefficients are all consistent.

The two most explained accounting components are "geographical dispersion" and "decentralization of accounts." Neither of these

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[1] The R square increases are used to weight the coefficients for the R square measure. See above, pages 124-27.

components is very consistent or inconsistent. Both are explained mostly by the control system level of variables and both derive most of their inconsistency from that level. "Geographical dispersion" thus is the leading accounting input component, and "decentralization of accounts" is the leading accounting output component.

"Geographical dispersion" and "unit differentiation-vertical" were treated together with one another as "divisionalization of the accounting system" in the analysis of relationships within the accounting system.[1] It is notable that both are excellently explained by organizational components. Divisionalization of the accounting system is an important accounting system concept which is strongly related to organizational variables.

In addition to "decentralization of accounts," the rest of the accounting output components—"size-information output," "report differentiation," and "sophistication of techniques"—are well explained by organizational components. In the analysis of relationships within the accounting system, "sophistication of accounting techniques" was found to be the only accounting output component not directly related to the other output components.[2] It preserved its idiosyncratic nature here by being the only output component to have all of its coefficients inconsistent with the hypotheses.

None of the other accounting components besides the divisionalization components and the output components were significantly explained

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[1] See above, page 151.

[2] See Figure 2 (page 148) and the discussion on page 149.

by organizational components. In general, it can be said that the overall organization exerts its primary influence on accounting systems (in this sample of companies) by determining whether the accounting system is divisionalized and by necessitating that certain types of accounting output be produced. Apparently other organizational arrangements (accounting input components) such as quantity of resources applied to the accounting system ("accounting size-resource input"), aspects of organzation structure of the accounting system besides divisionalization ("job structure complexity," "authority levels," and "unit differentiation-horizontal"), personnel quality ("education" and "general"), and mechanization are more unique to particular accounting systems.[1]

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[1] It may be speculated that there are tradeoffs among these unique aspects of accounting systems. For example, greater job structure complexity and mechanization may be associated with lower personnel quality, and vice versa. The multiple regression research design ignored the interrelationships among accounting components that would have incorporated such tradeoffs. See above, page 130, for a discussion of the nature of this limitation.

Chapter 5

INTEGRATION OF THE RESEARCH FINDINGS

In Chapter 4, the individual research findings were discussed without very much consideration of how they relate to each other. The purpose of this chapter is to attempt to pull together the research findings into a relatively simple and understandable block of internally consistent research findings.

The first step in integrating the research findings is summarizing the major generalizations from Chapter 4. Then the basic model, originally developed in Chapter 2, is revised to account for the research findings, particularly those which were found to be inconsistent with the Chapter 2 basic model. The reasons for the changes in the revised basic model are discussed in two sections—one on the organizational levels and variables, and one on the accounting system variables. Finally, some revisions of the three hypotheses developed in Chapter 2 are necessitated by the basic model revisions.

GENERALIZATIONS FROM THE RESEARCH FINDINGS

There are many expected and unexpected findings in the data that were analyzed in Chapter 4. Before attempting to integrate them, it is useful to assemble the generalizations that were developed in Chapter 4.

1. As a group, characteristics of the overall organization are important to the determination of characteristics of the accounting system (page 160).

2. Characteristics of the accounting system are not very important to the explanation of other characteristics of the accounting system (page 144).

3. Divisionalization-centralization is an important dimension of the accounting system which is strongly related to other accounting variables and to organizational variables (pages 146, 179).

4. The characteristics of accounting output are important variables of the accounting system which are strongly related to other accounting variables and to organizational variables (pages 144, 179).

5. The output of accounting systems apparently develops in two alternative directions: the provision of more sophisticated information only for high-level management or the provision of more unsophisticated information for lower levels of management (page 150).

6. Centralized accounting systems tend to emphasize the provision of sophisticated information for high-level management while divisionalized accounting systems tend to emphasize the provision of unsophisticated information to high and lower-level management (page 156).

7. Increases in the development of the overall structural complexity level are associated with increases in the development of the accounting system (this confirms hypothesis one), though the overall structural complexity level was not as strongly associated with the accounting system as anticipated (page 166).

8. Increases in the sophistication of the production process are strongly associated with increases in the development of the accounting system (this confirms hypothesis three; see page 167).

9. The control system level is strongly associated with the accounting system but increases in the development of different characteristics of the control system are associated with both increases and decreases in the development of the accounting system (this fails to confirm hypothesis two; see page 166).

10. Process sophistication is the only important process variable used in this dissertation (page 170).

11. Increases in company size do not lead to increases in the development of the accounting system, though they significantly influence some accounting system characteristics (page 170).

12. All of the pure structural complexity variables (those involving the breakup of the organization into parts on various dimensions: "job structure complexity," "divisional differentiation," and "authority levels") were positively associated with the development of the accounting system (pages 170, 172, and 174).

13. All of the standardization variables were negatively associated with the development of the accounting system (the relationship between the accounting system and standardization is thus consistent with hypothesis two; see page 172).

14. The control systems "direct supervision" and "personnel quality" have positive relationships to the development of the accounting system. Apparently supervisors and higher-quality personnel need more accounting information to be effective. This complementary relationship apparently supersedes the negative relationship predicted by hypothesis two (page 173).

15. Decentralized companies do not have more fully developed accounting systems, as predicted by hypothesis two (page 174).

16. Accounting variables, other than divisionalization-centralization and the accounting output variables, are not significantly influenced by the overall organization (pages 179-80).

REVISION OF THE BASIC MODEL

Though two of the three hypotheses incorporated in the basic model are confirmed, there are so many inconsistencies and loose ends in the research findings that some revision of the basic model is advisable. Figure 3 outlines a revised basic model which is designed to incorporate many of the research findings while retaining as much simplicity as possible. The roles of some of the explainer variables are reinterpreted in light of the research findings. Some variables which

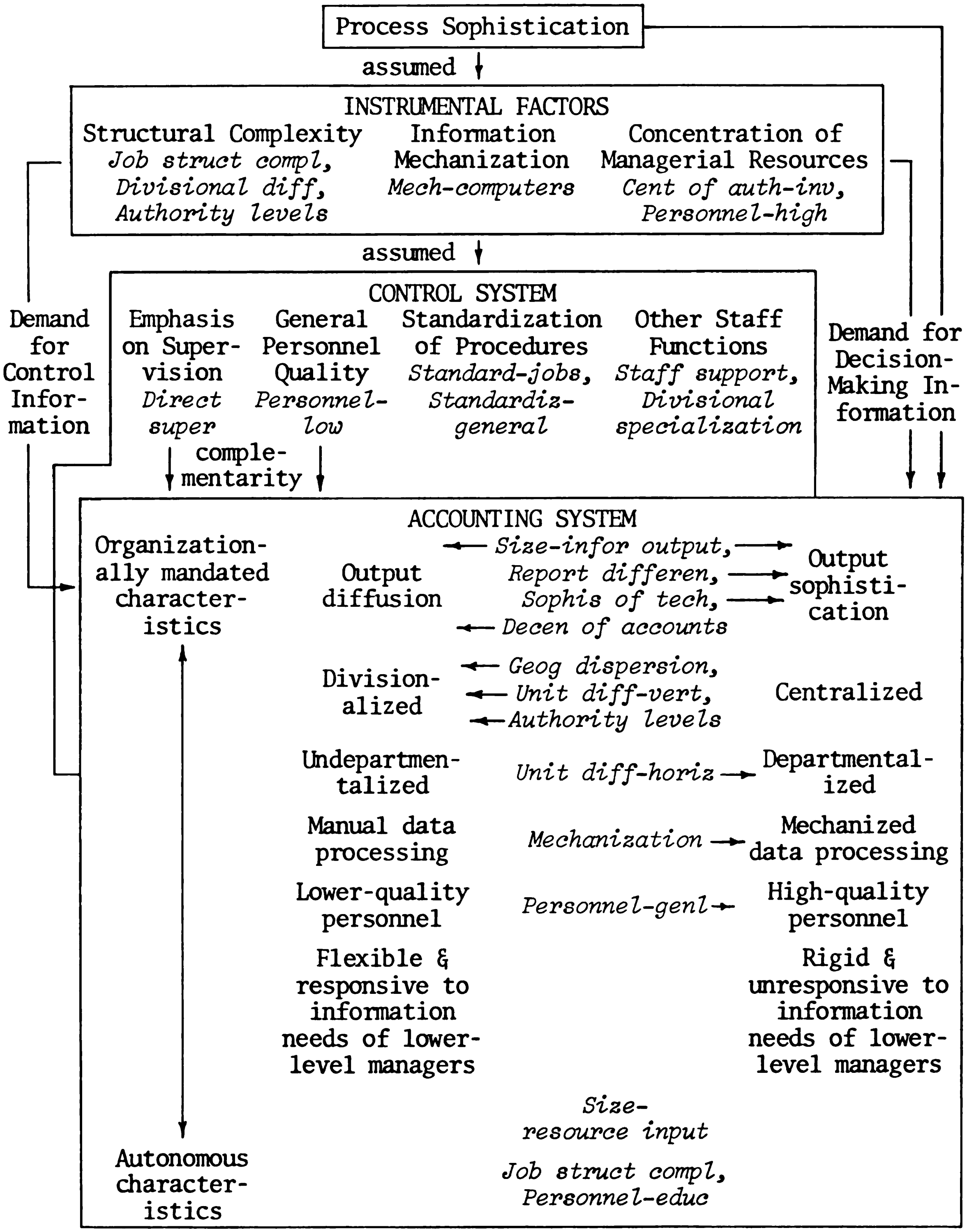

Figure 3

The Revised Basic Model
(This figure is a revision of the basic model
presented in Figure 1, page 44)

appear to act together are merged into overall concepts. The roles of the explainer levels are reinterpreted as necessary. The accounting system variables are rearranged in accord with their influenceability by organizational variables and by each other. These changes are described in the following two sections.

Table 18 includes the regression coefficients for the stepwise regressions of the accounting variables on the potential organizational variables. These coefficients are the same as those in Table 5 (page 101), except that the rows and columns have been rearranged in accord with the revised basic model. The accounting system variables (columns) which are presumed to act together are placed together. The reader will find it useful to refer to Table 18, as well as Figure 3, while reading the discussion in the following sections.

RECONSIDERATION OF THE ORGANIZATIONAL LEVELS AND VARIABLES

The purpose of this section is to analyze and justify the changes that were made in the organizational levels and variables of the revised basic model, Figure 3. The major changes that were made in the levels were as follows:

1. The process level was narrowed to the single variable "process sophistication," since the other two process variables were not important.
2. The overall structural complexity level was renamed "instrumental factors" to indicate that it includes more than just structural complexity.
3. Complementarity between the accounting system and other control systems was recognized as possibly accounting for positive relationships.

Table 18

Regression Coefficients for the Stepwise Regressions of the Thirteen Accounting Components on Nineteen Potential Organizational Explainer Components—Rows and Columns Rearranged per the Revised Basic Model[a]

Organizational Explainer Component	Organizationally Mandated Characteristics[b]						
	Output Diffusion-Sophistication				Centralized-Division-alized		
	A	H	J	I	D	E	G
Process							
Sophistication	0.6	0.7	•	•	0.2	-0.4	•
Output diversity	•	•	•	•	•	•	•
Materials input diversity	•	•	-0.5	•	•	0.3	•
Instrumental factors							
Size	•	•	-0.3	•	-0.8	0.3	•
Structural complexity							
Job structure complexity	0.4	•	•	0.4	•	•	•
Divisional differentiation	•	•	•	•	0.6	•	•
Authority levels	•	•	•	•	0.4	•	•
Information mechanization							
Mechanization-computers	•	•	•	•	•	•	•
Concentration of managerial resources							
Centralization of auth-invest	•	0.6	•	-0.5	•	0.3	•
Personnel quality-high	•	•	•	-0.2	0.5	•	•
Control system							
Complementary							
Direct supervision	0.2	•	•	0.4	1.0	•	0.6
Personnel quality-low	0.3	•	0.4	0.3	•	•	-0.4
Standardization of procedures							
Standardization-jobs	•	•	•	•	•	-0.8	•
Standardization-general	•	-0.4	•	0.3	-0.8	•	•
Other staff functions							
Staff support	•	•	•	•	•	•	•
Divisional specialization	•	•	•	•	•	•	•

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[a] These are the same coefficients as those in Table 5 (page 101). The thirteen columns of accounting system components represent different regressions. Each column includes the coefficients for the explainer components which were added to the regressions of the accounting system component which heads the column. The rows and columns are rearranged

Table 18 (Cont'd.)

Organizational Explainer Component	Autonomous Characteristics^b						Coef. Signs Exp.
	F	K	M	B	C	L	
Process							
Sophistication	•	•	•	•	•	•	
Output diversity	•	•	•	0.5	•	•	+
Materials input diversity	•	•	•	•	•	•	
Instrumental factors							
Size	•	•	•	•	•	•	
Structural complexity							
Job structure complexity	•	•	•	•	•	•	
Divisional differentiation	•	•	•	•	•	•	
Authority levels	•	•	•	•	•	•	+
Information mechanization							
Mechanization-computers	•	0.5	•	•	0.5	•	
Concentration of managerial resources							
Centralization of auth-invest	•	•	•	•	•	•	
Personnel quality-high	•	•	•	•	•	•	
Control system							
Complementary							
Direct supervision	•	•	•	•	•	•	+
Personnel quality-low	•	•	•	•	-0.4	•	
Standardization of procedures							
Standardization-jobs	•	•	•	-0.5	•	•	
Standardization-general	•	•	•	•	•	•	
Other staff functions							-
Staff support	•	•	•	•	•	-0.4	
Divisional specialization	-0.4	•	•	•	•	•	

as follows: The organizational variables (rows) which are presumed to act together are placed together. The accounting system variables (columns) which are presumed to act together are placed together.

[b] *Accounting System Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

Some of the organizational variables are merged into overall concepts or redefined. The three variables which measure structural complexity are merged. The new variable, concentration of managerial resources, is proposed to account for the inconsistent coefficients of two organizational variables. The meanings of other variables are refined.

An especially important finding is the strong and consistently positive relationship of the process level to the accounting system. There are several implications of this finding. First the accounting system does not develop only in response to the control needs of a company. As was explained on page 39, one of the main reasons for including the process level (the only aspect of context measured in this dissertation) was that the stage of development of the accounting system may be related to demands for decision-making information necessitated by the complexity of the production process. The strength and consistency with hypothesis three of the explanation of the accounting system by the process level supports this explanation.

The structural complexity level in the basic model includes some variables, such as company size and mechanization, which are not, strictly speaking, structural complexity. As was discussed in the model development stage on page 50, the key requirement for inclusion in the overall structural complexity level was that a variable was perceived to increase control and coordination problems. An assumption of the model, though it was not tested in this dissertation, is that context influences the variables that are included in the overall structural complexity level. The overall structural complexity level is renamed "instrumental factors" to clarify the fact that it includes more than pure structural complexity. These instrumental factors are necessary to the accomplishment of the production process, but they may have effects on the development of the accounting system either because of additional control needs or because of additional information needs.

All three of the "pure" structural complexity[1] explainer variables used in this dissertation—"job structure complexity," "divisional differentiation," and "authority levels"—were found to lead to the development of the accounting system. It had been proposed in the model development stage on page 46 that authority levels, in contrast to the other two structural complexity variables, might alleviate control problems and thus (as a control system) be negatively related to the accounting system. The uniformly positive effect of all three structural complexity variables, including "authority levels," suggests the more general proposition that increasing structural complexity (of all types) leads to the development of the accounting system. Thus the three variables are merged into the concept "structural complexity" and incorporated in the revised basic model as an instrumental factor, and "authority levels" is removed from the control system level.

Since hypothesis two, postulating negative relationships among control systems, was not confirmed, a reconsideration of the role of the control system level is necessary. It seems unlikely that the accounting system is the only part of an organization which contributes to the

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[1] "Structure" was defined above, on page 27, as something composed of parts. All three of these variables have to do with the breakup of the organization into parts along various dimensions.

control function. Why then would positive relationships be found between control systems? One explanation is that there may be complementary relationships between control systems. One control system may need the other in order to be fully effective. This explanation has been suggested to explain the positive relationships between the accounting system and both personnel quality and direct supervision. Supervisors and higher-quality personnel can be assumed to need more accounting information to be fully effective in performing their control functions. If the complementary explanation is true, then all-negative relationships between the accounting system and other control systems cannot be expected. This complementarity explanation is incorporated in the revised basic model for the relationships of the accounting system to direct supervision and personnel quality.

In contrast to direct supervision and personnel quality, the control system standardization variables had strong and consistently negative relationships to the accounting system in conformance with hypothesis two. Thus it can be said that companies with standardized procedures do not need as large or complicated accounting systems. Standardization of procedures thus remains in the control system level. Negative relationships to the accounting system are expected since no complementarity is evident in the research findings.

The only other control system variable that was consistent with hypothesis two was "staff support," which has a single negative coefficient on accounting system "personnel quality-education." Thus "staff support" is not a very important explainer of the accounting system. However, the overall structural complexity variable "divisional specialization" was also negatively related to the accounting system. It had been assumed in the model development stage (page 49) that a company with many different types of divisions (as measured by "divisional specialization") would have more control problems and thus need a more fully developed accounting system. The negative relationship of "divisional specialization" to the accounting system disputes that explanation. It is possible that many of the different types of divisions perform staff functions which are, in fact, control systems. For example, personnel and data processing divisions exert control over employees within their areas of responsibility. If this explanation is true, then "divisional specialization" and "staff support" can be classified as control system staff functions which have negative relationships to the accounting system. In other words, companies with well-developed staff functions other than accounting do not need as fully developed accounting systems.

It is interesting to note that, of the two mechanization variables, only "mechanization-computers" has any effect on the accounting system. "Mechanization-general" was not used as an explainer of any of the accounting system components. Thus this dissertation has found no evidence that the general level of mechanization of a company, including the degree of production mechanization, has anything to do with the stage of development of its accounting system. On the other hand, "mechanization-computers" was an important explainer whose relationships to the accounting system were consistent with hypothesis one, confirming its role as an instrumental factor (formerly overall structural complexity). It can be said that more computerized companies have more fully developed accounting systems.[1] The explanation of this positive association suggested by hypothesis one is that computerization contributes to the control problems of the company, perhaps because of the variety of employees required in a computer operation, and thereby necessitates the development of the accounting system to alleviate those problems.

The centralization variables were somewhat of an enigma. It was assumed in the model development stage (pages 34 and 46) that centralization acts as a control system by preventing deviation from top management plans. It thus is expected to be negatively related to the accounting system, which is also assumed to act as a control system. It seems logical that decentralized companies would need additional reports on the performance of lower-level decision-making management.

The research findings dispute this assumption. "Centralization of authority-purchasing" was not used as an explainer of any of the accounting system variables, while "centralization of authority-investment" was positively related to the stage of development of the accounting system. Two explanations can be dismissed immediately. It is difficult to conceive of decentralization as contributing to control or of the existence of complementarity between the accounting system and centralization. Consequently, another explanation must be sought.

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[1] "Mechanization-computers" was positively related to two accounting system variables, "mechanization" and "job structure complexity." The relationship of "overall company mechanization" to "accounting system mechanization" is to be expected. The relationships of "mechanization-computers" to "accounting job structure complexity" is the major concern here.

Why would centralized companies have more fully developed accounting systems? A possible explanation is that some companies may employ highly educated and skilled management at the top management levels instead of dispersing their managerial resources to all levels. High-quality managers have a great need for sophisticated accounting information which ordinary managers might not be able to use. In such companies, most decision-making is confined to top management, since lower-level management is not qualified to make decisions. If this explanation is true, then "centralization of authority-investment" actually measures "concentration of managerial resources." Such concentration is an instrumental factor since it facilitates the accomplishment of the production process.

In light of the re-evaluation of the role of centralization, "personnel quality-high level" was re-examined. It was found on page 173 not to be consistent or inconsistent with hypothesis two. It now seems more appropriate to place it under the caption "concentration of managerial resources" developed for "centralization of authority-investment." It seems logical that control is exercised primarily over lower-level employees, and thus "personnel quality-low level," as discussed on page 173, would act as a control system. "Personnel quality-high level" is proposed to measure concentration of managerial resources at the highest level.

In addition to the three explainer variables which were not used to explain any accounting system variables,[1] three other variables were

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[1] These were "geographical dispersion," "mechanization-general," and "centralization of authority-purchasing."

not incorporated in the revised basic model (Figure 3). The most important was company size, which was an important explainer of the accounting system but had varied effects on the development of the accounting system. Company size apparently induces the development of some accounting system characteristics while restricting the development of others.[1] In consequence, it was not possible to postulate its overall relationship to the accounting system, and it was left out of the revised basic model.

The other two variables not incorporated in the basic model were "output diversity" and "materials input diversity." Both of these process variables were weak explainers, and one was inconsistent with hypothesis three. "Process sophistication" so dominated the process level of explainers that it was adopted as the overall concept in the revised basic model in Figure 3.

