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THE CITY UNIVERSITY BUSINESS SCHOOL

LONDON

"A MULTIVARIATE ANALYSIS OF STRUCTURE, CONTEXT, STRATEGY, AND STYLE"

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This Thesis is submitted for the Degree of

Doctor of Philosophy in Management Studies

July 1979

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ACKNOWLEDGEMENTS

I am greatly indebted to Professor Peter H. Grinyer for his continued guidance of this research project from development of the conceptual model, through analysis and interpretation of results to its conclusion, and for his constructive criticisms and encouragement throughout.

I would like to express my thanks to executives of the companies who participated in this research and gave of their valuable time to provide the information required.

I would also like to thank the administrative staff of the City University Business School, especially those in charge of the Library and research facilities. My especial gratitude is due to [redacted] who typed drafts of this thesis with patience and the greatest of care.

Finally, I would like to pay tribute to [redacted] for their patience, support and encouragement throughout the entire period of this research.

ABSTRACT

The research reported in this thesis details an integration of the three major streams of research: the Aston bureaucracy oriented research; the Chandler inspired strategy/structure research; and Khandwalla's stylistic oriented research, using data collected in structured interviews with senior executives of 45 companies in the Electrical Engineering Industry in the United Kingdom.

Multivariate analysis of data collected resulted in a critical replication and extension of the Aston and National Studies on dimensions of organisational structure and their contextual predictors. The controversy over the relationships between centralisation and other bureaucratic characteristics was resolved by showing that decentralisation of tactical but not strategic decisions is associated with bureaucracy. Professional qualifications was also found to be a further aspect of bureaucracy, substantiating Weber's assertion that bureaucracy is a strategy of control based on knowledge. In addition, a bridge was constructed between the organisational behaviour and strategy/structure schools of thought by using an archetypal, ordinal, scale of structural configuration.

The analysis of contextual predictors of organisational structure provided further empirical evidence in support of size as a major predictor of organisational structure and against the technological imperative. The range of contextual variables considered in the Aston Studies was extended by inclusion of a measure of technology of design and development, based on Perrow's conceptual model. This measure was shown to have good predictive power and

was related to organisational complexity (qualifications and number of degree holders) independently of size.

Fifteen dimensions of management style were identified, using factor analysis of data based on Khandwalla's stylistic variables. The adoption of each style of management by the companies was shown to vary considerably depending on their contextual, i.e. situational, characteristics and extent of bureaucratisation.

The strategy/structure and organisational behaviour schools of research were integrated by relating strategy to degree of bureaucratisation, contextual variables and organisational styles. The strategy/structure linkage was found to be strong for this sample of companies, ranging in size from 45 to 17,000 employees. Moreover, strategy was more significantly correlated with size than with structure. In view of the association between size and structure, adoption of a multidivisional structure might thus be a response to larger size and greater complexity of product market posture.

Finally, in addition to 'structure', strategy was shown to be strongly related to all bureaucratic characteristics and the linkage found between strategy and structure, with the exception of size, was independent of other correlates of the latter.

PART A

INTRODUCTION TO

CUBS STUDY

CHAPTER I

INTRODUCTION

1.1 OBJECTIVES OF THE STUDY

Over the past two decades, management researchers have extensively investigated structural characteristics of organisations. Based on Weber's (1947) formulation of bureaucracy, researchers have developed operational measures of bureaucratic characteristics and investigated their interrelationships. The research tools have been increasingly refined and mainly cross-sectional studies have been carried out on large samples of organisations. Empirical studies conducted in the U.S.A. by Hall (1963), and Hage and Aiken (1967) basically relied on perceptions of individuals as to the extent of structure or bureaucratisation. In contrast, the Aston Studies in the U.K. (Pugh et al, 1968) were based on objective measures of structure. The Aston team developed detailed operational scales for formalisation, specialisation, standardisation, centralisation and hierarchy of control, and in this way broke the Weberian ideal into its constituent dimensions. They further showed that these bureaucratic characteristics, with the exception of centralisation, were interrelated.

