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AN EMPIRICAL STUDY OF BUREAUCRATIC STRUCTURAL DIMENSIONS AND THEIR RELATIONSHIP TO THE VARIABLE ORGANIZATIONAL SIZE

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Thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Ph.D. in Education Administration

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CURRICULUM STUDIORIUM

John Robert Goodwin was born July 12, 1927, in Insigner, Saskatchewan, Canada. He received the Bachelor of Arts degree in Psychology from the University of British Columbia, Vancouver, in 1951. He received the Master of Business Administration degree in Management from Queen's University, Kingston, in 1968. The title of his Management Consulting Project was Dover's Limited.

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INTRODUCTION

Social organizations have recently received considerable popular and scientific attention. Popular discussion ranges through the ecological and materialistic limits to growth to scenarios on the implication of continued increase in the size of the organization. Social scientists on the other hand try to point out some of the distinctive structural dimensions of the organization, to indicate some of the causes and results of these dimensions, and to indicate their interrelationship within the context of a formal organization.

A review of the literature directs attention to the inconclusive results concerning the relationship between organizational structure and organizational size. The question arises whether there necessarily exist organizational structural differences that reflect differences in the size of the organization. Hall, Haas, and Johnson (1967) maintain:

> The relationship between organizational size and organizational structure has been a persistent subject in the literature. However, interest in this area, which has been expressed at both the inferential and empirical levels, has not resulted in a definitive set of propositions or findings (903).

Pugh et al. (1968) concede that concepts in this area are primitive and that one must develop a conceptual scheme which allows comparison among organizations with respect to size and structure. Once the scheme is developed, the role of size may be extended by studying unique types of organizations.

This study investigates the concepts of organizational size and organizational structure. Specifically, this is a study of bureaucratic structural dimensions and their relationship with organizational size in

a number of homogeneously complex organizations. The relationships are based on a theoretical model of organizational context and structure derived from Weber's bureaucratic theory (1947), the Aston group studies (1968) of contextual and structural variables, and the Reimann framework (1973) of structural dimensions. The organizational units investigated are the Ontario Colleges of Applied Arts and Technology.

In particular the research is to investigate: (a) the aspects of size to measure; (b) the size-structural relationships; (c) organizational size as a determinant of organizational structure; and (d) the dimensionality of structure. The uniqueness of the college population, which provides control on a number of context variables, will allow the study to support the possible causal relationship of the independent context variable, size, to organization structure. The results of the study should provide additional insight into the concepts of size and structure in formal organizations.

Chapter I

REVIEW OF THE LITERATURE

This chapter provides a framework and model for the relationships of organizational size and organizational structure, delineates and provides the conceptual basis of structure, and of size, reviews the relevant studies indicating the relationship between the variables, and states the research hypotheses.

1. A Theoretical Framework

A review of the organizational theories, given in the literature, is used to develop a theoretical model of the total organization. This research tests a portion of the model specifically pertaining to the relationship between organizational size and organizational structure.

Organizational theory, as a formal area of study, dates to the turn of the century. The earliest thinkers, the classical organization theorists, provide a conceptual framework and terminology for further study. The evolution of classical theory develops through three areas of research. The first, usually titled scientific management theory, is closely associated with the work of Frederick Taylor. Scientific management is most concerned with the use of men as adjuncts to machines in the performance of routine productive tasks (Schoderbek et al., 1975: 109). Two structural dimensions advocated by scientific management include specialization, defined as a division of labour confined to a single function; and standardization, defined as the specification of established procedures.

Max Weber's (1947) theory of bureaucracy constitutes the second area of classical theory. The characteristics of bureaucratic structure provide interesting variables which are capable of being studied empirically. They include rules and procedures drawn up to cover official functions and conduct of office; a specific sphere of competence, with necessary authority and means of compulsion; official positions formed in a hierarchy; administrative acts, decisions and rules formulated and recorded in writing; and a hierarchy of authority with centralization of control and supervision.

The third area, administrative theory, is based on the writings of Fayol, 1929; Mooney and Reiley, 1939; and Urwick, 1940 (Wexley and Yukl, 1977: 32). This theory suggests ideal designs for organizational structure. Included in the administrative structural dimensions and set forth as principles are hierarchial levels, span of control, departmentation, staff-line relationships, and centralization. The structural dimensions of bureaucracy and administrative theory are quite similar.

In summary the classical theory has suggested a number of primary variables or dimensions of organizational structure. The major dimensions include:

1. A division of labour based on functional specialization,
2. A set of standardized rules and procedures for the conduct of the office,
3. A well-defined hierarchy of official positions consisting of a number of levels,
4. A written record of formalized acts, rules and decisions,
5. The degree to which control is concentrated or centralized,

6. The span of control of the officers, and

7. The staff-line relationship indicating the ratio of administrative personnel to production personnel.

Neoclassic or human relations theory emerges to rectify the shortcomings of classical theory. The emphases of neoclassical theory are on the human dimension of management and on the informal organization. While an important field of study, it is not considered relevant to the present research. Blau and Schoenherr note:

> Formal organizations as well as other social structures exhibit regularities that can be analysed in their own right independent of any knowledge about the individual behavior of their members. (1971: viii)

Organizational structure dimensions can thus be examined without reference to the member behaviour. Today, organization theory is characterized by the extension of the earlier theories and the emergence of behavioural science research. Using social science research methods, behavioural science attempts to study various aspects of organizations, adds a great deal to the theories, and provides a means for empirically testing the theories. Behavioural science is classified in terms of three different levels:

(1) the behaviour of individuals,
(2) the behaviour of groups, and
(3) the complex organization as an integrated whole. (Filley et al., 1976: 17)

It is the third level of behavioural science research, the total complex organization, which is of interest in this study.

> Here the total organization is examined in relation to other total organizations--as in systems or organizational classification--or the design of the total system and its effects on behavior studied. Much of the work in this area has sprung from tests of Max Weber's theory of bureaucracy (1947). (Filley et al., 1976: 17)

In order to attain a greater insight into the total organization, Haire (1959) looked to the biological sciences and borrowed the living organism model. This model reorients the researchers, firstly, to examine factors inside the organization as per the classical theorists, and secondly to examine the context within which the organization lives and functions. Assuming the organization is pursuing a goal of survival, he perceives the external environmental contexts as presenting threats which cause the organization to develop protective structures. From this and other studies of the organization as an organism (Leavitt, 1964; Starbuck, 1965) evolves the systems theory of organizations. This modern theory considers the organization as an open system which interacts with, is dependent on, and seeks to control and adapt to its environment. A system is defined as:

> a set of objects together with relationships between the objects and between their attributes connected or related to each other and their environment in such a manner as to form an entirety or whole. (Schoderbek et al., 1975: 30)

Thus causal connections are noted between the components of the system indicating that a change in one subsystem creates a chain reaction in the other subsystems. Also stressed in the situation is the dependence of the organizational structure on the environmental context within which it exists.

Pugh et al. (1963), in the Aston studies, recognized the primitive state of the organizational structural concepts. Drawing from the theory of bureaucracy and other management writings, this group formulated the following five primary dimensions of organizational structure:

1. Specialization,
2. Standardization,
3. Formalization,
4. Centralization, and
5. Configuration. (Pugh and Hickson, 1968)

Further their studies postulated the contextual-structural relationships. Using the concepts advanced by Bakke (1959), they delineated and operationalized seven contextual variables. The list of variables includes origin and history, ownership and control, size, charter, technology, location, and dependence.

In summary organizations are hypothesized to be goal-oriented with the major long range goal being survival. The environment provides the opportunities and limits in the development of an organization. The environmental contextual variables interact with and cause development of the structural component of the organization.

The basic hypothesis of the present research is that organizational structural dimensions are related to organizational size. While it is assumed that increase in size is a resultant of other unspecified causal factors, it appears to have a causal relationship with structure. The notion which makes size solely responsible for the resultant structure is naive. However, at the same time, emphasis is placed on the size

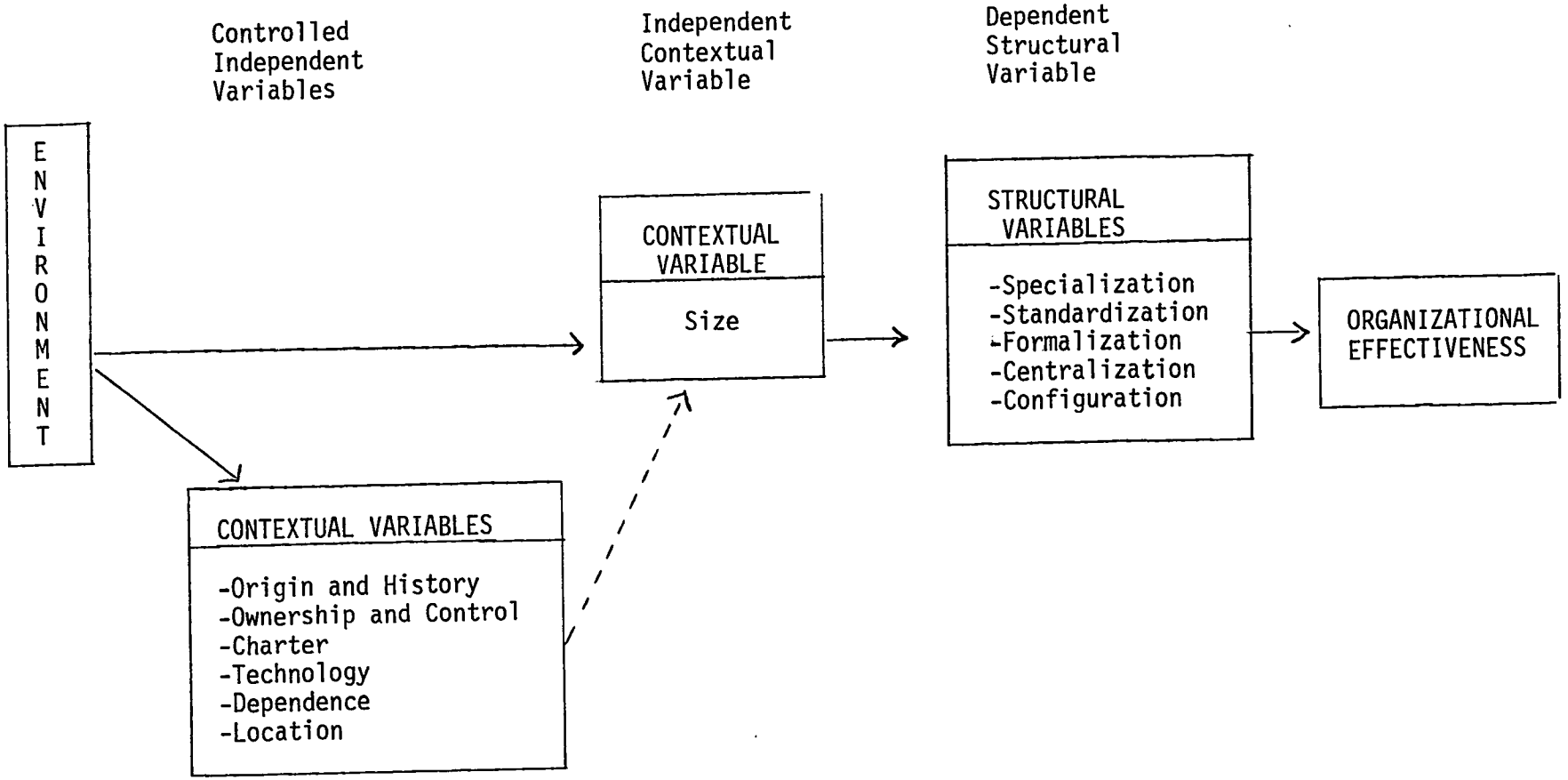
aspect which is held to be relevant to the structure on the basis of previous writings (Weber, 1947; Pugh et al., 1968; Hinings et al., 1967; Child, 1972). Other authors (Woodward, 1958; Hall, Haas and Johnson, 1967; Aldrich, 1972) indicate contextual variables, such as technology, are also important in determining structure.

This present study therefore assumes there is a possibility of an interaction between size and other contextual variables which tends to determine organizational structure.

The Aston group (Pugh et al., 1963, 1968) set forth five structural dimensions and seven contextual dimensions. Using these dimensions as variables, they are depicted as a model (Figure 1). This basic systems theory model postulates relationships among the variables of external environment, context, structure, and effectiveness. The environment variables, basically outside the control of the organization, provide the opportunities and constraints used to create viable organizations. The contextual variables indicate the context within which the organization exists. While they are of great importance, they are controlled to some extent by the organization. The structural variables make up the superstructure or skeleton of the organization. They are the durable and formally sanctioned relationships within the organization by which the organization moves towards its goals. The effectiveness variables evaluate the goal attainment of the organization. These measures, in the short term, generally include productivity, efficiency, and worker satisfaction. The long term measure is organizational survival.

The model outlines the perceived relationship of the environment, context, structure and effectiveness variables. It indicates the areas for researching and in particular the relationship between contextual and structural variables. The next portion of this paper discusses the variables and reviews the relevant studies.

Figure 1. Theoretical Model of the Relationship Between Organizational Size and Structure.



2. The Variables

A review of the approaches to organizational structure given in the literature and a conceptualization of structure used in this study is followed by an examination of the concept of organizational size. Once the concepts are established, the relationships as indicated in the model are supported by relevant studies.

(a) Organizational Structure

While there does not appear to be a universally accepted definition of structure, there is general agreement that structure does exist. Bakke declares:

> the current student of organizational behavior will not find a commonly accepted definition of the structure of the social organization suitable for his purpose in the study of such specific purpose organizations as work teams, departments, companies, unions, schools, churches, and the like. (1959: 17)

Instead, the concept of organizational structure was expressed in terms of dimensions that appeared to be related to the structure. Holdaway et al. point out "there is general agreement that structure refers to those deliberate patterns of relationships in organizations" (1975: 37). Indeed, accepting the above as factual Khandwalla defined organizational structure as:

> the network of durable and formally sanctioned organizational arrangements and relationships. ...And it is, or is intended to be, an appropriate administrative means by which the organization goes about achieving the purpose for which it was set up. (1977: 482)

Traditionally, these durable deliberate patterns of relationships that constitute organizational structure were defined in terms of the dimensions of Weber's model of rational bureaucracy[1]. The model's dimensional perspectives, cited as bureaucratic attributes, originally included:

1. A continuous organization of official functions bound by rules.
2. A specific sphere of competence:
   a. Involves specific division of labour.
   b. Provision of the incumbent with the necessary authority to carry out these functions.
   c. Necessary means of compulsion are clearly defined and their use is subject to definite conditions.
3. Organization of offices follows the principle of hierarchy; that is, each lower office is under control and supervision of a higher office.
4. The rules which regulate the conduct of an office may be technical rules or norms.
5. In the rational type, it is a matter of principle that the members of the administrative staff should be completely separated from ownership of the means of production or administration.
6. In the rational type case, there is also complete absence of appropriation of his official position by the incumbent.
7. Administrative acts, decisions, and rules are formulated and recorded in writing, even in cases where oral discussion is the rule or even mandatory.
8. Legal authority can be exercised in a wide variety of different forms. (Weber, 1947: 330-332)

The Weberian model indicated the administrative staff possessed other characteristics. First, the office holders were personally free and subject to authority only with respect to their impersonal official

---

1 While forms of bureaucracy can be traced into the early history of man, it remained for the publication and translation of this classical work of Max Weber to kindle the interest in bureaucratic structure.

obligations. Second, there was a clearly defined hierarchy of offices in which the sphere of competence was specified for each office, and candidate selection was on the basis of technical qualification. Third, the office was the sole or primary occupation of the incumbent. Fourth, promotion was based on either or both seniority and achievement. Finally, the incumbent was subject to strict and systematic discipline in the conduct of his office. (Weber 1947: 333-341) Because the emphasis of this research was on the bureaucratic structural dimensions, it became imperative to examine the bureaucratic attributes in greater detail.

An administrative structure, or the anatomy of the organization, outlined by these bureaucratic attributes, was considered universal, that is generally applicable to any work organization. Consequently, early research assumed the absolute presence of the bureaucratic dimensions in all organizations. This assumption resulted in researchers measuring the extent of presence of these dimensions in order to determine the bureaucratic qualities of each organization.

Udy queried the absolute presence of these bureaucratic dimensions.

> From a sociological point of view, his [Weber's] specifications for the "rational bureaucracy" superficially resemble the categories of a model. Yet on closer scrutiny they prove to be alleged concrete attributes, rather than variables or categories in a classificatory scheme. (1959: 791)

Reformulating seven of Weber's bureaucratic attributes as variables and using a crude present versus absent measurement, Udy distinguished three positively associated variables of bureaucracy. These variables were hierarchy of authority, administrative staff, and

rewards differentiated according to office.

Another major study (Hall 1963) postulated structural dimensions of bureaucracy. Based on the frequency of citation and theoretical importance, Hall selected and delineated what were considered the major bureaucratic structural dimensions. Using the subjective assessment of the employees for a data base, six dimensions were singled out as meaningful bureaucratic structural attributes found in all organizations to a greater or lesser degree. Thus he contended the dimensions existed in the form of a continuum. As a consequence an ideal-type bureaucracy and a non-bureaucratic organization appeared to have bureaucratic structural dimensions to a degree. These dimensions took in:

1. A division of labour based upon functional specialization.
2. A well-defined hierarchy of authority.
3. A system of rules covering the rights and duties of positional incumbents.
4. A system of procedures for dealing with work situations.
5. Impersonality of interpersonal relations.
6. Promotion and selection for employment based upon technical competence. (1963: 33)

A third landmark study, advocating the concept of structural dimensions, was conducted by the Aston group (Pugh et al., 1968). This group believed the structural concepts, while central to organizational theory, remained primitive in empirical application. "What is needed is precise formulation of characteristics of organization structure, and development of measuring scales which will assess the differences quantitatively" (Pugh and Hickson, 1968: 375). Drawing from the theory of bureaucracy and from management writings, the differences in organizational structure were fairly adequately subsumed into six primary dimensions of

structure: specialization, standardization, formalization, centralization, configuration, and flexibility. These primary structural attributes were defined and operationalized into scaled measures.

Using the scaled measures, the Aston group evaluated the structural differences systematically across fifty-two diverse work organizations. Through principal component analysis the researchers were able to empirically establish four basic, orthogonal components of organizational structure: structuring of activities, concentration of authority, line control of workflow, and the supportive component (Pugh et al., 1968: 89).

This monumental study with its objective measuring devices provided management theorists with a much needed method of comparison between organizations. Both the reappraisal studies and the replication studies added support to the delineated structural dimensions. Inkson et al., (1970), revised and shortened the measuring instrument. This short form, tested for accuracy of representation, correlated very highly (0.91 - 0.97) with the two independent dimensions of structure.

In a further attempt to clarify the relevant structural dimensions, Reimann (1973) utilized the three measures, functional specialization, formalization of role definition, and lack of autonomy, from the revised Inskon schedule. To these he added eight bureaucratic measures considered significant and representative of organizational structure. These

measures included:

1. delegation of authority,
2. centralization index,
3. functional dispersion,
4. hierarchial control,
5. functional specificity,
6. staff density.
7. administrative density, and
8. vertical span (1973: 464-465).

Reimann, using principal component analysis and varimax rotation, produced three uncorrelated structural components: specialization (functional specialization and vertical span), formalization (formalization of role and lack of autonomy), and decentralization (delegation of authority and centralization index). These components describe the same aspects of bureaucratic structure as did the Aston studies. A fourth dimension, administrative density (administrative density and staff density), also was found. Together, the four dimensions accounted for 75.5 percent of the total variance.

Holdaway et al. (1975), studying the educational sector in Western Canada, were basically concerned with the ability of the Aston methodology to differentiate the structural differences between four groups of similar organizations. These researchers used a modified version of the Inkson information schedule (1970: Appendix A). Data were collected on the structural dimensions of functional specialization, formalization, centralization, autonomy, standardization, and configuration. The configuration dimension included measurements of (1) the chief executives' span of control, (2) subordinate ratio, (3) percentage of clerks, (4) percentage of non-workflow personnel, and (5) percentage of superordinates.

Principal component analysis and varimax rotation, performed on the structural data, provided three components of structure: bureaucratic control (formalization, standardization of personnel procedures, centralization and autonomy [negative]); administrative configuration (functional specialization, chief executive span [negative], percentage of superordinates, percentage of clerks, and subordinate ratio [negative]); and non-workflow proportion (subordinate ratio [negative] and percentage of non-workflow employees).