RECONSIDERATION OF THE ACCOUNTING SYSTEM VARIABLES

The purpose of this section is to incorporate key accounting system concepts and to order the accounting system variables in the revised basic model. The key accounting system concepts found in Chapter 4 were "centralization-divisionalization" and "sophisticated high-level output, unsophisticated lower-level output." Two bases of ordering the accounting system variables were used. First they were ordered by the degree they are influenced by organizational variables. Second they are ordered by the types of accounting systems developed in Chapter 4:[2]

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[1] See Table 18, page 186.

[2] See above, pages 155-58.

centralized-sophisticated techniques versus divisionalized-unsophisticated techniques.

A very important finding of this disseration was that accounting system characteristics differ greatly in the extent they are determined by characteristics of the overall organization.[1] Some accounting characteristics, such as the output variables and the divisionalization variables, are well explained by organizational variables, while others, such as "personnel-education" and "unit differentiation-horizontal," are poorly explained. This suggests the possibility that some characteristics of accounting systems may be mandated by the overall organization. These characteristics in turn may influence other characteristics of the accounting system which are more autonomous from the overall organization. In Figure 3, the accounting system characteristics are ordered vertically by the extent of their influenceability by the overall organization.

The accounting system characteristics are ordered horizontally by the association of characteristics of the accounting system (alternative types of accounting systems) discussed on pages 155-58. A basic accounting system distinction was found there between those which emphasize sophisticated accounting information for top-level management and those which emphasize elementary accounting information for high and lower levels of management. Emphasis on sophisticated accounting information is labeled "output sophistication" in Figure 3, while emphasis on elementary accounting information for lower management levels is labeled "output diffusion." This basic distinction is essentially

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[1] See above, pages 167-74.

mandated by the overall organization since all of the output variables are extensively explained by organizational variables. In summary, the overall organization determines whether the accounting system will emphasize output sophistication or output diffusion.

A second basic accounting system distinction is between those which are divisionalized and those which are centralized. Centralized accounting systems have a single accounting office for the entire company, while divisionalized accounting systems have accounting offices at division headquarters. Like the output variables, the divisionalization variables which measure this distinction are also extensively explained by organizational variables. It was suggested that centralized accounting systems tend to emphasize output sophistication, while divisionalized accounting systems tend to emphasize output diffusion. Consequently, the output and divisionalization characteristics are ordered in the same direction in Figure 3.

The rest of the accounting system variables were explained less than average by organizational variables.[1] Some of the characteristics represented by these variables tend to be associated with one or the other types of accounting systems: centralized-output sophistication and divisionalized-output diffusion. Centralized accounting systems tend to be more departmentalized, more mechanized, and have higher quality personnel than divisionalized accounting systems. Three accounting system variables were not clearly associated with the centralized-output sophistication, divisionalized-output diffusion dimension. These were

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[1] See Table 17, page 169.

"size-resource input," "job structure complexity," and "personnel-education." Since they were also poorly explained by organizational variables, they were placed at the "autonomous" end of the accounting system ordering of characteristics. The possible association of "flexibility and responsiveness to information needs of lower-level managers" with the "divisionalized-output diffusion" type was suggested on page 156, though flexibility and responsiveness were not measured in this dissertation.

REVISION OF THE HYPOTHESES

Perhaps the most important changes in the revised basic model concern the relationships between the levels of explainer variables—process, instrumental factors, and control system—and the accounting system level. The direction of these relationships was predicted by the hypotheses listed on page 57. The directions actually found, as well as changes in the variables and levels of variables discussed in the preceding sections of this chapter, necessitate some refinements of those hypotheses.

Hypothesis three stated:

> 3. The more sophisticated is the production process of the organization, the more the accounting system must be developed since it must provide more and better information for management decisions.

The strong and consistently positive relationship of the process level to the accounting system confirms hypothesis three, and no revision is necessary.

Hypothesis one stated:

1. Structurally complex organizations tend to have more fully developed accounting systems to contribute to the resolution of greater control and coordination problems, given the process and stage of development of other control systems is held constant.

The consistently positive relationship of the overall structural complexity level to the accounting system confirmed hypothesis one. If the definition of structural compexity in the hypothesis is restricted to "pure" structural complexity,[1] the hypothesis is very strongly confirmed. However, the generally poor explanatory power of the overall structural complexity level, the reinterpretation of some of the variables within the level, and the renaming of the level "instrumental factors" require some refinement of hypothesis one.

Hypothesis one explained that control and coordination problems as a result of overall structural complexity necessitated the development of the accounting system. The control and coordination explanation is probably true for "pure" structural complexity but may not be true for the other instrumental factors, information mechanization and concentration of managerial resources. Companies with high concentration of managerial resources need sophisticated accounting information for top-level management decision-making, but their control information needs are probably not as great since authority is centralized. Thus the effect of concentration of managerial resources on the accounting system does not go through the control system.

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[1] These are the three variables having to do with the breakup of the organization into parts: "job structure complexity," "divisional differentiation," and "authority levels."

The effect of information mechanization on the accounting system was discussed on pages 191-92. The control and coordination explanation does not seem reasonable for information mechanization. The positive relationship between the accounting system and information mechanization is probably due to one or both of the following reasons: (1) The same information needs that necessitate the development of the accounting system also favor computerization to improve the efficiency and effectiveness of the overall information provision function. (2) In small companies, such as those in the sample, the computer function is located within the accounting function.

In light of the above, hypothesis one is restated as follows:

> 1. Organizations with highly developed instrumental factors tend to have more fully developed accounting systems either to contribute to the resolution of greater control and coordination problems or to satisfy greater needs for information for decision-making.

Hypothesis two stated:

> 2. The stage of development of the accounting system is inversely related to that of other control systems, when process and structural complexity are held constant, since control systems are partial substitutes for one another.

The key change with respect to the control system level is that negative relationships can only be expected when there is no complementarity.[1] Consequently, hypothesis two is restated as follows:

> 2. The stage of development of other control systems is inversely related to the stage of development of the accounting system since control systems are partial substitutes for one another, given process and structural complexity are held constant and also given there is no complementarity between the accounting system and other control systems. When complementarity does exist, the accounting system may be positively related to the complementary control system.

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[1] See above, page 190.

Chapter 6

SUMMARY AND CONCLUSIONS

The purpose of this chapter is to tie the dissertation together, discuss its implications, and suggest avenues for future inquiry. There are four sections of the chapter. The first reviews the steps in the inquiry in a brief manner so that the reader may have a perspective on the entire dissertation. The second section summarizes the important findings of the study. The third section discusses some implications of the findings of studies of this type for accountants and managers in organizations. The fourth section proposes future research in the area of the organizational implications for accounting.

REVIEW OF THE STEPS IN THE INQUIRY

In order that the reader may gain perspective on the entire dissertation, this section summarizes the major steps in the dissertation. The first step, in Chapter 2, is to review literature in the fields of sociology (organization research) and accounting which led to the development of the basic model of this dissertation. The basic model consists of some general presumed relationships between about twenty variables of an organization and about ten variables of its accounting system. These general relationships are incorporated in three hypotheses which are tested in this dissertation. The hypotheses predict the direction, positive or negative, of relationships between three levels of organizational variables and the accounting system variables.

The research design is covered in Chapter 3. A sample of eighteen small manufacturing companies in southern Michigan was selected to test the hypotheses and generally examine relationships between variables of their overall organizations and variables of their accounting systems. Over one hundred questions were addressed to the controllers or chief financial officers of these companies in on-site interviews. The responses to these questions were, in some cases, mathematically manipulated to produce measurements which correspond to the variables in the basic model. For each variable in the basic model, there were from three to twenty measurements after the mathematical manipulations. These were combined into a single measurement for each variable using principal components analysis.

The relationships between the accounting system variables and the organizational variables were calculated using stepwise multiple regression analysis. This technique finds subsets of the organizational variables which are the best possible explainers of each accounting variable. Using the results of the multiple regression analysis, measures of the explanatory power of each organizational variable are calculated which are, generally speaking, the number of times it is used in the subsets for the different accounting variables. The explanatory power of levels of organizational variables is calculated in a similar manner. The explainability of each accounting system variable is calculated, generally speaking, as the number of organizational variables in the subset used to explain it. Measures of the degree the research findings confirm the three hypotheses are calculated. These are called "consistency with the hypotheses" and are essentially the proportions of the relationships between accounting components and organizational components which have the direction, positive or negative, that is predicted by the hypotheses. Consistency with the hypotheses is calculated for individual organizational variables, levels of organizational variables, and accounting system variables.

The relationships among the accounting system variables were also calculated using stepwise multiple regression analysis. Measures of explanatory power and explainability of the accounting variables with respect to other accounting variables were calculated. In addition, the relationships among the accounting variables were analyzed using path analysis.

The output of the preceding techniques are the research findings which are interpreted in detail in Chapter 4. Chapter 5 attempts to integrate the research findings of Chapter 4. A revised basic model is developed which strives to explain those research findings which are inconsistent with the original basic model. The hypotheses are also revised in accord with the revisions in the basic model.

IMPORTANT FINDINGS

This section summarizes the most important findings of the study. These findings are incorporated in the revised basic model and revised hypotheses developed in Chapter 5. The purpose of this section is to lay out the important findings in a narrative style.

The most important finding of the study is that organizational characteristics are important to the determination of many characteristics of the accounting system. The research design of this dissertation cannot reveal whether the organizational characteristics cause changes in accounting system characteristics, but that seems to be a logical assumption.

Structural complexity, defined as the breakup of the organization into parts along various dimensions, leads to the development of the accounting system. A logical explanation of this finding is that structural complexity creates control and coordination problems for organizations which must be alleviated by the development of control systems, particularly the accounting system.

The sophistication of the production process is a very important factor which leads to the development of the accounting system. A logical explanation for this finding is that process sophistication creates a great demand for accounting information for decision-making.

The stage of development of the accounting system is negatively related to the stage of development of some control systems. These control systems are "standardization of procedures" and "other staff functions." A logical explanation of these negative relationships is that each of the control systems helps alleviate control and coordination problems created by structural complexity. The control systems are to some extent substitutable in alleviating these problems. To the extent that one is highly developed, the other does not need to be as highly developed.

The stage of development of the accounting system is positively related to the stage of development of some other control systems. These control systems are "supervision" and "personnel quality." An explanation of these positive relationships is provided by complementarity, the extent that control systems developed together are more effective than any one developed separately. Supervisors and quality personnel are more effective in alleviating control and coordination problems when they are provided with adequate accounting information.

Some "instrumental factors" other than structural complexity lead to the development of the accounting system. An "instrumental factor" is a characteristic of a company which provides the means for it to manufacture product. For example, the organization structure of a company, as measured by structural complexity, provides the environment within which the manufacturing process takes place. Two other "instrumental factors" were found: "information mechanization" and "concentration of managerial resources." Concentration of managerial resources is the extent a company puts exceptionally high-quality personnel at the top managerial levels, leaving much poorer personnel at lower managerial levels. It is logical that high-quality top executives may demand sophisticated accounting information for decisions that lower-quality top executives in other companies might not be able to use. The positive relationship between overall company information mechanization and accounting system mechanization is intuitively logical.

The overall organization influences primarily the nature of the output of the accounting system. Accounting system output involves the nature of reports, the places in the organization where they are sent, and the sophistication of accounting techniques. The overall organization has its greatest effect on whether accounting systems stress output sophistication or output diffusion. Output sophistication is the emphasis on producing sophisticated accounting reports for top-level management. Output diffusion is the emphasis on producing unsophisticated information for high and low levels of management.

The characteristics of accounting system output seem to require the development of certain patterns of accounting system organization structure. A centralized accounting system seems to be associated with output sophistication, and a divisionalized accounting system seems to be associated with output diffusion. Centralized accounting systems have a single accounting office at the company headquarters, while divisionalized accounting systems have accounting offices at division headquarters. Some other characteristics of accounting systems seem to be associated with the two types: centralized-output sophistication and divisionalized-output diffusion. Centralized accounting systems tend to be more departmentalized, more mechanized, and have higher quality personnel than divisionalized accounting systems.

IMPLICATIONS FOR ACCOUNTANTS AND MANAGERS

The purpose of this section is to suggest some practical uses for the findings of this and similar studies of the relationships of characteristics of the overall organization to characteristics of the accounting system.

Perhaps the most promising application is to the design of accounting systems. Research of this type can provide designers with an indication of the typical type of accounting system organization structure associated with given accounting output requirements and the typical type of accounting output necessitated by given overall organizational characteristics. Of course the typical accounting output and accounting organization structure characteristics are not necessarily the optimum ones. But the range of values of a characteristic considered by the designer may be narrowed when he knows the typical value.

As an example, consider a company with great concentration of managerial resources at the top level. It may be found in studies similar to this one that such companies require very sophisticated accounting information.[1] It has been found by this study that sophisticated output tends to be produced by centralized accounting systems. Consequently, an accounting system designer for such a company might lean toward a centralized accounting system.

Another very interesting example goes beyond accounting system design to overall organization design. It involves the tradeoff among control systems. This dissertation has found that the stage of development of the accounting system is negatively related to the degree procedures are standardized and the stage of development of other staff functions, say personnel and data processing. Given a fixed need for control and coordination, mandated by process, instrumental factors, and perhaps other variables, is it cheaper to standardize procedures, develop the accounting system, or develop other staff functions? Also,

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[1] The research findings for this relationship were not clear cut, though it seems intuitively reasonable.

which of the three control systems are more effective in alleviating control and coordination problems? Research such as this can begin to answer these questions.

Research of this type can make generally known to accountants the organizational and accounting terminology and concepts they need to consider in making decisions not involving accounting systems design. For example, the concepts of output sophistication and output diffusion ought to be known to accountants. An accountant in a company that emphasizes output diffusion should recognize the limitations of the accounting system so far as producing sophisticated accounting information. Accountants ought to recognize some of the organizational factors which produce demands respectively for control information and decision-making information. For example, evidence from this dissertation suggests that complex organization structure creates a demand for control information. On the other hand, it has been suggested that the sophistication of the production process creates a demand for decision-making information.

Another very important role of the research is the impact it may have on the attitudes of managers and accountants within organizations. Both should appreciate the organizational constraints on the accounting system. Managers often castigate accountants personally for being inflexible and malicious. If they understood the degree that the nature of the accounting system is governed by organizational considerations, they would realize that accounting personnel are not to blame for the nature of the system. On the other hand, knowledge of organizational considerations might induce accountants to be more responsive to the needs of managers, as reflected in their role in the overall organization.

PROPOSED FUTURE RESEARCH

The purpose of this section is to suggest various types of research in the area of the relationship between the overall organization and the accounting system. Two purposes should be served by such research: it should overcome certain shortcomings in the research design of this dissertation; and it should cover some new substantive areas, such as the reaction of accounting users to various types of accounting systems.

The most important weakness of this dissertation has been the inability to demonstrate causality. The measurements in this cross-sectional study were taken at a single point in time and thus there is no way to show that changes in one variable cause changes in another. Yet causality has been the primary interest of the dissertation. All of the hypotheses were stated in a causal manner. It would have been desirable to be able to say that characteristics of overall structural complexity caused the development of the accounting system. Yet all that could be said was that characteristics of overall structural complexity are associated with the stage of development of the accounting system.

The only way to establish causality is with a longitudinal study of some type. Measurements must be taken at multiple points in time for the same companies. This would require either a very long study in which the interviewer returned to the companies at periodical intervals, or it would require companies which could provide data on organizational and accounting characteristics at one or more points in the past as well as the present. The second approach is much more feasible but places some restrictions on the study. First, the data collected must be of a nature that typical companies would be able to obtain them readily for the past point in time. It is very likely that a complex interview instrument such as that used in this dissertation could not be used in such a longitudinal study. Second, companies must be selected which have had changes in the organizational characteristics measures. For example, sample companies which had not grown in size could demonstrate nothing about the influence of size on the accounting system. In summary, a longitudinal study is recommended with a limited number of carefully chosen measurements collected from a sample of companies that have grown and otherwise changed their organizations. Such companies should of course be able to reconstruct the measurements at a given past point in time.

Another major shortcoming of this dissertation has been the pervasive effects of the small sample size, as discussed on page 130. It is recommended that future studies, whether cross-sectional or longitudinal, have a sample size of at least thirty, and that a holdout sample in addition to the thirty be used to validate the relationships that are found.

In addition to the preceding statistical considerations, future studies should include some additional substantive areas. The strength of process as an explainer of the stage of development of the accounting system suggests that other characteristics of organization context[1] should be examined. The environment of the organization may be an important explainer of the stage of development of its accounting system. Such environmental characteristics as the type of community (urban or rural), the political situation, the existence of consumer and other special-interest groups in the community, the extent of labor unionization, and the economic growth rate of the community might be considered. Naturally a complex and changing environment can be expected to be associated with the development of financial accounting (the production of information for outsiders to the organization). Additional reports might be required for government agencies, community organizations, special-interest groups, etc. But it would be interesting to find if complex environment were associated also with the development of management accounting (the production of information for employees of the organization). Do managers need more information to cope with a complex and changing organization environment?

The measurement of process sophistication in this dissertation was essentially a very crude treatment of technology. It was not expected that it would play such a vital role with respect to the development of the accounting system. Future studies should measure technology in more systematic and orthodox ways than has been done in this study. It has been shown in this study that the technology of the organization is important to the stage of development of the accounting system. Research questions for future studies should be directed toward

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[1] See above, page 38, for a discussion of context.

determining what aspects of technology are important to the accounting system, and specifically how those aspects relate to the accounting system.

APPENDICES

APPENDIX A

QUESTIONS FOR INTERVIEWS AND MEASUREMENT RULES

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June 1974

Classification	Definitional Rules	Questions	Coding Rules
GENERAL MEASUREMENT RULES	1. The major purpose of the research is to investigate how control systems are structured in companies which have been relatively free to develop. Consequently, the study is restricted to companies which are independent entities not owned or controlled by other companies. The unit of analysis is an organization or set of organizations which are under common managerial influence. The company boundary is determined by this unit of analysis and is defined to include all subsidiary companies, 50% or more of whose ownership is held by the parent company. The boundary should be observed with respect to all questions. All employees and all locations of all the companies within the boundary should be included in respective questions, and employees and locations outside the boundary should be excluded. 2. When a question inquires about an overall company characteristic which differs over product lines, organizational units, subsidiary companies, etc., construct an overall company index of the characteristic using a weighted average of the indices of the product lines. organizational units, companies, etc., based on an appropriate variable, such as revenues. If a weighted average is not obtainable, have the respondent estimate, as objectively as possible, the typical value of the index for the included product lines, organizational units, companies, etc. 3. In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the		1. Score a yes answer as 1 and a no answer as 2. 2. For multiple choice answers, score the first choice as 1, the second choice as 2, etc. When more than one choice is selected for a multiple choice question, average the scores of the choices selected. This average is likely to be a nonsense number but at least it will be a discreet answer for coding. 3. Convert all percentages to decimal proportions (move the decimal point two places to the left). 4. Round off quotients to three places to the right of the decimal point or two places to the right of the decimal point if the quotient is a dollar figure.

Classification	Definitional Rules	Questions	Coding Rules
	number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.		
	4. Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.		
	5. Units are defined to include only collections of three or more employees with a supervisor.		
	6. A controllership unit is defined as at least three nonsupervisory employees with accounting or finance jobs (see specific definitional rule 99,100,101) and an accounting or finance supervisor.		
	7. Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.		
GENERAL			
Organization Chart		1. Does the company have an organization chart? May we have a copy?	
Financial Statements		2. May we have a copy of your financial statements?	1 = Yes 2 = Just balance sheet 3 = No
Personnel List		3. May we have a list of company personnel with their job titles (payroll printout)?	
PROCESS			
Sophistication			
Value added		4. Average selling price of the primary product	
		5. Average materials cost per unit of the primary product	

Classification	Definitional Rules	Questions	Coding Rules
Development costs	Include market research costs. If a significant amount of research and product development (and market research) costs are capitalized or if such costs vary materially over the years, record as the answer to this question the typical amount of such costs incurred annually over the years, regardless of whether capitalized or expensed.	6. Total annual research and product development costs	
	Use cost of goods sold unless it does not approximate normal annual manufacturing costs due to the disposal of large amounts of inventory produced in prior years, the production of large amounts of inventory for sale in future years, or other reasons.	7. Total annual manufacturing costs (exclude research and product development costs)	
Production cycle		8. Length of production cycle for the primary product in weeks	
Output Diversity Number products	Products are different if they employ different materials or technology.	9. How many essentially different products does the company produce?	
Number customers	Consider as separate customers different units of a customer-company to which products are sold separately.	10. How many regular customers does the company have?	
OVERALL STRUCTURAL COMPLEXITY Size	Consider as separate suppliers different units of a supplier-company from which products are purchased separately.	11. From how many suppliers does the company purchase materials and supplies on a regular basis?	
Number of employees		12. How many full-time employees does the company have now?	
		13. Do the numbers of full-time employees fluctuate materially over the year?	
		14. If so, how many full-time employees were employed on the average over the last year?	When the answer to question 13 is no, code question 14 as the answer to question 12.