Child (1972a) replicated the Aston Study on a national sample, largely confirmed their results, but questioned their findings on centralisation. This was the first of a series of replications which yielded broadly comparable results but failed to resolve the controversy over centralisation (see Pugh and Hickson, 1976, Pugh and Hinings, 1976, and Pugh and Payne, 1977 for convenient collections of

the papers). These developments have been accompanied by the emergence of the contingency theory of organisational structure, whereby structural variations have been attributed to situational factors. The Aston researchers considered size and technology, together with a number of other 'contextual' , largely company characteristics, as predictors of organisational structure (Pugh et al, 1969a).

The bureaucracy oriented studies quoted above were in a quite different tradition to that inspired by Chandler (1962). Chandler found in his study of major American diversified companies that divisional structures had been adopted in response to problems posed for senior management by diversified businesses. Chandler's thesis was subsequently confirmed by Wrigley (1970); Channon (1973, 1975) ; Rumelt (1974) ; and Grinyer, Al-Bazzaz and Yasai-Ardekani (1978), among others. In this process, ordinal scales were suggested which, although crude by comparison with those of the Aston and National Studies, seemed to have considerable explanatory power as well as intuitive appeal.

In parallel, and from an equally different perspective, Khandwalla (1974a, 1977) had undertaken a survey of organisational design and related this design to both environmental variables and performance. His measures of 'organisation' were ordinal scales, some of which were based on the 'organic-mechanistic' dimension of Burns and Stalker (1961), and so relate to what might be called 'organisational style'.

Drawn from different traditions or schools, the 'bureaucracy' measures of Aston and National, 'strategy' and 'structure' typologies of the Chandler (1962) based research, and 'stylistic' ordinal scales of the Canadian study of Khandwalla may be seen as complementary. However, because each is measuring aspects of the same organisational phenomena from a different perspective, it is important and interesting to investigate the relationships between them. This is the first major objective of this research.

Since the emergence of the contingency theory, researchers have directed their attention on isolating factors influencing the structure of the organisations. Although a number of situational factors have been identified, the advocates of the contingency theory have only emphasised the importance of a few selected situational factors. Their attention has mainly been focused on the influence of size (Weber, 1947; Blau, 1970; Pugh et al, 1969a; and Child, 1973a), technology (Woodward, 1958; Perrow, 1967; Harvey, 1968; Hage and Aiken, 1969; Zwerman, 1970; and Blau et al, 1976), and stability, uncertainty and diversity of the environment (Burns and Stalker, 1961; Lawrence and Lorsch, 1967; and Negandhi and Reimann, 1973).

Most of the recent empirical studies have investigated effects of single situational factors in isolation. Few have, however, considered a number of situational factors in their studies. Pugh et al (1969a), for instance, considered size, technology, dependence, charter, and number of operating sites in a multivariate prediction of organisational structure. Child (1975) extended this range of situational factors by inclusion of further measures of the environment. In particular, he investigated the effects of market and

technological variability together with size and technology on the structure of the organisation. Even so, a large proportion of structural variation is still unaccounted for. Child (1972b) argued that the recent empirical studies had ignored an important situational factor, that of the 'manager's strategic choice'. He further postulated a model in which management's choice played a central role in determining organisational structure and level of performance achieved. Negandhi (1975) also called for a more comprehensive treatment of contextual, i.e. situational, factors. In his integrating model of organisation he grouped the situational factors into three categories of organisational environment (e.g. size and technology), task environment (e.g. suppliers and customers), and societal environment (e.g. social and economic factors).

There is clearly a need to consider a wider range of situational factors in a single study if one seeks to gain a better understanding of organisational structure and functioning. In this way, not only may the interrelationships between contextual factors themselves be determined, their relative influence on structure may also be assessed more comprehensively. This is the second major objective of this research.

In addition to considering too narrow a range of situational factors, many of the major empirical studies of organisational structure use different concepts and hence definitions of characteristics under investigation, making inter-study comparisons extremely difficult, if not impossible. This problem is particularly acute with respect to situational variables. Technology, for instance, has been defined and operationalised in a number of different ways (see

(Section 3.4.4). Also as noted by Stanfield (1976) reviewing studies on technology, there often seems to have been a failure on the part of the theorists to draw boundaries between operational measure of technology and structure. This problem is not, however, restricted only to measures of technology. Theorists have tried to capture the impact of the environment on organisational structure through the concept of uncertainty. Various measures of environmental uncertainty have been developed (Lawrence and Lorsch, 1967; Duncan, 1972; Tosi et al, 1973; and Downey et al, 1975). Here again, as Child (1970: 386) notes, the problem of boundary setting between environmental and structural measures exists:

> "Lawrence and Lorsch, for instance, analyse certain variables which they claim to be environmental by reference to what are at least partially organisational procedures."