Various structural dimensions, utilized in some of the major research studies, are summarized in Tables 1 to 8. From these studies and from the above discussions, it was proposed to gather data on five measures of bureaucratic structure and five measures of configuration structure, which appear to have some relationship with organizational size. These measures include the following basic dimensions:

1. Functional specialization measured as the number of support non-line functions carried out by designated workers at least half of their available working day (Holdaway et al., 1975).
2. Formalization of role definition measured the extent to which rules, procedures, instructions and other communications were written (Inkson et al., 1970).
3. Autonomy measured as the degree to which decisions are made within the unit of the organization (Inkson et al., 1970).
4. Delegation of authority measured as the ratio of the number of specific management decisions the chief executive delegated to the number he had authority to make (Reimann, 1973).

5. Centralization measured as a function of (a) the locus of decision making with respect to major and scientific functional policies, (b) the degree of information sharing between levels, and (c) the degree of participation in long range planning (Reimann, 1973).
6. Vertical span measured as the number of levels in the hierarchy including the top-chief executive-and-bottom-worker level (Reimann, 1973).
7. Span of control measured as a function of (1) the number of employees who report directly to the chief executive officer, and (2) the subordinate ratio, the mean number of instructors who reported directly to their immediate supervisors, such as department chairmen (Holdaway et al., 1975).
8. Percentage of clerks measured as the percentage of employees who were engaged in clerical duties (Holdaway et al., 1975).
9. Percentage of non-workflow personnel, the percentage of employees who were not engaged in instruction or supervision (Holdaway et al., 1975).
10. Percentage of superordinates (administrative ratio) measured as the full-time equivalent percentage of employees in supervisory positions, including non-workflow supervisory positions (Holdaway et al., 1975).

These measures were considered representative of the major factors of organizational structure.

In summary, the first task in this section was to delineate the structural dimensions of an organization. The present study assumed there were relevant dimensions of structure which were important characteristics in the comparative study of organizations. Based on Weber's bureaucratic attributes, the differences in organizational structure have been delineated by the Aston group into six primary dimensions. The first five dimensions were operationalized and scaled as structural variables. Modified versions of the Aston bureaucratic measures provided the instrumentation, used in recent research, to

TABLE 1

Summary of Major Studies of
Structural Variables: Specialization

Researcher	Definition of Specialization - Division of Labour
Weber 1947	A specific sphere of competence, with division of labour, necessary authority and means of compulsion
Pugh et al. 1963	The division of labour within the organization
Rushing 1967	The distribution of individuals among the structural parts
Hinings et al. 1967	A division of labour in the organization; a clear cut distribution of organizational tasks among a number of positions as official duties
Rushing 1968	The total number of occupational differences among individuals, in this case, all the production personnel
Pugh et al. 1968 Inkson et al. 1970	The division of labour within the organization, the distribution of official duties among a number of positions
Hall 1972	A division of labour based upon functional specialization
Child 1972	Functional specialization is the extent to which official duties are divided between discrete, identifiable functional areas and role specialization - the extent to which official duties are divided within functional areas.
Reimann 1973	Functional specialization is at least one person performing that particular function and no other function
Hickson et al. 1974	Functional specialization is the degree to which the activities of the organization are divided into mutually exclusive sets
Holdaway et al. 1975	Functional specialization is the number of support nonline functions carried out by designated individuals at least one-half of their available working time.
Blau et al. 1976	(1) the number of job titles (2) an index of occupational diversity and (3) the Pugh et al. measure of functional specialization

TABLE 2

Summary of Major Studies of
Structural Variables: Formalization

Researcher	Definition of Formalization
Weber 1947	Administrative acts, decisions and rules formulated and recorded in writing
Pugh et al. 1963, 1968	How far communication and procedures in an organization are written down and filed
Rushing 1965	The routinizing of performance in formal rules and by keeping written records of work performance
Hall, Haas, and Johnson 1967	Is measured by roles, authority relations, communications, norms and sanctions, procedures
Inkson et al. 1970 Child 1972	The extent to which rules, procedures, instructions, and communications are written
Reimann 1973	The extent to which rules, procedures, instructions and other communications were in writing
Hickson et al. 1974	The degree to which the intended behaviour is prescribed in writing
Holdaway et al. 1975	The number of documents in the institution used for specifying roles and checking on role performance
Ouchi 1977	The formality with which rules and regulations are communicated to employees

TABLE 3

Summary of Major Studies of
Structural Variables: Autonomy

Researcher	Definition of Autonomy
Weber 1947	Provision of the incumbent with the necessary authority to carry out the functions
Duncan 1973	The degree of participation in decision making
Reimann 1973	Lack of autonomy is having top management refer certain levels of decisions to higher levels of authority
Hickson et al. 1974	The degree to which decisions are made within the unit of the organization
Holdaway et al. 1975	The extent to which relevant decision making authority is inside the organization
Robey, Bakr and Miller 1977	Operations, autonomy is the proportion of final decisions made by the resident operations manager and his staff, which includes any decision delegated by him to his subordinates

TABLE 4

Summary of Major Studies of
Structural Variables: Delegation of Authority

Researcher	Definition of Delegation of Authority
Reimann 1973	The ratio of the number of specific management decisions the chief executive delegated to the number he had authority to make
Khandwalla 1974	The extent to which the chief executive officer of the firm has delegated decision-making authority in each of the nine key areas of decison-making

TABLE 5

Summary of Major Studies of
Structural Variables: Centralization

Researcher	Definition of Centralization
Weber 1947	A hierarchy of authority with centralization of control and supervision
Pugh et al. 1963, 1968	The locus of authority to make decisions affecting the organization
Child 1973	The extent to which locus of authority to make decisions affecting the organization is confined to higher levels of the hierarchy
Reimann 1973, 1975	A function of (a) the locus of decision making with respect to major and specific functional policies (b) the degree of information sharing between levels and (c) the degree of participation in long range planning
Holdaway et al. 1975	The distribution of decision making authority through the hierarchy
Blau et al. 1976	Decentralization of decision making authority was measured by gathering information on the level at which 25 key decisions were made
Evers, Bohlen and Warren 1976	The degree to which power is concentrated in a social system-developed from eight decision making areas
Robey, Bakr and Miller 1977	The number of final decisions made at each level (multiplied by weight assigned to that level and summing of all levels)
Pugh 1977	The degree to which authority to make certain decisions is located at the top of the management hierarchy

TABLE 6

Summary of Major Studies of
Structural Variables: Vertical Span

Researcher	Definition of Vertical Span (Hierarchy)
Weber 1947	Organization of offices follow the principle of hierarchy that is each lower office is under control and supervision of a higher office
Woodward 1958, 1965	Number of levels of the organization
Hall, Haas and Johnson 1967	Number of levels of the organization
Pugh et al. 1968	The number of job positions between the chief executive and the employees directly working on the output
Blau and Schoenherr 1971	Number of managerial levels in an organization
Hall 1971	A hierarchy of authority
Meyers 1972	A count of number of hierarchial levels plus one for department heads
Goldman 1973	Number of hierarchial reporting steps from salesperson to chief executive
Reimann 1973 Reimann 1975	The number of levels in hierarchy including the top-chief-executive-and-bottom-worker-level
Blau et al. 1976	The number of managerial levels
Ouchi 1977	The total number of levels of hierarchy counting each level from the chief executive officer to the sales person in the store's largest merchandising division
Robey, Bakr and Miller 1977	A count of hierarchial positions on the organizational chart provided by each property

TABLE 7

Summary of Major Studies of
Structural Variables: Span of Control

Researcher	Definition of Span of Control
Weber 1947	There is a clearly defined hierarchy of offices with each office having a defined sphere of competence - differentiation of functions
Dale 1952	Number of employees reporting directly to chief executive officer
Entwistle and Walton 1961	Number of people reporting to college presidents and corporate chief executives
Woodward 1958, 1965	(1) Number of executives responsible to the chief executive, and (2) the average span of control of production department first-line supervisors
Pugh et al. 1968	(1) Number of employees reporting to the chief executive, (2) the ratio of subordinate to first workflow superordinates, and (3) percentage of total employees that were direct-output employees
Zwerman 1970	Number of employees reporting to the chief executive and first-line supervisors
Blau and Schoenherr 1971 Blau et al. 1976	Number of people reporting to (1) directors, (2) division heads, (3) local office managers, and (4) first-line supervisors
Goldman 1973	Over buyers - average number of buyers supervised by each merchandise manager Over sales - average number of sales personnel supervised by each department manager
Heron 1973 Holdaway et al. 1975 Friesen et al. 1976	(1) The number of employees who reported directly to the chief executive officer (2) Subordinate ratio, the mean number of instructors who reported directly to their immediate supervisors, such as department chairmen

TABLE 8

Summary of Major Studies of
Structural Variables: Administration Personnel Ratios

Researcher	Definition of Administration Personnel Ratios
Terrien and Mills 1955	Administrative component is computed as the mean percentage of the administrators (superintendant, his assistants and immediate staff, principals, business managers and the like) to the total staff
Anderson and Warkov 1961	The percentage of all employees classified in the category "General Hospital Administration"
Haas, Hall and Johnson 1963	Supportive component - all persons engaged in activities which contribute indirectly to attainment of organizational goals
Woodward 1958, 1965	Ratio of managers and staff to other organization members
Rushing 1967 Pondy 1969	Ratio of administration personnel to production personnel. Administrative is the sum of managers, officials, professionals and clerks. Production is the sum of craftsmen, operatives and labourers
Tosi and Patt 1967	Administrative ratio: A/P - where A is all personnel not directly involved in production and P is the total personnel in hospital
Holdaway and Blowers 1971	Administrative ratio (1) administrative personnel/number of schools AP/NS (2) 100 administrative personnel/number of professional and administrative staff 100 AP/NPA (3) 100 professional personnel/number of professional and administrative staff 100 PP/NPA (4) administrative personnel plus school principals/number of schools APP/NS (5) 1000 APP/NPA (6) 100 APP/NPA (7) 100 APP/number of classroom teachers
Blau and Schoenherr 1971	Clerical Ratio: sum of all clerical personnel/total personnel, times one hundred Supervisory Ratio: sum of all supervisory personnel/total personnel, times 100 Staff Ratio: number of administrative staff, staff and technical equivalent positions divided by total number of equivalent positions, times 100

...../cont'd

Table 8
(continued)

Researcher	Definition of Administration Personnel Ratios
Hendershot and James 1972	Supervisory-teacher ratio: number of supervisors and principals divided by the number of teachers
James 1972	Supportive employment: the relative size, i.e., number of people in the component to the total number of personnel of each of (1) managerial component; (2) clerical; (3) total administrative = (1) + (2); and (4) differences between (1) and (2) above
Goldman 1973	Administrative ratio: proportion of executives and supervisory personnel to total personnel
Reimann 1973	Staff density; the ratio of the total number of specialists to the total number of employees Administrative density: the ratio of the number of line supervisors, managers, and staff personnel to the total number of employees
Champion and Betterton 1974	Administration production ratio: A/P. The proportion of individuals performing administrative functions in relation to the total number of production personnel
Freeman and Haman 1975	Administrative intensity: the relative size of the two personnel components: the administrative; and the production-worker (teacher)
Holdaway et al. 1975	Configuration variables include: (1) Chief executive's span of control, the number of employees who report directly to the chief executive officer. (2) Subordinate ratio, the mean number of instructors who report directly to their immediate supervisors, such as department chairmen. (3) Percentage of clerks, the percentage of employees who were engaged in clerical duties. (4) Percentage of non workflow personnel, the percentage of employees who were not engaged in instruction or supervision. (5) Percentage of superordinates, the full-time equivalent percentage of employees in supervisory positions, including non workflow supervisory positions
Evers, Bohlen and Warren 1976	Managerial component ratio: number of management (those who had at least one person reporting to them) divided by total number of employees Clerical component ratio: number of clerks divided by total number of employees Administrative component ratio: managerial component plus clerical component divided by total number of employees

obtain numerically standard information necessary for a comparative systematic study.

Secondly, based on the review, researchers contended that bureaucratic structure was multidimensional (Pugh et al., 1968; Reimann, 1973; Holdaway et al., 1975). However, others supported the unidimensional concept that a single component represented a configuration of structural variables (Hall, 1963; Child, 1972). This present report will hypothesize that bureaucratic structure is multidimensional.

(b) Organizational Size

> Inasmuch as one of the most notable characteristics of the contemporary Western world appears to be a proliferation of formal organizations, the problem of the effects of size per se seems to be deserving of exploration (Terrien and Mills, 1955: 11).

As early as 1955, theorists studying organizations made size of organizations a compelling issue. In a review of 80 empirical comparative studies of size and organization structure, Kimberly (1976) noted the research activity, as measured by the number of published studies, has doubled every five years for the past twenty years. Intuitively, size does appear to interact with a multitude of other organization structure variables, for example specialization. Nevertheless, research has provided inconsistent and contradictory answers to such questions as what is the role of size. Pugh et al. (1969) and Blau et al. (1976) reported that size appeared to be the most important contextual variable explaining differences in structure. On the other

hand, Woodward (1958); Hall, Haas and Johnson (1967); Goldman (1973) supported the technology variable as the more important determinant of structure. Is size then a determinant of variability in the structure of an organization?

What is size? In the literature the conceptual definitions of size were lacking, although size was generally considered as an expansion of the organization. The operational definitions, as revealed by the literature reviews, tended to define size in terms of measurements such as the number of employees, the net assets, student enrollment, average daily patient load, regular dues-paying membership, annual sales, and revenue.

In attempting to define and operationalize size, Hall speculated that: "Size is obviously the number of employees in an organization" (1972: 109). Support for such a definition was available. Terrien and Mills (1955: 11-13) utilized the number of employees as an adequate measure of size in studying the effects of changing size upon internal structure. In their size, complexity and formalization study, Hall et al. stated that "determination of organization size for this study was quite simple. The total number of paid employees in the organization was taken as an accurate measure of size" (1967: 905). Pugh et al. (1968), Blau and Schoenherr (1971), and Holdaway et al. (1975) also measured size by the number of employees. This appeared as the most common measure of size (see Table 9 for the operationalized definitions of size included in the reviewed literature). Kimberly indicated, "sixty-five of the 80

TABLE 9

Summary of Major Size Studies

Researcher	Definition of Size	Source of Data
Dale (1952)	Number of employees	American industrial companies n=141
Terrien and Mills (1955)	Number of employees in a school district	732 elementary schools, 100 high schools, 68 unified and city schools.
Anderson and Warkov (1961)	Annual average daily patient load Total hospital labor force	Veterans Administration Hospitals n=49
Entwistle and Walton (1961)	Colleges - total enrolment Small businesses - number of employees	College and universities n=20 Small manufacturing firms n=14
Haas, Hall and Johnson (1963)	Number of full-time and equivalent employees	Heterogeneous organizations n=30
Pugh et al. (1963)	Number of employees Total net assets	Work organizations in the U.K. n=52
Woodward (1965)	Number of personnel	British manufacturing firms n=100
Rushing (1965)	The mean number of employees per establishment is derived for each industry	1960 U.S. population figures as reported in Occupation by Industry and 1958 U.S. Census of Manufacture and the Statistical Abstracts
Hall, Haas and Johnson (1967)	Number of employees	Heterogeneous organizations n=75
Hinings et al. (1967)	Logarithm of the number of employees	Work organizations in the U.K. n=52
Indik (1964)	Total number of employees	Business and volunteer organizations n=5

TABLE 9 (Cont'd.)

Researcher	Definition of Size	Source of Data
Rushing (1967)	Total number of craftmen, operatives and laborers in each industry	Industries from Occupation by Industry Report of 1960 U.S. Census n=41
Tosi and Patt (1967)	Number of full-time personnel	U.S. army hospitals n=36
Pondy (1969)	Total number of craftmen, operatives and laborers in each industry	Industries from Occupation by Industry Report of 1958 and 1960 Census n=45
Rushing (1968)	Total personnel Total production personnel	Manufacturing industries from 1960 U.S. Census n=44
Pugh et al. (1969)	Number of employees Total net assets Number of employees in parent organization Logarithm of the number of employees	Work organizations in the U.K. n=52
Hickson et al. (1969)	Number of employees	Work organizations in the U.K. n=52
Inkson et al. (1970)	Logarithm of the total number of employees	Manufacturing and service organizations n=40 Organizations in longitudinal study n=14
Hickson et al. (1970)	Logarithm of number of employees	Manufacturing organizations n=31
Zwerman (1970)	Number of employees	Manufacturing firms in Minneapolis-St.Paul metropolitan area n=55
Campbell and Akers (1970)	The number of persons holding regular due-paying membership	Autonomous national voluntary occupational associations n=197

TABLE 9 (Cont'd.)

Researcher	Definition of Size	Source of Data
Holdaway and Blowers (1971)	Number of schools Number of pupils Number of professional and administrative staff Number of classroom teachers	Urban school systems in Western Canada n=41
Blau and Schoenherr (1971)	Number of full-time employees	Offices of U.S. Bureau of Employment and Security Agencies n=53, Local Officer n=1201
Hinings and Lee (1971)	Number of employees	Manufacturing organizations n=9
Aldrich (1972)	Logarithm of number of employees	Manufacturing and service organizations (Pugh et al. data) n=46
Meyers (1972)	Number of full-time employees in a department	Departments of finance of city, county and state governments n=194
Child (1972)	Number of employees	Manufacturing and service firms in England n=82
Child and Mansfield (1972)	Logarithm of number of employees	Manufacturing and service organizations n=82
Hendershot and James (1972)	Number of students enrolled	American school districts n=292
James (1972)	Total number of personnel	General hospitals in middle and eastern Tennessee and south-western Kentucky n=91
Child (1973)	Total number of employees, counting part-time employees as half	Manufacturing organizations in the U.K. n=54

TABLE 9 (Cont'd.)

Researcher	Definition of Size	Source of Data
Pfeffer and Leblebici (1973)	Number of employees in the organization	Manufacturing organizations in Illinois n=38
Reimann (1973)	Total number of full-time employees	Manufacturing firms in various industries n=19
Goldman (1973)	Total number of employees	Department stores in northeastern U.S. n=124
Mansfield (1973)	Logarithm of total number of full-time organizational employees	Work organizations n=82
Child (1973)	Logarithm of total numbers employed	Organizations of business n=78
Hinings and Foster (1973)	Number of church members	Literature review
Hickson et al. (1974)	Logarithm of number of employees	Manufacturing firms in Ohio, Birmingham and Toronto n=70
Champion and Betterton (1974)	Average daily bed occupancy	Two samples of hospitals - general hospitals n=9, Tuberculosis hospitals n=41
Freeman and Hannan (1975)	Enrolment	School districts in California n=769
Holdaway et al. (1975)	Number of employees (all non-student employees in each institution) Number of students expressed in full-time equivalents Number of programs of one year duration	Community, private, agricultural colleges and technological institutions n=23

TABLE 9 (Cont'd.)

Researcher	Definition of Size	Source of Data
Friesen et al. (1976)	Number of students Teacher staff Employee staff	Secondary schools n=40
Blau et al. (1976)	Number of employees	Manufacturing concerns in New Jersey n=110
Evers, Bohlen, and Warren (1976)	Total number of employees	Farmer cooperatives in a midwest U.S. state n=53
Kimberly (1976)	The physical capacity of the organization The personnel available to the organization The organizational inputs and outputs Discretionary resources available to an organization	Review of 80 empirical comparative studies more than 80% used personnel available at the size measure
Robey, Bakr and Miller (1977)	Population of area serviced Number of buses owned by the system	Urban transit systems n=25

articles reviewed--more than 80 percent used this measure" (1976: 582).

A hospital study determined the dimension of size through two scales. "The first independent variable, organization size was measured by the Annual Average Daily Patient Load...An alternative measure of organizational size is the total hospital labour force" (Anderson and Warkov, 1961: 24). The correlation between these size measures was 0.966.

The Aston group postulated seven contextual variables as potential causal factors of organizational structure. Of these, the major contextual variable was organizational size. This group provided three operational measurements of size, first by the number of employees, second by the net assets utilized, and finally by the number of employees in the parent organization. The first two measures were highly correlated (r=0.78). Due to the distribution of the size data (mean=3,370; S.D.=5,313) the logarithm of size was employed and the resultant correlation was 0.81 (Pugh et al., 1969: 97-98). Other researchers such as Inkson et al. (1970), Hickson et al. (1974), Aldrich (1972) and Child (1972) also used the logarithm of the total number of employees as the measurement of organizational size.

In the study of the educational sector, Holdaway et al. (1975) postulated three measures of size.

> Number of employees is defined as all non-student employees in each institution. Although number of faculty is commonly used as a measure of size, it is not reported in the study because it correlates .99 with the number of non-student employees. Number of students is expressed in full-time equivalents. Number of programs are those of at least one year duration. (1975: 41)

Kimberly (1976), in his article, argued the necessity to include size measures other than the number of employees. Using the various operational definitions of size, he derived four important aspects which should be considered in the selection of size measures:

(1) The physical capacity of the organization,
(2) The personnel available to an organization,
(3) Organizational inputs or outputs, and
(4) Discretionary resources available to an organization (1976: 587-588).