Classification	Definitional Rules	Questions	Coding Rules
Financial size		15. Total annual revenues	
		16. Total annual expenses before taxes	
		17. Total assets	
		18. Total owners' or stockholders' equity	
Division of Labor			
Elaboration of job titles	These questions are involved with the degree of elaboration of the job structure of the company by means of differences in job titles. For the sake of objectivity, the measurer should in general not look behind the job titles to differences in the actual jobs of employees. The emphasis is on whether the company distinguishes jobs formally rather than whether the occupants of jobs perform different functions. In general, the wording of the job title determines whether it is counted as a separate job title. However, considerable judgement must be used. If job titles with the same wording are on approximately the same authority level, they should be counted as the same title, even if the actual functions of employees in the positions are quite different. If job titles with the same wording are on considerably different authority levels, a significant difference in the scope or scale of responsibilities is indicated and the job titles should be considered different. Job titles should be considered different even if the only difference is reference to a different product, process, or function but should not be considered different if the only difference is reference to a geographical area, company location, sex designation, or work shift. Job titles should be considered the same if the only difference is word order. When an employ- (continued)	19. How many different job titles does the company employ?	
Concentration among job titles		20. How many of the company's employees are classified under the single job title which includes the most employees?	
		21. How many of the company's employees are classified under the single job title which includes the second to the highest number of employees?	

Classification	Definitional Rules	Questions	Coding Rules
Financial size		15. Total annual revenues	
		16. Total annual expenses before taxes	
		17. Total assets	
		18. Total owners' or stockholders' equity	
Division of Labor Elaboration of job titles	These questions are involved with the degree of elaboration of the job structure of the company by means of differences in job titles. For the sake of objectivity, the measurer should in general not look behind the job titles to differences in the actual jobs of employees. The emphasis is on whether the company distinguishes jobs formally rather than whether the occupants of jobs perform different functions. In general, the wording of the job title determines whether it is counted as a separate job title. However, considerable judgement must be used. If job titles with the same wording are on approximately the same authority level, they should be counted as the same title, even if the actual functions of employees in the positions are quite different. If job titles with the same wording are on considerably different authority levels, a significant difference in the scope or scale of responsibilities is indicated and the job titles should be considered different. Job titles should be considered different even if the only difference is reference to a different product, process, or function but should not be considered different if the only difference is reference to a geographical area, company location, sex designation, or work shift. Job titles should be considered the same if the only difference is word order. When an employ- (continued)	19. How many different job titles does the company employ?	
Concentration among job titles		20. How many of the company's employees are classified under the single job title which includes the most employees? 21. How many of the company's employees are classified under the single job title which includes the second to the highest number of employees?	

Classification	Definitional Rules	Questions	Coding Rules
	ee's job is split between two job titles already counted, do not count his job title. Since the purpose of the question is to determine the degree of elaboration of the job structure (horizontal differentiation of jobs) rather than the degree of differentiation of status, seniority, or salary levels (vertical differentiation of jobs), different grades of the same job title should not be considered separate titles. Therefore, ignore the words junior, senior, or other similar prefatory words in job titles unless the titles appear on different authority levels. In that case, the titles should be considered different since a significant difference in the scope or scale of responsibilities is indicated.		
Geographical Dispersion **Differentiation of locations**	Locations are considered separate only if there is land between them not owned or controlled by the company (except a street). Locations for manufacturing, sales, research, general administration, or any other company function should be included. The locations of agencies which operate on a contractual basis with the company and whose staff are not company employees should not be included. The private office of a salesman should not be included even if the rent is paid by the company.	**22. At how many spatially separated locations are company activities carried on or based from?**	**When the raw response to question 22 is 1, score the raw and coded responses to questions 23 and 105 as X.**
Concentration of employees among locations		**23. How many employees are assigned to the location with the highest number of employees?**	When the raw response to question 22 is 1 or 2, score the raw and coded responses to questions 24 and 106 as X.
		24. How many employees are assigned to the location with the second highest number of employees?	
Distance between locations		25. What is the distance in miles between the most distant company locations?	When there is only one location, score the response as 0.
Unit Differentiation **Lowest level**	In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.	26. How many first-line production supervisors (foremen and their equivalents) are there in the company?	
Highest level		27. What is the span of control of the chief executive? Include secretaries but do not include deputies or assistants.	

Classification	Definitional Rules	Questions	Coding Rules
	Units are defined to include only collections of three or more employees with a supervisor	28. How many of the employees who report to the chief executive (or his deputy) head units of at least three employees?	
Unit Specialization Lowest level	When individual first-line production supervisors supervise sets of functions, count the sets, not the functions.	29. How many different production functions are supervised by first-line production supervisors?	Score an answer indicating the company is specialized as 1 and an answer indicating the company is unspecialized as 2. Score intermediate degrees of specialization as decimals between 1 and 2.
Highest level		30. What is the basis for the assignment of responsibilities to the units (divisions) whose heads report to the chief executive (or his deputy)? _____ Products _____ Functions _____ Geography _____ Other, specify _______________	Unspec Spec Unspec When possible, code question 30 as follows. Score each of the units whose heads report to the chief executive or his deputy (question 28) as 1 if it is a functional unit and 2 if it is a product or geographical units. Add the scores and divide by the number of such units (question 28).
	Units are defined to include only collections of three or more employees with a supervisor.	31. How many of the employees who report to the chief executive (or his deputy) head units through which products pass (operating units)?	
	Operating units (as opposed to staff units) are units through which the product passes. They include all production, purchasing, and sales units, etc.	32. How many of the employees who report to the chief executive (or his deputy) head units in which production takes place?	
	Units are defined to include only collections of three or more employees with a supervisor.	33. How many of the above units in which production takes place deliver most of their products to other production units?	When the answer to question 32 is 1, score both questions 33 (raw and coded) and 34 as X.
		34. What proportion of the output (on a dollar basis) of the above production units is typically delivered to other such units for further processing?	
Mechanization Workflow integration		35. Which of the following categories most accurately describes: a. The bulk of the equipment used by the company in its workflow (production) b. The most automatic piece of equipment used by the company in its workflow (ignore thermostatic governors)	

Classification	Definitional Rules	Questions	Bulk Equipment	Most Automatic	Coding Rules
		Handtools and manual machines	0	0	
		Powered machines and tools	1	1	Code tape-controlled machines as 3, automatics which repeat cycles, unless there is evidence that their characteristics differ from those of that category.
		Single-cycle automatics and self-feeding machines	2	2	
		Automatics which repeat cycles	3	3	
		Self-measuring and adjusting by feedback	4	4	
		Computer controlled	5	5	
		(Circle appropriate number in each column.)			
Energy utilization energy expenses		36. Total annual expenses related to nonhuman energy acquisition (coal, oil, electricity, gas, etc.).			
Computerization list		37. What computers does the company have on the premises?			# language programmed computers
computer expense	In addition to computer hardware expense (question 39), include salaries of all company employees, supplies used in connection with, and any other expenses supporting the computer function.	38. Total annual computer expense (including processing and other services purchased from outsiders)			
	Include annual equipment rental and depreciation on all computers and accessory equipment (key punch machines, etc.).	39. Total annual computer hardware expense			
Electric typewriters		40. How many electric typewriters does the company use in its operations?			
Capital-labor mix					
capital equipment per employee		41. Total fixed capital, excluding land 42. Total annual wage and salary expense			
depreciation divided by wage and salary expense	Include depreciation charged to production and depreciation included in various expense categories.	43. Annual financial statement depreciation expense			
capital asset turnover					
CONTROL SYSTEM					
Direct Supervision					
Supervisory ratio		44. How many employees supervise at least two other employees?			

Classification	Definitional Rules	Questions	Coding Rules
First-line span of control	In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.	45. What is the average span of control of all first-line production supervisors (foreman and their equivalents)?	
	Include all employees on the level where most of the nonsupervisory employees are located (some supervisors may be on this level) and all employees on levels below the level where most nonsupervisory employees are located. For example, production workers in the manufacturing division may be on the fifth level while the lowest-level employees in the quality control department, assigned to the manufacturing division, may be on the sixth level. For this example, include the lowest-level employeer in the quality control department and their supervisors with the other fifth and lower-than-fifth level employees. Operating units (as opposed to staff units) are units through which the product passes. They include all production, purchasing, and sales units, etc.	46. What is the total number of people on the lowest authority level of each operating division?	
	Include all employees on the level which is numbered one less than the number of the level where most of the nonsupervisory employees are located. Some of these employees may not be first-line supervisors and some may be nonsupervisory employees. For example, production workers in the manufacturing division may be on the fifth level while the (continued)	47. What is the total number of people on the level immediately above the lowest authority level of each operating division?	

Classification	Definitional Rules	Questions	Coding Rules
	lowest-level employees in the safety department, assigned to the manufacturing division, may be on the fourth level. For this example, include the lowest-level employees in the safety department (even though they are not first-line supervisors) with the other fourth-level employees.		
Staff Support of Line Staff ratio	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	48. How many employees ordinarily work directly on the product of the company, performing a production function (direct labor employees?	
Differentiation of staff functions		49. For which of the following staff functions does the company have at least one employee whose principle duty is that function? ____ Personnel ____ Engineering ____ Finance ____ Data processing ____ Planning ____ Research and development ____ Employee relations ____ Public relations ____ Environmental affairs ____ Legal affairr number checked	When the same individual is checked for more than one staff function, include only one of his functions in the total number of staff functions for which the company has at least one employee whose principle duty is that function. Include only functions performed by company employees. Do not include functions performed by members of the board of directors (unless they also hold other positions in the company) or independent agents, such as lawyers, CPA's, etc. Check the space for planning only if the company has at least one employee whose principle duty is long-range planning. Do not check the planning space for specialists in production scheduling. Check the space for research and development if the company has at least one employee whose principle duty is either manufacturing technology or market research.
Clerical ratio	Clerical jobs include any involved with routine record keeping, record filing, correspondence, and the operation of machines designed to accomplish these functions. The best way to delineate the term clerical jobs is the listing of titles which have been included and some borderline titles which have been excluded. Included: any title with the word clerk, stenographer, or variations thereof in it; accounting clerk; secretary; executive secretary; order processor; varitypist; switchboard operator; telephone operator; console operator; key punch operator Excluded: generally any supervisor; draftsman; estimator; timekeeper; accountant; corporate secretary; order analyst; administrative assistant; messenger	50. How many employees have predominantly clerical jobs?	

Classification	**Definitional Rules**	**Questions**	**Coding Rules**
	In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.		
Authority Levels	Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level. When summing the number of authority levels, count as a separate level workers at the bottom of the heirarchy (who have no authority over others). Count the number of levels through each division down to the level where most nonsupervisory employees in the division are located.	51. How many levels of authority are there between the chief executive and lowest-level employees (inclusive)? Most (deepest division) Average (of all divisions)	
Education and Experience of Personnel Formal education lowest level	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	52. How many years of formal education are normally required of entering direct labor employees?	
highest level	Years of formal education are counted from elementary school (excluding kindergarten) onward. A high school graduate is considered to have 12 years of formal education and a person with a B.A. or equivalent degree is considered to have 16 years of formal education.	53. What is the average number of years of formal education of the employees who report to the chief executive (or his deputy)?	
overall		54. How many employees have B.A. or equivalent degrees?	
Training	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	55. How many weeks (full time equivalent) of formal training (not including on the job training) within the company do direct labor employees normally receive during their first year of employment?	

Classification	Definitional Rules	Questions	Coding Rules
Experience lowest level		56. What is the average number of years that direct labor employees have been employed by the company?	
highest level		57. What is the average number of years that employees who report to the chief executive (or his deputy) have been employed by the company?	
Salary lowest level	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function. Include in the cost of fringe benefits those required by law, such as payroll taxes, those required by (union) contract, and those voluntarily but normally paid by the company. Include vacation pay in average annual salary without fringe benefits or bonus, not "average annual cost fringe benefits per employee."	58. What is the average annual salary of direct labor employees? Without Fringe Benefits ____ Average Annual Cost Fringe Benefits per Employee ____	Annual wages (called salaries in these questions) should be stated for the normal amount of hours worked, including overtime. Hourly rates should be adjusted to reflect the proportion of overtime worked.
highest level	Answer this question for the employees in question 28, those who report to the chief executive and head units of at least three employees.	59. What is the average annual salary of employees who report to the chief executive? Without Fringe Benefits or Bonus ____ Average Annual Cost Fringe Benefits per Employee ____ Typical Bonus ____	
average			
Staff benefits lowest level			
highest level			
Centralization of Authority Concentration of compensation		60. How much wages and salaries are paid to the most highly paid ____ % of the employees? Employees % # ____ Wages and Salaries ____ 1 2 25 $ % 14	Wages and salaries should be stated on the same basis as total annual wages and salaries (question 42). If bonuses and/or fringe benefits are included in total annual wages and salaries, they should be included for the top so many employees.

Classification	Definitional Rules	Questions	Coding Rules
Investment authority	In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.	61. What is the lowest authority level (counting down from the chief executive) which can approve investment expenditures under: Investment — Lowest Level $ 100 ____ $ 1,000 ____ $10,000 ____	
		62. Total capital expenditures during past year ____	
	Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.	63. What is the lowest authority level (counting down from the chief executive) which can approve investment expenditures under ____ % of the investment budget? Budget % — Investment — Lowest Level 1 5 25	Budget % X 62
Pricing authority		64. What is the lowest authority level (counting down from the chief executive) which can approve price changes? ____	
Purchasing authority	These questions refer to approval of purchases for current requirements. Do not consider special purchases of items not ordinarily purchased.	65. What is the lowest authority level (counting down from the chief executive) which can approve purchases of materials under: Purchase — Lowest Level $ 100 ____ $ 1,000 ____ $10,000 ____	
		66. Total annual cost of materials ____	Exclude from cost of materials items bought and sold but not processed by the company.

Classification	Definitional Rules	Questions		Coding Rules
	In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.	67. What is the lowest authority level (counting down from the chief executive) which can approve purchases of materials and supplies under ____% of total annual materials cost? Lowest Level ______ Cost % Purchase 1 5 25	Cost % X 66	
Budget participation	Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level. These questions refer to approval of purchases for current requirements. Do not consider special purchases of items not ordinarily purchased.	68. How many of the employees who report to the chief executive (or his deputy) and head units of at least three employees submit budget proposals for their units?		
	Units are defined to include only collections of three or more employees with a supervisor.	69. Do employees below the employees who report to the chief executive (or his deputy) and head units of at least three employees participate in the budget-setting process? ____ Yes ____ No	Decen Cen	Score an answer indicating the company is standardized as 1 and an answer indicating the company is not standardized as 2. Score intermediate degrees of standardization as decimals between 1 and 2.
Standardization of Procedures Procedures manual		70. Does the company have a manual of procedures? ____ Yes ____ No	Stand Unstand	When personnel procedures are included in the general manual of procedures, score question 71 as the total number of pages in the manual, question 74 as the number of pages involved with personnel matters, and question 73 as yes.
	When there are more than one manuals, sum the pages in all of them.	71. How many pages are in the manual of procedures?		
		72. How many words are on an average page of the procedures manual(s)?		When the answer to question 70 is no, score the raw response 71 and the coded response 72 as 0 and score the raw response 72 as X.

Classification	Definitional Rules	Questions	Coding Rules
Personnel procedures manual		73. Does the company have a manual of personnel procedures? _____ Yes Stand _____ No Unstand	Score an answer indicating the company is standardized as 1 and an answer indicating the company is not standardized as 2. Score intermediate degrees of standardization as decimals between 1 and 2.
	When there are more than one manuals, sum the pages in all of them.	74. How many pages are in the manual of personnel procedures?	
		75. How many words are on an average page of the personnel procedures manual(s)?	When personnel procedures are included in the manual of procedures, score question 71 as the total number of pages in the manual, question 74 as the number of pages involved with personnel matters, and question 73 as yes.
Personnel rating		76. Does the company have a standardized personnel rating form? _____ Yes Stand _____ No Unstand	
		77. Are direct labor employees rated at regular intervals? _____ Yes Stand _____ No Unstand	When the answer to question 73 is no, score the raw response 74 and the coded response 75 as 0 and score the raw response 75 as X.
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	78. With what frequency are direct labor employees rated?	Score the answer to question 78 the number of weeks between regular ratings. When employees are not rated regularly, score the answer X.
Employment contracts		79. How many employees are covered by written contracts of employment?	
		80. How many of the direct labor employees are covered by written contracts of employment?	
Unionization	When different locals of the same union negotiate separately with different units of the company and there is no union-wide negotiation, count each separate negotiation as a union.	81. With how many unions does the company negotiate collective bargaining agreements?	

Classification	Definitional Rules	Questions		Coding Rules
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	82. How many company employees are members of unions? 83. How many direct labor employees are members of unions?		
Information booklets	Information booklets is defined to include any written information about the company or its employee benefit plans. A copy of the union contract or the annual report qualifies as an information booklet. The information must be formally distributed to individual employees as a matter of company policy rather than just being made available.	84. To how many employees are information booklets given?		
Organization charts		85. How many employees are given an organization chart?		
Job descriptions		86. For how many employees are there written job descriptions?		
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	87. For how many direct labor employees are there written job descriptions?		
Policies		88. Does the company have written policies? _____ Yes _____ No	 Stand Unstand	Score an answer indicating the company is standardized as 1 and an answer indicating the company is not standardized as 2. Score intermediate degrees of standardization as decimals between 1 and 2.
Production schedule		89. Does the company have a production schedule? _____ Yes _____ No	 Stand Unstand	
Salary grades	Interpret question 90 as the average number of salary grades for the direct labor job titles.	90. How many salary grades are there for direct labor employees?		
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	91. What is the basis for salary increases for direct labor employees? _____ Predominantly seniority _____ Predominantly merit _____ Predominantly negotiation _____ Other, specify _______________	 Stand Unstand Stand	
Forms control	Generally a system of forms control entails having most company forms standardized and requiring the authorization of all new forms. It might but need not entail controlled access to forms and controlled usage of them through prenumbering.	92. Does the company have a system of forms control? _____ Yes _____ No	 Stand Unstand	

Classification	Definitional Rules	Questions		Coding Rules
		82. How many company employees are members of unions?		
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	83. How many direct labor employees are members of unions?		
Information booklets	Information booklets is defined to include any written information about the company or its employee benefit plans. A copy of the union contract or the annual report qualifies as an information booklet. The information must be formally distributed to individual employees as a matter of company policy rather than just being made available.	84. To how many employees are information booklets given?		
Organization charts		85. How many employees are given an organization chart?		
Job descriptions		86. For how many employees are there written job descriptions?		
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	87. For how many direct labor employees are there written job descriptions?		
Policies		88. Does the company have written policies? _____ Yes _____ No	 Stand Unstand	Score an answer indicating the company is standardized as 1 and an answer indicating the company is not standardized as 2. Score intermediate degrees of standardization as decimals between 1 and 2.
Production schedule		89. Does the company have a production schedule? _____ Yes _____ No	 Stand Unstand	
Salary grades	Interpret question 90 as the average number of salary grades for the direct labor job titles.	90. How many salary grades are there for direct labor employees?		
	Direct labor employees are employees who spend most of their time working directly on the product, performing a production function.	91. What is the basis for salary increases for direct labor employees? _____ Predominantly seniority _____ Predominantly merit _____ Predominantly negotiation _____ Other, specify _____________	 Stand Unstand Stand	
Forms control	Generally a system of forms control entails having most company forms standardized and requiring the authorization of all new forms. It might but need not entail controlled access to forms and controlled usage of them through prenumbering.	92. Does the company have a system of forms control? _____ Yes _____ No	 Stand Unstand	

Classification	Definitional Rules	Questions	Coding Rules
Time and motion studies		93. How often does the company utilize time and motion studies? _____ Frequently _____ Sometimes _____ Seldom _____ Never	Stand Unstand
ACCOUNTING CONTROL SUBSYSTEM Size Proportion employees in controllership departments	Include as employees assigned to controllership units all employees (regardless of whether they have accounting or finance jobs) of the unit headed by the chief financial officer (as defined in specific definitional rule 111,132,136, 138), all employees of other controllership units (as defined in general definitional rule 6), and all other employees with accounting or finance jobs (see specific definitional rule 99).	94. How many employees are assigned to controllership units?	
Proportion employees receiving reports		95. How many employees ordinarily receive cost, profit and loss, or budget reports of any kind?	
Financial data accumulation centers	Financial data accumulation centers are ways in which the company accumulates costs and/or revenues. They always include the balances of more than one cost or revenue account. Do not ever count only one account as a financial data accumulation center. Consider as separate financial data accumulation centers different levels of aggregation of the same costs and/or revenues. Do not consider as separate financial data accumulation centers different reports presented for the same center. For example, cash flow, contribution, cost, and revenue reports may be prepared for the same divisional financial data accumulation center. Financial data accumulation centers may be broken down in two ways: by function and by financial items included. The functional breakdown separates out responsibility centers, product centers, and centers accumulating costs and/or revenues for other purposes. Costs and/or revenues for which a specific individual is held responsible are accumulated in responsibility centers. Costs and/or revenues for a product or product line, for which no one individual is held responsible, are accumulated in product (continued)	96. For how many financial data accumulation centers are costs and/or revenues accumulated?	