On structure, although two different approaches to measurement have been adopted (subjective measures of Hall (1963), and Hage and Aiken (1967), and objective measures of the Aston Studies, Pugh et al (1968)), the problem is somewhat different. Studies using the two different approaches to measurement have in general resulted in consistent but different patterns of associations between structural variables considered. Holdaway et al (1975) and Sathe (1978) suggest that the two different approaches to measurement tap different aspects of organisational structure. Objective measures reflect the designed and subjective measures the emergent structure. For structure, therefore, the two approaches may indeed be measuring different characteristics. Even so, not all studies adopting either approach include all identified structural characteristics, still making inter-study comparisons extremely difficult.

Inter-study comparability is, therefore, of primary concern. Consequently a synthesis of the Aston, Khandwalla and Chandler based research is sought in the research reported in this thesis by inclusion of measures used in these earlier studies and by careful selection of available research tools for measurement of other organisational characteristics. This is the third major objective of this research.

In summary, then, the three major objectives of this study are:

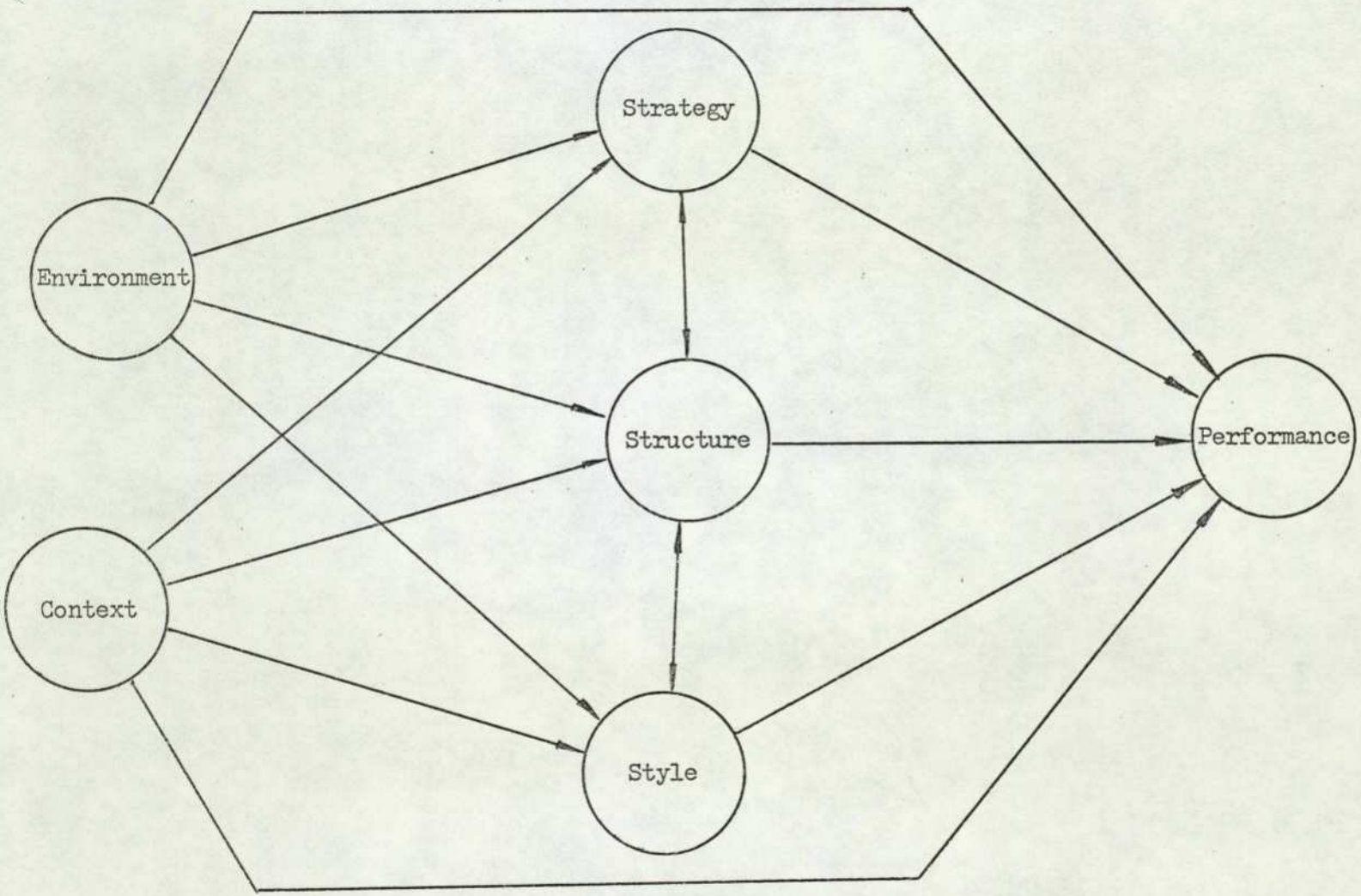
(1) To integrate three major streams of research: the Aston's bureaucracy oriented research; the Chandler inspired strategy/structure research; and the Khandwalla's stylistic oriented research.