As a result, this present research intends to utilize four distinct measures of size. First, the physical capacity of the organization is measured by the number of post-secondary programs, of at least one year duration, given at each institution. Second, the number of full-time employees is utilized to measure the available personnel. Third, for the measurement of organizational input, the number of full-time equivalent students is used. And finally, the total institution revenue is considered to measure the discretionary resources.

In summary, researchers frequently use the most convenient size measure without considering all the aspects of size. Many studies (Pugh et al., 1968; Holdaway et al., 1975) indicate a relationship exists between the size measures, and this relationship justifies the use of any one measure. However, little attempt is made to isolate an adequate measure of size. It is proposed to examine the relationship between four size measures in order to delineate one adequate dimension which accounts for a large proportion of the common factor variance.

The review, to this point, has delineated the major dimensions of structure. Ten of these dimensions were defined and utilized in this

study. The independent variable of size was defined and four measures of size were proposed. The remainder of the literature review will develop the possible relationships as postulated by the proposed theoretical model, a framework for the study, and a more explicit and detailed description of the possible relationships between size and structure.

(c) Relevant Research Studies

> The overwhelming size of modern organizations and its effects on bureaucratic structure and process have been a subject of wide concern to sociologists and administrative scientists in the past decades, stimulating a wide variety of comparative research aimed at discovering and delineating the relationship between size and a host of other organizational variables. (Goldman, 1973: 89).

A predominant assumption in the literature relating to the total organization contends that organizational size has far reaching effects on other organizational characteristics. This concern over size has stimulated a great deal of research, however, the conclusions reached with regard to the size relationships are rather contradictory and inconsistent.

Many of the early studies assumed implicitly that a positive relationship exists between size and bureaucratic structure, that is with an increase of size the organization became more bureaucratic. For example, Dale (1952), using a sample of 141 American companies, found the span of control of the chief executive officer increased with the size of the company. This finding was supported by Entwistle and

Walton (1961) and their study of 20 university and colleges and 14 manufacturing firms. However, Woodward (1958, 1965), studying 100 British manufacturing firms, indicated size has little effect on the span of control of the chief executive officer and the first line supervisors. Indeed, Woodward reported the span of control was related to the technology of the firm. Zwerman's (1970) research claimed the chief executive span of control was closely related to the size of the workforce while the span of the first line supervisor was not related to the size of the workforce. Blau and Schoenherr (1971), Goldman (1973) and Blau et al. (1976), tended to add support that size was positively related to span of control.

In 1955, Terrien and Mills proposed a study to obtain information regarding the effect of size upon the intra-organizational structure. Studying certain school districts in California, these researchers supported the hypothesis that the administrative component contained a higher mean percentage of the total staff in the large school districts as compared to smaller school districts. On the other hand, the research of Anderson and Warkov (1961) who studied certain United States hospitals led, on the surface at least, to a direct contradiction of the conclusion reached by Terrien and Mills.

> In addition to Anderson and Warkov, other studies have found that as an organization increases in size, the relative size of the AP ratio [Administrative Ratio] decreases (Haas et al., 1963; Haire, 1959; Blau and Scott, 1962; Indik, 1964; Tosi and Patt, 1967; Pondy, 1967). Studies which have found a positive relationship to exist between organization size and proportionate size of administrative component (in addition to Terrien and Mills) include Dubin (1958) and Raphael (1967). (Champion and Betterton, 1974: 99)

With respect to reaching a general conclusion that an increase in administration was a function of the sheer growth in organization size, Anderson and Warkov added a note of caution. They suggested that a highly important and possibly explanatory variable might well be organizational complexity rather than organizational size. Other possible mediating variables might include technology and professionalism.

Holdaway and Blowers (1971), in a longitudinal examination of forty-one school systems, supported the Anderson and Warkov hypothesis of a negative relationship between the administrative ratio and the size of the organization. In other words the larger school system showed a stronger tendency to have smaller administrative ratios than the smaller school system.

Champion and Betterton replicated the Anderson and Warkov study which defined size of hospitals as the annual average daily patient load. They supported the original hypothesis that, "(1) the larger the hospital organization, the smaller the A/P (Administrative Ratio) ratio, and (2) the more 'complex' the hospital organization, the larger the A/P ratio", (1974: 105).

One explanation for the inconsistent findings was the possible existence of a non-linear relationship. Furthermore, as Champion and Betterton pointed out, the administrative ratio was smaller in larger hospital organizations but larger in more complex organizations.

The relationship between size and managerial succession has come under empirical scrutiny but the findings have been inconsistent.

Likewise, the effects of organizational size on work performance have been examined and again the findings are unclear. People such as Dubin, however, go so far as to assert that size was probably the most important variable in fostering the growth of bureaucracy in an organization (1958: 368).

Hall's findings in his empirical assessment of the concepts of bureaucracy differed with Dubin's statement. As he pointed out:

> ...evidence obtained during the course of the research indicated that the commonly noted factors of organizational size and age were not related to the degree of bureaucratization on the six dimensions...none of the rank order correlation coefficients indicated any significant relationship between age and size and degree of bureaucratization. (1972: 38)

As these findings are based on a small sample of ten organizations, Hall suggested they should not be taken as conclusive.

The Hall study (1961) was worthy of further examination as it provided one methodology for studying the relationship between organizational size and organizational structure. Using a questionnaire, measuring six bureaucratic dimensions, data were collected from a stratified sample of employees in ten organizations. These subjective perceptions and attitudes, expressed on a five point Likert-scale, described the degree of bureaucratization of the organization.

The six dimensions--hierarchy of authority, division of labour, behaviour rules, procedures, impersonality, and technical competence--were measured using sixty-two items. Results of the research upheld Hall's major hypothesis:

> Bureaucracy is a condition which does not exist in a present-absent dichotomy; rather it exists in degrees along the six dimensions studied. (1961: 26)

As a result, the dimensions of bureaucracy appeared to be present to some degree in all organizations.

Recognizing that organizational size has been intuitively accepted as a possible contributor to the bureaucratic structure of the organization, Hall further hypothesized that:

> The degree of bureaucratization along all dimensions will increase as organizational size increases. (1961: 27)

Using Spearman's rank order correlation, size was found to correlate with hierarchy of authority (0.277), division of labour (0.362), rules (0.398), procedures (-0.201), impersonality (0.133) and technical qualifications (0.483) (Hall, 1961: 40, Table 5). However, these findings were not significant at the 0.05 level of confidence and Hall concluded size was apparently not a critical factor in the degree of bureaucratization present in the ten organizations studied (1961: 39).

A further study by Hall, in conjunction with Haas and Johnson, found an inconsistent relationship between size and other structural components. Indeed they suggested "size may be rather irrelevant as a factor in determining organizational structure" (1967: 912).

Aldrich supported this interpretation by asking "how can size have a causal impact on organizational structure or organizational technology?" (1972: 32). He argued that personnel were not accumulated prior to the structuring of the organization activities. Further

he developed a plausible theory using technology as the determining factor of organizational structure.

Much earlier than the work of Aldrich, a milestone study by Woodward (1958) hypothesized technology as the major causal factor of organizational structure. In particular each form of technology was found to have a specific

(1) number of levels of organization,
(2) span of control of first line supervisors, and
(3) ratio of managers and staff to other organizational members.

Size was found not to be a significant causal factor of structure.

On the other hand, Pugh et al. (1963), Hickson et al. (1969), Blau and Schoenherr (1971), Child (1972), Holdaway et al. (1975), and Khandwalla (1974), contend that size was a major determining factor of organizational structure. The Aston group suggested one explanation for the preceding inconsistent findings.

> There has been almost no systematic exploration of the causal connection between contextual factors and certain administrative systems rather than others or certain group and individual behaviour rather than others. (Pugh et al., 1963: 291)

A second explanation was provided by Child as he examined the operational level.

> Two examples may be given of difficulties at the operational level. The first concerns the problem of tautology in relationship between variables which form part of one another and share items in common...A second operational problem lies in the use of measures which may be conceptually acceptable, but which are operationally inadequate. (1972: 175)

A second methodology for studying the relationships between organizational size and organizational structure is sometimes called

the Aston approach, and is the work of Pugh et al. (1963). Recognizing the lack of systematic exploration of the relationships, the Aston studies attempted to examine the structure of the organization in relation to the contextual variables. The first step was to attempt "to develop an empirically based multidimensional analysis of the structural variables of the organization" (1963: 298). As did Hall's, this research drew upon the classical theories, in particular on Weber's bureaucracy, to conceptualize six dimensions of organizational structure which fairly adequately describe the difference in organizational structure:

1. Specialization: Specialization is concerned with the division of labour within the organization, the distribution of official duties among a number of positions (functional specialization)...and the extent to which specialist roles exist within each of the sixteen functional specializations (role specialization).
2. Standardization: Standardization of procedures...an event that has regularity of occurance and is legitimized by the organization. Consists of two factors--(1) procedures defining Task and Image, and (2) procedures controlling personnel selection and advancment.
3. Formalization: Formalization denotes the extent to which rules, procedures, instructions, and communications are written. Three subscales formed (1) Formalization of Role Definition, i.e., written terms of reference, job descriptions and manuals of procedures. (2) Information Passing, i.e., documents intended to pass from hand-to-hand, and (3) Recording of Role Performance, i.e., the accomplishment of some part of the role.
4. Centralization: Centralization has to do with the locus of authority to make decisions affecting the organization. This determined the lowest level in hierarchy with the formal authority to make each decision as well as indicate the degree of autonomy of a particular unit.

5. Configuration: Configuration is the shape of the role structure. The vertical span of control is the height of the workflow super-ordinate hierarchy. Lateral width is the span of control.
6. Flexibility: Flexibility expresses change in organizational structure. The three main factors include the amount of change, the speed of change and the acceleration of change. (1968: 72-79)

From this basis, 64 scales were constructed to measure various aspects of the dimensions of structure. Data were collected from 52 work organizations through a series of interviews. In an attempt to minimize the subjectively reported data, documentary evidence was gathered to substantiate the facts. Sixteen scales were subjected to product-moment correlation and principal-component analysis. Four orthogonal components were extracted which accounted for seventy-four percent of the variance.

Component 1. Structuring of Activities encompassed standardization, specialization, formalization and vertical span.

Component 2. Concentration of Authority encompassed centralization, autonomy, percentage workflow superordinates and standardization of procedures.

Component 3. Line Control of Workflow encompassed subordinate ratio, formalization of role performance recording percentage of workflow subordinates; and standardization of procedures for selection and advancement.

Component 4. The Supportive Component encompassed percentage of clerks, percentage of non-workflow personnel and vertical span. (Pugh et al., 1968: 89)

As a result of establishing these dimensions of structure it became possible to study relationships between dimensions of context and dimensions of structure.

Consequently, in their 1969 article, Pugh et al. postulated that the organizational structure was closely related to the context within

which it functioned and that these contextual factors might explain much of the variation in organizational structure. Based on the concepts advanced by Bakke (1959), this group delineated and operationalized seven organizational contextual variables. The contextual variables included:

1. Origin and History: the impersonality of origin.
2. Ownership and Control: public accountability.
3. Size: number of employees, net assets utilized, and number of employees in parent organizations.
4. Charter: Scales (i) multiplicity of output, (ii) type of output, (iii) consumer and/or producer output, (iv) consumer orientation of output, (v) self-image, (vi) policy on multiple outputs, and (vii) client selection.
5. Technology: Scales of workflow rigidity, the automaticity mode, the automaticity range and interdependence of workflow segments.
6. Location: number of operating sites.
7. Dependence: dependence on parent organization (Pugh et al., 1969).

Once these independent variables were operationalized and measured, their relationships with the dependent variables of organizational structure were studied. The study supported size, dependence, location and technology as predictors of the dimensions of organizational structure. The relationship between size and structural variables received considerable attention.

> The correlation between the logarithm of size and structuring of activities (r=0.69) lends strong support to descriptive studies of the effect of size on bureaucratization...Larger organizations tend to have more specialization, more standardization and more formalization than smaller organizations. The lack of relationship between size and the remaining structural dimensions...was equally striking. (Pugh et al., 1969: 95)

Hall et al. indicate further support for the effect of size:

> There is agreement that size affects structure, but there is no agreement on the relative importance of size vis-à-vis other aspects of organizational structure. (1967: 904)

In a literature review, Child and Mansfield also found organizational size to be a more significant predictor of organizational structure.

> Organization theorists such as Blau and Pugh, working with a bureaucracy as a major point of reference, have, as a result of large-scale comparative studies, given prominence to size rather than technology as the major predictor of organization structure (cf. Blau, 1970; Blau and Schoenherr, 1971; Pugh et al., 1969). (1972: 369)

In summary, the Aston approach provided future researchers with instruments to measure organizational differences systematically thus enabling a more rigorous and comparative study. This technique, through correlation and principal component analysis, made it possible to examine relationships between contextual and structural variables. This research added support to the assumption that size appears as a predictor of organizational structure.

Using size and technology as independent variables and specialization as the dependent variable, Hinings et al. hypothesized that specialization correlates with size and technology. The results indicated support for the hypothesis, with the following relationship, size-specialization 0.75, technology-specialization 0.34, and size and technology with specialization 0.81. Again, the results indicated size to be the most important single element in predicting specialization.

In an empirical reappraisal of the technology-structure relationship, and examining only the thirty-one manufacturing units

included in the Aston data, Hickson et al. (1969: 378) found some moderate correlation for their hypothesis that organizational technology was strongly related to organizational structure. That technology was of primary importance, however, was not supported. Other variables, i.e., size, contributed more to the total variance. As the logarithm of number of employees, size was related with specialized roles (0.83), standardization procedures (0.65), formalized documentation (0.67), and centralization of decisions (-0.47) (Hickson et al., 1969). Technology showed connections only for those measures directly centered on the production workflow. In subsequent studies Hinings and Lee (1971), Child (1972), and Mansfield (1973) found size to be positively related to the structural variables of standardization, formalization, and specialization and to be negatively related to centralization.

In order to make the Aston technique convenient to administer but retain technical soundness, Inkson et al. developed an abbreviated schedule.

> The aim in the present study was to develop a short form of the schedule of organizational information to represent accurately the major dimensions of context and structure established. (1970: 318)

Subsets of scales were used for the major contextual variables of technology and dependence and for the structural variables of structuring of activities (measures of functional specialization and formalization of role definition) and concentration of authority (measures of the lack of autonomy). Using data from the original Aston sample, correlations

between full form and short form were between 0.91 and 0.97. Structuring of activities was correlated with size (0.61) and technology (0.51). Concentration of authority was correlated with dependence (0.66) (1970: 318). This study indicated that the abbreviated interview method provides relevant data to allow the examination of relationships between the contextual and structural variables.

The work of the Aston group was taken as the basic framework for analyzing the educational sector by Holdaway et al. (1975). Using a modified version of the Inkson interview schedule, this research examined the relationships of the contextual and structural variables. Their sample of 23 institutions consisted of community, private and agricultural colleges and technological institutes in Western Canada.

In the college analysis, three structural components were isolated. Component one, bureaucratic control which appeared to be concerned with measures designed to control behaviour, consisted of variables of formalization (0.82), standardization of personnel procedures (0.73), centralization (0.92) and autonomy (-0.92). Administrative configuration, the second component, appeared to be related to ratios of people reporting to superordinates, included variables of functional specialization (0.63), chief executive span (-0.80), percentage of superordinates (0.84), percentage of clerks (0.61), and subordinate ratio (-0.66). Finally, the third component, non-workflow proportion included variables of subordinate ratio (-.57) and percentage of non-workflow employees (0.82) (1975: 46). The correlation reported between size (number of

employees) and the isolated component of bureaucratic control (0.47), and administrative configuration (0.25). Utilizing a second measure of size (the number of programs) these correlations became 0.71 and 0.15 respectively (1975: 48).

Reimann (1975), in a study of nineteen manufacturing firms, reported size to be significantly correlated with specialization (number of levels in hierarchy, and functional specialization). Blau (1976), measuring the relationship of size and structural variables, reported consistently large correlations between size and structural differentiation, which includes the number of managerial levels, number of divisions, number of sections, number of job titles and the Aston measure of functional specialization. He also found that large factories have a wider span of control of middle and first-line managers than small factories.

The preceding review of empirical research supported the generalization that organizational contextual variables and organizational structure were related. Still one may ask, "What are the determinants of variability in structural characteristics of organizations?" (Kimberly, 1976: 571). Size and technology appear to account for a large portion of the structural variations. What is the role of size?

The role of size in organization theory may be extended by studying unique types of organizations. As indicated by Pugh et al., there is a need to select a particular aspect of context a priori as the determining variable of structure (1968: 91). Child examined the

appropriateness of the basis of sampling used to make generalizations about organizational structure:

> a sample with organizations of widely varying status or one with considerable homogeniety of status. The latter appears to be preferable for a comparison of variables in any way associated with the notion of hierarchy (1972: 173).

Blau and Schoenherr (1971) used only one type of organization, the employment security agencies, in their research. In building general theories of organizations they considered it necessary to replicate the findings from one type in another type of organization.

Two research strategies for studying the effects of size with other variables were proposed by Robey, Bakr and Miller.

> First, multivariate research can be undertaken to assess the relative and interactive effects of size with variables such as technology. ...However, a second strategy is more realistic for many researchers. This second approach is to collect cross-sectional data from industries utilizing similar or identical technologies. If measures of size and certain dependent variables are reasonably well standardized in different industries or technological groupings, then comparisons may be made across studies. From a number of studies, conclusions may be drawn about the relative impact of size and other contextual variables on organization structure. This strategy controls for, rather than measures, variables which may explain organization structure and is an efficient alternative to multivariate longitudinal research. (1977: 379)

As size appeared to be one of a number of variables which together may determine organizational structure, this study selected the contextual variable size and studied its effects on organizational structure. The study was designed to control for all other contextual variables identified by the Aston Group through the selection of a unique

group of homogeneous organizations as the population. Thus it was postulated that any significant differences in structural dimensions were basically due to the size variable. As the size structural relationship has not been examined where so many of the other contextual variables were controlled, the results should add to the growing body of knowledge regarding the effect of size.

The basic framework for analyzing structure and size was based on the work of Pugh et al. as modified by Reimann and Holdaway et al. This method of analysis was selected as it represented the most comprehensive and rigorous approach to analysis. It is based on objective measures of structure rather than subjective perceptions of employees, and it is able to discriminate between similar organizations.

In summary, the research on the effects of size or organizational structure is inconclusive at this time. By selecting a homogeneous set of organizations and utilizing a modified Pugh et al. analytical framework, it is believed this research will add some small portion to the general theories of organizations.

3. Rationale for the Study

The Aston model identified five basic bureaucratic aspects and seven contextual dimensions as significant variables of organizational structure and organizational context. The stable meaningful organizational characteristics were operationally defined and measures were developed. This step allowed researchers to examine the

relationships between the contextual and structural variables. From the relationships, the Aston group generated a model which indicated "an estimate can be made of an organization's structural characteristics from a knowledge of the contextual features (size, dependence, technology)" (Pugh and Hickson, 1972: 273). The Aston studies group contend the structural variables are influenced by the contextual variables. This present study is trying to isolate the relationship between one contextual variable, size, and the structural variables. As the study attempts to hold the contextual variables other than size constant, size could be used to estimate or predict the organizational structural characteristics.

Why study organizational size and organizational structure? Certain studies have shown relationships between size and structure previously. However, it is important to test the hypotheses again because of conflicting results. Richard Hall (1961), studying ten organizations, reported bureaucracy exists in degrees along six structural dimensions. He further hypothesized that the degree of bureaucratization will increase as organizational size increases. The relationships to support this hypothesis were not significant. The Hall study described the organizational structure as a unidimensional concept. The dimensions were not specifically treated individually and as independent to one another. The data collected depended on the response of employees, thus the subjective assessments may be perceptual measures rather than actual measures of the organizational structure.

Replication of study to obtain similar results is most difficult where a different sample is used. Further, secondary data, to verify the responses, is not available.

To eliminate the subjective data difficulties the Aston group (Pugh et al., 1963, 1968) attempted to develop standard techniques to test organization theory. Bureaucratic structural aspects were operationalized to characterize organizational structure and to be used as variables in the study of organizations. The significant contribution from their studies was the development of a standard schedule for measuring the structural and contextual variables of work organizations. This standard measuring system allows the researchers to analyze the organizational variables using objective rather than subjective data. Thus the Aston research has become the conceptual framework for suceeding studies. The results of the Aston studies may vary from other studies as their sample of work organizations included many branch organizations.

Child (1972), in a replication of the Aston studies, used a sample of 82 work organizations. The differences in the Child sample as compared to the Aston sample were (1) location of the organizations, (2) sub-units or branches were not used, (3) the sample was confined to business organizations, and (4) the sample was stratified by size and selected from six industries (165). The results of Child's study produced similar positive correlations between size and specialization, standardization, and formalization as in the Aston studies. However, the

correlation between size and centralization is noticeably lower in the Aston studies. The second major difference between the two studies is the possibility that organizational structure is a unidimensional variable.