Classification | **Definitional Rules** | **Questions** | **Coding Rules**

Report frequency

centers (including job or contract centers; see specific definitional rule 114). The breakdown by financial items included separates out cost, revenue, profit, and contribution centers. Only costs are accumulated for cost centers; only revenues for revenue centers; and both costs and revenues are accumulated for profit and contribution centers.

For all companies which prepare company-wide financial statements, the company-wide way of accumulating costs and revenues is considered one financial data accumulation center. Company-wide financial data accumulated for a unit should be counted as one additional financial data accumulation center, regardless of how many ways that data is classified in different reports. For example, count as one financial data accumulation center a set of reports on company-wide sales, broken down by customer, geographical area, or product line. But count as separate financial data accumulation centers separate reports on sales made by different sales units.

97. What is the minimum frequency with which cost or profit and loss reports for their respective areas of responsibility are presented to:

	Frequency					
	Not Presented	Yearly	Monthly	Weekly	Daily	Other
Top management	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Middle management	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
First-line supervisors	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

For answers involving frequency or the length of time periods, score the answer the number of days in the time period. If reports are issued daily, score the answer 1; if reports are issued weekly, score the answer 7; if reports are issued monthly, score the answer 30; and if reports are issued yearly, score the answer 365. If reports are not issued, score the answer X.

For the two coded responses 97, score the first the average of the frequencies for the levels to which cost or profit and loss reports are presented and the second the number of the three levels listed to which cost or profit and loss reports with any frequency are presented.

Expenses

Include as expenses of all controllership units and activities all expenses of the unit headed by the chief financial officer (as defined in specific definitional rule 111,132,136,138), all expenses of other controllership units (as defined in general definitional rule 6), and the salaries of all employees with accounting or finance jobs not assigned to the above units. Include all direct expenses of the units, such as salaries, supplies, and depreciation of controllership equipment, and whatever indirect (allocated) expenses are normally charged to the units, such as depreciation of building. When the company does not accumulate expenses for the controllership units, an estimate should be made of only the direct expenses of those units.

98. Total expenses of all controllership units and activities

Classification

Structural
  Complexity
  Division of labor
    elaboration of
      job titles
    concentration
      among job
      titles

Definitional Rules

These questions are involved with the degree of elaboration of the job structure of the company by means of differences in job titles. For the sake of objectivity, the measurer should in general not look behind the job titles to differences in the actual jobs of employees. The emphasis is on whether the company distinguishes jobs formally rather than whether the occupants of jobs perform different functions. In general, the wording of the job title determines whether it is counted as a separate job title. However, considerable judgement must be used. If job titles with the same wording are on approximately the same authority level, they should be counted as the same title, even if the actual functions of employees in the positions are quite different. If job titles with the same wording are on considerably different authority levels, a significant difference in the scope or scale of responsibilities is indicated and the job titles should be considered different. Job titles should be considered different even if the only difference is reference to a different product, process, or function but should not be considered different if the only difference is reference to a geographical area, company location, sex designation, or work shift. Job titles should be considered the same if the only difference is word order. When an employee's job is split between two job title already counted, do not count his job title. Since the purpose of the question is to determine the degree of elaboration of the job structure (horizontal differentiation of jobs) rather than the degree of differentiation of status, seniority, or salary levels (vertical differentiation of jobs), different grades of the same job title should not be considered separate titles. Therefore, ignore the words junior, senior, or other similar prefatory words in job titles unless the titles appear on different authority levels. In that case, the titles should be considered different since a significant difference in the scope or scale of responsibilities is indicated.

Include the job titles of all the employees included in the answer to question 94, those of the unit headed by the chief financial officer (as defined in specific definitional rule 111,132, 136,138), those of other controllership units (as defined in general definitional rule 6), and those of other employees with accounting or finance jobs. Accounting and finance jobs generally are involved with the recording, processing, interpretation, and dissemination of financial information. The best way to delineate the term accounting and finance jobs is the listing of titles which have been included and some borderline titles which have been excluded.

Questions

99. How many different job titles are assigned to controllership units?

100. How many of the employees of the controllership units are classified under the single job title which includes the most employees of controllership units?

101. How many of the employees of the controllership units are classified under the single job title which includes the second to the highest number of employees of controllership units?

Coding Rules

Included	Excluded
VP--Finance Any title with the words controller, accountant, or bookkeeper in it	VP--Finance and Administration Purchasing titles (unless they are the only other titles in a department with a majority of nonpurchasing accounting and finance jobs)

Classification	Definitional Rules	Questions	Coding Rules
Geographical dispersion differentiation of locations proportion locations with controllership concentration of employees among locations	Locations are considered separate only if there is land between them not owned or controlled by the company (except a street). Locations for manufacturing, sales, research, general administration, or any other company function should be included. The locations of agencies which operate on a contractural basis with the company and whose staff are not company employees should not be included. The private office of a salesman should not be included even if rent is paid by the company.	102. At how many of the spatially separated company locations are controllership personnel located?	
		103. How many of the controllership employees are assigned to the company location with the highest number of controllership employees?	When the raw response to question 102 is 0 or 1, score the raw and coded responses to question 103 as X.
		104. How many of the controllership employees are assigned to the company location with the second highest number of controllership employees?	When the raw response to question 102 is 0, 1, or 2, score the raw and coded responses to question 104 as X.
		105. How many of the controllership employees are assigned to the company location with the highest number of company employees?	When the raw response to question 22 is 1, score the raw and coded responses to questions 23 and 105 as X. When the two company locations with the highest numbers of company employees (questions 23 and 24) have the same number of employees, score questions 105 and 106 both as the average number of controllership employees at the two locations.
		106. How many of the controllership employees are assigned to the company location with the second highest number of company employees?	When the raw response to question 22 is 1 or 2, score the raw and coded responses to questions 24 and 106 as X.
distance between locations	A controllership unit is defined as at least three nonsupervisory employees with accounting or finance jobs (see specific definitional rule 99,100,101) and an accounting or finance supervisor.	107. What is the distance in miles between the most distant company locations where controllership units are located?	When there is only one location, score the response as 0.

Classification

Unit differentiation

Authority levels

Definitional Rules

A lowest-level controllership unit is a special type of controllership unit (general definitional rule 6). The nonsupervisory employees must be on the level where the largest number of such employees are located or below that level. The supervisors must be on the level immediately above the level of the largest number of nonsupervisory employees. For the purpose of these questions, any supervisors below the level above the level of the largest number of nonsupervisory employees is treated as a nonsupervisory employee. Also, all employees on levels below the level of the largest number of nonsupervisory employees are treated as being on that level. In simple terms, the structure is collapsed up to its widest point. If some lowest-level controllership groupings do not qualify as controllership units solely because controllership supervisors do not have 3 controllership subordinates, count as an additional lowest-level controllership unit all the nonsupervisory employees (if three or more) in these groupings and the supervisor to whom the grouping supervisors report. In other words, create an artificial unit with supervisors on the third level up from the level of the largest number of nonsupervisory controllership employees. Consider only controllership employees in a direct authority line to the chief financial officer (as defined in specific definitional rule 111,132,136,138). The authority line to the chief financial officer should not have divided responsibility (as mentioned in question 126) with any nonfinancial personnel. In general, these lower-level

Questions

108. How many lowest-level controllership units are there in the company?

109. At what authority level are the lowest-level personnel in these lowest-level controllership units?

110. What is the lowest authority level where employees whose primary function is controllership are located? This level might be lower than that in question 109 if controllership employees are attached to operating units.

controllership units will be broken down functionally. But if they are broken down by segment or organizational unit for which they perform controllership activities, their heads should not report to the heads of those nonfinancial units, even partially.

In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.

Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.

Coding Rules

If the chief financial officer or highest controllership employee heads the only controllership unit in the company, score the answer to question 108 as 1 and the answer to question 109 as the number of the level immediately below the chief financial officer or highest controllership employee. If no unit qualifies as a controllership unit, score the answer to question 108 as 0 and the answer to question 109 as X.

Classification

System Complexity
Report
differentiation

Definitional Rules

The chief financial officer or highest controllership employee is considered to be the highest company official whose primary duties are finance and accounting. General administration and other nonfinancial areas should not constitute a predominant part of his job but data processing may be under his jurisdiction and may constitute a predominant part of his job as long as finance and accounting make up the rest of his job. For example, a vice-president in charge of administration and finance would not generally be considered the chief financial officer. If one of his subordinates were the controller, the controller would be considered the chief financial officer.

In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.

Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.

Do not count forecasting as budgeting.

Questions

111. At what authority level is the chief financial officer?

112. Which of the following types of information are provided to the indicated levels in formal reports?

Type of Report	Top Mgt	Mid Mgt	1st Line Super
Budgeted segment costs	[ ]	[ ]	[ ]
Budgeted segment profits	[ ]	[ ]	[ ]
Flexible budgets	[ ]	[ ]	[ ]
Variances from segment budget:			
volume or capacity	[ ]	[ ]	[ ]
price or rate	[ ]	[ ]	[ ]
efficiency, usage or mix	[ ]	[ ]	[ ]
Multi-year segment profit or cost summaries	[ ]	[ ]	[ ]
Employee turnover	[ ]	[ ]	[ ]
Quality control	[ ]	[ ]	[ ]
Product profitability	[ ]	[ ]	[ ]
Exception reports	[ ]	[ ]	[ ]
On call reports	[ ]	[ ]	[ ]

Coding Rules

Total Number Checked for Columns

When an overall variance (not broken into volume or capacity; price or rate; or efficiency, usage, or mix variances) from budget is calculated, score one check.

Classification	Definitional Rules	Questions	Coding Rules
Proprotion profit centers	Include both contribution centers and profit centers. In other words, the question is about the number of financial data accumulation centers for which both revenues and costs are accumulated.	113. For how many profit centers are costs and revenues accumulated?	
Proportion product centers	In order to be counted as a product center, as opposed to some other functional type of center, the center must accumulate at least some costs and revenues for a product or product line. Do not count as product centers either separate product revenues listed in sales analyses by products or separate product costs listed in manufacturing reports by product. A product center must not correspond to some other functional type of center, such as a responsibility center. Thus product centers must either overlap the units of the company or be more finely broken down than they are. Do not count responsibility centers as product centers, even if the responsibility centers accumulate costs and revenues for a product or product line. Consider job order or contract reporting as product line reporting. The typical number of jobs in progress at any one time, for which costs and revenues are accumulated, is included in the number of product centers.	114. For how many product centers are costs and revenues accumulated?	
Decentralization of accounts cost reports		115. To which of the following authority levels are statements of costs but not revenues presented? [ ] 2nd level [ ] 5th level [ ] 3rd level [ ] 6th level [ ] 4th level [ ] 7th level Insert NA when level does not exist in company. Lowest Level 115	Score the answers to questions 115 and 116 the number of the lowest level checked. When no level is checked, score the answer 1.
profit and loss reports	Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.	116. To which of the following authority levels are profit and loss reports typically presented? [ ] 2nd level [ ] 5th level [ ] 3rd level [ ] 6th level [ ] 4th level [ ] 7th level Insert NA when level does not exist in company. Lowest Level 116	

Classification	Definitional Rules	Questions	Coding Rules
Accounting Techniques Standard costs	Standard costs need not be incorporated in the general ledger. Consider an applied overhead rate as standard costs based on historical costs (1) unless it is an engineering-based optimum capacity rate and total overhead costs are estimated based on a technical engineering study, in which case consider an applied overhead rate as standard costs based on a technical engineering study (2).	117. On which of the following bases are standard costs typically developed for the following cost elements? 0. Standard costs not developed 1. Historical costs 2. Technical engineering study *. Other, specify ______ 0 1 2 * Materials cost [ ] [ ] [ ] [ ] Labor cost [ ] [ ] [ ] [ ] Overhead cost [ ] [ ] [ ] [ ] (Check only one basis for each cost element.)	For coded response 117, sum the scores for the three cost elements and divide by 3.
Fixed and variable costs		118. Are costs separated into fixed and variable components: [ ] on a company-wide basis [ ] for product lines [ ] for organizational units	For coded responses 118 and 119, sum the scores for the three parts. Score 2 for company-wide basis and 1 each for product lines and organizational units.
Breakeven points		119. Are breakeven points calculated: [ ] on a company-wide basis [ ] for product lines [ ] for organizational units	
Cost-volume-profit	Consider all elementary methods as graphical methods and all sophisticated methods as mathematical methods. Elementary methods include judgemental classification of the accounts into fixed and variable categories, drawing a line by sight on a scatter diagram, high-low method, etc. Sophisticated methods include regression analysis, etc.	120. On which basis are cost-volume-profit relationships calculated? (Elaborate.) [ ] graphical [ ] mathematical [ ] other basis, specify ______ [ ] do not calculate cost-volume profit relationships	For coded response 120, score graphical methods as 1, mathematical methods as 2, and cost-volume-profit relationships not calculated as 0. When both graphical and mathematical methods are used, score the response as mathematical methods, 2.
Budgeting		121. Which items are budgeted at least one year in advance on a company-wide basis? [ ] all revenues [ ] all expenses [ ] operating revenues [ ] operating expenses [ ] some operating revenues [ ] some operating expenses [ ] do not budget	For coded response 121, sum the scores for the different choices. Score all revenues and all expenses as 3, operating revenues and operating expenses as 2, some operating revenues and some operating expenses as 1, and do not budget as 0.

Classification	Definitional Rules	Questions	Coding Rules
Capital budgeting		**122. What information is developed for decisions on major capital projects:** ☐ payback period ☐ accounting rate of return ☐ net present value ☐ internal rate of return ☐ other, specify ____________ ☐ no information developed	**For coded response 122, score payback period and accounting rate of return 1, net present value and internal rate of return 2, and no information developed 0. When more than one choice is checked, score the highest numbered response.**
Controllable and noncontrollable	**Interpret lower-level responsibility reports to include responsibility reports for any segment of the company's operation but not for the company as a whole.** In general, deputies or assistants to officials are considered to occupy the same position as the official. Thus deputies or assistants are not considered separate levels in calculating the number of authority levels, or subordinates in calculating the span of control of the official. Employees who report to the deputy or assistant are included in the official's span of control.	123. Do lower-level responsibility reports **generally include** expenses or revenues **not controllable by the** manager for whom the report is prepared? ☐ yes ☐ no 124. If so, are controllable **expenses and revenues segregated from** noncontrollable **expenses and revenues in** these lower-level responsibility reports? ☐ yes ☐ no ☐ not applicable	When the answer to question 123 is no, score 124 as X. When there are no lower-level responsibility reports, score the answers to questions 123 and 124 as X.
Centralization of Authority **Reliance on central controller's department**	Authority levels are numbered down from the chief executive who is defined to be on the first authority level. For example, a vice-president who reports to the chief executive (or his deputy) is on the second authority level.	**125. At what authority level are the heads of the highest set of controllership units below the central controller's unit?**	When there are no qualifying controllership units (see specific definitional rule), score the raw response 125 as the answer to question 51 and the raw and coded responses to question 126 as X.
Reporting responsibility of division controller	These controllership units are a special type of controllership unit (general definitional rule 6) which is primarily responsible for controllership activities of some segment of the company but not the company as a whole.	**126. To whom do the heads of these controllership units which are below the central controller's unit report?** ☐ higher-level controllership personnel — **Cent** ☐ operating management — **Decent** ☐ divided between higher-level controllership personnel and operating management ☐ other, specify ____________	Score an answer indicating the company is centralized as 1 and an answer indicating the company is decentralized as 2. Score intermediate degees of centralization as decimals between 1 and 2. Score the choices: Choice (Raw) — Score (Coded) 1 — 1 2 — 2 3 — 1.5 4 — as applicable

Classification	Definitional Rules	Questions	Coding Rules
Mechanization Computerization	Consider only computer time of computers located on the premises of the company. A controllership unit is defined as at least three nonsupervisory employees with accounting or finance jobs (see specific definitional rule 99,100,101) and an accounting or finance supervisor.	127. What is the proportion of all computer time utilized by the company devoted to controllership units' activities?	When the company does not have any computers, score question 127 as X.
		128. Which of the following financial activities are performed, at least in part, on a computer? [ ] payroll [ ] billing and receivables [ ] disbursements and payables [ ] inventory [ ] cost accounting [ ] general ledger [ ] budget accounting [ ] internal audit	Total Number Checked
Report automation	These should be end-use reports rather than intermediate accumulations of data from which the end-use reports will be assembled.	129. What proportion of the standardized reports produced by the company for internal purposes are printed out automatically, as the result of some mechanical or electronic process?	
Capital-labor mix	Include the salaries of all employees included in the answer to question 94 (see specific definitional rule).	130. Wages and salaries paid to employees assigned to all controllership units	
Education and Experience of Personnel Formal education lowest level	Years of formal education are counted from elementary school (excluding kindergarten) onward. A high school graduate is considered to have 12 years of formal education and a person with a B.A. or equivalent degree is considered to have 16 years of formal education.	131. How many years of formal education are normally required of the lowest-level controllership employees (cost accountants, etc.)?	
highest level	The chief financial officer or highest controllership employee is considered to be the highest company official whose primary duties are finance and accounting. General administration and other nonfinancial areas should not constitute a predominant part of his job but data processing may be under his jurisdiction and may constitute a predominant part of	132. How many years of formal education does the highest controllership employee (controller, chief accountant, chief financial officer, treasurer) have?	

Classification	Definitional Rules	Questions	Coding Rules
	his job as long as finance and accounting make up the rest of his job. For example, a vice president in charge of administration and finance would not generally be considered the chief financial officer. If one of his subordinates were the controller, the controller would be considered the chief financial officer.		
overall	Count the B.A. and equivalent degrees for all the employees included in the answer to question 94 (see specific definitional rule).	**133. How many of the employees who are assigned to controllership units have B.A. or equivalent degrees?**	
Training	The chief financial officer or highest controllership employee is considered to be the highest company official whose primary duties are finance and accounting. General administration and other nonfinancial areas should not constitute a predominant part of his job but data processing may be under his jurisdiction and may constitute a predominant part of his job as long as finance and accounting make up the rest of his job. For example, a vice-president in charge of administration and finance would not generally be considered the chief financial officer. If one of his subordinates were the controller, the controller would be considered the chief financial officer.	134. How many weeks (full time equivalent) of formal training (not including on the job training) within the company do the lowest-level controllership employees (cost accountants, etc.) normally receive during their first year of employment?	
Experience **lowest level**		135. What is the average number of years that the lowest-level controllership employees (cost accountants, etc.) have been employed by the company?	
highest level		136. How many years has the highest controllership employee (controller, chief accountant, chief financial officer, treasurer) been employed by the company?	
Salary **lowest level**	Include in the cost of fringe benefits those required by law, such as payroll taxes, those required by (union) contract, and those voluntarily but normally paid by the company. Include vaca- (continued)	137. What is the average annual salary of the lowest-level controllership employees (cost accountants, etc.)? Without Fringe Benefits ____ Average Annual Cost Fringe Benefits per Employee ____	**Annual wages (called salaries in these questions) should be stated** for the normal amount of hours worked, including overtime. Hourly rates should be adjusted to reflect the proportion of overtime hours worked.

Classification	Definitional Rules	Questions	Coding Rules
highest level	tion pay in average annual salary without fringe benefits or bonus, not "average annual cost fringe benefits per employee."	138. What is the annual salary of the highest controllership employee (controller, chief accountant, chief financial officer, treasurer)? Without Fringe Benefits or Bonus ______ Average Annual Cost Fringe Benefits per Employee ______ Typical Bonus ______	
	The chief financial officer or highest controllership employee is considered to be the highest company official whose primary duties are finance and accounting. General administration and other nonfinancial areas should not constitute a predominant part of his job but data processing may be under his jurisdiction and may constitute a predominant part of his job as long as finance and accounting make up the rest of his job. For example, a vice-president in charge of administration and finance would not generally be considered the chief financial officer. If one of his subordinates were the controller, the controller would be considered the chief financial officer.		
average			
Staff benefits			
lowest level			
highest level			

APPENDIX B

INTERPRETATION OF COMPONENTS

APPENDIX B

INTERPRETATION OF COMPONENTS

The four sections of Appendix B analyze the meaning and other characteristics of each variable in the dissertation. The variables are measured by component scores and henceforth are referred to as components.[1] Each component's properties are first summarized in the following format:

Component name:	....
Eigenvalue:	...
Percent variance explained:[2]	...
Direction:[3]	positive or negative
Consistency:[4]	...
Number of measurements:	...