(2) To test the contingency theories of organisational structure by including a much wider range of situational variables such as size, technology and the environment among others, and to investigate the relationships between these situational variables.

(3) Related to objectives 1 and 2, to provide for inter-study comparability by using well established measurement tools with a view to modifying and refining the existing measures and, in addition, to introduce measures in areas not covered by earlier researchers where gaps exist and there is a need for a more comprehensive treatment of the characteristics.

The integrating approach to study of organisations adopted in this study is shown schematically in Figure 1.1 where arrows indicate the direction of hypothesised influence.

Figure 1.1 Hypothesised Relationships. An Integrated Approach.



From the three primary objectives, the study was designed to permit the following sub-objectives to be attained. Since the full study is much wider than that reported in this thesis, results relating to objectives A1 to A7 will be reported and those relating to objectives B1 to B8 will be reported in a series of planned publications.

(A1) Replicate the Aston and National Studies on dimensions of organisational structure and in particular to contribute to resolution of controversy over centralisation.

(A2) Extend the range of structural variables by inclusion of measures of organisational complexity, in particular, level of professional qualifications, as in the National Study (Child, 1973a), and to test a hypothesis that it is a constituent part of bureaucracy.

(A3) Relate the Aston measures of structure to an ordinal measure of organisational type derived from the strategy/structure school.

(A4) Replicate the Aston and National Studies on contextual predictors of organisational structure and extend them by inclusion of a new measure of technology.

(A5) Relate the Aston measures of structure to Khandwalla's stylistic ones.

(A6) Relate the contextual variables to stylistic measures.

(A7) Relate the structural, contextual and stylistic variables to a measure of strategy based on the strategy/structure school.

(B1) Extend the Aston and National Studies by inclusion of a wider range of environmental variables and to test hypotheses that

organisational variables are related to them.

(B2) Test a number of hypotheses relating 'stylistic' variables to these environmental variables.

(B3) Test a number of hypotheses about the fit between strategy and structure, on the one hand, and environmental pressure on the other (see Grinyer, Al-Bazzaz and Yasai-Ardekani, 1978, for a discussion of these hypotheses).

(B4) Find how interrelationships between measures of bureaucracy, strategy, structure, and style are affected by company and wider environmental variables.

(B5) Test hypotheses about relationships between the extent of formal planning and measures of bureaucracy, 'structure', strategy, 'style', and environment.

(B6) Establish relationships between measures of bureaucracy and financial performance when controlling for company and environmental variables (see Child, 1975).

(B7) Establish relationships between 'style' and financial performance when controlling for company and wider environmental variables.

(B8) Extend Grinyer et al's (1978) study of the relationships between strategy, structure, the environment and financial performance by inclusion of a wider range of environmental variables and measures of financial performance (see Grinyer and Norburn, 1975).