Holdaway et al. (1975) studied a population consisting of twenty-three colleges and technical institutions. The size ranged from 38 to 639 full-time employees, seventeen of the twenty-three institutes had less than 100 employees. The range of sizes in these institutions was much smaller than in the previous studies. Further, the population differed in type of organizations (public service institutions) and in location (Canada). The initial results of this study support the Aston findings in that a positive relationship was indicated between size and specialization, formalization, and standardization. Centralization, contrary to the previous studies, was also found to be positively correlated with size. Further the study's results varied when principal component analysis produced two different major components of structure.

In the Robey, Bakr and Miller study (1977) of twenty-five urban transit systems, the relationships between size and certain structural variables were examined. The findings indicated the correlation between size and centralization are negative but not significant. Nor was the size found to be predictive of the number of hierarchial levels. Autonomy, however, was found to be positively related tosize. However, in contrast to the Aston methodology, scores for structural variables were based on perceptions of employees rather than on the more objective quantitative

data used by the Aston group. This difference in methodology may account for the varying results.

As the size-structure relationship has been reported with conflicting results and as the principal components of structure vary in each study, it is important to re-examine both the relationship hypothesis and the multidimensional hypothesis.

The size of an organization is a compelling issue. Pugh et al. (1968) and Blau et al. (1976) support size as the major predictor of structure. However, these above studies, while considering size as an expansion of the organization, have not indicated a theory of organization which encompasses the size variable. Generally size has been accepted as either a contextual or structural variable and then operationally defined in terms of some measurement such as the number of employees (Table 9 displays operationalized definitions of size for a number of studies). Some size measures appear to be used because of the availability of data, other measures are justified on the grounds they were used in previous studies. Pugh et al. (1968) proposed three measures of size: number of employees, financial assets and size of the parent organization. Each measure was used in an attempt to expose some relationships with organizational structure that may not appear when the other measures were considered. A correlation (0.78) between number of employees and financial assets led this group to use number of employees to represent both aspects of size.

In the Holdaway et al. (1975) study, the major contextual variables, as outlined in the Aston studies, were used. One of these contextual variables was organizational size. The measures of size used in the study appear to be adopted as 'equivalents' to the Aston measures. The rationale for the three selected measures was not given. Hall (1963) indicated the number of employees was a good measure of size because it correlated highly with other size measures. However, Child (1973) reports, for five possible measures of size, the intercorrelations range from 0.31 to 0.88.

The contradictory results and the rationales for selecting size measures indicate reconsideration of size is in order. Kimberly (1976), in a literature review concerning the size dimension, draws out four important aspects of size that should be considered in selecting the measure of this variable. They include:

(1) the physical capacity of the organization,
(2) the personnel available to the organization,
(3) the organizational input or output,
(4) the discretionary resources available to the organization (Kimberly, 1976: 587-588).

As it was considered each of these measures might indicate some different relationships and as other studies did not utilize all these measures, it was deemed necessary to measure and correlate dimensions of size which represent the above aspects. A positive relationship is hypothesized and is examined.

(a) Assumptions of the Study

1. There are relevant dimensions of structure which are important characteristics in the comparative study of organizations.
2. The adapted Pugh et al. revised instruments are valid and reliable measures of the dimensions of structure and context.
3. The colleges as an organizational group are homogeneous bureaucratic organizations. (The contextual variables are very similar as described in Chapter Two.)
4. Each college operates as an independent unit
5. The enacted legislation and basic charter is the same for each college.
6. The contextual variables are causal of structural differences.

(b) Limitations

1. The study is limited to the theoretical and descriptive evidence concerning structural dimensions and size dimensions of the formal organization.
2. The study is limited to the methodology used and the authenticity of data collected.
3. The study is limited to the view of the organization obtained. The methodology ascertains the formal structure of the organization which may be at variance with what actually occurs.
4. The study is limited by the selection of respondents within the organization.

(c) Delimitations

1. The study is limited to the colleges of applied arts and technology in Ontario.
2. The findings of the research can only be tentatively generalized beyond the colleges of applied arts and technology in Ontario.

4. Statement of Hypotheses

For the purpose of this study size is assumed to be a contextual variable. However, during the discussion of size, the adequacy of the size measures and the intercorrelations between the size dimensions is questioned. Do the size dimensions, to be measured, consider the important aspects of size? Are the size dimensions intercorrelated for this population of institutions? This study uses four operationally defined dimensions of size that appear to measure the important size aspects as brought forth by Kimberly (1976). These dimensions are considered to be conceptually independent. It is suggested however that the size variables are correlated to a high degree and may be considered essentially interchangeable. Hypothesis One is concerned with the relationship of the size dimensions as follows.

HYPOTHESIS I: The college size dimensions of number of employees, number of full-time equivalent students, number of courses, and total institutional revenue are positively related.

It may be recalled that the theoretical model postulated relationships between size, other contextual variables and organizational structure. It is also considered that the contextual variables influence the structural variables. In this study, all contextual variables other than size are considered as controlled variables. They are controlled through the selection of the highly homogeneous group of organizations, the Ontario Colleges of Applied Arts and Technology.

Hypothesis Two is concerned with the relationship between organizational size and organizational structure. The literature review indicates conflicting results; for example: specialization is related to size in a large number of studies; formalization is postively related to size (Pugh et al., 1969; Child, 1972) and is negatively related to size (Rushing, 1967); centralization was found positively related to size by Holdaway et al. (1975), negatively related to size by Hinings and Lee (1971) and Child (1972), and not significantly related to size by Robey et al. (1977). It is expected that size would be positively related to the structural variables of specialization, formalization, vertical span, delegation, and chief executive span; inversely related to centralization; and not significantly related to the percentage of clerks, and percentage of non-workflow personnel. These expected relationships are hypothesized as follows:

HYPOTHESIS II: The college size as measured by the number of full-time employees is related to the organization structure.

The question of the correlation between the administrative ratio and organizational size is reported seperately, but as an adjunct to Hypothesis Two, in order to accentuate this supposed relationship. Early educational studies (Terrien and Mills, 1955) indicate a high positive relationship. Anderson and Warkov (1961) and Champion and Betterton (1974) in their hospital studies report a negative relationship. Pugh et al. (1968), and Child (1972) report a small but negative relationship while Holdaway et al. (1975) indicate no relationship

between these variables. The expected relationship is hypothesized as follows:

HYPOTHESIS IIA: Large colleges have a smaller administrative ratio than the smaller colleges.

The last hypothesis deals with the unitary concept and the multidimensional concept of bureaucratic structure. The Weberian bureaucratic aspect of structure has been accepted and used as a unidimensional concept without question. Hall (1961, 1963) reports that bureaucracy exists along a continuum from no bureaucracy to total bureaucracy although the bureaucratic dimensions were not specifically treated as independent to one another. However, the Aston group, (Pugh et al., 1969), question the unidimensionality of structure.

Using measures of the more significant Weberian structural dimensions and subjecting the data to principal component analysis, the Aston group reported a multidimensional concept. Child (1972), replicating the Aston studies, reports the possibility of a single dimension which represents the more important structural variables. Reimann (1973) and Holdaway et al. (1975) report the bureaucratic structure as multidimensional. As the dimensionality of bureaucratic structure is in question, the dimensional concept is examined with the expected results hypothesized as follows:

HYPOTHESIS III: The bureaucratic structure is multi-dimensional rather than unidimensional.

The research methodology employed in testing the preceding hypothesis will be presented in the following chapter.

TABLE 10

Summary of Major Research Studies
with Size and Organizational Structural Variables

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Dale (1952)	*I.V. Size **D.V. Span of Control	American Industrial Companies n=141	Span of control of the chief executive increases with company size
Terrien and Mills (1955)	I.V. Size D.V. Administrative component	732 Elementary Schools 100 High Schools 68 Unified and City Schools	The administrative staff contained a higher mean percentage of the total staff in large school districts as compared to smaller school districts
Anderson and Warkov (1961)	I.V. Size D.V. Administrative component	n=49 Veterans Administrative hospitals	The two size measures correlate between 0.966 and 0.977 The larger the hospital size the smaller the percent of all personnel in administration The relationship between size of hospital and proportion of personnel in administration was not linear
Entwistle and Walton (1961)	I.V. Size D.V. Span of Control	n=20 Colleges and Universities n=14 small manufacturing firms	Span of control increases with size
Haas, Hall, and Johnson (1963)	I.V. Size D.V. Supportive component	n=30 Heterogeneous organizations	Percentage of personnel in supportive component decreases as size increases
Pugh et al. (1963)	I.V. Contextual Variables D.V. Structural Variables	Literature review	Postulated a set of variables that are capable of empirical verification Value (1) propositions about structure and functioning at the organizational level can be more clearly stated and verified, (2) the typology will serve as a means of controlling organizational factors when organizational research is attempted

*independent variable **dependent variable

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Woodward (1965)	I.V. Size Technology D.V. Span of Control Hierarchy Administrative-personnel ratio	n=100 British manufacturing firms	Size has little effect on the span of control of chief executive and first line supervisors Span of control related to type of technology As levels of technology used increases so does the number of levels of authority (hierarchy) The administrative-personnel ratio varies with the type of technology used rather than by increase in size
Rushing (1965)	I.V. Size D.V. Formal rules index	n=41 Manufacturing Industries	There is a negative correlation between organizational size and formal rules index
Hall, Haas, and Johnson (1967)	I.V. Size D.V. (1) Complexity (2) Formalization	n=75 Heterogeneous organizations	The relationship between size and other structural components are inconsistent More hierarchial levels are found in larger organizations Size may be rather irrelevant as a factor in determining organizational structure
Hinings et al. (1967)	I.V. (1) Size (2) Technology D.V. Specialization	n=52 Work organization in the U.K.	There was a correlation between size and specialization (0.75) There was a correlation between technology and specialization (0.34) No correlation between size and technology (0.08) Size is the most important single element in determining organizational structure
Indik (1964)	I.V. Size D.V. Number of supervisors	n=5 Business and volunteer organizations	The percentage who are supervisors was correlated negatively with the total number of employees. The relationship is logrithmic and curvilinear

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Rushing (1967)	I.V. Size D.V. (1) Ratio of administrative personnel to production personnel (2) Division of labour	n=41 Industries	Size is inversely associated with relative size of administration (r=-0.20) The division of labour is positively associated with the relative size of the total number of administrative personnel (r=0.51)
Tosi and Patt (1967)	I.V. Size D.V. Adminsitrative Ratio	n=36 U.S. Army hospitals	Size is negatively correlated with administrative ratio
Pondy (1967)	I.V. Size D.V. Ratio of Administrative personnel to production personnel	n=45 Industries	Administrative intensity decreases with organizational size
Rushing (1968)	I.V. Hardness of Material D.V. Division of labour	n=44 Manufacturing Industries	Hardness of material seems clearly to impose constraints on division of labour of manufacturing industries
Pugh et al. (1968) Pugh and Hickson (1968)	Primary dimensions of structure (1) Specialization (2) Standardization (3) Formalization (4) Centralization (5) Configuration	n=54 Work organizations in the U.K.	Empirically established four components underlying dimensions of organizational structure (1) Structuring of activities - (standardization, specialization and formalization) (2) Concentration of authority (centralization (-), autonomy (-), non-workflow personnel, standarization of selection (3) Line control of workflow - (workflow superordinates, subordinate ratio). (4) Supportive component - (percentage of clerks, vertical span, percentage of workflow personnel

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Pugh et al. (1969)	I.V. Contextual Variables Size Location Technology Dependence D.V. Structuring of activities Concentration of authority Line control of workflow	n=54 Work Organizations in the U.K.	Size, dependence, technology, and location are critical in the prediction of the two major dimensions; structuring of activities and concentration of authority The study establishes a framework of operationally defined and empirically validated concepts, which will enable processual and dynamic studies to be carried out on a much more rigorous and comparative basis Size correlates with structuring of activities (r=0.69). Larger organizations tend to have more specialization, more standardization and more formalization than smaller organizations
Hickson et al. (1969)	I.V. (1) Size (2) Technology D.V. Structuring of activities Concentration of authority Line control of workflow	n=46 Work organizations in the U.K. n=31 Manufacturing organizations	Operations technology accounts for only a small portion of the total variance in structural dimensions Size is related to structuring of activities (r=0.69) Dependence is related to concentration of authority (r=0.63)
Inkson et al. (1970)	I.V. Technology Dependence Size D.V. Structuring of activities Concentration of authority	n=40 Manufacturing and service organizations n=14 Organizations in longitudinal study	Abbreviated method allowed investigation of relationships between size, technology, and dependence and the structural variables of structuring of activities and concentration of authority Size correlates with structuring of activities (0.61) Dependence correlates with concentration of authority (0.66)

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Inkson et al. (1970)	Organization variables -Workflow integration -Dependence -Structuring of activities -Functional specialization -Formalization -Diffusion of authority	n=46 - 25 British Manufacturing firms and 21 U.S. firms paired for size	Correlation comparison supports the view that structural differences in organizations are due far more to variations in size, technology and dependence than in national origin
Hickson et al. (1970)	I.V. Size Technology Independence D.V. Structuring of activities Concentration of authority Line control of workflow	N=31 Manufacturing organizations	Operations technology is shown to affect only those structural variables immediately impinged on by the workflow. Technology has greater effect on structure of small organizations
Zwerman (1970)	I.V. Size D.V. Span of control	N=55 Manufacturing firms in Minneapolis-St. Paul metropolitan area	Span of control of chief executive closely linked to size of the labour force. Span of control of first-line supervisors not related to size of the labour force
Campbell and Akers (1970)	I.V. Size D.V. Ratio of staff to the number of associated members	N=197 autonomous national voluntary occupational association	The relative staff component was negatively related to organizational size

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Holdaway and Blowers (1971)	I.V. Size D.V. Administrative ratio	N=41 Urban school systems in Western Canada	A negative relationship exists between the administrative ratio and size of the organization The administrative ratio tends to be smaller in the larger school systems Time and size should be considered when analyzing size of administrative proportion
Blau and Schoenherr (1971)	I.V. Size D.V. Span of control Division of labour Hierarchy Managerial ratio Clerical ratio Staff ratio	Offices of U.S. Bureau of Employment and Security Agencies N=53 Local offices N=1201	The larger the agency or division the wider is the span of control of its directors and the average span of control of its division heads, local office managers and first-line supervisors The larger the agency the more pronounced is the division of labour (0.78) Large agency size generates hierarchial differentiation of the authority structure into many different managerial levels (size related to hierarchial levels 0.73) Managerial ratio declines with increase in size but increases with increased complexity Size has no effect on clerical ratio The proportion of supervisory personnel declines with increasing size The proportion of staff personnel declines with increasing size
Hinings and Lee (1971)	I.V. Size D.V. Specialization Standardization Formalization Centralization Configuration	N=9 Manufacturing organizations	There is a strong positive relationship between size and structural variables of specialization (0.84), standardization (0.84), formalization (0.83), and vertical span (0.82). There is a significant and negative relationship between size and centralization (-0.64) and percentage of workflow superordinates (-0.73)

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Aldrich (1972)	I.V. Size Technology D.V. Structure	N=46 Manufacturing and service organizations (Pugh et al. data)	Technology emerges as a variable of major importance in a reanalysis
Meyers (1972)	I.V. Size D.V. Number of major subordinates Number of levels of hierarchy Number of supervisors	N=194 Departments of Finance of city, county and state government	(1) the effect of size is ubiquous (2) causality is unidimensional, other parameters have almost no effect on size (3) the effect of size are greatest on parameters which managers cannot easily manipulate (4) the apparent causal relationships among parameters other than size vanish when size is controlled
Child (1972)	I.V. Size D.V. Specialization Formalization Centralization Configuration Standardization	N=82 Manufacturing and service organizations	The strong nexus found by the Aston group between specialization, standardization, formalization and vertical span is replicated with exception of percentage of non-workflow personnel. There is a strong positive correlation between specialization, standardization and formalization. The centralization of decision-making was found to be negatively related to structuring. It is possible to find a single dimension which represented a configuration of all the basic important structural variables: specialization, standardization, formalization, centralization and vertical span. This suggests a modification of the Aston position to a unitary conception of these dimensions of organizational structure.

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Child and Mansfield (1972)	I.V. (1) Size (2) Technology D.V. Specialization Standardization Formalization Centralization Configuration	N=82 Manufacturing and service organizations	Size is the contextual variable most strongly related to structural variables. The relationship of technology and structure was greatest in small organizations.
Hendershot and James (1972)	I.V. Size D.V. Supervisor-teacher ratio	N=292 American school districts	There is a stable negative relationship between supervisory-teacher ratio and size.
James (1972)	I.V. Size D.V. Supportive component	N=91 General hospitals in middle and eastern Tennessee and South-western Kentucky	The relative size of the managerial component and size are negatively related. The relative size of the administrative component and size are negatively related. The relative size of the clerical component not significantly related to size
Child (1973)	I.V. Size D.V. Structuring of activities Centralization of decision-making	N=82 Manufacturing organizations in the U.K. N=46 - Aston study N=9 - Hining & Lee study N=53 - Blau & Schoenherr study	Size of the organization is positively related to the structuring variables of specialization, standardization and formalization. Size of the organization is negatively related to centralization of decision-making. Size is a major but not the only predictor of organization structure-complexity.

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Reimann (1973)	I.V. Size D.V. Functional Specialization Formalization Lack of Autonomy Delegation of authority Centralization index Functional dispersion Hierarchial control Functional specificity Staff density Administrative density Vertical span	N=19 Manufacturing firms in various industries	Varimax rotation identified four independent dimensions of structure: (1) Decentralization-most heavily loaded on the measures of centralization (negative) and delegation (2) Specialization-most heavily loaded on the measures of functional specialization, vertical span and functional specificity respectively (3) Formalization-heavily loaded on measures of lack of autonomy and formalization of roles (4) Administrative density loaded on measures of administrative density and hierarchial control Specialization related to size, formalization related to dependence. There is a wide variety of structural arrangements.
Goldman (1973)	I.V. Size D.V. Span of control Hierarchy of authority Horizontal differentiation Administrative ratio	N=124 Department stores in North-eastern U.S.	Span of control over buyers not related to size Span of control over sales personnel positively correlated to size Strong relationship between size and the number of levels (r=0.51) The effect of large size is to increase the horizontal differentiation (r=0.28) Size and differentiation have opposite effects on the proportion of managers-increase size induces managerial savings

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Mansfield (1973)	I.V. Size D.V. Bureaucratic System Centralization of decision-making	N=82 Work organizations	Size is positively related to bureaucratic system and negatively related to centralization. The direct relationship between bureaucratization and centralization of decision-making is weak but tends to be negative. Large bureaucratic organizations are much more likely to have decentralized the loci of decision-making than small non-bureaucratic organizations.
Hinings and Foster (1973)	I.V. Size D.V. Structuring of activities Concentration of authority Organizational climate	Literature review	Hypothesis that size has a direct effect on structuring of activities and an indirect effect on both structuring of activities and concentration of authority through the variables of availability of human and financial resources
Hickson et al. (1974)	I.V. Size D.V. Formalization Functional specialization Autonomy	N=70 Manufacturing firms in Ohio, Birmingham and Toronto	The direction and magnitude of the relationship especially between size and formalization and specialization, and between dependence and autonomy was consistent with the Pugh et al. findings
Champion and Betterton (1974)	I.V. (1) Size (2) Complexity D.V. Administration production ratio (A/P)	N=9 General hospitals N=41 Tuberculosis hospitals	Size of hospital organization is inversely related to the A/P ratio. Complexity of the organization is directly related to the A/P ratio.

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Freeman and Haman (1975)	I.V. Size D.V. Administrative intensity	N=796 school districts in California	The A/P ratios are too complex to be useful in many analyses and cross-sectional analysis may be misleading
Holdaway et al. (1975)	I.V. Size D.V. Functional specialization Formalization Centralization Autonomy Standardization Configuration	N=23 community, private, agricultural colleges and technical institutions	The Aston methodology was applicable to homogeneous organizations. Through use of factor analysis, three factors were developed. (1) Bureaucratic control which consists of formalization, standardization of personnel procedures, centralization and autonomy (2) Administrative configuration which consists of functional specialization, chief executive span (negative), percentage of superordinates, percentage of clerks and subordinate ratio (negative) (3) Workflow propositions which is positively loaded on percentage of non-workflow employees and negatively loaded on subordinate ratio
Friesen et al. (1976)	I.V. Size D.V. Specialization Formalization Centralization Standardization Configuration	N=40 secondary schools	The Aston methodology was found to be discriminatory between small similar organizations Three dimensions of structure were found: (1) Dispersion of authority (2) Role professionalization (3) Role specialization

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Blau et al. (1976)	I.V. Size D.V. Span of control Vertical differentiation Size of various personnel components Decentralization of decision-making Division of labour	110 manufacturing firms	Percentage of personnel in direct production positively related to size Percentage of supportive (indirect and non-production) personnel negatively related to size The larger the organization the more it is divided into vertical levels, horizontal subunits and occupational specialties. The span of control of division heads, section heads, and first-line supervisors positively correlated with size. The span of control of the chief executive is negatively correlated with size. When structural differentiation are controlled, size is revealed to exert strong influence on nearly all personnel components and span of control.
Evers, Bohlen and Warren (1976)	I.V. Size D.V. Managerial component ratio Clerical component ratio Administrative component ratio Production component ratio Differentiation Centralization Formalization	N=53 Farmer cooperatives in a midwest U.S. state	Organizational size is inversely related to managerial ratio and administrative ratio Size is positively related to the production component Both the number of major departments and the number of positions were significantly correlated with size

TABLE 10 (Cont'd.)