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[1] See pages 72-89 for a step-by-step description of the way components are derived.

[2] Eigenvalue and percent variance explained are discussed on pages 77-80. Their values for the components in the dissertation are listed in Table 4, page 74.

[3] The direction of a component may be either positive or negative and is the way the component varies with the variable it measures. If high component scores indicate large amounts of the variable, the component was defined to be positive. If low component scores indicate large amounts of the variable, the component was defined to be negative. The direction of the components was determined on the basis of the signs of the component loadings of the high-loading measurements. If most of such loadings were negative the component was determined to be negative, but if most of such loadings were positive the component was determined to be positive. In other words, if most of the more significant measurements increase as the component increases, the component is positive. If most of the more significant measurements decrease as the component increases, the component is negative. Negative components are not defective in any way, but their associations with other components must be reversed in the interpetation phase of the study.

[4] Consistency is the proportion of the component loadings on a component which have the same sign as the majority of such loadings. If

Next, information on the component loadings[1] of the measurements incorporated in the respective components is presented in this format:

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
......	....	....
......	....	....
......	....	....

Large loadings which will be used to refine the meaning of components are italicized. A dagger (†) beside a measurement name indicates a measurement which varies in the direction opposite to that of the concept of interest. The loadings for such measurements must be interpreted as having the sign opposite to that listed. An asterisk (*) next to a loading indicates a loading with a sign that is inconsistent (taking into account daggers) with the direction of its component. Following the tabular information just described, the components are analyzed in narrative form.

Process Components

Component name:	Process sophistication
Eigenvalue:	3.5
Percent variance explained:	50.5
Direction:	positive
Consistency:	85
Number of measurements:	7

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all of the measurement loadings have the same sign, the component is 100 percent consistent. Even if the loadings are negative, the component is still 100 percent consistent since the component has negative direction. Consistency can therefore never be less than 50 percent. The average consistency of the components isolated in this study is 83 percent.

[1] The nature of component loadings is discussed on pages 79-81. All the component loadings used in the dissertation are assembled in Table 20, pages 293-99.

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.97	R4	SELLING PRICE
0.90	R5	MATERIALS COST
0.97	C5A	R4-R5 (value added)
0.40	C5B	(R4-R5)/R4 (proportion value added)
-0.29*	C6	R6/R4 (research emphasis)
0.01	C7	R6/R7 (research emphasis)
0.78	R8	PRODUCTION CYCLE-length

With an eigenvalue of 3.5, this component is a fairly good explainer of the original measurements. It has positive direction and is fairly consistent. Only one of the seven original measurements, research expenses divided by selling price, varies in the wrong direction, and that is explainable by the fact that selling price, a high positive-loading measurement, is in the denominator of the inconsistent measurement.

The highest loading measurements are selling price and value added. The length of the production cycle is also fairly highly loaded. The lack of any strong association with current research expenditures is surprising and indicates that the component is very production-oriented.

Component name: Process-output diversity
Eigenvalue: 1.3
Percent variance explained: 65.2
Direction negative
Consistency: 100
Number of measurements: 2

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.81	R9	NUMBER PRODUCTS
-0.81	R10	NUMBER CUSTOMERS

"Process-output diversity" is a poor explainer of the two measurements, number of products and number of customers, with an eigenvalue of only 1.3. It is a 100 percent consistent negative component and is equally loaded on the two measurements, number of products and number of customers.

Overall Structural Complexity Components

Component name: Company size
Eigenvalue: 5.6
Percent variance explained: 93.9
Direction: negative
Consistency: 100
Number of measurements: 6

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.95	R12	NUMBER EMPLOYEES NOW
-0.96	R14	NUMBER EMPLOYEES AVERAGE
-0.99	R15	REVENUES
-0.98	R16	EXPENSES
-0.98	R17	ASSETS
-0.95	R18	EQUITY

"Company size" is one of the best explainers of the original measurements in the study, having an eigenvalue of 5.6. It is a 100 percent consistent negative component. All of the loadings on the original measurements are above 0.95. The financial measures of size are highly consistent with the employee measures of size for this sample of companies.

Component name: Company job structure complexity
Eigenvalue: 2.1
Percent variance explained: 71.4
Direction negative
Consistency: 33-100
Number of measurements: 3

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.80	C19	R19/R14 (elaboration of job titles)
-0.82	C20	(R20/R14)/(1/R19) (employee job concentration)
-0.92	C21	(R21/[R14-R20])/(1/[R19-1]) (employee job concentration)

"Company job structure complexity" is a below-average explainer of its original measurements, with an eigenvalue of 2.1. It is most heavily loaded on the measures of employee job concentration (inequality of numbers of employees in different jobs) but has a significant loading on elaboration of job titles. Conceptually, division of labor is most closely related to elaboration of jobs rather than concentration of employees in jobs. Consequently, the definition of the component should be modified to "complexity of the job structure." In this sample of companies, the concentration of employees in a few jobs increases as the number of jobs increases.

"Company job structure complexity" was determined to be a negative component solely due to its negative loading on elaboration of job titles. The consistency of the component is not a meaningful measure since there was no a priori notion of how employee job concentration should have varied with elaboration of job titles.

Component name: Company geographical dispersion
Eigenvalue: 2.8
Percent variance explained: 69.4
Direction negative
Consistency 50-100
Number of measurements: 4

LOADING	*MEASURE-MENT NAME*	*DESCRIPTION AND CALCULATION*
-0.95	R22	LOCATIONS-number
-0.58	C22	R22/R14 (differentiation of locations)
-0.90	C23	(R23/R14)/(1/R22) (geographical employee concentration)
-0.85	R25	DISTANCE BETWEEN LOCATIONS

"Company geographical dispersion" is an average explainer of its original measurements, having an eigenvalue of 2.8. It is most heavily loaded on number of locations but has significant loadings on distance between locations and concentration of employees at the largest locations. The component was determined to be negative due to its negative loadings on number of locations and distance between locations. Its consistency is questionable for the same reasons as "company job structure complexity": there was no a priori notion of how geographical employee concentration should have varied with number of locations. It is interesting that the concentration (inequality) measures were positively related to the absolute number measures (elaboration and differentiation) for both "company job structure complexity" and "company geographical dispersion."

Component name:	Company divisional differentiation
Eigenvalue:	3.8
Percent variance explained:	63.6
Direction:	negative
Consistency:	83
Number of measurements:	6

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.15*	C26	R26/R14 (lowest level unit differentiation)
-0.83	R27	CHIEF SPAN OF CONTROL
-0.97	R28	DIVISION HEADS-number
-0.58	C28	R28/R27 (highest level unit differentiation)
-0.97	R31	OPERATING DIVISIONS-number
-0.94	R32	PRODUCTION DIVISIONS-number

"Company divisional differentiation" is a relatively good explainer of the original measurements, with an eigenvalue of 3.8. It is a consistent negative component since all of the significant loadings are negative. Only one of the original measurements, lowest level unit differentiation (number of first-line supervisors divided by number of employees), was not a measure of divisional differentiation and its loading, though inconsistent, was nonsignificant. All the measures of divisional differentiation had high loadings and consequently the definition of "company divisional differentiation" should be narrowed to "divisional differentiation."

Component name: Company divisional specialization
Eigenvalue: 2.4
Percent variance explained: 60.3
Direction: negative
Consistency: 75
Number of measurements: 4

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.61*	C29	R29/R26 (lowest level unit specialization)
0.85	R30†	DIVISION RESPONSIBILITIES-products, functions, geography
-0.73	C31	(R28-R31)/R28 (proportion nonoperating divisions)
-0.89	C32	(R28-R32)/R28 (proportion nonproduction divisions)

"Company divisional specialization" is a somewhat poor explainer of the original measurements, having an eigenvalue of 2.4. It has negative direction since the highest loading three of the four measurements are negatively associated with the component. The only inconsistency is the fourth measurement, lowest-level unit specialization, which varies positively with "company divisional specialization." "Company divisional specialization" primarily explains specialization on the divisional level. It is apparent from "company divisional differentiation" and "company divisional specialization" that there is no strong positive relationship (and perhaps no relationship at all) of differentiation and specialization between the divisional and lowest levels of the sample companies.

Component names: Company mechanization-general; Company mechanization-computers
Eigenvalues: 4.0; 3.9
Percent variances explained: 28.8; 28.0
Directions: positive; positive
Consistencies: 71; 79
Numbers of measurements: 14; 14

LOADINGS	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.36 ; 0.01	R35A	MECHANIZATION BULK
0.21 ; 0.15	R35B	MECHANIZATION MOST
0.80 ; -0.34*	C36A	R36/R16 (energy intensiveness)
0.45 ; 0.70	C36B	R36/R4 (energy intensiveness)
-0.04*; *0.80*	R37	NUMBER COMPUTERS
-0.22*; 0.79	C38A	R38/R16 (computerization)
0.37 ; *0.79*	C38B	R38/R4 (computerization)
-0.30*; 0.77	C39A	R39/R16 (computerization)
0.37 ; *0.79*	C39B	R39/R4 (computerization)
-0.43*; -0.11*	C40	R40/R14 (electric typewriters per employee)
0.92 ; 0.12	C41A	R41/R14 (fixed capital per employee)
0.87 ; 0.08	C41B	R41/R17 (proportion assets fixed)
0.79 ; -0.25*	C43A	R43/R42 (depreciation/wage and salary expense)
-0.44 ; -0.28	C43B†	R15/R41 (capital asset turnover)

The first component extracted for the fourteen mechanization measurements explained only 31 percent of the total variance of those measurements. Consequently, a second component was added which increased the total explanation (by the two components together) to 57 percent. The two components were then rotated using varimax rotation to produce the two components, "company mechanization-general" and "company mechanization-computers," used in this study. "Company mechanization-general" and "company mechanization-computers" are both good explainers, having eigenvalues of 4.0 and 3.9, respectively.

"Company mechanization-general" is loaded heavily on four measures of general (perhaps production-oriented) mechanization: energy intensiveness (proportion energy expenditures to total expenditures), fixed capital per employee, proportion assets fixed, and depreciation divided by wage and salary expense. The component was determined to be positive on the basis of the positive loadings on these four measurements. "Company mechanization-general" seems fairly consistent even though four of the measurements have negative loadings on the component. These loadings are relatively small, three of the inconsistent measurements being heavily associated with the second component, "company mechanization-computers."

"Company mechanization-computers" is most heavily loaded on three measures involving use of computers: number of computers, proportion computer hardware expenses, and proportion computer total expenses. "Company mechanization-computers" was determined to be positive based on its positive loadings on these three measurements. "Company mechanization-computers" is fairly consistent, having negative loadings on only three of the measurements. These loadings are small, and two of the three are heavily associated with the first component, "company mechanization-general."

Control System Components

Component name:	Company direct supervision
Eigenvalue:	2.0
Percent variance explained:	67.2
Direction:	positive
Consistency:	100
Number of measurements:	3

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.63	C44	R44/R14 (supervisory ratio)
-0.89	R45†	FIRST LINE SPAN
-0.91	C47†	R46/R47 (ratio employees first two levels)

"Company direct supervision" is a reasonably good explainer of the three measurements, with an eigenvalue of 2.0. The maximum the eigenvalue could be is 3.0, and 67 percent of the variance is explained. It is a perfectly consistent positive component since all three loadings are positive. The strongest loadings are on two measurements of span of control on the lowest company levels, but overall supervisory ratio, the third measurement, is also significantly loaded.

Component name:	Company staff support
Eigenvalue:	1.5
Percent variance explained:	48.6
Direction	positive
Consistency:	67
Number of measurements:	3

LOADING	*MEASURE-MENT NAME*	*DESCRIPTION AND CALCULATION*
-0.27*	C48	(R14-R44-R48)/R14 (staff ratio)
0.86	R49	STAFF FUNCTIONS (differentiation of)
0.80	C50	R50/R14 (clerical ratio)

"Company staff support" is a poor explainer of the three original measurements, having an eigenvalue of only 1.5 and explaining only 49 percent of the variance. It is heavily loaded on only the two measurements, differentiation of staff functions and clerical ratio. The direction of "company staff support" is determined to be positive based on its positive loadings on these two measurements. The loading on the third measurement, staff ratio, though inconsistent, is small. Staff ratio was estimated by a surrogate measure which may have been defective. This would account for the low explaining power and the inconsistency of the component.

Component name:	Company authority levels
Eigenvalue:	1.7
Percent variance explained:	86.2
Direction:	negative
Consistency:	100
Number of measurements:	2

LOADING	*MEASURE-MENT NAME*	*DESCRIPTION AND CALCULATION*
-0.93	R51A	LEVELS MOST
-0.93	R51B	LEVELS AVERAGE

Even though the eigenvalue of "company authority levels" is only 1.7, it is a good explainer of the two measurements of number of authority levels. The maximum the eigenvalue could be is 2.0 (the number of measurements). Eighty-six percent of the variance is explained.

"Company authority levels" is consistently negative. Both loadings are large and equal to one another.

Component names: Company personnel quality-high level; Company personnel quality-low level
Eigenvalues: 3.7; 3.3
Percent variances explained: 24.7; 22.3
Directions: positive; positive
Consistencies: 73; 80
Numbers of measurements: 15; 15

LOADINGS	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.06 ; *0.64*	R52	DIRECT LABOR EDUCATION
0.52 ; -0.03*	R53	DIVISION HEAD EDUCATION
0.05 ; -0.65*	C53	R53-R52 (difference high-low education)
0.40 ; -0.10*	C54	R54/R14 (proportion BA degree employees)
-0.02*; 0.48	R55	WEEKS TRAINING
0.12 ; 0.13	R56	DIRECT LABOR SENIORITY
-0.49*; 0.49	R57	DIVISION HEAD SENIORITY
-0.56*; 0.38	C57	R57-R56 (difference div. head and dir. lab. seniority)
0.00 ; *0.79*	C58	R58A+R58B (direct labor compensation)
0.87 ; 0.35	C59DA	R59A+R59B+R59C (division head compensation)
0.91 ; 0.18	C59DB	C59DA-C58 (difference high-low compensation)
0.14 ; *0.78*	C59IA	R42/R14 (average compensation)
0.42 ; 0.48	C59IB	R58B/C58 (proportion direct labor benefits)
-0.35*; 0.48	C59IC	R59B/C59DA (proportion division head benefits)
0.90 ; 0.11	C59ID	R59C/C59DA (proportion division head bonus)

The first component extracted for this group of fifteen measurements accounted for only 25.3 percent of the variance. Consequently, a second component was added which increased the total explanation (by the two components together) to 47 percent. Such a level of explanation by two components is inadequate but it was necessary to discard other possible components in order to keep the number of variables down and the analysis simple.

The two components were rotated using varimax rotation to produce the two components, "company personnel quality-high level" and "company personnel quality-low level." "Company personnel quality-high level" and "company personnel quality-low level" are reasonably good explainers, having eigenvalues of 3.7 and 3.3, respectively.

"Company personnel quality-high level" is loaded heavily on three measures of division head compensation: total division head compensation, difference division head and direct labor compensation, and proportion division head bonus. Thus its meaning should be narrowed to "quality of high-level personnel." "Company personnel quality-high level" was determined to be positive due to its positive loadings on these three measures. Four of the fifteen measurements have inconsistent loadings (negative) on "company personnel quality-high level." Two of these are nonsignificant, but two measures of division head seniority are significantly negative and thus "company personnel quality-high level" must be considered somewhat inconsistent. This inconsistency suggests that seniority is inversely related to salary characteristics of division heads for this sample of companies. The researcher is tempted to speculate that younger, more qualified division heads are hired at higher salaries but that more senior but less competent division heads are retained at lower salaries. Thus seniority is not a measure of personnel quality on the division level. The research results provide no backing for this, however.

"Company personnel quality-low level" is loaded heavily on two measures of direct labor quality—education and compensation—and one measure of average compensation for the company as a whole. Thus the meaning of "company personnel quality-low level" is narrowed to "quality of low-level personnel." "Company personnel quality-low level" was determined to be positive based on its positive loadings on these three measures. Only three measurements are negatively (inconsistently) loaded on the component, and two of the loadings are nonsignificant. The third negative loading, difference high-low education on "company personnel quality-low level," is explainable by the fact that direct labor education is subtracted from division head education. Thus "company personnel quality-low level" is fairly consistent.

Component names:	Company centralization-investment; Company centralization-purchasing
Eigenvalues:	5.3; 3.6
Percent variances explained:	29.3; 20.2
Directions:	negative; negative
Consistencies:	100; 67
Numbers of measurements:	18; 18

LOADINGS	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.29 ; 0.54*	C60A	R60A/R42 (compensation concentration-top 1%)
-0.24 ; 0.64*	C60B	R60B/R42 (compensation concentration-top 2%)
-0.11 ; 0.15*	C60C	R60C/R42 (compensation concentra-top 25%)
0.73 ; 0.22	C61A†	R61A/R51A (decentralization-investment authority-$100)
_0.87_ ; 0.08	C61B†	R61B/R51A (decentralization-investment authority-$1,000)
_0.82_ ; -0.07*	C61C†	R61C/R51A (decentralization-investment authority-$10,000)
_0.88_ ; 0.09	C63A†	R63A/R51A (decentralization-investment authority-1%)
0.70 ; 0.10	C63B†	R63B/R51A (decentralization-investment authority-5%)
0.64 ; 0.08	C63C†	R63C/R51A (decentralization-investment authority-25%)
0.42 ; 0.17	C64†	R64/R51A (decentralization-pricing authority)
0.47 ; 0.51	C65A†	R65A/R51A (decentralization-purchase authority-$100)
0.56 ; 0.46	C65B†	R65B/R51A (decentralization-purchase authority-$1,000)
0.47 ; _0.74_	C65C†	R65C/R51A (decentralization-purchase authority-$10,000)
0.35 ; _0.82_	C67A†	R67A/R51A (decentralization-purchase authority-1%)
0.11 ; _0.82_	C67B†	R67B/R51A (decentralization-purchase authority-5%)
0.24 ; 0.61	C67C†	R67C/R51A (decentralization-purchase authority-25%)
0.21 ; -0.02*	C68†	R68/R28 (divisional budget participation)
-0.57 ; 0.22*	R69	BUDGET PROPOSALS BELOW DIVISION

The first component extracted for this group of eighteen measurements accounted for only 34 percent of the variance. Consequently, a second component was added which increased the total explained variance (by the two components together) to 50 percent. The two components were rotated using varimax rotation to produce the two components, "company centralization-investment" and "company centralization-purchasing."

"Company centralization-investment" is an excellent explainer, having an eigenvalue of 5.3. "Company centralization-purchasing" is a good explainer, having an eigenvalue of 3.6.

"Company centralization-investment" is loaded heavily on three measures of decentralization of investment authority. Consequently the definition of "company centralization-investment" is narrowed to "centralization of investment authorization." "Company centralization-investment" was determined to be negative due to its negative loadings on these three measurements. "Company centralization-investment" is a totally consistent negative component in that all loadings are in the opposite direction to that which would be expected.

"Company centralization-purchasing" is loaded heavily on three measures of decentralization of materials purchase authority. Consequently, the definition of "company centralization-purchasing" is narrowed to "centralization of purchase authorization" or perhaps, more broadly, "centralization of operating decision-making." "Company centralization-purchasing" was determined to be negative based on its negative loadings on these three measurements. Six of the fifteen measurements are inconsistently related to "company centralization-purchasing," but only two have significant loadings in the wrong direction. These are two of the measures of compensation concentration, top 1 percent and top 2 percent of employees. This is quite surprising in that, for this sample of companies, the higher are the top personnel paid, the more decentralized are purchasing (and perhaps all operating) decisions. It is possible that other variables influence both compensation concentration and decentralization of purchasing decisions. High salaries are paid not only to employees with administrative skills but also to employees with special expertise. Companies which employ a high proportion of staff experts will tend to have more compensation concentration. Such companies might also tend to be more progressive in that they allow decisions to be made by lower-level personnel. Another possibility is that high-quality and highly paid top-level administrators perceive advantages to decentralization of operating authority. This might suggest that decentralization rather than centralization contributes to the control and coordination process. It also might suggest that decentralization and quality of high-level administrative personnel are complementary rather than substitutable control subsystems. Also, this analysis would suggest that compensation concentration is not a measure of centralization of either investment or purchasing decisions. Instead, it may be a measure of the quality of high-level personnel.