For convenience, to contrast it with the Aston and National Studies, this research conducted at the City University Business School will be called the CUBS Study.

1.2 STAGES OF THE STUDY

(1) Literature search - An initial search was undertaken at the start of the study. In addition, study of the literature has continued throughout its duration. The details of pertinent literature will not be presented in this Chapter since it is discussed extensively in the text (see also the Bibliography).

(2) Questionnaire design - The initial questionnaire was based on major earlier studies (see Appendix A), following discussions within the City University Business School.

(3) Sample selection - A sample of 45 companies in the Electrical Engineering Industry in the U.K. was randomly selected from a population of 502 companies in South East England. The industry was chosen for its importance and the fact that it comprised a wide range of sizes, technologies and environments.

(4) Pilot study - This was carried out on a sample of 5 companies using structured interviews.

(5) Revision of the questionnaire - In the light of comments made in the pilot study, the initial questionnaire was revised to remove ambiguities.

(6) Data collection - Structured interviews were conducted with senior executives of a further 40 companies and additional information as necessary was collected from the 5 companies which had participated in the pilot study, to give a full sample of 45 companies.

(7) Analysis was carried out using the SPSS package on the University of London CDC 6600 computer.

(8) Following the analysis, chapters of the thesis were written, and further analysis found appropriate was undertaken to answer additional questions posed during this process.

1.3 STRUCTURE OF THE THESIS

This study is divided into four parts. Part A, introduction to the study, includes Chapters 1 & 2. Chapter 2 provides a detailed account of research methodology: the sample frame, sample selection, method of data collection, and questionnaire design are discussed more fully. Also a brief account is given of the measurements and scales and statistics used in the study.

Part B, a critical replication and extension of the Aston and National Studies, is detailed in Chapters 3, 4 & 5. In Chapter 3, operational measures of organisational structure and context used in earlier major studies are critically reviewed. Special attention is paid to criticisms by Child (1972a), Child and Mansfield (1972), Mindlin and Aldrich (1975) and Mansfield (1973). Multi-item scales are all subjected to item value analysis and reliability coefficients are calculated. Where the pattern of inter-item correlations is suggestive of possible multi-dimensionality of the scale, factor analysis has been used to identify the underlying dimensions. In addition a number of new scales are defined. These include additional measures of organisational complexity and an archetypal, ordinal, scale based on the strategy/structure research as well as a new measure of technology of design and development based on Perrow's (1967) conceptualisation of technology.

Chapter 4 reports a replication of the Aston and National Studies on dimensions of organisational structure. Results of the correlation and multivariate analyses are compared with those of the Aston, National and Coventry Studies to determine whether their findings are equally valid for the CUBS sample and the controversy over the relationship of centralisation with other bureaucratic characteristics is addressed. The analysis of bureaucracy is extended by inclusion of

a measure of professional qualification and the hypothesis that use of more professionally qualified office holders is a further aspect of bureaucracy is tested. Also Weber's (1947) hypothesis that bureaucracies typify the more complex organisations is tested by relating the structural variables to the ordinal scale for the complexity of organisational type based on Chandler (1962) and in this way a link is forged between the bureaucracy and the strategy/structure schools. A deeper analysis of centralisation is undertaken by investigating the possible multidimensionality of the centralisation scale. Based on the factor analysis of items in the scale, new indices of centralisation of financial, marketing and operating decisions are developed and related to other structural characteristics.

A replication and extension of the Aston and National Studies on the predictors of organisational structure is the subject of Chapter 5. The hypotheses are drawn from the literature relating to the two schools of thought, the size determinism school and the technological imperative school, and tested by analysis of the data from the CUBS sample. The results are compared with those of major earlier studies. In addition, relationships between other contextual variables of age, dependence, charter, and number of operating sites used in the Aston Studies and structural variables are investigated. This range of contextual variables is extended by inclusion of the measure for technology of design and development and used in multiple regression analyses treating bureaucratic characteristics as dependent variables. In an Addendum to Chapter 5, a critical review of the comparative study by Hickson et al (1974) is carried out in the light of the findings of the CUBS Study.