Researchers	Relevant Variables	Source of Data	Major Findings or Conclusions
Kimberly (1976)	I.V. Size	Literature review of 80 empirical comparative studies	Postulates it is essential to use four measures of size: (1) the physical capacity of the organization (2) the personnel available to the organization (3) the organizational inputs or outputs (4) discretionary resources available to an organization
Robey, Bakr and Miller (1977)	I.V. Size D.V. Centralization of authority Operation autonomy levels	N=25 urban transit systems	Size is positively related to the degree of operations autonomy. No significant correlation between size and centralization of authority and number of levels. The research on the effects of size is inconclusive at this time.

CHAPTER II

RESEARCH METHODOLOGY

A comprehensive interview schedule, to assess organizational size and organizational structure as proposed by the theoretical model, was developed. The interview responses supplemented with organizational documentation provide the basic data for this study. Subjecting the data to statistical analysis yields some information regarding the relationship between the variables. This chapter therefore discusses under four major subheadings: the population, the constant contextual variables, the instrument, and the statistical procedures employed to test the hypotheses.

1. The Population

As the major thrust of this study was to investigate the effect of the contextual variables on organization structure, it was deemed essential to control, to some extent, many of the independent contextual variables. For this reason, a population of homogeneous organizations, the twenty-two Ontario Colleges of Applied Arts and Technology, was selected. Of this total, twenty (or 91%) agreed to participate in the study. These twenty colleges constituted the study population.

The colleges, listed in Table 11, are of one type of institution: publicly supported colleges of applied arts and technology. Established by the Government of Ontario in 1965, these institutions provide non-university, post-secondary education for the adults and out-of-school youths. They are established as crown corporations and are located in

TABLE 11

The Ontario Colleges of Applied Arts and Technology*

	College	Location
1.	Algonquin	Ottawa
2.	Cambrian	Sudbury
3.	Canadore	North Bay
4.	Centennial	Scarborough
5.	Conestoga	Kitchener
6.	Confederation	Thunder Bay
7.	Durham	Oshawa
8.	Fanshawe	London
9.	George Brown	Toronto
10.	Georgian	Barrie
11.	Humber	Rexdale
12.	Lambton	Sarnia**
13.	Loyalist	Belleville**
14.	Mohawk	Hamilton
15.	Niagara	Welland
16.	Northern	South Porcupine
17.	St. Clair	Windsor
18.	St. Lawrence	Kingston
19.	Sault	Sault Saint Marie
20.	Seneca	Willowdale
21.	Sheridan	Oakville
22.	Sir Sanford Fleming	Peterborough

*Source: Ministry of Colleges and University College Affairs Branch, 1974.

**Did not participate in the study.

the Province of Ontario. Their size ranges from 189 to 1,285 full-time employees, with the mean size being 582.5.

The colleges operate as seperate corporations under the Ministry of Colleges and Universities and are governed by their own board of governors. The college areas are established using previously delineated economic regions as the prime criterion. All colleges are supported partially by tuition fees and by government grants.

2. The Constant Contextual Variables

Using the work of Bakke (1959) as a base, Pugh et al. (1969) conceptualized seven contextual variables which have been advanced as possible predictors of structural dimensions. Included in this group of variables were origin and history, ownership and control, charter, technology, location, and dependence. The predictive effect of each contextual variable was assumed to have a similar or a constant effect on the structural dimensions of each college. The other contextual variable, size, was the independent variable in this study. The assumed constant contextual variables are discussed below in order to indicate the similar effect these variables have on each college.

Origin and History. This concept was operationally defined through three aspects: impersonality of origin, age, and historical change. A major modification was deemed essential in order for Ontario to develop a totally integrated education system. To this end, on May 21, 1965, the Honourable William G. Davis, Minister of Education, introduced a

"bill providing enabling legislation for the establishment and operation of a system of COLLEGES OF APPLIED ARTS AND TECHNOLOGY" (Ontario Department of Education, 1967: 5). This dates the origin of the Ontario colleges. In 1967, twenty colleges opened their doors to new students. Since this time two colleges, Canadore (1971) and Sault (1971) have been added. While some of the colleges inherited a physical plant from the Provincial Technical Institutions, the basic college concept was so radical a departure that the colleges were considered a new and unique organization. It may be noted that the measures of origin, age and historical change are similar for each of the colleges and assumed in this study to have a common effect on each college.

Ownership and Control. Two aspects, public accountability and the relationship of the ownership to the management of the organization, operationally defined this concept. In this sample each college was incorporated, under the Ontario Corporation Act, as a crown corporation. Public accountability for each college was high. The relationship of ownership to management was similar for each college. The board of governors of the college sets policy and is legally responsible for its operation. Each board is responsible to the Council of Regents, the provincial regulatory agency within the Ministry of Colleges and Universities. In the Pugh et al. studies this variable was related to concentration of authority (0.63). Again, it was assumed this variable had a similar effect on all colleges.

Charter. Two aspects, the purpose or goal of the organization in terms of its output and the ideological aspects, were operationally defined using seven ordered category scales. The college population was given a broad responsibility:

> To meet the needs of graduates from any secondary school program apart from those wishing to attend university; and to meet the educational needs of adults and out-of-school youths, whether or not they are secondary school graduates. (Ontario Ministry of Colleges and Universities, 1971-72: 17)

The college goals were delineated to provide an advanced education system, which would: (a) provide equality of opportunity, (b) develop each individual to the limit of his ability, and (c) enhance the growth and expansion of the economy. The ideological aspect for the colleges was based on the following four principles:

1. They must embrace total education, vocational and avocational, regardless of formal entrance qualifications, with provisions for complete vertical and horizontal mobility.

2. They must develop curricula that meet the combined cultural aspirations and occupational needs of the students.

3. They must operate in the closest possible cooperation with business and industry, and with social and other public agencies, including education, to ensure that curricula are at all times abreast, if not in advance, of the changing requirements of a technological society.

4. They must be dedicated to progress, through constant research, not only in curricula but in pedagogical techniques and in administration (Ontario Department of Education, 1967: 1).

The purpose, responsibilities, goals and ideological principles included in the charter for each college were very similar.

Technology. This concept was defined by three aspects: operations technology, materials technology, and knowledge technology. The Aston studies indicated a moderate correlation between the measures of technology and structure. By sampling from the same general product group, control appears to be exerted over technology. Woodward's (1958) measures of technology were virtually impossible to apply as all the colleges were classfied in the same technology category. Her study reasons that firms using similar technology have similar organizational structure. As this research measured a set of homogeneous organizations it appeared there was little variation in the three technological aspects. The effects of technology on each college structure were assumed to be very similar.

Dependence. This concept reflected the relationships of the organization with other organizations in its social environment. The scales take into consideration: (a) the impersonality of origin, (b) its status (branch, plant, headquarters, etc.), (c) public accountability of the ultimate owners, and (d) the size of the organizational unit relative to the total parent organization (Reimann, 1975: 231). An examination of measurements of status, organization representatives, suppliers, customer influence, customer links, dependence on largest customers, did not provide significantly different scores for each organization. Each college was a crown corporation with a twelve-member Board of Governors as trustees. The Ontario government provided the

basic financing other than a small student fee.

Location. This concept reflected the geographical, cultural, and community setting. While location varied for each college, an attempt was made to have the areas comparable. Previously, the province was divided into economic regions. This division became the prime criterion for the establishment of college areas. Further division within the economic areas was accomplished using the following criteria:

1. projection of student enrollment,
2. geographic nature of the region,
3. the economic resources, and
4. the economic function.

However, despite the attempt to make each college area similar, location as an intervening variable may have influenced the results of the study.

In summary, the population included twenty of twenty-two Ontario Colleges of Applied Arts and Technology. The uniqueness of the colleges and the context within which they operate provided a control on a number of the contextual variables. Thus, the relationship of the variable organization size appeared to be less contaminated with multivariate relationships. It is indeed this uniqueness that made this research of such great interest.

3. The Instrument

The instrument, an interview schedule, was designed to provide measures of organizational size and organizational structure. As noted in the literature review, the basic framework of the interview schedule was the work of Pugh et al. (1968). Subsequently, the interview schedule

was abbreviated by Inkson et al. (1970) for administrative convenience but with retention of technical soundness. Both Reimann (1973) and Holdaway et al. (1975), with minor modifications, used an expanded version of the abbreviated schedule in their research. The present study adopted the abbreviated Inkson et al. schedule which measures formalization, specialization and autonomy; the Reimann (1973) measures of delegation of authority, centralization, and vertical span; and the Holdaway et al. (1975) measures of chief executive span of control, subordinate ratio, percentage of clerks, percentage of non-workflow personnel and percentage of superordinates. Thus an interview schedule covering the major aspects of organizational structure was available. Only minor modifications in wording were required to make it more applicable to the sample organizations. A copy of the interview schedule can be found in Appendix 1.

The interview items appeared to have a high degree of face validity. More significantly an external criterion group consisting of senior administrative members from two Ontario colleges and a group of university professors reviewed the items prior to their inclusion in the schedule. They indicated that all the scales were valid.

Interviews were conducted with the President and/or senior executives of the Ontario Colleges of Applied Arts and Technology. The interviews were used to gather factual information about the colleges. Documents, such as multi-year plans, calendars, job analysis and policy

memoranda were used to provide further information and a method of verifying answers obtained in the interviews. The interviews and document collection were carried out personally by the researcher, during July and August, 1976. Twenty of the total population of twenty-two Ontario colleges participated in the study.

Arrangements for each interview were accomplished through corresponding with each college President, soliciting his support in carrying out the study. At the same time, a suggested schedule for visiting the college was proposed. Prior to the visit, the arrangements were confirmed by phone. Based on the standardized schedule, each interview lasted between one and two hours. Upon completion of the interview, the President generally directed the researcher to various college executives who might provide further essential information and the relevant documents.

The interview-survey design technique is one recommended by Simon (1969). Simon, on the art of empirical investigation, stated that one learns about relationships between variables, especially causal variables, using this survey technique. Further Kerlinger (1964) stated interviewing allowed for the gathering of factual information, including the necessary sociological data. He indicated one of the main advantages of interviewing was the accuracy of the information. Finally, interviews were used for data collection in prior studies of a similar nature by Pugh et al. (1968), Reimann (1973), and Holdaway et al. (1975).

The following describes in detail the measures used in tapping various constructs.

(a) The Independent Variable - Organizational Size

Based on the discussion of size, four distinct measures of size were utilized. Pugh et al. used two measures of size that are incorporated in this study:

(a) the number of full-time employees, and
(b) the net assets (1969: 97).

Holdaway et al. added the remaining measures of:

(c) the number of students expressed in full-time equivalents, and
(d) the number of programs of at least one year duration (1975: 41).

These measures were operationalized for the present study. The total number of employees included the maximum number of people who were annotated as full-time employees on the college payroll during the 1974-75 college year. The number of students was calculated by the colleges using a cost full-time equivalent formula as developed by the Ontario Ministry of Education. The number of programs, lasting at least two consecutive semesters, presented during the 1974-75 year was also determined. The assets were measured as the total annual institutional revenue as reported to the Ministry of Education.

The following questions were used to obtain measures of the size of the organization.

1. What was the total number of people continuously employed, on a full-time basis, by the college, during the year 1974-75?

2. What was the total institutional revenue as reported by your college for the 1974-75 year?

3. How many full-time and cost full-time equivalent students attended the college during the 1974-75 year?

4. How many programs, of two semesters or greater length, were offered and given during the 1974-75 year?

The actual numbers were validated by using college and Ministry records.

As stated previously, a variety of measures of size have been used. Hall pointed out that "there is a high correlation among the different possible measures" (1972: III). In the Aston studies, the size measures of the number of employees and the net assets employed were correlated 0.78 (Pugh et al., 1969: 95). Holdaway et al. (1975) reported a correlation of 0.79 between number of employees and number of programs.

It was hypothesized that the intercorrelations of the size measures used in this study would compare favourably with those in the previously noted studies.

Most of the empirical studies in the area of organizational size used the number of employees or, when the distribution of data was considered not normal, the logarithm of the number of employees as the basic measure. The review of the literature supported the use of these measures as valid indicators of size.

(b) The Dependent Variables - Organizational Structure

Defined as a network of durable and deliberate patterns of relationships, Pugh et al. (1968), developed measures of structures that

can be adapted for general use, and measured dimensions of specialization, standardization, formalization, centralization and configuration. This initially massive and awkward instrument was revised and shortened by Inkson et al. (1970). In the revised form, measures of structure consisted of functional specialization, formalization of role definition, and lack of autonomy of organizations. Both the Holdaway et al. (1975), and Reimann (1973) studies utilized a modified version of the Inkson measuring instrument.

For this research, structural measures, specialization, formalization and lack of autonomy, were assessed using the Inkson scales. It was, however, necessary to modify the wording of these scales in order to make them applicable to the colleges.

The first measure, functional specialization, was defined as:

> Specialization is considered to exist when at least one person in that organization performs that function and no other function for at least half of his time. No account is taken of either (a) the specialist's status or (b) whether an organization has many specialists or only one. For each activity for which there is a specialist the organization scores one. (Reimann, 1973: 472-474).[2]

Two questions were used to measure functional specialization: (a) Who is responsible for (position title)? and (b) Does he perform that function and no other function for at least half of his time (Yes--No)?, were asked for each of seventeen items:

1. Developing, legitimizing and symbolizing the organization's charter--for example, public relations officer, coordinator of information services.

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2 The material and definitions of the following measures are adopted from Reimann's interview schedule. Reimann's schedule included the three measures taken from Inkson et al.

2. Disposing of, distributing, and following-up on students having completed the program--for example, vocational counsellors, liaison officers with business and/or universities.

3. Arranging transportation, buses, etc., for students and/or staff, between campuses and as required--for example, a transportation clerk.

4. Acquiring and allocating human resources--for example, a personnel manager.

5. Training and development programs for faculty and staff--for example, a training and development manager.

6. Maintaining human resources and promoting their identification with the organization--for example, sports and social director, magazine editor.

7. Obtaining and controlling materials and equipment--for example, purchasing manager, stock control clerk.

8. Maintaining and erecting buildings and equipment--for example, maintenance engineer, works engineer.

9. Recording and controlling financial resources--for example, accountant, comptroller.

10. Controlling the workflow--for example, planning director.

11. Controlling the quality standards for various programs--for example, admissions officer.

12. Assessing and devising ways of classroom presentation.

13. Devising new programs, courses.

14. Developing and operating administrative procedures--for example, statistician.

15. Dealing with the legal and insurance requirements--for example, lawyer.

16. Acquiring information on the operational field--for example, market researcher.

17. Processing information--for example, manager, electronic data processing.

The dimension of formalization, the second measure, was defined as:

> The degree of formalization of role specification in the organization is given by the number of specific role-defining documents--from a set list which exists in the organization, and, in some cases, the extent of their application or distribution (Reimann, 1973: 473).

and was assessed with the following ten items:

	Score
1. Information booklets given to:	
none,	0
few employees,	1
many employees,	2
all employees.	3
2. Number of information booklets:	
none,	0
1,	1
2,	2
3,	3
4 or more.	4
3. Organization chart given to:	
none,	0
chief executive only,	1
chief executive plus other executive,	2
chief executive plus all/most division heads	3
4. Written operation instruction:	1
5. Written terms of reference or job description:	
for masters (various categories),	1
for paraprofessionals,	1
for administrators,	1
for support personnel (clerical),	1
for chief executive.	1
6. Manual procedurees (standing orders):	1
7. Written statements of policies:	1

8. Written lecture schedule or program schedule: 1
9. Written course outlines available to instructors: 1
10. Written contracts of employment: 1

The following definition was used for the third measure, autonomy:

> Autonomy is the number of decisions from a set list which can be taken by the President even though the decision may be subject to routine later ratifications (Reimann, 1973: 473).

Twenty-two items were used to assess this dimension. The question, "Do you, as President, make the decision?" (Yes--No) was posed for each of the following items:

1. Faculty establishment.
2. Appointments of faculty members from outside organization
3. Promotion of administrative members
4. Salaries of administrative members
5. To spend unbudgeted or unallocated money of capital items
6. To spend unbudgeted or unallocated money on extra faculty or staff
7. What type or what brand, visual aid equipment is to be purchased
8. To determine new courses to offer as components of full-time programs
9. To determine school territory from which to draw students
10. The extent and type of market to be aimed for--applied arts, business
11. To determine fee structure
12. To decide on performance appraisal of faculty members
13. Allocate the work among available personnel
14. Dismiss a faculty member
15. Training methods to be used
16. Buying procedures

17. Which suppliers of materials are to be used
18. To set the admission standards for students
19. To alter responsibilities/areas of work of the administrative department
20. To alter responsibilities/areas of work of the academic department
21. To create a new department
22. To create a new job

The binary data results were scored one for "Yes" response and zero for "No" response for each of the twenty-two items. The higher score indicated greater autonomy within the organization.

Data were gathered on other measures deemed to represent some major dimensions of organizational structure. Based on Reimann (1973: 465-467), scales which measure the delegation of authority, centralization index and vertical span were added to this instrument.

The dimension delegation of authority was defined as:

> the number of decisions the President had authority to make but delegated to the subordinates (Reimann, 1973: 464).

The twenty-two items for measuring autonomy were utilized to measure delegation by having the President indicate whether he delegated each decision and to whom he delegated that decision. Scoring of delegation of authority consisted of the ratio of number of specific management decisions the President delegated to those decisions for which he had autonomy.

Centralization index was a function of:

> (a) the locus of decision-making with respect to major and scientific functional policies, (b) the degree of information-sharing between levels, and (c) the degree of participation in long-range planning (Reimann, 1973: 464).

The following six items were used to assess this dimension:

1. Locus of Decision-Making (Programs offered any one year)
   (a) President and an academic committee 1
   (b) President with the help of the particular Dean 2
   (c) President alone 3

2. Locus of Decision-Making (Maximum and minimum number of students per classroom lecture)
   (a) President and an academic committee 1
   (b) President with the help of the particular Dean 2
   (c) President alone 3

3. Locus of Decision-Making (Manpower Policies)
   (a) President's committee with representatives of all functional areas 1
   (b) President with personnel manager 2
   (c) President alone 3

4. Locus of Decision-Making (Selection of Academic Deans and Principals)
   (a) President's committee with representatives from all functional areas 1
   (b) President with personnel manager 2
   (c) President alone 3

5. The Degree of Participation in Long-Range Planning
   (a) All levels of executives--top, middle, and lower 1
   (b) Top level with some representatives of middle level executives 2
   (c) President alone 3

6. The Degree of Information Sharing
   (a) Considerable--general memos on all major aspects of college's operations 1
   (b) Fair--special reports on company's affairs distributed to only top level and middle level executives 2
   (c) Little--all information kept secret from everybody except for a few top level executives 3

The centralization index score was obtained by adding the rankings obtained for all six items. The maximum possible score for this item was eighteen.

The number of levels in the hierarchy including the top-chief executive and bottom-worker levels defines vertical span. One item, the number of levels of authority as indicated on the organization chart, assessed this dimension.

In order to measure the configuration variables included in this study, the measures and definitions were adopted from the Holdaway et al. (1975) schedule. The first measure of this group was the chief executives' span of control which was measured by the number of employees who report directly to the chief executive officer. Second, the percentage of clerks which was the percentage of the total number of employees engaged in clerical duties. The percentage of non-workflow personnel, the third measure, included the sum of professional staff, the clerical workers and the non-clerical workers, all of whom were not engaged in instruction or supervision. Finally, the fourth measure was the percentage of superordinates (the administrative ratio) which included the percentage of full-time employees in supervisory positions, including non-workflow supervisory positions. This dimension was determined by the ratio of the number of full-time professional administrative staff including supervisors and academic chairmen (this consisted of all members not covered by a collective agreement) to the total number of full-time personnel in the organization.