Component names:	Company standardization-jobs; Company standardization-general
Eigenvalues:	6.3; 4.2
Percent variances explained:	31.4; 21.1
Directions:	positive; negative
Consistencies:	60; 70
Numbers of measurements:	20; 20

LOADINGS	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.01*; *0.84*	R70†	PROCEDURES MANUAL
-0.22*; *-0.85*	C72	R71×R72 (total procedures manual words)
0.33*; *0.75*	R73†	PERSONNEL PROCEDURES MANUAL
-0.04*; *-0.85*	C75	R74×R75 (total personnel procedures manual words)
0.73*; 0.04	R76†	PERSONNEL RATING FORM
0.72*; -0.14	R77†	DIRECT LABOR RATING
0.93 ; 0.19*	C79	R79/R14 (proportion written contract employees)
0.89 ; 0.23*	C80	R80/R48 (proportion written contract direct employees)
0.26 ; -0.13	R81	NUMBER UNIONS
0.95 ; 0.21*	C82	R82/R14 (proportion union members)
0.90 ; 0.21*	C83	R83/R48 (proportion direct labor union members)
-0.14*; -0.24	C84	R84/R14 (proportion information booklet employees)
-0.33*; -0.24	C85	R85/R14 (proportion organization chart employees)
-0.78*; -0.18	C86	R86/R14 (proportion job description employees)
-0.69*; -0.12	C87	R87/R48 (proportion direct job description employees)
-0.07 ; 0.50	R88†	WRITTEN POLICIES
0.19*; 0.26	R89†	PRODUCTION SCHEDULE
-0.53 ; -0.49*	R91	WAGE INCREASE BASIS-seniority, merit, negotiation
0.26* *0.73*	R92†	FORMS CONTROL
-0.09 ; 0.20	R93†	TIME AND MOTION STUDIES

The first component extracted for this group of twenty measurements accounted for only 37 percent of the variance. Therefore, a second component was added which increased the total explained variance to 52 percent. The two components were rotated using varimax rotation to produce the two components "company standardization-jobs" and "company standardization-general." "Company standardization-jobs" is an excellent explainer (eigenvalue 6.3), while "company standardization-general" is a very good explainer (eigenvalue 4.2).

"Company standardization-jobs" is heavily loaded on four measures involving the proportion of employees covered by written contract and the proportion of union members. It appears that "company standardization-jobs" is a measure of unionization rather than standardization. "Company standardization-jobs" is determined to be positive based on the directions of loadings on these four measurements. An astonishing twelve of the remaining sixteen measurements are inconsistently loaded on the component. Three of these are significant: personnel rating form, direct labor rating, and proportion of job description employees. These inconsistencies can be explained by the possibility that unions take over many of the personnel control functions formerly performed by the company. Thus personnel rating is not necessary (nor tolerated by the union). Also, the proportion of supervisory employees necessary to control workers might be less. Such supervisors in nonunionized companies might be in the category of employees with job descriptions (salaried employees). Thus unionized companies would tend to have a lower proportion of job description employees. The inconsistencies between the unionization and the explicit standardization measures suggest that unionization and standardization are substitutes for one another.

"Company standardization-general" is heavily loaded on four measures of the existence and extensiveness of the procedures manuals and one measure of the existence of forms control. Thus "company standardization-general" is confirmed as a measure of traditional standardization of procedures. It is determined to be negative based on its negative loadings on the above five measures. Five measurements are inconsistent with the direction of the component. Four of these are nonsignificant. It is interesting that these are the four high-loading measurements on "company standardization-jobs," measures of unionization and proportions of employees covered by written contract. This tends to confirm the substitutability of unionization and standardization. The fifth inconsistent measurement is wage increase basis. More standardized companies (based on "company standardization-general" scores) tend to give wage increases more on merit than standardized criteria such as seniority or negotiation. This is explainable by the fact that more standardized companies tend to be less unionized. Unions would prohibit management discretion over wage increases. Thus wage increases based on merit can occur only in standardized, nonunionized companies.

Accounting System Components

Component names: Accounting size-information output; Accounting size-resource input
Eigenvalues: 1.9; 1.8
Percent variances explained: 27.4; 26.0
Directions: positive; positive
Consistencies: 86; 57
Numbers of measurements: 7; 7

LOADINGS	_MEASUREMENT NAME_	_DESCRIPTION AND CALCULATION_
0.26 ; _0.84_	C94	R94/R14 (proportion controllership employees)
_0.72_ ; 0.09	C95	R95/R14 (proportion employees receiving reports)
_0.75_ ; -0.13*	R96	DATA CENTERS
0.58 ; 0.01	C96	R96/(R9+R44) (data center elaboration)
-0.10 ; 0.42*	C97A†	(R97A+R97B+R97C)/3 (average report frequency)
0.08 ; _0.88_	C98A	R98/R16 (proportion controllership expenses)
_-0.64_*; -0.38*	C98B	R98/R4 (controllership expense emphasis)

The first component extracted for this group of seven measurements accounted for only 33 percent of the variance. Therefore, a second component was added which increased the total explained variance to 53 percent. The two components were rotated using varimax rotation to produce the two components "accounting size-information output" and "accounting size-resource input." Both "accounting size-information output" and "accounting size-resource input" are poor explainers, having eigenvalues of only 1.9 and 1.8, respectively. The poor explanatory powers of these two components are disappointing. Size of the accounting system is an extremely important concept in this study. The fact that it took two components to explain a reasonable proportion of the variance of only seven measurements is very poor.

"Accounting size-information output" is heavily loaded on three measurements: proportion of employees who receive reports, number of data centers, and controllership expense emphasis (controllership expenses divided by selling price of product). Unfortunately, the direction of the controllership expense emphasis loading is not consistent with the loadings on the other two measurements. Apparently selling price (the denominator) varies more than controllership expenses (the numerator). Selling price has a high positive loading on "process sophistication," and "process sophistication" (as is shown in the subsequent analysis) is heavily and positively associated with "accounting size-information output." High selling price causes controllership expense emphasis to be low and thus its loading to be inconsistent. On the basis of this reasoning, the inconsistent measurement is disregarded and the direction of the component is determined to be positive, based on the positive loadings of the other two high-loading measurements. Since all other measurements are consistent with the direction of the component, it may be considered fairly consistent. The high-loading measurements indicate the meaning of the component has mostly to do with the output of the accounting system, the extensiveness of report dissemination, and the number of data centers.

"Accounting size-resource input" is heavily loaded on proportion of controllership employees and proportion of controllership expenses. Thus its meaning has mostly to do with the input to the accounting system, human and financial resources. The positive loadings on these two measurements indicate the component is positive. Three of the measurements have inconsistent loadings, none of which is very significant. Average report frequency, the highest loading of the inconsistent measurements, is conceptually more of an aspect of output than of input.

Component name: Accounting job structure complexity
Eigenvalue: 2.0
Percent variance explained: 50.8
Direction: negative
Consistency: 75
Number of measurements: 4

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.57	C99A	R99/R94 (elaboration of job titles)
-0.47	C99B	R99/R19 (proportion controllership job titles)
-0.89	C100	(R100/R94)/(1/R99) (employee job concentration)
-0.83	C101	(R101/[R94-R100])/(1/[R99-1]) (employee job concentration)

"Accounting job structure complexity" is a below-average explainer of its original measurements, having an eigenvalue of 2.0 and

and explaining only 51 percent of the variance. It is most heavily loaded on the measures of employee job concentration. The loadings of the two measures of relative number of job titles, elaboration of job titles and proportion controllership job titles, are not very significant and are inconsistent in direction with one another. As was mentioned for "company job structure complexity," division of labor is conceptually more closely related to number of job titles than to employee job concentration. However, the inconsistency prevented the use of the measures of relative number of job titles to determine the direction of "accounting job structure complexity." Consequently, "accounting job structure complexity" was determined to be negative on the basis of its negative loadings on the employee job concentration measures, which are in the same direction as the employee job concentration loadings on "company job structure complexity." As with "company job structure complexity," the heavy loadings on employee job concentration suggest that the meaning of "accounting job structure complexity" should be expanded to "complexity of the accounting job structure." Since one of the two measures of relative number of job titles must be conceptually in the correct direction, the consistency of "accounting job structure complexity" is 75 percent.

Component name: Accounting geographical dispersion
Eigenvalue: 3.4
Percent variance explained: 56.3
Direction: negative
Consistency: 83-100
Number of measurements: 6

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.86	R102	# CONTR LOCATIONS
-0.84	C102A	R102/R94 (differentiation of controllership locations)
-0.72	C102B	R102/R22 (proportion controllership locations)
0.28	C105	R105/R23)/(R94/R14) (geographical employee concentration)
-0.71	R107	CONTR LOCATION DISTANCE
-0.91	C107	R107/R25 (proportion contr location distance)

"Accounting geographical dispersion" is a good explainer of the original measurements, with an eigenvalue of 3.4. It is most heavily loaded on proportion of controllership location distance, number of controllership locations, and differentiation of controllership locations. It was determined to be negative based on its negative loadings on these three measurements. All of the other measurements were consistent with the direction of the component except geographical employee concentration. As was explained under "company geographical dispersion," there is no a priori notion of how geographical employee concentration should vary with the other measures of geographical dispersion. Consequently, consistency, though good, cannot be determined exactly. It is interesting that the positive association of concentration measures with absolute number measures found for the company as a whole ("company job structure complexity" and "company geographical dispersion") was not found for the accounting system ("accounting job structure complexity" and "accounting geographical dispersion").

Component name: Accounting unit differentiation-horizontal
Eigenvalue: 1.6
Percent variance explained: 54.4
Direction: positive
Consistency: 100
Number of measurements: 3

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.46	R108	LOWEST CONTR UNITS (number)
0.75	C108A	R108/R94 (elaboration of lowest contr units)
0.93	C108B	R108/R26 (elaboration of lowest contr units)

Since all three of the original measurements for the principal components procedure which isolated "accounting unit differentiation-horizontal" are based on question 108 (page 231), the measurement rules which were used in interpreting responses to question 108 are especially important for determining the meaning of "accounting unit differentiation-horizontal." Question 108 asks about the number of lowest-level controllership units in the company. One of the definitional rules for question 108 stipulates that only accounting units in a direct authority line to the chief executive officer should be counted as lowest-level controllership units. This would exclude divisional accounting departments, responsible to division heads. Consequently, "accounting unit differentiation-horizontal," which is based on question 108, is defined as the horizontal differentiation of units within the central accounting department. Though unit specialization was not measured for the accounting system, it is probable that it would be positively related to "accounting unit differentiation-horizontal" since the multiple units of a central accounting department would probably be assigned different functions.

"Accounting unit differentiation-horizontal" is a relatively poor explainer of the original measurements, having an eigenvalue of only 1.6. It is loaded most heavily on the two calculated measures of elaboration of lowest controllership units. The loadings on all three measurements are consistently positive, making the component positive. Since the three measures are closely related, the definition of the component is very tight, the horizontal elaboration of lowest-level controllership units within the central controller's department.

Component name:	Authority levels
Eigenvalue:	3.0
Percent variance explained:	73.9
Direction:	negative
Consistency:	100
Number of measurements:	4

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.86	C109	R109/R51A (depth of lowest contr units)
-0.90	C110	R110/R51A (depth of lowest contr emps)
-0.81	C111A	(R110-R111)/R51A (vertical width contr function)
-0.87	C111B	(R109-R111)/R51A (vertical width contr function)

"Authority levels" is a good explainer of its original measurements, with an eigenvalue of 3.0. It explained 73.9 percent of the variance of its four measurements. It is loaded heavily and fairly equally on all the four measures, two of depth of the lowest controllership units and two of vertical width of the controllership function. It is a perfectly consistent negative component.

Component name: Report differentiation
Eigenvalue: 4.3
Percent variance explained: 61.5
Direction: negative
Consistency: 85
Number of measurements: 7

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.10*	C112	R112A+R112B+R112C (report diversity)
-0.84	R113	PROFIT CENTERS
-0.58	C113A	R113/R96 (proportion profit centers)
-0.86	C113B	R113/R44 (profit center elaboration)
-0.88	R114	PRODUCT CENTERS
-0.92	C114A	R114/R96 (proportion product centers)
-0.95	C114B	R114/R9 (product center elaboration)

"Report differentiation" is a good explainer of its original seven measurements, with an eigenvalue of 4.3. It is most heavily loaded on three measures of product center elaboration and two measures of profit center elaboration. The component is reasonably consistent. The only inconsistent loading is on report diversity (different types of reports produced), and it was very insignificant. Nevertheless, it is quite surprising that report diversity is not positively associated with elaboration of product and profit centers. "Report differentiation" was determined to be negative based on its negative loadings on the five top loading measurements.

Component name: Sophistication of accounting techniques
Eigenvalue: 3.3
Percent variance explained: 55.2
Direction: positive
Consistency: 83
Number of measurements: 6

LOADING	*MEASURE-MENT NAME*	*DESCRIPTION AND CALCULATION*
0.81	C117	(R117A+R117B+R117C)/3 (standard cost usage)
0.94	C118	WEIGHTED FIXED-VARIABLE
0.86	C119	WEIGHTED BREAKEVEN (use of cost-volume-profit analysis)
0.88	R120	COST-VOLUME-PROFIT (sophistication of)
-0.50*	R121	BUDGET ITEMS INCLUDED
0.07	R122	CAPITAL PROJECT INFORMATION

"Sophistication of accounting techniques" is an above-average explainer of its six original measurements, having an eigenvalue of 3.3. It is most heavily loaded on four of the six measurements: classification of costs as fixed and variable, use of cost-volume-profit analysis, sophistication of cost-volume-profit techniques, and standard cost usage. "Sophistication of accounting techniques" was determined to be positive based on its positive loadings on these four measurements. The only inconsistent loading was for extensiveness of the budgetary system. This inconsistent loading was reasonably large.

Component name:	Decentralization of accounts
Eigenvalue:	1.7
Percent variance explained:	56.3
Direction:	positive
Consistency:	100
Number of measurements	3

LOADING	*MEASURE-MENT NAME*	*DESCRIPTION AND CALCULATION*
0.91	C115	R115/R51A (depth lowest cost reports)
0.18	C116	R116/R51A (depth lowest profit reports)
0.91	C97B	PROPORTION REPORT LEVELS

"Decentralization of accounts" seems to be a relatively poor explainer of its original three measurements, with an eigenvalue of 1.7.

It is heavily loaded on two of the three measurements, depth of lowest cost reports and proportion of report levels to which reports are presented. Though consistent in direction with the other two measures, depth of lowest profit reports is nonsignificantly loaded on "decentralization of accounts." This may indicate that profit reports are not generally presented to levels below the top two. Though it poorly explains the depth of profit reports, "decentralization of accounts" explains well the other two measurements. "Decentralization of accounts" is determined to be perfectly consistent and positive based on its positive loadings on all three measurements.

Component name:	Unit differentiation-vertical
Eigenvalue:	2.0
Percent variance explained:	97.8
Direction:	negative
Consistency:	100
Number of measurements:	2

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.99	C125A†	R125/R51A (reliance on central controller's dept)
0.99	C125B†	(R125-R111)/R51A (reliance on central contr's dept)

The intent of the researcher was to measure centralization of the accounting function in a way similar to the way Simon *et al.* measured it in their study.[1] Their "centralization" was measured by whether lower-level accounting department heads report to higher-level accounting department managers or to operating managers. Thus their "centralization" is not centralization as it is conventionally defined, the

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[1] Herbert A. Simon, George Kozmetsky, Harold Guetzkow, and Gordon Tyndall, *Centralization vs. Decentralization in Organizing the Controller's Department* (New York: Controllership Foundation, Inc., 1954), pp. 8-9.

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level at which key decisions are made. Instead, their "centralization" has to do with the level at which the accounting structure is attached to the overall organization structure.

The question which was intended to measure the Simon *et al.* "centralization" is question 126 on page 235 (the answer is recorded as measurement R126). It inquired about whether accounting department heads below the central controller's department report to higher-level accounting managers or to operating management. Unfortunately, only seven of the eighteen companies had accounting departments below the central accounting department which satisfied the definitional rule (discussed on page 235). The rest of the answers to question 126 were thus considered missing, and measurement R126 was discarded.

The remaining two measurements of accounting function centralization were developed by the researcher. They have to do with reliance on the central accounting department, as measured by the number of levels between the central accounting department and the next-lowest-level accounting departments. For the eleven companies without lower-level accounting departments, the number of levels was the total number of levels in the overall company structure minus the level of the central accounting department. In essence, the measurements are of whether the company has any lower-level accounting departments. Thus their meaning is more akin to accounting department unit differentiation than to centralization of authority. Consequently, for purposes of this study, the definition of "accounting unit differentiation-vertical" is changed to "accounting system, unit differentiation-vertical."

As is specified in the definitional rule for question 125 (page 235), the definition of lower-level accounting departments for the purpose of this question is restricted to accounting departments for segments (most likely divisions) of the company, as opposed to specialized accounting departments for the company as a whole (such as budgeting departments, accounts receivable departments, etc.). Consequently, the definition of "accounting unit differentiation-vertical," based on question 125, is refined to the "divisional differentiation of the accounting function."

"Accounting unit differentiation-vertical" is an almost perfect explainer of the two original measurements, having an eigenvalue of 2.0. The loadings of the two measurements of reliance on the central controller's department are both almost 1. The component is perfectly consistent. The direction of "accounting unit differentiation-vertical" is determined to be negative since high numbers indicate there are no lower-level accounting departments and thus no unit differentiation.

Component name:	Mechanization
Eigenvalue:	2.4
Percent variance explained:	79.7
Direction:	negative
Consistency:	100
Number of measurements:	3

LOADING	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
-0.92	R128	COMPUTERIZED FINANCIAL ACTIVITIES (number of)
-0.88	R129	MECHANIZED REPORTS (proportion)
0.88	C130†	R130/R98 (capital-labor mix)

"Mechanization" is a reasonably good explainer of its three original measurements, having an eigenvalue of 2.4 (maximum possible, 3.0) and explaining 80 percent of the variance. It is heavily loaded on all three measurements: number of computerized financial activities, proportion of mechanized reports, and capital-labor mix. "Mechanization" is a perfectly consistent negative component, as is indicated by the negative loadings on all three measurements.

Component names: Personnel-education; Personnel-general
Eigenvalues: 1.8; 1.5
Percent variances explained: 22.5; 19.3
Directions: positive; positive
Consistencies: 75; 75
Numbers of measurements: 8; 8

LOADINGS	*MEASUREMENT NAME*	*DESCRIPTION AND CALCULATION*
0.86 ; 0.32	C132	(R132-R53)/R53 (highest educ compared to div heads)
0.90 ; -0.20*	C133	(R133/R94)/(R54/R14) (BA's compared to overall company)
-0.20*; *-0.56**	R134	WEEKS TRAINING-CONTR
0.02 ; 0.25	C135	(R135-R56)/R56 (low contr seniority compared to dir lab)
-0.31*; *0.72*	C136	(R136-R57)/R57 (high contr seniority compared to div hds)
0.19 ; 0.45	C137B	(C137A-C58)/C58 (low contr compens compared to dir lab)
0.26 ; 0.23	C138IA	(R130/R94)/(R42/R14) (aver contr sal compared with company)
0.06 ; *0.50*	C138IB	(R137B/C137A)-(R58A/C58) (low benefits comp with dir lab)

The first component extracted for this group of eight measurements accounted for only 23 percent of the variance. Consequently, a second component was added which increased the total explained variance to 42 percent. This level of explanation is the lowest for any group of measurements in the study and is consistent with the other set of personnel components, "company personnel quality-high level" and "company personnel quality-low level," which had the second lowest level of explanation, 47 percent. Apparently the disparate and indirect nature of the personnel quality measurements prevents higher levels of explanation. Nevertheless, it was necessary to discard other possible components in order to keep the number of variables down and the analysis simple.

The two components were rotated using varimax rotation to produce the two components, "accounting personnel quality-education" and "accounting personnel quality-general." Both were poor explainers, having eigenvalues of only 1.8 and 1.5, respectively.

"Accounting personnel quality-education" is loaded heavily on only two of the eight measurements: highest-level education compared to division heads, and BA degrees compared to overall company. The high loadings on the education measurements indicate the component has to do with the "educational qualifications" of accounting system employees. Positive loadings on the two high-loading measurements determine the direction to be positive. Two of the measurements are inconsistently loaded on the component: weeks training of controllership employees, and high-level controllership seniority compared to division heads. Neither of these inconsistent loadings is large, but both can be explained. Senior personnel tend to have less educational qualifications. Consequently, companies with more senior personnel tend to have personnel with lower educational qualifications. Also, companies which can hire educationally qualified personnel need training programs less. Thus "accounting personnel quality-education" can be considered reasonably consistent.

"Accounting personnel quality-general" is loaded most highly on three measurements: weeks training of controllership employees, high-level controllership seniority compared to division heads, and low-level employees' fringe benefits compared with direct labor. The positive loadings on the seniority and fringe benefits measures determine the component to be positive, and this is confirmed by the majority of positive loadings (six out of the eight loadings). Unfortunately, the weeks training of controllership employees is inconsistently and significantly loaded on "accounting personnel quality-general." This is consistent with training's inconsistent loading on "accounting personnel quality-education." The explanation is analogous: smoothly running accounting systems with experienced and well-paid personnel do not need formal training programs. This explanation of training as just a remedial device is only speculation which needs to be tested in other studies. The only other inconsistent loading is BA degrees compared to overall company, which is nonsignificant. Its significant association with "accounting personnel quality-education" suggests we can ignore it for "accounting personnel quality-general." Thus "accounting personnel quality-general" can be considered reasonably consistent.