The analysis of bureaucracy, strategy and style presented in Chapters 6 & 7 is the subject of Part C. In Chapter 6, factor analysis of scales based on Khandwalla's (1974a) operational measures is used to identify different styles of management. The dimensions so identified are then related to structural and contextual variables of Chapters 4 & 5.

The interrelationships between strategy (as defined by the strategy/structure school) and structural, contextual and stylistic variables are investigated in Chapter 7. The size, strategy, structure relationships implicit in Chandler's (1962) thesis are tested. The strategy/structure school of research is extended by relating strategy to bureaucracy to test whether the more diversified companies are more structured or bureaucratic. The correlation analyses presented in Chapter 7 further extend this school of thought by relating strategy to other contextual variables such as age, dependence, charter, number of operating sites and the technology of design and development as well as the identified dimensions of style.

Part D includes Chapter 8 which gives a brief account of the major contributions of this research to studies on organisations. Practical implications for design of organisational systems are discussed and a direction for future research is outlined.

CHAPTER II

METHODOLOGY

2.1 SAMPLE FRAME

As was mentioned in the introduction (Chapter 1), the electrical engineering industry was chosen as the subject of the survey because of, first, its importance and, second, the fact that it encompasses a wide range of company sizes, technologies and environments. The sample frame used consisted of 502 electrical engineering companies in South East England listed in the 'Report on Census of Production, Directory of Business for Electrical Engineering Industry' published by the Department of Trade and Industry, 1968. Nine subsections of the electrical engineering industry were represented in this sample frame. Companies located in South East England were chosen for their accessibility to the researcher.

2.2 METHOD OF SAMPLING

The initial aim was to obtain a random sample stratified by size. However, due to lack of information on the size of the companies in the population, random sampling of the whole of the population was adopted as the method of sample selection. Companies in the sample frame were numbered from 1 to 502 and random number tables were used to select the sample (see Yamane, 1973: 1110). The random sample would be expected to include companies from each sector of the industry in proportions equal to their frequency in the sample frame. In total 139 companies were selected from which 45 agreed to participate in the research, giving a response rate of 32%. Table 2.2.1 shows the number of companies in each sector of the industry in the population and the randomly selected sample. Also shown are numbers expressed as percentages of the population and the sample respectively. As may be seen from Table 2.2.1, the resulting sample composition in terms of industrial sectors represented is approximately the same as that which would have been obtained if proportionate stratified sampling was used, i.e. where the sample size from each stratum is proportional to its population size (see Moser and Kalton, 1977: 85). The sample is, therefore, representative of the industry in terms of industrial sectors. A sample of over 30 is generally accepted by statisticians as adequate for purposes of statistical inference and the sample size of 45 was, therefore, accepted as adequate. Ideally, a larger sample would have been used, but this was precluded due to both time and resource constraints. Even so, the sample is only one less than that used in the final analysis in the original Aston Study and, moreover,

Table 2.2.1 Frequency distribution of companies in the population and the sample by subsection of industry

Standard industrial classification minimum list heading	Industry subsection	Number of companies in the population	Number of companies in the sample	Number of companies in each subsection of industry as %'age of total for the population	Number of companies in each subsection of industry as %'age of total for the sample
361	Electrical machinery	91	6	18.1	13.3
362	Insulated wires and cables	21	0.0	4.2	0.0
363	Telegraph and telephone apparatus and equipment	26	1	5.2	2.2
364	Radio and electronic components	97	10	19.3	22.2
365	Broadcast receiving and sound producing equipment	36	4	7.2	8.9
366	Electronic computers	17	1	3.4	2.2
367	Radio, radar and electronic capital goods	72	11	14.3	24.4
368	Electric appliances, primarily for domestic use	39	4	7.8	8.9
369	Miscellaneous electrical goods	103	8	20.5	17.8
	TOTAL	502	45	100.0	100.0

did not include multiple branches of the same organisations. It is however, considerably smaller than Child's National sample of 82 organisations but, being drawn from one industry, is considerably more homogeneous. Table 2.2.2 shows the sample of 45 companies stratified by size and subsector of industry.