4. Statistical Analysis

Several types of analyses were performed in order to validate the measuring instrument and explore the hypotheses. Because some minor changes were made in the instrument an item analysis technique, the Brogden's general biserial correlation coefficient (Levy & Pugh, 1969) was used as in the original Aston studies. The purpose of this analysis was to assess how well an item discriminates between organizations arranged along a continuum defined by a whole sets of items. As the editorial changes were in the units measuring specialization and delegation, the analysis was restricted to these two items. The item coefficients were used to drop units in order to improve the general correlation. The Brogden's coefficient calculations are included in Appendix 3.

From the size and structural scores, arithmetic means, the arithmetic sums, standard errors, and standard deviations were computed for use in further calculations.

To explore the first hypothesis, a Pearson's product-moment correlation was used. This explored the extent to which each measurement of size was a measure of the same thing. A high correlation between the four measures would provide support for the hypothesized relationship.

The second hypothesis, the college size as measured by the number of full-time employees is related to the organizational structure, was also explored by using Pearson's product-moment correlation. The

correlations indicate the relationships between organizational size and the structural dimensions. This would indicate that the organizational size is predictive of organizational structure. Hypothesis IIA is also examined as above.

An analysis and interpretation of the correlation coefficients may indicate certain structural dimensions tend to group together and therefore may be reduced to a smaller set of components or ideally to one component. These components account for a large portion of the total common variance. Principal component analysis was used to determine whether the structural components can be reduced to a set of uncorrelated variables on the basis of the relationships indicated in the data. Varimax rotation was used to facilitate interpretation by having each variable loaded on as few dimensions as possible. Hypothesis III states that the bureaucratic structure is multidimensional rather than unidimensional. The principal component analysis results will indicate support for this hypothesis if the variables cannot be reduced to one component.

CHAPTER III

PRESENTATION OF RESULTS

In this chapter, the data relevant to the hypotheses of the study are presented and are examined in three sections. The first section deals with Hypothesis I which is concerned with the relationship between the various measures of size. Section two examines Hypothesis II pertaining to the relationship between organizational structure and organizational size and Hypothesis IIA which deals with the relationship between the configurational variable, administrative ratio and the college size. Finally, section three deals with the multi-dimensional concept of bureaucratic structure in Hypothesis III.

Because of editorial changes made in the instrument with regards to specialization and delegation of authority, the scales were verified by item analysis using Brogden's general biserial correlation coefficient (GBR). The mean GBR for specialization was 0.81 and the individual scale correlation ranged from 0.48 to 1.0. The delegation of authority GBR was 0.84 with the item scale correlation ranging from 0.53 to 1.0. Thus the correlational values reaffirmed that these structural variables, which the scales operationalized, were substantially unidimensional variables. As a result of this analysis, items two and sixteen were dropped from the specialization dimension and items one, four, nine, fourteen and twenty-one were dropped from the delegation dimension.

1. Size Relationship

It was discussed previously that a considerable number of the aspects of size should be included in the measurement of size. As a consequence four measures were utilized. Hypothesis I was concerned with the relationships between these four measures. It was hypothesized that a high positive relationship existed between the measures of size and that one size measure could be utilized in the remainder of the study.

The four measures of size, for each of the colleges in the study, are presented in Table 12. Using the SPSS program, Condescriptive, the summary statistics were produced. These statistics provided descriptive measures of each variable such as measures of central tendency by the mean and measures of dispersion by the range, standard deviation, and variance. The descriptive statistical data that detailed the size measures are depicted in Table 13.

A Pearson product-moment correlation matrix of all of the measures of size is presented in Table 14. It was clear from Table 14 that the measures of size correlated very highly. The total number of full-time employees correlated 0.98 with the number of full-time equivalent students, 0.81 with the number of programs, and 0.99 with the total institutional revenue. All correlations were significant at the .001 level. Hypothesis I was supported by this analysis. As the measure "the number of full-time employees" had a very high correlation with the other size measures it was used as the size measure for the remainder of this research.

TABLE 12
Size Characteristics - Ontario Colleges
of Applied Arts and Technology
(N=20 Organizations)

College	Number of Full-Time Employees	Number of Full-time Equivalent Students	Number of Programs	Total Institutional Revenue (Million)
01. Algonquin	1285	10067	109	27.8
02. Cambrian	282	2615	51	7.6
03. Canadore	223	1522	25	5.1
04. Centennial	643	4589	73	13.5
05. Conestoga	650	4374	38	11.9
06. Confederation	382	2318	35	8.9
07. Durham	189	1511	33	3.8
08. Fanshawe	832	6563	89	17.7
09. George Brown	1213	10195	79	26.5
10. Georgian	371	2486	38	7.9
11. Humber	1030	8250	76	21.4
14. Mohawk	828	6197	37	18.0
15. Niagara	438	2900	57	9.7
16. Northern	282	1349	26	5.7
17. St. Clair	536	4745	51	12.5
18. St. Lawrence	573	4461	68	12.8
19. Sault	277	1812	38	5.7
20. Seneca	786	7464	63	19.4
21. Sheridan	512	4754	56	12.9
22. Sir Sanford Fleming	318	2673	44	6.2

TABLE 13

A Description of the Data that Constituted Each of the Four Size Variables (N=20 Organizations)

Basic Statistics / Size Variables	Number of Full-Time Employees	Number of Full-Time Equivalent Students Var 013	Number of Programs Var 17[illegible]	Total Institutional Revenue (Millions)
Mean	582.500	4542.250	54.300	12.740
Standard Error	72.628	621.432	5.029	1.577
Standard Deviation	324.804	2779.128	22.490	7.051
Variance	105497.421	7723551.039	505.800	49.723
Minimum	189.000	1349.000	25.000	3.800
Maximum	1285.000	10195.000	109.000	27.800
Sum	11650.000	90845.000	1086.000	257.800
[illegible] To	[illegible].487 734.513	3241.[illegible]78 5842.[illegible]2	4[illegible]4 64.[illegible]	[illegible]

TABLE 14
Product-Moment Correlations Maxtrix of
Alternative Measures of Organizational Size
(N=20 Organizations)

Variables	1	2	3	4
1. Number of Full-time Employees	1.000	.9820	.8132	.9900
2. Number of Full-time Equivalent Students		1.000	.8227	.9920
3. Number of Programs			1.000	.8236
4. Total Institutional Revenue (Millions)				1.000

Note: All correlations are significant at the .001 level

2. Size-Structure Relationship

Hypothesis II stated that there was a relationship between the structural dimensions and organizational size. It will be recalled that eleven measures were used to assess organizational structure in this study. The SPSS program Condescriptive provided the descriptive statistical data of the structural variables as presented in Table 15. The data for size were displayed in Table 13.

Once again a Pearson correlation matrix was prepared in order that the researcher may compare the relationship between each of the four organizational size measures and eleven measures of organizational structure. The results are presented in Table 16.

In the present study, size as measured by the number of full-time employees correlated positively with the structural dimensions specialization (0.75), delegation of authority (0.85), supervisory span (0.64), and vertical span (0.68). Further size correlated negatively with the centralization dimension (-.41). The other structural variables, formalization, autonomy, the chief executive span of control, ratio of clerks, ratio of non-workflow personnel and ratio of superordinates did not indicate a significant relationship with the independent variable size. This study supported the relationship between size and some of the variables of structure.

Hypothesis IIA indicated large colleges have a smaller administrative ratio than the smaller colleges. The administrative ratio was recorded on Table 15 and Table 16 as the percentage of superordinates.

TABLE 15

A Description of the Data That Constituted Each of the Structural Variables (N=20 Organizations)

Structural Variables / Basic Variables	Special-ization	Formal-ization	Autonomy	Dele-gation	Central-ization	Vertical Span	C.E. Span	Supervisor Span	% Clerk	% Nonwork-flow Personnel	% Super-ordinate
Mean	8.950	17.750	16.400	.755	9.200	5.100	6.450	16.700	22.200	36.950	12.500
Standard Error	.583	.376	.255	.032	.468	.176	.495	1.709	1.625	1.400	1.004
Standard Deviation	2.605	1.682	1.142	.145	2.093	.788	2.212	7.644	7.266	6.262	4.490
Variance	6.787	2.829	1.305	.021	4.379	.621	4.892	58.432	52.800	39.208	20.158
Minimum	5.000	14.000	12.000	.588	6.000	4.000	3.000	6.000	13.000	25.000	5.000
Maximum	15.000	21.000	17.000	1.000	14.000	7.000	10.000	30.000	42.000	47.000	22.000
Sum	179.000	355.000	328.000	15.102	184.000	102.000	129.000	334.000	444.000	739.000	250.000

TABLE 16

Product Moment Correlations of Alternative Measures of Size
With Selected Variables of the Organization Structure
(N=20 Organizations)

	Special-ization	Formal-ization	Autonomy	Dele-gation	Central-ization	Vertical Span	C.E. Span	Supervisor Span	% Clerk	% Nonwork-flow Personnel	% Super-ordinate
Number of Employees	.7527***	.1700	.0200	.8528***	-.4099*	.6843***	-.0644	.6254**	.2609	.1243	-.2042
	(.001)	(.237)	(.467)	(.001)	(.036)	(.001)	(.394)	(.002)	(.133)	(.301)	(.194)
Number of Full-time Equivalent Students	.7843***	.0818	-.0241	.8825***	-.3760*	.6959***	-.1184	.6372***	.3098	.1905	-.2744
	(.001)	(.366)	(.460)	(.001)	(.050)	(.001)	(.310)	(.001)	(.092)	(.211)	(.121)
Number of Courses	.5219**	.1307	-.0263	.8246***	-.3938*	.3814*	-.2934	.5595**	.4643*	.2126	-.2221
	(.009)	(.291)	(.456)	(.001)	(.043)	(.49)	(.105)	(.005)	(.020)	(.184)	(.173)
Institutional Total Revenue (Millions)	.7437***	.1268	-.0275	.8649***	-.3849*	.6761***	-.0883	.6553***	.3289	.1899	-.2184
	(.001)	(.297)	(.454)	(.001)	(.047)	(.001)	(.356)	(.001)	(.078)	(.201)	(.178)

Note: * significant at .05 level
** significant at .01 level
*** significant at .001 level

The administrative ratio correlated negatively with size as measured by the number of employees (-0.20). While the relationship was in the hypothesized direction it was very small.

3. The Multidimensional Concept

A correlation matrix of the structural measures show that relationships do exist between a number of variables. Table 17 exhibits the correlation matrix of the structural dimensions. Since the structural variables are intercorrelated and since the literature is unclear on the dimensionality of bureaucratic structure, a principal component analysis is used to determine if the structural variables could be reduced to one component. "The single most distinctive characteristic of principal component analysis is its data reduction capability." (Nie et al., 1970: 209). That is to say, this technique enables one to reduce the data to a smaller set of components which accounts for the interrelationships within the data. The SPSS subprogram FACTOR, using principal component analysis with iterations and varimax rotation, was used to complete the analysis calculations.

The analysis utilized all twenty cases, 11 items and specified that only those dimensions with an eigenvalue greater than 1.0000 be rotated. This conformed with the rule proposed by Kaiser in 1960 (Tatsuoka, 1971: 147). This criterion ensured only components accounting for at least the amount of average variance of a variable will be treated as significant (Nie at al., 1970: 219). Under these conditions four

TABLE 17
Correlation Matrix of Eleven
Selected Variables of Structure
(N=20 Organizations)

	1	2	3	4	5	6	7	8	9	10	11
Specialization	1.0000	.0931	-.2228	.8497	-.5967	.1952	.2321	-.4027	.5922	-.0690	.2635
Formalization	.0931	1.0000	-.0274	.0062	-.2692	.1163	-.0712	.0592	-.1787	.1592	.1945
Autonomy	-.2228	-.0274	1.0000	-.2063	.3610	-.0482	-.2987	.4104	.0702	.0292	.2013
Delegation	.8497	.0062	-.2063	1.0000	-.5146	.3372	.2439	-.4104	.5017	-.1939	.3674
Centralization	-.5967	-.2692	.3610	-.5146	1.0000	-.3316	-.2000	.2185	-.2043	.0250	-.0553
% Clerks	.1952	.1163	-.0482	.3372	-.3316	1.0000	.2894	.2001	.1526	-.5233	.3214
% NWF Personnel	.2321	-.0712	-.2987	.2439	-.2000	.2894	1.0000	-.6244	.0437	-.3479	.0261
% Superordinates	-.4027	.0592	.4104	-.4104	.2185	.2001	-.6244	1.0000	0.	-.0451	-.0138
Vertical Span	.5922	-.1787	.0702	.5017	-.2043	.1526	.0437	0.	1.0000	-.0876	.3984
C.E. Span	-.0690	.1592	.0292	-.1939	.0250	-.5233	-.3479	-.0451	-.0876	1.0000	.1765
Supervisory Span	.2635	.1945	.2013	.3674	-.0553	.3214	.0261	-.0138	.3984	.1765	1.0000

components were identified which accounted for seventy-four percent of the variance. Table 18 shows the varimax rotated loadings for each of the four components.

Consistent with past research, (Holdaway et al., 1975; Pugh et al., 1968), loadings greater than |.40| were used as the minimum level for selecting the variables loading on each component in the rotated matrix. Thus the variables specialization (.83), delegation (.79), vertical span (.77), and supervisory span (.47) loaded on component one. Component two was loaded on by percentage of superordinates (.88), percentage of non-workflow personnel (-.64), and autonomy (.54). The percentage of clerks (.84), and chief executive span of control (-.72), were the loading variables of component three. The variables loading on component four include formalization (.56), and centralization (-.54).

The principal component analysis produced four components with each of the variables loading on only one component. Thus the findings add support to the multidimensionality of the bureaucratic structural variables.

In summary, first a large positive relationship was found between the four size measures. The "number of full-time employees" measure appeared as an adequate measure of size and was utilized as such for the remainder of the study. Second, relationships were found between organizational size and certain dimensions of organizational structure. Finally, four components of structure were isolated thus supporting the multidimensional concept of bureaucratic structure. The implications of these results are discussed in the succeeding chapter.

TABLE 18
Varimax Rotation of Principal
Components of Structural Variables
(N=20 Organizations)

	Component 1	Varimax Rotated	Component 2	Varimax Rotated	Component 3	Varimax Rotated	Component 4	Varimax Rotated
Specialization		.83023		-.38955		.01788		.18750
Formalization		-.00495		.04296		-.05116		.55555
Autonomy		.03044		.53634		-.03430		-.19282
Delegation		.78588		-.36466		.17640		.11868
Centralization		-.37507		.35720		-.13599		-.54227
% Clerks		.23631		.07117		.83889		.29333
% NWF Personnel		.03965		-.63919		.36707		-.11575
% Superordinates		-.13475		.87805		.16656		.11157
Vertical Span		.76836		.08425		.06109		-.20800
C.E. Span		-.00327		.11587		-.72116		.21912
Supervisor Span		.46936		.16326		.03539		.12133
Percentage of Variance of Non-rotated Components		31.0		16.8		14.3		12.0

CHAPTER IV

DISCUSSION OF RESULTS

In this chapter a discussion and interpretation of the main findings of the study are presented and related to the empirical evidence in the relevant areas. This chapter is divided into three sections, (1) the size measures, (2) the relationship between organizational size and organizational structure, and (3) the multi-dimensionality of the structural variables. In each section the results are considered in light of existing organizational theory.

1. The Size Measure

The issue of size has for a long time intrigued researchers. Generally the theory of size concentrated in two areas. The first area dealt with the location of the variable in the organizational scheme while the second area considered the dimensionality of the size variable.

Is size a dimension of organizational context or is it a structural characteristic? Size as a variable has been defined and utilized in both roles. This appears to result from a lack of systematic exploration of size. The Aston studies utilize size a contextual variable, that is one of the variables within which structure is developed, rather than as a characteristic of structure. It is considered that much of the variation of organization structure might be explained by the contextual variables. Further research has supported the use of the contextual concept. While

this concept was not tested in the present research it was assumed that size was a contextual variable.

The second area, the dimensionality of size, was questioned in this research. Is size unidimensional? Can one valid, readily available measure be used as an index of the concept size? The Aston studies, after defining size as a contextual variable, developed measures which included the number of employees, the net assets, and the number of employees in the parent organization. Other operationalized definitions of size included the number of employees, the net assets, student enrollment, average daily patient load, regular dues paying members, number of regular church members, average bed occupancy, number of programs, population of area served and number of buses. These numerous definitions may lead to the ambiguity of the size variable.

Kimberly (1975), from an extensive literature review, conceived a number of conceptually independent but important aspects which should be included on measuring size. These aspects took into account physical capacity, personnel, inputs and outputs, and discretionary resources. He contended the correlation between the various measures was not sufficient to justify the use of only one measure of size as being the same concept. While the various aspects of size warrant investigation, it would appear to the writer that the correlations between size measures are large enough to justify the usage of one measure. Throughout the literature review, studies have reported, in many instances, a high correlation

between size measures. Anderson and Warkov (1961) indicated the average daily patient load (physical capacity)[3] correlated 0.96 with the total hospital labour force (personnel). The measurement of size in the Pugh et al. (1969) study included the number of employees (personnel) and the net assets (discretionary resources). The correlation coefficient of these two measures was 0.78 and when the log of the two measures was used the correlation increased to 0.81. Holdaway et al. (1975) reported a correlation of 0.99 between number of employees (personnel) and the number of faculty (personnel). Further, they found the number of programs (physical capacity) correlated 0.79 with the number of employees (personnel). From these results it may be inferred there is a high correlation between the various aspects of size.

The results of the present study, taken as a whole, provided clear support for the unidimensionality of size. The hypothesized relationships between the measures of size was upheld. Indeed the correlations between the measure "number of full-time employees" and the other size dimensions ranged from 0.81 to 0.99. The high correlations would indicate each measurement is measuring a large proportion of the same dimension. While these findings may be specific for this population, it is of interest to note the correlations in other diverse studies indicated similar relationships between measures of size. It would appear the measure "number of full-time employees" may be generalized beyond this population.

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3 After each size measure the aspects of size, as conceptualized by Kimberly, were added in brackets by the author to indicate the aspect each measurement appeared to measure.

It could not be expected that the number of full-time employees would predict totally the other dimensions of size. One dimension, "the number of programs" had the lowest correlation at 0.81. This compared closely with the Holdaway et al. (1975) study which reported a correlation of 0.79 between the same variables. It would appear a portion of the variance for this variable is accounted for by the relationship of the measure "number of programs" to one or more intervening variables. However, the "number of programs" measured a large proportion of the same dimension as the other size measures.

The need to have a valid, readily available measure of size was the chief impetus behind the examination of size dimensions. The result of this investigation indicated that the number of full-time employees measurement achieved this goal. Thus it may be said this study achieved a single measure of size that was consistent with the empirical evidence on size relationships, and may justify the use of one measure for the concept of size. To the general theory of organization it would appear the measurement of size using the number of employees was an adequate measure. This study tended to support the usage of such a measure and should remove some questions regarding the measurement of size as used in previous research.

2. The Relationship Between Organizational Size And Organizational Structure

This study was concerned with the structural differences and the relationship of the differences with organizational size. The

attention given to size was stimulated by the potential predictive role as postulated in the Aston and subsequent studies, and as predicted by the conceptualized theoretical model. Using data collected at one point in time, while controlling for technology and other contextual variables, size was assumed to be predictive of the differences in organizational structure. The literature indicated support for positive relationship between size and specialization, formalization (Pugh et al., 1969; Inkson et al., 1970; Child, 1972), vertical span (Blau and Schoenherr, 1971; Hinings and Lee, 1971; Child, 1972), and chief executive span of control (Dale, 1952; Entwistle and Walton, 1961; Blau and Schoenherr, 1971), but not for such structural variables as clerical ratio (Blau and Schoenherr, 1971; James, 1972), autonomy (Pugh et al., 1969; Reimann, 1973) and non-workflow personnel (Pugh et al., 1969).

A negative ratio appeared likely for the percentage of super-ordinates (Anderson and Warkov, 1961; Rushing, 1967; Holdaway and Blower, 1971; Champion and Betterton, 1973) and centralization (Hinings and Lee, 1971; Child, 1973).

The results presented in Chapter 3, in Table 16, supported the size-structure relationship. It was found that organizational size was positively related to specialization (0.75), delegation (0.85), vertical span of control (0.68), supervisory span (0.62) and was negatively related to centralization (-0.41). All relationships were significant at the .05 level.

Despite differences between the samples, the above findings can be interpreted in the light of Pugh et al. (1968), and ensuing research. The relationships between organizational size and organizational structural variables, for relevant studies, are displayed in Table 19.

The first structural variable, specialization, has a high positive relationship with size. As size increases, specialization likewise increases. It is noted the Holdaway et al. study (1975) reports a smaller relationship between size and specialization. This may be due to the very small organizational size of their population. It may be postulated from the data on Table 19 and the results of this study that as the organization size increases specialization also increases therefore a sequence or ordering of specialization may be considered.