APPENDIX C

OTHER INFORMATION

APPENDIX C

OTHER INFORMATION

Dear Mr

We are conducting a study to determine how accounting systems are interrelated with other managerial control systems in companies and how these relationships differ in firms with different characteristics. We are collecting information for this study by means of interviews with company controllers and other company executives. The findings of the study may help us understand more clearly the need for accounting controls and perhaps the "trade offs" involved in selecting between accounting and other control devices. We would like to ask your assistance in this study by allowing us to visit with you. The enclosed short paper explains more about the project. Mr. Rosenzweig will be the primary researcher and will be using the data as part of his doctoral dissertation here at Michigan State University.

We are contacting you because your firm, as best we can determine, fits the size and manufacturing emphasis we are studying. We would like to obtain the research data needed from you through an interview at your firm. The questions are not concerned with attitudes but rather with the structural and financial characteristics of your company. You may have to refer to your records or other officials for some answers. We think you will find the questions interesting.

The answers will not be identified with your company in the research report, and they will be kept in the strictest confidence. We anticipate having 20 to 25 companies participate. We will be happy to send you a copy of the research results as soon as they are assembled. We hope the results will be both interesting and useful to you and your company.

We are restricting the current study to small or medium-size manufacturing companies (200 to 5,000 employees) which are not subsidiaries of other companies. We will call you in about a week. If you are willing to help us, we would like to set a date for the interview and answer any other questions you may have at that time.

Your cooperation will advance knowledge of the accounting control process. In addition, we hope you will also benefit from participation in this research effort.

Cordially yours,

Harold Sollenberger
Associate Professor of Accounting

Kenneth Rosenzweig
Doctoral Student

Table 19

Assignment of Measurements to Principal Components Procedures

Measurement Name	Description and Calculation	No. of Observations	Disposition[a]
INT-ORDER	COMPANY INTERVIEW ORDER	18	Z
R1	ORGANIZATION CHART	18	Z
R2	FINANCIAL STATEMENTS	18	Z
R3	PERSONNEL LIST	18	Z
R4	SELLING PRICE	18	Process sophistication
R5	MATERIALS COST	18	Process sophistication
C5A	R4-R5 (value added)	18	Process sophistication
C5B	(R4-R5)/R4 (proportion value added)	18	Process sophistication
R6	RESEARCH COSTS	18	X
C6	R6/R4 (research emphasis)	18	Process sophistication
R7	MANUFACTURING COSTS	18	X
C7	R6/R7 (research emphasis)	18	Process sophistication
R8	PRODUCTION CYCLE-length	18	Process sophistication
R9	NUMBER PRODUCTS	18	Process-output diversity
R10	NUMBER CUSTOMERS	18	Process-output diversity
R11	NUMBER SUPPLIERS	18	Materials input diversity (used as is)

[a] X = dropped once used for calculation of new variable; Y = dropped due to too few observations; Z = requests for general information—not used in subsequent analysis.

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R12	NUMBER EMPLOYEES NOW	18	Company size
R13	EMPLOYEE FLUCTUATION	18	X
R14	NUMBER EMPLOYEES AVERAGE	18	Company size
R15	REVENUES	18	Company size
R16	EXPENSES	18	Company size
R17	ASSETS	18	Company size
R18	EQUITY	18	Company size
R19	JOB TITLES	18	X
C19	R19/R14 (elaboration of job titles)	18	Company job structure complexity
R20	HIGHEST JOB TITLE	18	X
C20	R20/R14/1/R19 (employee job concentration)	18	Company job structure complexity
R21	NEXT JOB TITLE	18	X
C21	R21/(R14-R20)/1/(R19-1) (employee job concentration)	18	Company job structure complexity
R22	LOCATIONS-number	18	Company geographical dispersion
C22	R22/R14 (differentiation of locations)	18	Company geographical dispersion
R23	HIGHEST LOCATION EMPLOYEES	18	X
C23	R23/R14/1/R22 (geographical employee concentration)	18	Company geographical dispersion

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R24	SECOND LOCATION EMPLOYEES	13	X
C24	R24/(R14-R23)/1/(R22-1) (geographical employee concentration)	13	Y
R25	DISTANCE BETWEEN LOCATIONS	18	Company geographical dispersion
R26	FIRST LINE SUPERVISORS	18	X
C26	R26/R14 (lowest level unit differentiation)	18	Company divisional differentiation
R27	CHIEF SPAN OF CONTROL	18	Company divisional differentiation
R28	DIVISION HEADS-number	18	Company divisional differentiation
C28	R28/R27 (highest level unit differentiation)	18	Company divisional differentiation
R29	PRODUCTION FUNCTIONS	18	X
C29	R29/R26 (lowest level unit specialization)	18	Company divisional specialization
R30	DIVISION RESPONSIBILITIES-products, functions, geography	18	Company divisional specialization
R31	OPERATING DIVISIONS	18	Company divisional differentiation
C31	(R28-R31)/R28 (proportion nonoperating divisions)	18	Company divisional specialization
R32	PRODUCTION DIVISIONS	18	Company divisional differentiation

TABLE 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C32	(R28-R32)/R28 (proportion nonproduction divisions)	18	Company divisional specialization
R34	OUTPUT TO OTHER DIVISIONS	11	Y
R35A	MECHANIZATION BULK	18	Company mechanization-general; Company mechanization-computers
R35B	MECHANIZATION MOST	18	Company mechanization-general; Company mechanization-computers
R36	ENERGY EXPENSES	18	X
C36A	R36/R16 (energy intensiveness)	18	Company mechanization-general; Company mechanization-computers
C36B	R36/R4 (energy intensiveness)	18	Company mechanization-general; Company mechanization-computers
R37	NUMBER COMPUTERS	18	Company mechanization-general; Company mechanization-computers
R38	COMPUTER EXPENSE	18	X
C38A	R38/R16 (computerization)	18	Company mechanization-general; Company mechanization-computers
C38B	R38/R4 (computerization)	18	Company mechanization-general; Company mechanization-computers
R39	COMPUTER HARDWARE EXPENSE	18	X
C39A	R39/R16 (computerization)	18	Company mechanization-general; Company mechanization-computers
C39B	R39/R4 (computerization)	18	Company mechanization-general; Company mechanization-computers
R40	ELECTRIC TYPEWRITERS	18	X

TABLE 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C40	R40/R14 (electric typewriters per employee)	18	Company mechanization-general; Company mechanization-computers
R41	FIXED CAPITAL	18	X
C41A	R41/R14 (fixed capital per employee)	18	Company mechanization-general; Company mechanization-computers
C41B	R41/R17 (proportion assets fixed)	18	Company mechanization-general; Company mechanization-computers
R42	WAGE AND SALARY	18	X
R43	DEPRECIATION	18	X
C43A	R43/R42 (depreciation/ wage and salary expense)	18	Company mechanization-general; Company mechanization-computers
C43B	R15/R41 (capital asset turnover)	18	Company mechanization-general; Company mechanization-computers
R44	SUPERVISORS	18	X
C44	R44/R14 (supervisory ratio)	18	Company direct supervision
R45	FIRST LINE SPAN	18	Company direct supervision
R46	LOWEST LEVEL EMPLOYEES	18	X
R47	NEXT LOWEST LEVEL EMPLOYEES	18	X
C47	R46/R47 (ratio employees 1st 2 levels)	18	Company direct supervision
R48	DIRECT LABOR EMPLOYEES	18	X
C48	(R14-R44-R48)/R14 (staff ratio)	18	Company staff support
R49	STAFF FUNCTIONS (differentiation of)	18	Company staff support

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R50	CLERICAL EMPLOYEES	18	X
C50	R50/R14 (clerical ratio)	18	Company staff support
R51A	LEVELS MOST	18	Company authority levels
R51B	LEVELS AVERAGE	18	Company authority levels
R52	DIRECT LABOR EDUCATION	18	Company personnel quality-high level; Company personnel quality-low level
R53	DIVISION HEAD EDUCATION	18	Company personnel quality-high level; Company personnel quality-low level
C53	R53-R52 (difference high-low education)	18	Company personnel quality-high level; Company personnel quality-low level
R54	BA DEGREES	18	X
C54	R54/R14 (proportion BA degree employees)	18	Company personnel quality-high level; Company personnel quality-low level
R55	WEEKS TRAINING	18	Company personnel quality-high level; Company personnel quality-low level
R56	DIRECT LABOR SENIORITY	18	Company personnel quality-high level; Company personnel quality-low level
R57	DIVISION HEAD SENIORITY	18	Company personnel quality-high level; Company personnel quality-low level
C57	R57-R56 (difference div head and dir lab seniority)	18	Company personnel quality-high level; Company personnel quality-low level
R58A	DIRECT LABOR WAGE	18	X

Table 19 (Cont'd.)

Measure-ment Name	Description and Calculation	No. of Obser-vations	Disposition
R58B	DIRECT LABOR BENEFITS	18	X
C58	R58A+R58B (direct labor compensation)	18	Company personnel quality-high level; Company personnel quality-low level
R59A	2ND LEVEL SALARIES	17	X
R59B	2ND LEVEL BENEFITS	17	X
R59C	2ND LEVEL BONUS	16	X
C59DA	R59A+R59B+R59C (division head compensation)	15	Company personnel quality-high level; Company personnel quality-low level
C59DB	C59DA-C58 (difference high-low compensation)	15	Company personnel quality-high level; Company personnel quality-low level
C59IA	R42/R14 (average compensation)	18	Company personnel quality-high level; Company personnel quality-low level
C59IB	R58B/C58 (proportion direct labor benefits)	18	Company personnel quality-high level; Company personnel quality-low level
C59IC	R59B/C59DA (proportion division head benefits)	15	Company personnel quality-high level; Company personnel quality-low level
C59ID	R59C/C59DA (proportion division head bonus)	15	Company personnel quality-high level; Company personnel quality-low level
R60A	TOP 1% SALARIES	16	X
C60A	R60A/R42 (compensation concentration-top 1%)	16	Company centralization-investment; Company centralization-purchasing
R60B	TOP 2% SALARIES	16	X

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C60B	R60B/R42 (compensation concentration-top 2%)	16	Company centralization-investment; Company centralization-purchasing
R60C	TOP 25% SALARIES	17	X
C60C	R60C/R42 (compensation concentration-top 25%)	17	Company centralization-investment; Company centralization-purchasing
R61A	INVESTMENT AUTHORITY-$100	18	X
C61A	R61A/R51A (decentralization-investment auth-$100)	18	Company centralization-investment; Company centralization-purchasing
R61B	INVESTMENT AUTHORITY-$1,000	18	X
C61B	R61B/R51A (decentralization-investment auth-$1,000)	18	Company centralization-investment; Company centralization-purchasing
R61C	INVESTMENT AUTHORITY-$10,000	18	X
C61C	R61C/R51A (decentralization-investment auth-$10,000)	18	Company centralization-investment; Company centralization-purchasing
R62	CAPITAL EXPENDITURES	18	X
R63A	INVESTMENT AUTHORITY-1%	18	X
C63A	R63A/R51A (decentralization-investment auth-1%)	18	Company centralizationlinvestment; Company centralization-purchasing
R63B	INVESTMENT AUTHORITY-5%	18	X
C63B	R63B/R51A (decentralization-investment auth-5%)	18	Company centralization-investment; Company centralization-purchasing
R63C	INVESTMENT AUTHORITY-25%	18	X

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C63C	R63C/R51A (decentralization-investment auth-25%)	18	Company centralization-investment; Company centralization-purchasing
R64	PRICING AUTHORITY	18	X
C64	R64/R51A (decentralization-pricing authority)	18	Company centralization-investment; Company centralization-purchasing
R65A	PURCHASE AUTHORITY-$100	18	X
C65A	R65A/R51A (decentralization-purchase auth-$100)	18	Company centralization-investment; Company centralization-purchasing
R65B	PURCHASE AUTHORITY-$1,000	18	X
C65B	R65B/R51A (decentralization-purchase auth-$1,000)	18	Company centralization-investment; Company centralization-purchasing
R65C	PURCHASE AUTHORITY-$10,000)	18	X
C65C	R65C/R51A (decentralization-purchase auth-$10,000)	18	Company centralization-investment; Company centralization-purchasing
R66	MATERIALS COST	18	X
R67A	PURCHASE AUTHORITY-1%	17	X
C67A	R67A/R51A (decentralization-purchase auth-1%)	17	Company centralization-investment; Company centralization-purchasing
R67B	PURCHASE AUTHORITY-5%	17	X
C67B	R67B/R51A (decentralization-purchase auth-5%)	17	Company centralization-investment; Company centralization-purchasing
R67C	PURCHASE AUTHORITY-25%	17	X

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C67C	R67C/R51A (decentralization-purchase auth-25%)	17	Company centralization-investment; Company centralization-purchasing
R68	DIVISION BUDGET PROPOSALS	18	X
C68	R68/R28 (divisional budget participation)	18	Company centralization-investment; Company centralization-purchasing
R69	BUDGET PROPOSALS BELOW DIVISION	18	Company centralization-investment; Company centralization-purchasing
R70	PROCEDURES MANUAL	18	Company standardization-jobs; Company standardization-general
R71	PROCEDURES MANUAL PAGES	18	X
R72	PROCEDURES MANUAL WORDS	8	X
C72	R71×R72 (total procedures manual words)	18	Company standardization-jobs; Company standardization-general
R73	PERSONNEL PROCEDURES MANUAL	18	Company standardization-jobs; Company standardization-general
R74	PERSONNEL PROCEDURES MANUAL PAGES	18	X
R75	PERSONNEL PROCEDURES MANUAL WORDS	10	X
C75	R74×R75 (total personnel procedures manual words)	18	Company standardization-jobs; Company standardization-general
R76	PERSONNEL RATING FORM	18	Company standardization-jobs; Company standardization-general
R77	DIRECT LABOR RATING	18	Company standardization-jobs; Company standardization-general
R78	RATING FREQUENCY	6	Y

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R79	WRITTEN EMPLOYMENT CONTRACTS	18	X
C79	R79/R14 (proportion written contract employees)	18	Company standardization-jobs; Company standardization-general
R80	WRITTEN EMPLOYMENT CONTRACTS-DIRECT	18	X
C80	R80/R48 (proportion written contr direct employees)	18	Company standardization-jobs; Company standardization-general
R81	NUMBER UNIONS	18	Company standardization-jobs; Company standardization-general
R82	UNION MEMBERS	18	X
C82	R82/R14 (proportion union members)	18	Company standardization-jobs; Company standardization-general
R83	UNION MEMBERS-DIRECT	18	X
C83	R83/R48 (proportion direct labor union members)	18	Company standardization-jobs; Company standardization-general
R84	INFORMATION BOOKLETS	18	X
C84	R84/R14 (proportion information booklet employees)	18	Company standardization-jobs; Company standardization-general
R85	ORGANIZATION CHARTS	18	X
C85	R85/R14 (proportion organization chart employees)	18	Company standardization-jobs; Company standardization-general
R86	JOB DESCRIPTIONS	17	X

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C86	R86/R14 (proportion job description employees)	17	Company standardization-jobs; Company standardization-general
R87	JOB DESCRIPTIONS-DIRECT	17	X
C87	R87/R48 (proportion direct job description employees)	17	Company standardization-jobs; Company standardization-general
R88	WRITTEN POLICIES	18	Company standardization-jobs; Company standardization-general
R89	PRODUCTION SCHEDULE	18	Company standardization-jobs; Company standardization-general
R90	WAGE GRADES	13	Y
R91	WAGE INCREASE BASIS-seniority, merit, negotiation	18	Company standardization-jobs; Company standardization-general
R92	FORMS CONTROL	18	Company standardization-jobs; Company standardization-general
R93	TIME AND MOTION STUDIES	18	Company standardization-jobs; Company standardization-general
R94	CONTROLLERSHIP EMPLOYEES	18	X
C94	R94/R14 (proportion controllership employees)	18	Accounting size-resource input; Accounting size-information output
R95	EMPLOYEES RECEIVING REPORTS	18	X
C95	R95/R14 (proportion employees receiving reports)	18	Accounting size-resource input; Accounting size-information output
R96	DATA CENTERS	18	Accounting size-resource input; Accounting size-information output

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C96	R96/(R9+R44) (data center elaboration)	18	Accounting size-resource input; Accounting size-information output
R97A	REPORT FREQUENCY-TOP	18	X
R97B	REPORT FREQUENCY-MIDDLE	12	X
R97C	REPORT FREQUENCY-BOTTOM	4	X
C97A	(R97A+R97B+R97C)/3 (average report frequency)	18	Accounting size-resource input; Accounting size-information output
C97B	PROPORTION REPORT LEVELS	18	Decentralization of accounts
R98	CONTROLLERSHIP EXPENSES	17	X
C98A	R98/R16 (proportion controllership expenses)	17	Accounting size-resource input; Accounting size-information output
C98B	R98/R4 (controllership expense emphasis)	17	Accounting size-resource input; Accounting size-information output
R99	CONTROLLERSHIP JOB TITLES	18	X
C99A	R99/R94 (elaboration of job titles)	18	Accounting job structure complexity
C99B	R99/R19 (proportion controllership job titles)	18	Accounting job structure complexity
R100	HIGHEST JOB TITLE-CONTR	18	X
C100	R100/R94/1/R99 (employee job concentration)	18	Accounting job structure complexity
R101	NEXT JOB TITLE-CONTR	18	X

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C101	R101/(R94-R100)/1/(R99-1) (employee job concentration)	18	Accounting job structure complexity
R102	# CONTR LOCATIONS	18	Accounting geographical dispersion
C102A	R102/R94 (differentiation of locations)	18	Accounting geographical dispersion
C102B	R102/R22 (proportion controllership locations)	18	Accounting geographical dispersion
R103	HIGHEST CONTR LOCATION EMPLOYEES	10	X
C103	R103/R94/1/R102 (geographical employee concentration)	10	Y
R104	SECOND CONTR LOCATION EMPLOYEES	7	X
C104	R104/(R94-R103)/1/(R102-1) (geog employee concentration)	7	Y
R105	HIGHEST LOCATION CONTR EMPLOYEES	18	X
C105	R105/R23/R94/R14 (geographical employee concentration)	18	Accounting geographical dispersion
R106	SECOND LOCATION CONTR EMPLOYEES	13	X
C106	R106/R24/R94/R14 (geographical employee concentration)	13	Y

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R107	CONTR LOCATION DISTANCE	17	Accounting geographical dispersion
C107	R107/R25 (proportion contr location distance)	17	Accounting geographical dispersion
R108	LOWEST CONTR UNITS (number)	18	Accounting unit differentiation-horizontal
C108A	R108/R94 (elaboration of lowest contr units)	18	Accounting unit differentiation-horizontal
C108B	R108/R26 (elaboration of lowest contr units)	18	Accounting unit differentiation-horizontal
R109	LEVEL LOWEST CONTR UNITS	18	X
C109	R109/R51A (depth of lowest contr units)	18	Accounting authority levels
R110	LEVEL LOWEST CONTR EMPS	18	X
C110	R110/R51A (depth of lowest contr employees)	18	Accounting authority levels
R111	LEVEL CHIEF FIN OFFICER	18	X
C111A	(R110-R111)/R51A (vertical width contr function)	18	Accounting authority levels
C111B	(R109-R111)/R51A (vertical width contr function)	18	Accounting authority levels
R112A	INFO PROVIDED-TOP	18	X
R112B	INFO PROVIDED-MIDDLE	18	X
R112C	INFO PROVIDED-BOTTOM	18	X
C112	R112A+R112B+R112C (report diversity)	18	Accounting report differentiation

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R113	PROFIT CENTERS	18	Accounting report differentiation
C113A	R113/R96 (proportion profit centers)	18	Accounting report differentiation
C113B	R113/R44 (profit center elaboration)	18	Accounting report differentiation
R114	PRODUCT CENTERS	18	Accounting report differentiation
C114A	R114/R96 (proportion product centers)	18	Accounting report differentiation
C114B	R114/R9 (product center elaboration)	18	Accounting report differentiation
R115	LOWEST COST REPORT LEVEL	18	X
C115	R115/R51A (depth lowest cost reports)	18	Decentralization of accounts
R116	LOWEST PROFIT REPORT LEVEL	18	X
C116	R116/R51A (depth lowest profit reports)	18	Decentralization of accounts
R117A	STANDARD MATERIAL COST	18	X
R117B	STANDARD LABOR COST	18	X
R117C	STANDARD OVERHEAD COST	18	X
C117	(R117A+R117B+R117C)/3 (standard cost usage)	18	Sophistication of accounting techniques
R118A	FIXED-VARIABLE-COMPANY WIDE	18	X
R118B	FIXED-VARIABLE-PRODUCT LINES	18	X
R118C	FIXED-VARIABLE-UNITS	18	X

Table 19 Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
C118	WEIGHTED FIXED-VARIABLE	18	Sophistication of accounting techniques
R119A	BREAKEVEN-COMPANY WIDE	18	X
R119B	BREAKEVEN-PRODUCT LINES	18	X
R119C	BREAKEVEN-UNITS	18	X
C119	WEIGHTED BREAKEVEN (use of cost-vol-profit analysis)	18	Sophistication of accounting techniques
R120	COST-VOLUME-PROFIT (sophistication of)	18	Sophistication of accounting techniques
R121	BUDGET ITEMS INCLUDED	18	Sophistication of accounting techniques
R122	CAPITAL PROJECT INFORMATION	18	Sophistication of accounting techniques
R123	NONCONTROLLABLE EXPENSES	16	Y
R124	NONCONTROLLABLE SEPARATED	7	Y
R125	LEVEL CONTR UNIT HEADS	18	X
C125A	R125/R51A (reliance on central controller's dept)	18	Accounting unit differentiation-vertical
C125B	(R125-R111)/R51A (reliance on cent contr dept)	18	Accounting unit differentiation-vertical
R126	HEADS REPORT TO	7	Y
R127	CONTR COMPUTER TIME	12	Y
R128	COMPUTERIZED FINANCIAL ACTIVITIES (number of)	18	Accounting mechanization

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R129	MECHANIZED REPORTS (proportion)	18	Accounting mechanization
R130	CONTROLLERSHIP WAGES	17	X
C130	R130/R98 (capital-labor mix)	17	Accounting mechanization
R131	LOWEST CONTR EDUCATION	18	X
C131	(R131-R52)/R52 (lowest educ compared to dir lab)	13	Y
R132	HIGHEST CONTR EDUCATION	17	X
C132	(R132-R53)/R53 (highest educ compared to div heads)	17	Accounting personnel quality-education; Accounting personnel quality-general
R133	CONTROLLERSHIP BA DEGREES	18	X
C133	R133/R94/R54/R14 (BA's compared to overall company)	18	Accounting personnel quality-education; Accounting personnel quality-general
R134	WEEKS TRAINING-CONTR	18	Accounting personnel quality-education; Accounting personnel quality-general
R135	CONTR SENIORITY	17	X
C135	(R135-R56)/R56 (low contr seniority comp to dir lab)	17	Accounting personnel quality-education; Accounting personnel quality-general
R136	HIGHEST CONTR SENIORITY	18	X
C136	(R136-R57)/R57 (high contr seniority comp to div heads)	18	Accounting personnel quality-education; Accounting personnel quality-general

Table 19 (Cont'd.)