Table 2.2.2 Sample of 45 companies stratified by size and industrial classification

Company size categories (number of employees)			Number of companies in the sample in each standard industrial classification								
Range	Mean	Standard deviation	Components	Capital goods	Miscell-aneous	Machines	Broad-casting	Domestic	Computer	Telephone & telegraph	TOTAL
35-89	60.4	16.7	3	2	1		1				7
100-200	134.2	32.0	1	1	2	2					6
250-350	295.6	43.3	3	1	1	2	1	1			9
400-600	505.3	81.3	1	2	3	1	1		1		9
655-1600	1082.5	326.0	1	3	1	1		1		1	8
2300-3500	2766.6	524.9	1	1				1			3
4500-17000	9166.6	5572.7		1			1	1			3
		TOTAL	10	11	8	6	4	4	1	1	45

2.3 METHOD OF COLLECTING DATA

There are various methods of data collection: structured interview, unstructured interview, focused interview, direct observation, diary and postal questionnaires (see Moser and Kalton, 1977). Structured interview was chosen as the most appropriate method of data collection for the CUBS Study. As was mentioned in the introduction (Chapter 1), the CUBS Study in part replicates the earlier Aston and National Studies for which interview schedules were already available and structured interview was the method of data collection used in these earlier studies. In addition, the choice of this method was guided by the following considerations:

(a) Specific areas of be covered were already known and could be put in form of questions.

(b) The detailed nature of the areas covered.

(c) The length of the questionnaire.

(d) The desirability of assuring accuracy of information on predetermined salient points.

(e) The advantages of observing responses to both closed and open ended questions.

(f) The provision of the opportunity for clarification of questions and answers.

(g) Collection of supportive material from the respondents.

(h) The advantage of ensuring sponteneity of response.

(i) The declining rate of response to mailed questionnairs.

(j) The provision of a learning medium.

The large size of the sample and the length of the questionnaire precluded use of multiple interviews and only one person in each company was interviewed. The initial aim was to interview the Managing Director of the companies. However, the application for the interview was passed on to other senior executives in two thirds of the cases. In the end, only 13 Managing Directors were interviewed. However, all other interviewees were among the senior executives in the companies concerned. Table 2.3.1 shows the persons interviewed classified by the type of position held in the companies.

A standard questionnaire was used in the interviews to collect information on company characteristics. Wherever possible, documents such as organisation charts and information booklets were collected to cross check the data obtained. Any comments made by the interviewees were recorded in writing and used for clarification of responses to questions at the time of scoring of data.

A number of questionnaires were posted to some of the companies who did not agree to an interview and three completed questionnaires were returned by post. Interviews were conducted from July 1975 to the end of March 1976. In total, 42 companies were visited. Interview time ranged from one and a half hours to a complete day, but the average time was approximately three hours.

Table 2.3.1 Frequency Distribution of the Position of Managers Interviewed

POSITION	FREQUENCY
Managing Director	13
Assistant M.D.	6
Marketing Director/Manager	6
Sales Director/Manager	4
Production Director/Manager	6
Personnel Director/Manager	6
Technical Director/Manager	1
TOTAL	42

(Postal responses received from one Managing Director, one Assistant M.D. and one Technical Director.)

2.4 QUESTIONNAIRE DESIGN

The questionnaire was designed by drawing upon published interview schedules used in earlier studies and a thorough search of the literature. The questionnaire was divided into seven parts each addressing a different but inter-related area of the investigation (see Appendix A). In Part I information was sought on company's context: size, age, status, dependence on a larger organisation and configurational characteristics of lateral and vertical spans of control, the ratio of administrative to production personnel and the complexity of the overall administrative structure. Bureaucratic characteristics of formalisation, functional specialisation, qualification and decentralisation were covered in Part II. The majority of the questions in these two parts were drawn from the interview schedules developed for the Aston Studies (Pugh et al, 1968, 1969a; and Child, 1972a) and its abbreviated replications (Inkson et al, 1970a; McMillan et al, 1973; and Hickson et al, 1974).

Operations (manufacturing) technology, product market posture, intensity and importance of R&D activities, extent of product innovation and performance of innovations were measured through questions in Part III. This Part included a number of open ended questions as well as questions for which possible ranges of responses were classified as an aid to scale construction.