Little relationship is found between size and autonomy, chief executive span, percentage of non-workflow personnel, and percentage of clerks. With these variables one can conclude that size is not predictive of changes in these dimensions.

Centralization and size are negatively related, thus an increase in size predicts a decrease in centralization. The one exception to this finding is the Holdaway et al. (1975) study. They report a positive relationship between size and centralization. Again as that study is based on very small organizations it would indicate that perhaps there is a curvilinear relationship. That is very small organizations increase

TABLE 19

Comparison of Findings on Intercorrelations Between
Organizational Size and Organizational Structural Variables

Size / Structural Variables	Specialization	Formalization	Autonomy	Centralization	Vertical Span	C.E. Span	Subordinate Span	% Workflow Superordinates	% NWF Personnel	% Clerks	Delegation
Pugh et al. (1968)											
52 Organizations	0.67	0.55	0.09	-0.39	0.67	0.32	0.05	-0.13	0.36		
31 Mfr. Firms	0.75	0.67	-0.23	-0.47	0.77	0.28	0.04	-0.31	0.52	0.13	
Hinings and Lee (1971)	0.84	0.83	-0.10	-0.64	0.82	-0.23	-0.12	-0.73	0.39	-0.13	
Child (1972)											
82 Organizations	0.61	0.58	0.18	-0.58	0.65	0.15	0.13	-0.11	-0.13		
40 Mfr. Firms	0.65	0.69	0.10	-0.74	0.63	0.36	0.23	-0.03	-0.06		
Holdaway et al. (1975)	0.43	0.43	-0.31	0.47				0.03			
Present Study	0.75	0.17	0.02	-0.41	0.68	-0.06	0.63	-0.20	0.12	0.26	0.85

their centralization as the size increases. This allows the chief executive to maintain control of the decision-making. At some size level the chief executive is unable to cope with the situations and commences to decentralize. After this size level is reached, further increases in size would predict a decrease in centralization.

Further examinatior of Table 19 shows previous studies report a significant correlation between size and structural variable formalization. However, the correlation in this study emerged as very different. The colleges together have developed many role defining documents, for example union contracts, group benefit programs, retirement pension plans, and a system of job description introduced by a consulting firm. As there was universal use among the colleges of these role defining documents and as the colleges operated as a unit in many of these areas, the relationships generally found between size and formalization disappeared.

Examination of the raw data showed that eleven of the colleges scored either seventeen or eighteen on this variable. There was so little variation in the scores that a relationship did not show up. Indeed the organizations may be homogeneous through the extent of formalization and the close control exercised by the Ontario government. Further one may question the results of the Holdaway et al. (1975) study. The Institutions of Technology, because of direct government control, may be more formalized than the other colleges. As the three institutes

included in the study represented the large organization it may be the formalization relationship is due to factors other than size.

Additionally, a major intervening variable, complexity, may be an important determinant of other structural variables and in particular, formalization. Child (1973) postulated that complexity, while positively correlated with size, is a major predictor of formalization (documentation). Defining complexity as consisting of specialization of role, specialization of function and level of specialist qualification, Child reported complexity "as an important intervening variable between the context of the organization (of which size is a key aspect) and its formalization" (Child, 1973: 183).

A further deviation from the previous studies appeared in the subordinate span of control. This deviation, however, was supported by Blau and Schoenherr (1971) who reported that larger agency's or divisions' first-line supervisors had a wider average span of control. Blau et al. (1976), also reported the span of control of first-line supervisors had a weak association with size. Blau clarified this relationship:

> Although the association of size...with spans of control are generally weak, these zero-order correlations are misleading because the effects of size on most spans of control are concealed by the opposite influences of structural differentiation on them, as previous research indicated (Blau, 1972). When the three main forms of structural differentiation--number of levels, divisions, and sections--are controlled, size is revealed to exert strong influences on nearly all personnel components and spans of control (Blau et al., 1976: 26).

The literature provided conflicting findings on this relationship. The present study found a relationship (0.63) between size and supervisor span of control, thus the larger the college the wider the supervisor's span of control. While these findings supported Blau et al., it disagreed with Pugh et al. Reimann (1973) also reported that large factories have a wider span of control for middle- and first-line managers than small factories.

The relationship between organizational size and subordinate span of control may be characteristic only of similar type of educational institutions. Larger institutions have the resources to mount additional programs. These programs are sponsored by specific departments. As a result the department head has more instructors reporting to him thus increasing his span of control. However, further study on the supervisor's span of control is essential to verify the present findings.

As previously noted, the earliest studies, which examined the relationship of size, utilized the configurational variables of structure. Later research explored the relationship between size and the Weberian bureaucratic structural dimensions. While the Weberian dimensions included configuration, this study separated the bureaucratic from the configuration variables in order to test Hypothesis IIA. Based on the size-structural relationship, it was hypothesized that large colleges have a smaller administrative ratio than the small colleges.

The administrative ratio as indicated by the percentage of superordinates was related to size; although the association was small, it was in the direction predicted in Hypothesis IIA. Again other intervening variables may distort the effect of size on the configuration variable.

Theoretically, it appeared that as organizational size increased, changes occurred in certain specific dimensions of the college structure. That is, size appeared to affect a number of structural dimensions. As pointed out by Child (1973):

> The proportion of variance in major dimensions of organizational structure predictable from knowing the size of organizations appears to be highly consistent across different samples of organizations (171).

One could not expect that all the variables in organizational structure would be predicted by the contextual variable organization size. Other contextual and intervening variables yet to be investigated may also influence structure.

The findings indicated that size is an indicator of specialization, delegation, centralization (negative), vertical span and supervisor span but not of the other structural dimensions. This suggests that other contextual variables may have a determining influence on these other dimensions. It is furthermore possible that organizational size indirectly is related to structural dimensions through some intervening variable such as complexity.

The results of this investigation indicate that certain dimensions of that organizational structure could be predicted from a

knowledge of organizational size in this sample of twenty colleges. It should be stressed however that these relationships may not necessarily be obtained for all colleges or indeed for all organizations. To arrive at such a conclusion on the basis of one study involving twenty homogeneous organizations would seem premature. However, when this findings is added to the findings in other studies, one would tend to conceptualize the forgoing size-structural relationship as consistent in all organizations.

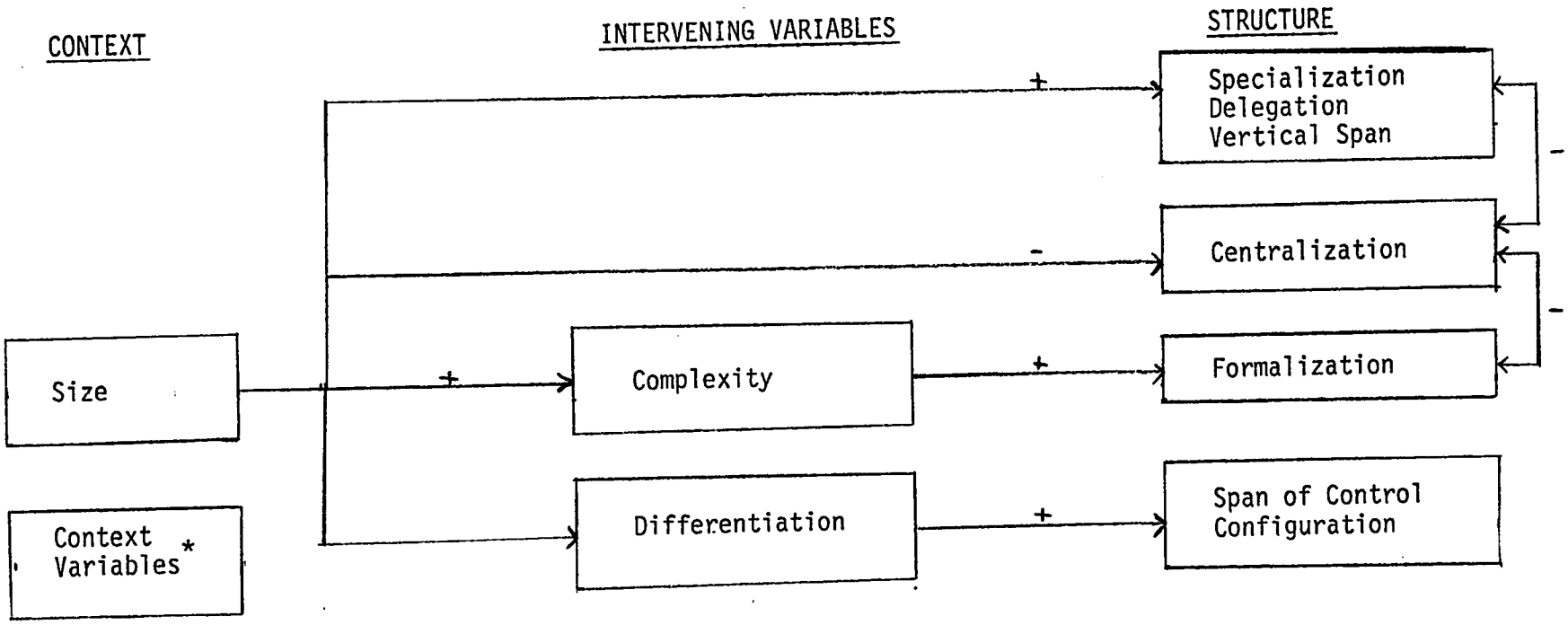
Childs' "Predicting and understanding organization structure" (1973), presented a logical and rational representation of organization context and organization structure. This representation was the suggested relationship as summarized in Child's national study. Child viewed the contextual variables as directly and indirectly causal of the structural variables. Applied to the findings of this research, one interpretation of the structural system is given in Figure Two.

It should be noted that Child's national study was a replication of the Aston group. According to Child's model size was correlated with the more important bureaucratic structural variables. In the present study, size seems to be related to four structural dimensions. Formalization was not supported, contrary to previous studies.

The present study does caution against over-generalization of results. The population was small and included a variety of locations. While caution is advised, and while the population selection controlled the other contextual variables, one might conclude size is generally a determinant of organizational structure.

FIGURE 2

A Modified Model of Contextual and Structural Relationships
For Ontario Colleges of Applied Arts and Technology
Based on Child's Organization Structure



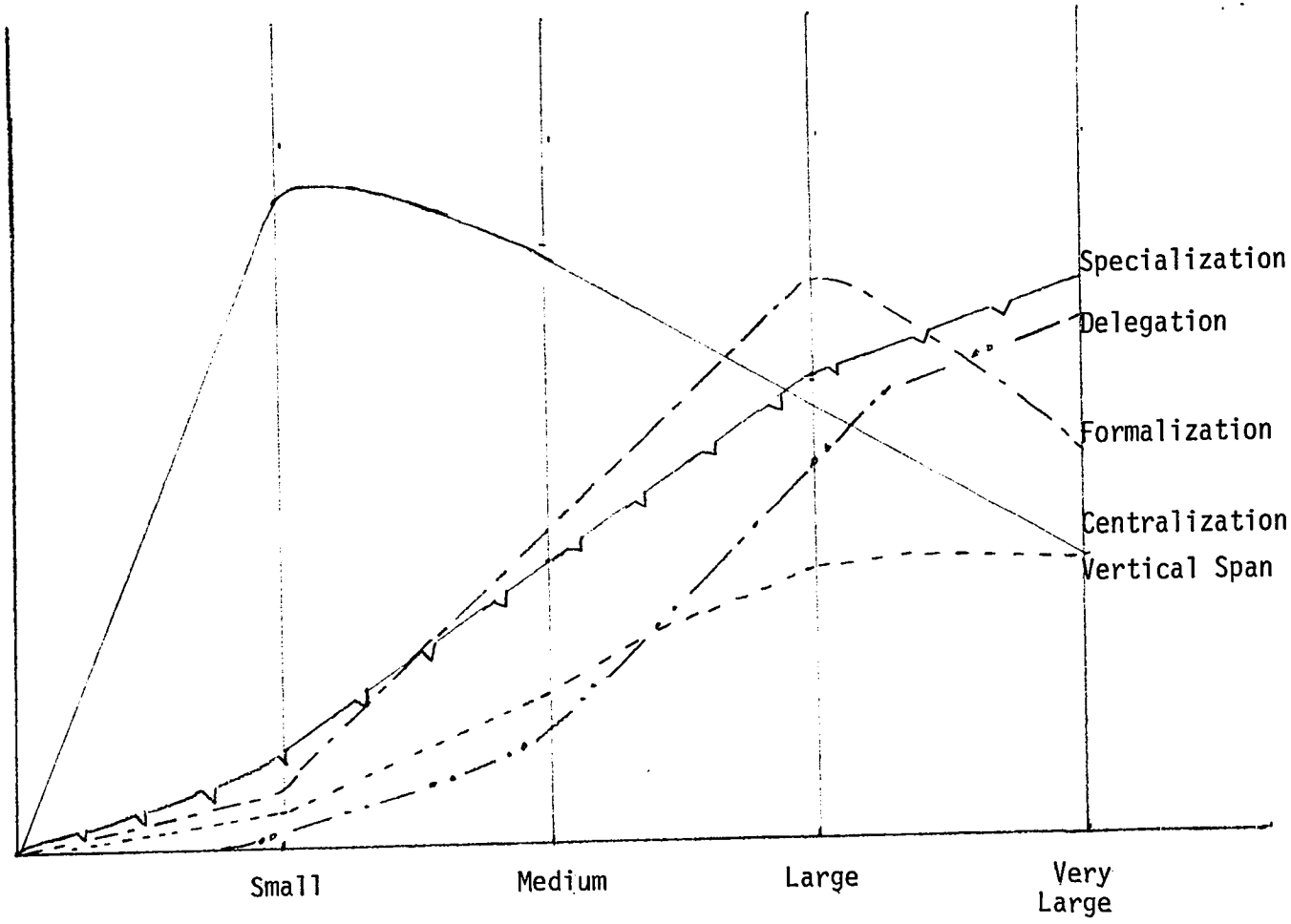
*Other contextual variables, for example technology, when they are not held constant may directly or indirectly affect or partially determine the structural dimensions.

In summary, the findings of this research supported the theory of organizational size. Size, as the uncontrolled independent variable, was found to be a potent predictive variable of organizational structure. This variable was positively related to specialization, delegation, levels of authority, and supervisor span, and negatively related to centralization.

At this point, a tentative hypothesis is proposed that states: at various limits of size the organization initiates a major structural change. Figure 3 depicts the tentative relationships. This would indicate a large positive relationship between the size and centralization for the small size organization after which centralization would commence to decrease. The president or manager tends to centralize control and decision-making to a point where he can no longer cope. The organization then makes a major corrective change by commencing to decentralize control and decision-making. Specialization would commence slowly in the small size organizations, increase rapidly through medium and large organizations, then stabilize in very large organizations. Formalization would indicate little increase in amount during the initial stage then would increase rapidly during the next two stages or until the documentation becomes to excessive, thus binding or inhibiting the organization's adaptability. Delegation of authority will increase as size increases in order that decisions may be made so that the organization may survive. The vertical span will increase as the limits of supervision are reached. Here this refers to the division of work by the level of authority. At some point the vertical span reaches a maximum and levels off.

FIGURE 3

Tentative Hypothesized Relationships Between Selected Structural Dimensions and Segments of Size



If the above results are valid, then organizational size is related to certain structural variables. The results of this study on organizational size and organizational structure have modestly added to the growing body of evidence supporting the indicated relationships.

3. The Multidimensionality of Structural Variables

It was predicted in Hypothesis Three that the bureaucratic structure is multidimensional, that is, the structure consists of a number of independent dimensions. One concern of this study is reducing the structural variables to a smaller set of dimensions which account for the interrelationships between the variables. The attention given to the unidimensional-multidimensional problem of the structural concept is stimulated by the potential of reducing the number of structural variables to one dimension.

Traditionally, organizational structure was considered to be unidimensional, that is the structural dimensions were present to some degree in all organizations. Based on this assumption, the bureaucratic structure of an organization was determined by measuring the presence of these dimensions. Hall (1963) reported six dimensions of bureaucracy which existed in the form of a continuum. He concluded that organizations may approach either one of bureaucratization and non-bureaucratization or fall between the two poles. Child's (1972) findings provided support for the unidimensional concept. Indeed he found a single factor which represented a configuration of all the more important structural variables.

He reported this structure conforms closely with the Weberian bureaucratic concept. Hinings and Lee (1971), although not subjecting their data to principal component analysis, found a high correlation between all of the more important structural variables.

In an attempt to reduce the number of variables in bureaucratic structure and to test the unidimensionality of structure, Pugh et al. (1968), subjected their data to principal component analysis. This group reported four uncorrelated components which accounted for seventy-four percent of the variance. These components were supported in replication studies (Hickson et al., 1969; Inkson et al., 1970). Thus the Aston group questioned whether the unidimensional concept of bureaucratic structure was adequate in describing the structure found in complex organizations. Reimann (1973) and Holdaway et al. (1975) also segregated a number of uncorrelated structural dimensions, thus supporting the multi-dimensional nature of bureaucratic structure.

Theoretically, it appears that bureaucratic structure consists of a number of uncorrelated dimensions. The results of this study, as reported in Chapter Three, tend to support the multidimensional bureaucratic structural concept. The structural variables are subjected to principal component analysis and varimax rotations. Four independent components are isolated which accounted for seventy-four percent of the total variance. Table 18 depicts the rotated loadings of the variables on each of the four components. It is noted the unrotated loading on component one tends to suggest that bureaucratic structure may be adequately described by a

single component. However, rotation yields substantial improvement by providing a distinct separation of variables on the components. It is through rotation that a clear break is evident between the components. Variables with loadings greater than .40 are selected as elements of each component. This cut-off point is considered adequate to discriminate between component elements. The results of this study appear to confirm the conclusions of Pugh et al., Holdaway et al., and Reimann, that the bureaucratic structure is multidimensional and that there are a number of uncorrelated underlying structural characteristics.

The above findings are compared against the rotated components of specific studies. This comparison is displayed in Table 20. In four cases the results indicate that the organization bureaucratic structure is multidimensional. That is organization structure consists of more than one uncorrelated component. Thus it may be stated that bureaucratic structure does exist in a present-absent dichotomy and that each component may or may not exist to some degree in the organization. As a consequence the results indicate that a variety of structural arrangements appear to be equally viable for this homogeneous sample of organizations.

It is noted from Table 20 that the components produced in the Pugh et al. study and the present study are comparable. In particular three components emerged in this study which tend towards duplicating the Aston components of structuring activities, concentration of authority, and the supportive component. That is the major structural variables tend to load on similar components thus they appear to describe the same aspects of

TABLE 20

Comparison of Rotated Factors Including the Loading Variables for Specific Studies

Pugh et al. (1968)	Child (1972)	Reimann (1973)
1. Structuring of Activities -Specialization -Standardization -Formalization -Vertical Span	1. Administrative Control -Specialization -Standardization -Formalization -Vertical Span -Centralization (negative)	1. Decentralization -Centralization (negative) -Delegation
2. Concentration of Authority -Autonomy -Centralization -Percentage of Workflow Superordinates		2. Specialization -Specialization -Vertical Span -Functional Specificity
3. Line Control of Workflow -Subordinate ratio -Percentage of Workflow Superordiantes		3. Formalization -Lack of Autonomy -Formalization
4. Supportive Element -Percentage Clerks -Percentage Non-workflow Personnel -Vertical Span		4. Administrative Density -Administrative Density -Hierarchial Control
TOTAL VARIANCE 74.0%	32.4%	75.6% (cont'd)

TABLE 20

(Continued)

Holdaway et al. (1975)		Present Study	
1. Bureaucratic Control		1. Structuring of Activities	
-Formalization		-Specialization	
-Standardization		-Delegation	
-Centralization		-Vertical Span	
-Autonomy (negative)		-Supervisory Span (subordinate ratio)	
2. Administrative Configuration		2. Concentration of Authority	
-Specialization		-Autonomy	
-Chief Executive Span (negative)		-Percentage of Non-workflow personnel (negative)	
-Percentage Superordinates		-Percentage of Superordinates	
-Percentage Clerks			
-Subordinate Ratio			
3. Non-workflow Proportion		3. Supportive Component	
-Subordinate Ratio (negative)		-Percentage of Clerks	
-Percentage Non-workflow personnel		-Chief Executive Span	
		4. Bureaucratic Control	
		-Formalization	
		-Centralization (negative)	
TOTAL VARIANCE	70.6%		74.1%

bureaucratic structure.

The major difference between the Aston and the present component analysis lies in the four component. The variables of formalization and centralization (negative) loaded on this component. Indeed, component four tends towards reproducing the bureaucratic control component indicated in the previous college study (Holdaway et al., 1975). The high degree of formalization, which is the written documentation of rules and regulations, would seem to associate with and support the concept of decentralization. The connection between these two variables would appear to be their role in describing bureaucratic control. Blau and Schoenherr support this concept:

> The restraints imposed by formalized procedures encourage the development of a less centralized authority structure that permits more flexible decision making (1971: 121).