Measurement Name	Description and Calculation	No. of Observations	Disposition
R137A	CONTR SALARY-LOWEST	17	X
R137B	CONTR BENEFITS-LOWEST	17	X
C137A	R137A+R137B (contr compensation-lowest)	17	X
C137B	(C137A-C58)/C58 (low contr compens comp to dir lab)	17	Accounting personnel quality-education; Accounting personnel quality-general
R138A	CONTR SALARY-HIGHEST	16	X
R138B	CONTR BENEFITS-HIGHEST	16	X
R138C	CONTR BONUS-HIGHEST	16	X
C138DA	R138A+R138B+R138C (controller's compensation)	16	X
C138DB	(C138DA-C59DA)/C59DA (compared to division heads)	14	Y
C138IA	R130/R94/R42/R14 (aver contr sal comp with company)	17	Accounting personnel quality-education; Accounting personnel quality-general
C138IB	(R137B/C137A)-(R58A/C58) (low benefits comp dir lab)	17	Accounting personnel quality-education; Accounting personnel quality-general
C138IC	(R138B/C138DA)-(R59B/C59DA) (high bens comp div hds)	14	Y
C138ID	(R138C/C138DA)-(R59C/C59DA) (high bons comp div hds)	14	Y

Table 20

Measurements Included in Components[a]

Loading	Measurement Name	Description and Calculation
Process Sophistication		
0.97	R4	SELLING PRICE
0.90	R5	MATERIALS COST
0.97	C5A	R4-R5 (value added)
0.40	C5B	(R4-R5)/R4 (proportion value added)
-0.29*	C6	R6/R4 (research emphasis)
0.01	C7	R6/R7 (research emphasis)
0.78	R8	PRODUCTION CYCLE-length
Process-Output Diversity		
-0.81	R9	NUMBER PRODUCTS
-0.81	R10	NUMBER CUSTOMERS
Company Size		
-0.95	R12	NUMBER EMPLOYEES NOW
-0.96	R14	NUMBER EMPLOYEES AVERAGE
-0.99	R15	REVENUES
-0.98	R16	EXPENSES
-0.98	R17	ASSETS
-0.95	R18	EQUITY
Company Job Structure Complexity		
-0.80	C19	R19/R14 (elaboration of job titles)
-0.82	C20	(R20/R14)/(1/R19) (employee job concentration)
-*0.92*	C21	(R21/[R14-R20])/(1/[R19-1]) (employee job concentration)
Company Geographical Disperion		
-*0.95*	R22	LOCATIONS-number
-0.58	C22	R22/R14 (differentiation of locations)
-0.90	C23	(R23/R14)/(1/R22) (geographical employee concentration)
-0.85	R25	DISTANCE BETWEEN LOCATIONS

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[a] Large loadings are italicized. * = The sign of the loading is inconsistent with the direction of the component. † = The measurement varies in the opposite direction from the concept of interest; interpret the loading as having the opposite sign.

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
Company Divisional Differentiation		
0.15*	C26	R26/R14 (lowest level unit differentiation)
-0.83	R27	CHIEF SPAN OF CONTROL
-0.97	R28	DIVISION HEADS-number
-0.58	C28	R28/R27 (highest level unit differentiation)
-0.97	R31	OPERATING DIVISIONS-number
-0.94	R32	PRODUCTION DIVISIONS-number
Company Divisional Specialization		
0.61*	C29	R29/R26 (lowest level unit specialization)
0.85	R30†	DIVISION RESPONSIBILITIES-products, functions, geography
-0.73	C31	(R28-R31)/R28 (proportion nonoperating divisions)
-0.89	C32	(R28-R32)/R28 (proportion nonproduction divisions)
Company Mechanization-General *Company Mechanization-Computers*		
0.36 ; 0.01	R35A	MECHANIZATION BULK
0.21 ; 0.15	R35B	MECHANIZATION MOST
0.80 ; -0.34*	C36A	R36/R16 (energy intensiveness)
0.45 ; 0.70	C36B	R36/R4 (energy intensiveness)
-0.04*; *0.80*	R37	NUMBER COMPUTERS
-0.22*; 0.79	C38A	R38/R16 (computerization)
0.37 ; *0.79*	C38B	R38/R4 (computerization)
-0.30*; 0.77	C39A	R39/R16 (computerization)
0.37 ; *0.79*	C39B	R39/R4 (computerization)
-0.43*; -0.11*	C40	R40/R14 (electric typewriters per employee)
0.92 ; 0.12	C41A	R41/R14 (fixed capital per employee)
0.87 ; 0.08	C41B	R41/R17 (proportion assets fixed)
0.79 ; -0.25*	C43A	R43/R42 (depreciation/wage and salary expense)
-0.44 ; -0.28	C43B†	R15/R41 (capital asset turnover)
Company Direct Supervision		
0.63	C44	R44/R14 (supervisory ratio)
-0.89	R45†	FIRST LINE SPAN
-0.91	C47†	R46/R47 (ratio employees 1st 2 levels)

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
		Company Staff Support
-0.27*	C48	(R14-R44-R48)/R14 (staff ratio)
0.86	R49	STAFF FUNCTIONS (differentiation of)
0.80	C50	R50/R14 (clerical ratio)
		Company Authority Levels
-0.93	R51A	LEVELS MOST
-0.93	R51B	LEVELS AVERAGE
		Company Personnel Quality-High Level *Company Personnel Quality-Low Level*
0.06 ; *0.64*	R52	DIRECT LABOR EDUCATION
0.52 ; -0.03*	R53	DIVISION HEAD EDUCATION
0.05 ; -0.65*	C53	R53-R52 (difference high-low education)
0.40 ; -0.10*	C54	R54/R14 (proportion BA degree employees)
-0.02*; 0.48	R55	WEEKS TRAINING
0.12 ; 0.13	R56	DIRECT LABOR SENIORITY
-0.49*; 0.49	R57	DIVISION HEAD SENIORITY
-0.56*; 0.38	C57	R57-R56 (difference div. head and dir. lab. seniority)
0.00 ; *0.79*	C58	R58A+R58B (direct labor compensation)
0.87 ; 0.35	C59DA	R59A+R59B+R59C (division head compensation)
0.91 ; 0.18	C59DB	C59DA-C58 (difference high-low compensation)
0.14 ; *0.78*	C59IA	R42/R14 (average compensation)
0.42 ; 0.48	C59IB	R58B/C58 (proportion direct labor benefits)
-0.35*; 0.48	C59IC	R59B/C59DA (proportion division head benefits)
0.90 ; 0.11	C59ID	R59C/C59DA (proportion division head bonus)
		Company Centralization-Investment *Company Centralization-Purchasing*
-0.29 ; 0.54*	C60A	R60A/R42 (compensation concentration-top 1%)
-0.24 ; 0.64*	C60B	R60B/R42 (compensation concentration-top 2%)
-0.11 ; 0.15*	C60C	R60C/R42 (compensation concentration-top 25%)
0.73 ; 0.22	C61A†	R61A/R51A (decentralization-investment auth-$100)
0.87 ; 0.08	C61B†	R61B/R51A (decentralization-investment auth-$1,000)
0.82 ; -0.07*	C61C†	R61C/R51A (decentralization-investment auth-$10,000)

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
0.88 ; 0.09	C63A†	R63A/R51A (decentralization-investment auth-1%)
0.70 ; 0.10	C63B†	R63B/R51A (decentralization-investment auth-5%)
0.64 ; 0.08	C63C†	R63C/R51A (decentralization-investment auth-25%)
0.42 ; 0.17	C64†	R64/R51A (decentralization-pricing authority)
0.47 ; 0.51	C65A†	R65A/R51A (decentralization-purchase auth-$100)
0.56 ; 0.46	C65B†	R65B/R51A (decentralization-purchase auth-$1,000)
0.47 ; *0.74*	C65C†	R65C/R51A (decentralization-purchase auth-$10,000)
0.35 ; *0.82*	C67A†	R67A/R51A (decentralization-purchase auth-1%)
0.11 ; *0.82*	C67B†	R67B/R51A (decentralization-purchase auth-5%)
0.24 ; 0.61	C67C†	R67C/R51A (decentralization-purchase auth-25%)
0.21 ; -0.02*	C68†	R68/R28 (divisional budget participation)
-0.57 ; 0.22*	R69	BUDGET PROPOSALS BELOW DIVISION
		Company Standardization-Jobs *Company Standardization-General*
0.01*; *0.84*	R70†	PROCEDURES MANUAL
-0.22*; *-0.85*	C72	R71×R72 (total procedures manual words)
0.33*; *0.75*	R73†	PERSONNEL PROCEDURES MANUAL
-0.04*; *-0.85*	C75	R74×R75 (total personnel procedures manual words)
0.73*; 0.04	R76†	PERSONNEL RATING FORM
0.72*; -0.14	R77†	DIRECT LABOR RATING
0.93 ; 0.19*	C79	R79/R14 (proportion written contract employees)
0.89 ; 0.23*	C80	R80/R48 (proportion written contract direct employees)
0.26 ; -0.13	R81	NUMBER UNIONS
0.95 ; 0.21*	C82	R82/R14 (proportion union members)
0.90 ; 0.21*	C83	R83/R48 (proportion direct labor union members)
-0.14*; -0.24	C84	R84/R14 (proportion information booklet employees)
-0.33*; -0.24	C85	R85/R14 (proportion organization chart employees

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
-0.78*; -0.18	C86	R86/R14 (proportion job description employees)
-0.69*; -0.12	C87	R87/R48 (proportion direct job description employees)
-0.07 ; 0.50	R88†	WRITTEN POLICIES
0.19*; 0.26	R89†	PRODUCTION SCHEDULE
-0.53 ; -0.49*	R91	WAGE INCREASE BASIS-seniority, merit, negotiation
0.26*; _0.73_	R92†	FORMS CONTROL
-0.09 ; 0.20	R93†	TIME AND MOTION STUDIES
		Accounting Size-Information Output _Accounting Size-Resource Input_
0.26 ; _0.84_	C94	R94/R14 (proportion controllership employees)
_0.72_ ; 0.09	C95	R95/R14 (proportion employees receiving reports)
_0.75_ ; -0.13*	R96	DATA CENTERS
0.58 ; 0.01	C96	R96/(R9+R44) (data center elaboration)
-0.10 ; 0.42*	C97A†	(R97A+R97B+R97C)/3 (average report frequency)
0.08 ; _0.88_	C98A	R98/R16 (proportion controllership expenses)
_-0.64_*; -0.38*	C98B	R98/R4 (controllership expense emphasis)
		Accounting Job Structure Complexity
0.57	C99A	R99/R94 (elaboration of job titles)
-0.47	C99B	R99/R19 (proportion controllership job titles)
_-0.89_	C100	(R100/R94)/(1/R99) (employee job concentration)
_-0.83_	C101	(R101/[R94-R100])/(1/[R99-1]) (employee job concentration)
		Accounting Geographical Dispersion
_-0.86_	R102	# CONTR LOCATIONS
_-0.84_	C102A	R102/R94 (differentiation of controllership locations)
-0.72	C102B	R102/R22 (proportion controllership locations)
0.28	C105	(R105/R23)/(R94/R14) (geographical employee concentration)
-0.71	R107	CONTR LOCATION DISTANCE
_-0.91_	C107	R107/R25 (proportion contr location distance)

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
		Accounting Unit Differentiation-Horizontal
0.46	R108	LOWEST CONTR UNITS (number)
0.75	C108A	R108/R94 (elaboration of lowest contr units)
0.93	C108B	R108/R26 (elaboration of lowest contr units)
		Accounting Authority Levels
-0.86	C109	R109/R51A (depth of lowest contr units)
-0.90	C110	R110/R51A (depth of lowest contr emps)
-0.81	C111A	(R110-R111)/R51A (vertical width contr function)
-0.87	C111B	(R109-R111)/R51A (vertical width contr function)
		Accounting Report Differentiation
0.10*	C112	R112A+R112B+R112C (report diversity)
-0.84	R113	PROFIT CENTERS
-0.58	C113A	R113/R96 (proportion profit centers)
-0.86	C113B	R113/R44 (profit center elaboration)
-0.88	R114	PRODUCT CENTERS
-0.92	C114A	R114/R96 (proportion product centers)
-0.95	C114B	R114/R9 (product center elaboration)
		Decentralization of Accounts
0.91	C115	R115/R51A (depth lowest cost reports)
0.18	C116	R116/R51A (depth lowest profit reports)
0.91	C97B	PROPORTION REPORT LEVELS
		Sophistication of Accounting Techniques
0.81	C117	(R117A+R117B+R117C)/3 (standard cost usage)
0.94	C118	WEIGHTED FIXED-VARIABLE
0.86	C119	WEIGHTED BREAKEVEN (use of cost-volume-profit analysis)
0.88	R120	COST-VOLUME-PROFIT (sophistication of)
-0.50*	R121	BUDGET ITEMS INCLUDED
0.07	R122	CAPITAL PROJECT INFORMATION

Table 20 (Cont'd.)

Loading	Measurement Name	Description and Calculation
		Accounting Unit Differentiation-Vertical
0.99	C125A†	R125/R51A (reliance on central controller's dept)
0.99	C125B†	(R125-R111)/R51A (reliance on central controller's dept)
		Accounting Mechanization
-0.92	R128	COMPUTERIZED FINANCIAL ACTIVITIES (number of)
-0.88	R129	MECHANIZED REPORTS (proportion)
0.88	C130†	R130/R98 (capital-labor mix)
		Accounting Personnel Quality-Education *Accounting Personnel Quality-General*
0.86 ; 0.32	C132	(R132-R53)/R53 (highest educ compared to div heads)
0.90 ; -0.20*	C133	(R133/R94)/(R54/R14) (BA's compared to overall company)
-0.20*; *-0.56**	R134	WEEKS TRAINING-CONTR
0.02 ; 0.25	C135	(R135-R56)/R56 (low contr seniority compared to dir lab)
-0.31*; *0.72*	C136	(R136-R57)/R57 (high contr seniority compared to div heads)
0.19 ; 0.45	C137B	(C137A-C58)/C58 (low contr compens compared to dir lab)
0.26 ; 0.23	C138IA	(R130/R94)/(R42/R14) (aver contr sal compared with company)
0.06 ; *0.50*	C138IB	(R137B/C137A)-(R58A/C58) (low benefits comp with dir lab)

Table 21

Zero-Order Pearson Correlations of Accounting Components on Each Other

Acctg. Component[b]	Accounting Component[b]												
	A	B	C	D	E	F	G	H	I	J	K	L	M
A		•	•	•	•	•	•	•	0.7	•	•	•	•
B	•		0.5	•	•	•	•	•	•	•	•	•	•
C	•	•		•	•	•	0.4	•	•	•	•	-0.6	•
D	•	•	•		0.7	•	•	•	•	•	•	•	•
E	•	•	•	•		•	•	•	•	-0.6	•	•	•
F	•	•	•	•	•		•	•	•	•	•	•	•
G	•	•	•	•	•	•		•	•	•	•	•	•
H	•	•	•	•	•	•	•		•	•	•	-0.4	•
I	•	•	•	•	•	•	•	•		•	•	•	•
J	•	•	•	•	•	•	•	•	•		•	•	•
K	•	•	•	•	•	•	•	•	•	•		•	•
L	•	•	•	•	•	•	•	•	•	•	•		•
M	•	•	•	•	•	•	•	•	•	•	•	•	

[a] Coefficient signs are adjusted for the direction of components. Coefficients are significant at the 0.10 level.

[b] *Accounting Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

Table 22

Zero-Order Pearson Correlations of Accounting Components with Other Components[a]

Org. Compo-nent[c]	Accounting Component[b]												
	A	B	C	D	E	F	G	H	I	J	K	L	M
						Process							
1	0.8	•	•	•	•	•	•	•	0.5	•	•	•	•
2	•	0.5	•	•	•	•	•	•	•	•	•	•	•
3	•	•	•	•	•	•	•	•	•	-0.5	•	•	•
						Overall Structural Complexity							
4	•	•	•	•	0.4	•	0.5	•	•	-0.4	•	•	•
5	0.6	•	•	•	•	•	•	•	•	•	•	•	•
6	•	•	•	0.5	•	•	•	•	•	•	•	-0.4	•
7	•	•	0.5	0.6	0.5	•	0.4	•	•	•	0.4	•	•
8	•	•	•	-0.4	•	-0.4	•	•	•	•	-0.5	•	•
9	•	•	•	•	•	•	•	•	•	-0.5	•	•	•
10	•	•	0.5	•	0.4	•	•	•	•	•	0.5	•	•
						Control System							
11	•	•	•	0.6	0.5	•	0.6	•	0.5	-0.4	•	•	•
12	•	0.5	•	•	•	•	•	•	•	•	•	-0.4	•
13	•	•	•	•	•	•	•	•	•	•	•	•	•
14	•	•	•	•	•	•	•	•	•	•	•	•	•
15	0.5	-0.4	-0.4	•	•	•	-0.4	0.4	•	•	•	•	•
16	•	•	•	•	•	•	•	0.4	-0.5	•	•	•	•
17	•	•	•	•	•	•	•	•	•	•	•	•	•
18	•	-0.5	•	-0.6	-0.6	•	•	•	•	•	•	•	•
19	0.5	•	•	•	•	•	•	•	0.6	•	•	•	•

[a] Coefficient signs are adjusted for the direction of components.

[b] *Accounting Components*: (A) Size-Information Output; (B) Size-Resource Input; (C) Job Structure Complexity; (D) Geographical Dispersion; (E) Unit Differentiation-Vertical; (F) Unit Differentiation-Horizontal; (G) Authority Levels; (H) Report Differentiation; (I) Decentralization of Accounts; (J) Sophistication of Techniques; (K) Mechanization; (L) Personnel Quality-Education; (M) Personnel Quality-General.

[c] *Organizational Components*: (1) Process Sophistication; (2) Process-Output Diversity; (3) Materials Input Diversity; (4) Company Size; (5) Company Job Structure Complexity; (6) Company Geographical Dispersion; (7) Company Divisional Differentiation; (8) Company Divisional Specialization; (9) Company Mechanization-General; (10) Company Mechanization-Computers; (11) Company Direct Supervision; (12) Company Staff Support; (13) Company Authority Levels; (14) Company Personnel Quality-High Level; (15) Company Personnel Quality-Low Level; (16) Company Centralization-Investment; (17) Company Centralization-Purchasing; (18) Company Standardization-Jobs; (19) Company Standardization-General.

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