It could not be expected that all the components would replicate the original Aston components.

Generally, there appears to be an interrelationship between the variables loading on any one particular component. For example, the relationship of the two variables in the bureaucratic control component is expressed as a negative correlation, that is as formalization increases, centralization tends to decrease and vice versa. This interrelationship is important particularly when an administrator contemplates a change in this structural dimension. The interrelationship would suggest that both variables must be considered whenever a change in bureaucratic control is introduced. Thus if a change is toward decentralization, it is generally

accompanied with increased formalization.

Centralization is the distribution of power; formalization is defined as the rules, procedures, instructions and other communications that are written; and both are used to retain control for the organization. That is to say, where decision making power is retained at the top of the organization there is little formalization as a control system. However, where decentralization or distribution of decision making powers to lower organizational levels is used it is accompanied with increased formalization. Hinings and Lee (1971) commented that as more regulations are introduced the organizations decentralize. From the results of his national study, Child (1972) reports:

> When organizations rely less on standard procedures for regulating and recording behavior, so (other things being equal) they tend to centralize the locus of decision making (174).

Mansfield (1973) further supports this relationship. In his study he reports that the increasing use of rules leads to a decentralization of decision making but not to the loss of control by the organization.

In summary it is suggested, whenever changes in bureaucratic control are introduced, that both structural variables be considered and changed accordingly.

It is worthy of note that all the variables which load on component one are also all the items that correlate directly with size. The size of the organization clearly showed as the contextual variable most closely associated with component one variables. This result underlines the likely effect on organization of increasing size. In the larger colleges increases in size appear predictive of increases in

specialization, delegation, vertical span and supervisor span of control.

In summary, the result of the investigation appears to support the multidimensional concept of bureaucratic structure. Further, these results suggest that the Ontario Colleges of Applied Arts and Technology may operate with various degrees of structure along the four uncorrelated dimensions. These dimensions appear to describe similar aspects of bureaucratic structure as did the earlier studies. The Weberian concept of bureaucratic type appears to be no longer useful.

SUMMARY AND CONCLUSIONS

By controlling some of the most relevant context variables, this study was able to concentrate its efforts to studying one specific context variable, organizational size, and to studying the structural variables of organizational bureaucracy. Thus the major purpose of the present study was to determine:

(1) a readily available measure of the size concept,

(2) the relationship that exists between organizational size and organizational structure, and

(3) the dimensionality of bureaucratic structure.

The variable size was operationalized as four measures. It was hypothesized there is a significant relationship between these measures. All measures intercorrelated ($r>.80$); the measure "number of full-time employees" had a strong association with each of the other measure of size so that the number of full-time employees was an adequate measure of that variable.

As expected, it was found that a relationship existed between the size variable and certain of the structural dimensions. Size was positively related to specialization, delegation, vertical span, supervisory span (subordinate ratio), and was negatively related to centralization. However, the forecasted size-formalization relationship was very small. The fact that the size variable showed a strong relationship with certain organizational structural variables led to the conclusion that size is important in influencing structural dimensions in the organization.

Principal component analysis indicated the structural variables were reduceable to four uncorrelated structural dimensions, therefore, the multidimensional concept was supported. Thus the Ontario colleges may operate with various degrees of structure along the four dimensions.

The results contribute to organization theory in four ways:

(1) The number of full-time employees is supported as an adequate measure of size;

(2) The Aston generalization of the relationship between organizational size and certain dimensions of organizational structure is upheld;

(3) The Aston proposition that size is predictive of structure is supported; and

(4) The unidimensionality of bureaucratic structure is not maintained. Organizations may operate with various degrees of structure along the four uncorrelated dimensions.

Since the present study was a field study, using cross-sectional data, generalizations of the results were made with caution, and may only apply to the college population. The results could be affected by inadequate control of the independent contextual variables, or could be a function of some intervening variables. Nevertheless, these results seem to support the relationships between organizational size and organizational structure, and to support the size-structure predictions of the variables investigated. Further, the reported results tend to support the multidimensionality of the bureaucratic structural dimensions.

Several unanswered questions emerging from this study suggest direction for further research. Of prime importance would be a study on the effect of structural adaptation to size on the overall effectiveness

of the organization. Other research might include: (a) isolation of different contextual variables and studying their effect on structure; (b) further examination of the size-formalization relationship; (c) relating size, complexity, and structure; (d) relating size, differentiation and structure, and (e) predicting major structural changes as the organization changes in size from a small to a medium to a large organization.

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APPENDIX 1

The Interview Schedule to Measure Organizational Structure and Size

COMPARATIVE ORGANIZATIONAL RESEARCH PROJECT

INFORMATION SCHEDULE

MEASURING ORGANIZATIONAL STRUCTURE, SIZE AND TASK DIVERSITY

CONFIDENTIAL

UNIVERSITY OF OTTAWA

Faculty of Graduate Studies
Department of Education Administration

OTTAWA, ONTARIO

John R. Goodwin
Principal Researcher

Name of Organization	
Location of Organization	
Person Interviewed	
Position or Title	
Date	

1.0 Origin, History and Location

_____

NAME OF COLLEGE

_____

DATE OF FOUNDATION

1.1 Was the college a historical outgrowth of an earlier institution? YES/NO

1.2 What institution(s)? _____

1.3 While the college was formed under Government Regulations (Bill 153), did any individual(s) in particular provide the impetus for the founding of this college?

Impetus provided by _____

Impetus provided by _____

1.4 What is designated as your geographic area of responsibility? (names of counties)

APPENDIX 1

2.0 Size

Size is the number of persons employed, on a full time basis, by the college in the year 1974/75.

2.1 Total number of persons employed by the college? _____

2.2 Total number of teaching staff? _____

2.3 Total number of non-teaching staff? _____

2.3.1 Professional Administrative staff? (including supervisors and academic chairmen if not covered by the Collective Agreement) _____

2.3.2 Professional staff? (librarian, counselors, etc.) _____

2.3.3 Clerical workers? (nonsupervisory) _____

2.3.4 Nonclerical, nonsupervisory workers? _____

2.4 Total number of full time and full time equivalent students in all programmes? _____

3.0 Hierarchial Control

Hierarchial control is a measure of the configuration of the organization's hierarchy incorporating (1) the height of the hierarchy, that is, number of levels, and (2) the average span of control. The base year is 1974/75.

3.1 May I have a copy of your organization chart?

		Obtained	To Be Mailed
3.2	How many levels of authority are indicated on the chart?		_____
3.3	How many subordinates report to:		
3.3.1	the President		_____
3.3.2	the Vice President (academic)		_____
3.3.3	the Vice President (administrative)		_____
3.3.4	the Academic Deans (average)		_____
3.3.5	the Department Chairmen (average)		_____
3.3.6	the Program Chairman (average)		_____
3.3.7	the Principal (average)		_____
3.3.8	the Academic Chairmen (average)		_____

APPENDIX 1

4.0 Functional Specialization

Specialization is considered to exist when at least one person in the organization performs that function and no other function for at least half of his time. No account is taken of either (a) the specialist's status or (b) whether an organization has many specialists or only one. For each activity for which there is a specialist the organization scores one.

Item Number	Who was responsible for (Position title).... during the year 1974/75	Half time circle Full time box
4.1	Developing, legitimizing and symbolizing the organization's charter - for example public relations officer, coordinator of information services.	YES NO
4.2	Disposing of, distributing and following-up on students having completed the program - for example vocational counsellors, liason officers with business and/or universities.	YES NO
4.3	Arranging transportation, buses, etc. for students and or staff, between campuses and as required - for example a transportation clerk.	YES NO
4.4	Acquiring and allocating human resources - for example personnel manager.	YES NO
4.5	Training and development programs for faculty and staff - for example a training and development manager	YES NO
4.6	Maintaining human resources and promoting their identification with the organization - for example sports and social director, magazine editor.	YES NO

Item Number	Who was responsible for (Position title).... during the year 1974/75	Half time circle Full time box
4.7	Obtaining and controlling materials and equipment - for example purchasing manager, stock control manager.	YES NO
4.8	Maintaining and erecting buildings and equipment - for example maintenance engineer, works engineer.	YES NO
4.9	Recording and controlling financial resources - for example accountant, comptroller.	YES NO
4.10	Controlling the workflow - for example planning director.	YES NO
4.11	Controlling the quality standards for various programs - for example admissions officer.	YES NO
4.12	Assessing and devising ways of classroom presentation.	YES NO
4.13	Devising new programmes, courses.	YES NO
4.14	Developing and operating administrative procedures for example - statistician.	YES NO
4.15	Dealing with the legal and insurance requirements - for example lawyer.	YES NO
4.16	Acquiring information on the operational field - for example market researcher.	YES NO

Item Number	Who was responsible for (Position title).... during the year 1974/75	Half time circle Full time box
4.17	Processing information - for example manager, electronic data processing	YES NO

5.0 Formalization (Documentation)

The degree of formalization of role specification in the organization is given by the number of specific role-defining documents - from a set list which exists in the organization, and, in some cases, the extent of their application or distribution.

		Score
5.1	Information booklets given to:	
	none	0
	few employees	1
	many employees	2
	all employees	3
5.2	Number of information booklets:	
	none	0
	1	1
	2	2
	3	3
	4 or more	4
	Total number:	
5.3	Organization chart given to:	
	none	0
	chief executive only	1
	chief executive plus other executive	2
	chief executive plus all/most division heads	3
5.4	Written operation instruction:	1
5.5	Written terms of reference or job description:	
	for masters (various categories)	1
	for paraprofessionals	1
	administrators	1
	support personnel (clerical)	1
	Chief Executive	1
5.6	Manual of procedures (standing orders)	1
5.7	Written statements of policies	1
5.8	Written lecture schedule or programme schedule	1

Formalization (Documentation)

	Score
5. 9 Written course outlines available to instructors	1
5.10 Written contracts of employment	1

6.0 Autonomy and Delegation of Authority

Autonomy

Autonomy is the number of decisions from a set list which can be taken by the President even though the decision may be subject to routine later ratification.

Delegation of Authority

The delegation of authority is the number of decisions the President had authority to make but delegated to the subordinates.

Item Number	Decision	Autonomy		Delegation	
6.1	Faculty establishment	1	0	1	0
6.2	Appointment of faculty members from outside organization	1	0	1	0
6.3	Promotion of administrative members.	1	0	1	0
6.4	Salaries of administrative members.	1	0	1	0
6.5	To spend unbudgeted or unallocated money on capital items.	1	0	1	0
6.6	To spend unbudgeted or unallocated money on extra faculty or staff.	1	0	1	0
6.7	What type or what brand, visual aid equipment is to be.	1	0	1	0
6.8	To determine new courses to offer as components of full time programs.	1	0	1	0
6.9	To determine school territory from which to draw students.	1	0	1	0
6.10	The extent and type of market to be aimed for - applied arts, business.	1	0	1	0
6.11	To determine fee structure.	1	0	1	0

Autonomy and Delegation of Authority

Item Number	Decision	Autonomy		Delegation	
6.12	To decide on performance appraisal of faculty members.	1	0	1	0
6.13	Allocate the work among available personnel.	1	0	1	0
6.14	Dismiss a faculty member.	1	0	1	0
6.15	Training methods to be used.	1	0	1	0
6.16	Buying procedures.	1	0	1	0
6.17	Which suppliers of materials are to be used.	1	0	1	0
6.18	To set the admission standards for students.	1	0	1	0
6.19	To alter responsibilities /areas of work of the administrative department.	1	0	1	0
6.20	To alter responsibilities /areas of work of the academic department.	1	0	1	0
6.21	To create a new department.	1	0	1	0
6.22	To create a new job.	1	0	1	0

7.0 Centralization Index

7.1 Locus of Decision Making (Programs offered any one year).

(a) President and an academic committee; 1
(b) President with the help of the particular Dean; 2
(c) President along. 3

7.2 Locus of Decision Making (Maximum and Minimum number of students per classroom lecture.

(a) President and an academic committee; 1
(b) President with the help of the particular Dean; 2
(c) President alone. 3

7.3 Locus of Decision Making (Manpower Policies).

(a) President's committee with representatives of all functional areas; 1
(b) President with personnel manager; 2
(c) President. 3

7.4 Locus of Decision Making (Selection of Academic Deans and Principals).

(a) President's committee with representatives from all functional areas; 1
(b) President with personnel manager; 2
(c) President alone. 3

7.5 The Degree of Participation in Long Range Planning.

(a) All levels of executives - top, middle, and lower; 1
(b) Top level with some representation of middle level executives; 2
(c) President alone. 3

7.6 The Degree of Information Sharing.

(a) Considerable - general memos on all major aspects of college's operations; 1
(b) Fair - special reports on company's affairs distributed to only top level and middle level executives; 2
(c) Little - all information kept secret from everybody except a few top level executives. 3

8.0 Task Diversity

DIVISIONS Post-Secondary Education	What divisions are offered?	PROGRAMS	How many programs were offered in 1974/75 year (each division)	How many programs have been added 1974/75 year as compared to 1973/74 (each division)	How may programs have been deleted 1974/75 year as compared to 1973/74 (each division)	What was the 1974/75 enrollment in the division?
Arts, Visual, Creative, General		26				
Apprenticeship & Pre-Employment		42				
Business: Accounting		6				
Business: Administration & Management		19				
Business: Data Processing		4				
Business: Marketing		5				
Business: Secretarial		8				
Communications		8				
Community Services		15				

Task Diversity

DIVISIONS Post-Secondary Education	What divisions are offered?	PROGRAMS	How many programs were offered in 1974/75 year (each division)	How many programs have been added 1974/75 year as compared to 1973/74 (each division)	How many programs have been deleted 1974/75 year as compared to 1973/74 (each division)	What was the 1974/75 enrollment in the division?
Food & Hospitality		6				
Health (Allied)		25				
Instructional Resource Service		4				
Technology/Technician (Engineering)		33				
Technology/Technician (General)		48				
TOTAL		249				

APPENDIX 2

Raw Data
for the Organizational Structural Dimensions

APPENDIX 2

Raw Data - Structural Dimensions

Structure Variables \ Colleges	01	02	03	04	05	06	07	08	09	10	11	14	15	16	17	18	19	20	21	22
Specialization	11	05	08	06	09	08	06	11	12	08	15	10	06	07	12	10	06	11	10	08
Formalization	20	18	17	18	21	19	17	18	14	18	19	19	17	16	17	20	18	17	17	15
Autonomy	16	17	16	16	17	16	17	17	17	17	17	17	17	17	12	16	16	16	17	17
Delegation	1.0	.647	.625	.688	.647	.625	.588	.941	1.0	.647	1.0	.765	.706	.588	.917	.813	.625	.750	.824	.706
Centralization	07	14	11	09	08	08	13	08	11	09	07	10	08	10	06	08	12	09	08	08
% of Clerks	34	18	15	27	13	25	22	22	21	30	19	17	20	13	21	27	16	25	42	17
% of NWF Personnel	35	38	44	45	27	39	25	35	34	31	45	36	38	30	41	32	40	44	47	33
% of Superordinates	16	13	09	13	13	16	17	11	12	22	05	13	9	21	05	14	08	09	12	12
Levels of Authority	5	4	4	6	5	5	5	5	7	5	6	6	4	5	5	5	4	6	5	5
Chief Executive Span	4	6	5	3	10	8	4	5	8	5	5	8	9	8	6	10	9	7	3	6
Supervisory Span	25	15	11	19	25	15	9	25	30	12	8	18	15	7	6	22	15	30	20	7

APPENDIX 3

Brogden General Biserial Correlation Calculations for Specialization and Delegation

APPENDIX 3

Brogden Correlation - Specialization

Variable / College	29	30	31	23	39	26	27	33	34	32	28	25	35	36	37	College Score
11	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15
09	x	x	x	x	x	x	x	x	-	-	x	x	x	-	x	12
17	x	x	x	x	x	x	x	x	x	x	x	-	x	-	-	12
01	x	x	x	x	x	x	x	-	x	x	x	-	-	x	-	11
08	x	x	x	x	x	x	x	x	x	x	-	-	-	x	-	11
20	x	x	x	x	x	x	x	x	x	x	-	x	-	-	-	11
14	x	x	x	x	x	x	x	x	x	-	-	x	-	-	-	10
21	x	x	x	x	-	x	x	x	x	x	-	-	-	-	-	9
18	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-	9
05	x	x	x	x	x	x	-	-	-	x	x	-	x	-	-	9
22	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	8
10	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	8
06	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-	8
03	x	x	x	-	x	-	x	x	x	x	-	-	-	-	-	8
16	x	x	x	x	-	x	x	x	-	-	-	-	-	-	-	7
19	x	x	x	x	x	-	x	-	-	-	-	-	-	-	-	6
04	x	x	x	x	x	-	x	-	-	-	-	-	-	-	-	6
07	x	x	x	x	-	x	-	x	-	-	-	-	-	-	-	6
15	x	x	x	x	x	x	-	-	-	-	-	-	-	-	-	6
02	x	x	x	-	x	x	-	-	-	-	-	-	-	-	-	5
Total	20	20	20	18	17	17	16	12	11	8	5	4	4	3	2	
GBR	1.0	1.0	1.0	.70	.48	.69	.76	.63	.75	.75	.88	.86	.86	.84	1.0	

APPENDIX 3

Brogden Correlation - Delegation

Variable / College	63	65	73	75	79	53	83	89	87	85	71	69	81	61	55	59	93	College Total
09	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17
11	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17
01	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	16
08	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	16
21	x	x	x	x	x	x	x	x	x	-	x	x	x	x	-	x	-	14
14	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	13
18	x	x	x	x	x	x	x	x	x	x	x	-	-	x	-	x	-	13
20	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	12
22	x	x	x	x	x	x	x	x	x	x	-	x	x	-	-	-	-	12
15	x	x	x	x	x	x	x	x	x	x	-	-	-	-	x	-	x	12
05	x	x	x	x	x	x	x	x	-	-	x	x	-	-	x	-	-	11
04	x	x	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	11
10	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-	11
17	x	x	x	x	x	x	x	x	x	-	-	-	-	-	x	-	-	11
02	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-	11
16	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-	10
07	x	x	x	x	x	x	x	x	-	x	-	-	x	-	-	-	-	10
19	x	x	x	x	x	x	-	x	-	-	x	-	-	x	-	x	-	10
06	x	x	x	x	x	x	x	-	-	-	x	x	-	-	-	-	x	10
03	x	x	x	x	x	-	x	x	x	x	x	-	-	-	-	-	-	10
Total	20	20	20	20	20	19	19	19	16	15	14	11	9	7	6	6	6	
GBR	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.90	.60	.61	.77	.79	.62	.53	.69	.73	

APPENDIX 4

Abstract of

An Empirical Study of Bureaucratic Structural Dimensions and Their Relationship to the Variable Organization Size

APPENDIX 4

Abstract of

An Empirical Study of Bureaucratic Structural Dimensions and Their Relationship to the Variable Organization Size[1]

Although the organizational size literature has doubled in each five year period for the last twenty years, evidence on the effect and relationship of organizational size and organizational structure has been inconsistent and inconclusive. Do differences exist in organizational structure that reflect the differences in the size of the organization? The purpose of this study was to investigate the above question through examination of a set of homogeneous organizations. The organizational units investigated are the Ontario Colleges of Applied Arts and Technology.

The general theoretical framework for the study was derived from Weber's bureaucratic theory (1947), the Aston group's contextual and structural variables (1968), and Reimann's framework of structural dimensions (1973). Based on this general framework, the study examined the relationship between organizational size and dimensions of organizational structure. In particular, the research investigated (a) the measures of size, (b) the size-structural relationship, (c) organizational size as determinant of organizational structure, and (d) the dimensionality of structure.

As was predicted, a significant relationship existed between size and certain structural dimensions. Size was found to be positively related

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1 John R. Goodwin, doctoral thesis presented to the School of Graduate Studies of the University of Ottawa, Ontario, October 1978, vii-144.

to specialization, delegation, vertical span, supervisory span (subordinate ratio), and was negatively related to centralization. A marked exception to the predicted relationship was the small negative correlation between size and formalization.

A secondary question answered in this study has to do with the dimensionality of the structural variables. Principal component analysis indicated that the structural variables were reduceable to four independent structural dimensions. The multidimensional concept of structure was supported.

Suggestions for further research included:

1. analysing the effect of structural adaptation to size on the overall effectiveness of the organization;
2. isolation of other of the contextual variables and studying their effect on structure;
3. relating organizational size, organizational complexity, and organizational structure;
4. relating organizational size, organizational differentiation and organizational structure;
5. a longitudinal study of organizational size and organizational structure in the Ontario colleges.