Part IV was designed to measure the relationships of the company with its environment. This Part included quantitative as well as perceptual measures of the general, industry specific and task environments. In particular, variability, predictability,

and threat inherent in general social, political and economic conditions; variability and complexity of the market and technological conditions specific to the company's sector of industry; and the extent of constraint, competition and dependence resulting from the interactions of the company with elements of its 'task environment' were measured. Perceptions of top management on this range of relationships were measured by using Likert type scales. Quantitative measures of the environment included the number of suppliers, percentage of raw materials and parts supplied by the ten largest suppliers, percentage of sales to largest ten customers and through different distribution channels and, share of the company of its three most important markets.

Part V included 44 Likert type questions designed to measure organisational styles adopted by the companies. Part VI measured the frequency of use of each type of communication channel available (formal: written communications and formal scheduled meetings; and informal: telephone and face to face informal communications) to top management for communicating with superiors, colleagues, subordinates and members of the environment. Scope of formal planning and control were measured by number of written plans, number of budgets, and number of written control documents in Part VII. Also the types of incentive schemes operated by the company for different hierarchical levels and their effectiveness were recorded and, finally, information was sought on the interviewee's education and career pattern.

2.5 PILOT TESTING

The questionnaire designed was tested by a pilot study in five companies. Interviewees were asked to make comments on the structure of the questionnaire, its content, the clarity of questions, the amount of detail and on any other point they considered important. In the light of their comments the modifications made to the questionnaire included development of a more detailed measure of functional specialisation and a complete restructuring of Part III in relation to aspects of product innovation. Respondents also felt that part VI, relating to communications, required a great deal of time to complete. In view of the amount of detailed information sought in the other Parts of the qustionnaire and the greater importance attached to them in the CUBS Study it was decided to ask the interviewees to respond to the other Parts first, and if time permitted, to provide answers for Part VI.

The modified version of the questionnaire was used in the remaining 40 companies and the additional information introduced as a result of the modifications was obtained from the first five companies by telephone or post.

2.6 MEASUREMENT AND SCALES

Company characteristics were measured by 357 variables in total, including the items that in some cases were grouped together to form new scales. The type of scale varied depending on the particular characteristic involved. Most of the variables were measured on ordinal scales. For instance, overall complexity of administrative structure was measured on a seven point ordinal scale. Ordinal Likert type scales were used to measure the perceptions of top management on their environment and the organisational style variables. Bureaucratic characteristics of formalisation, functional specialisation and qualifications were measured using scales which have been described by Labovitz (1970) as ordinal of equidistant nature. Other company characteristics such as lateral and vertical spans of control, size and age of the company, were measured on interval or ratio scales. Details of definitions of measures and the scaling procedures are discussed in the following chapters. A summary of scales used in the CUBS Study is presented in Appendix A. The problem of construction of scales from a collection of items is addressed in Appendix B, where a number of theoretical scaling models, both unidimensional and multidimensional, are presented, using the measure of functional specialisation as an illustration.

2.7 STATISTICAL METHODS USED IN ANALYSIS

Siegel (1956) has argued forcefully that non-parametric statistics should be used in analysis of data with ordinal levels of measurement. With reference to measures of association, use of Spearman's r and Kendall's tau correlation coefficients are strongly recommended. Labovitz (1970) has, however, demonstrated that where ordinal scales are of equidistant nature and, especially where the number of rank categories is high, the more powerful parametric measure of association, the Pearson's product moment correlation coefficient, may be safely used. He argued that:

> "Although some small error may accompany the treatment of ordinal variables as interval, this is offset by the use of more powerful, more sensitive, better developed, and more clearly interpretable statistics with known sampling error". (Labovitz, 1970: 515)

Moreover, Havlicek and Peterson (1977) have shown that failure to meet the basic assumptions had little effect upon the distribution of Pearson's product moment coefficients obtained.

Clearly the complex inter-relationships among organisational characteristics call for the use of the more powerful parametric statistics such as multivariate techniques of partial correlations, multiple regression and factor analysis. Although assumptions implicit in the use of such techniques are not fully satisfied by data with ordinal levels of measurement, their use may considerably enhance the understanding of the complexities of the inter-relationships among organisational characteristics. These techniques may, therefore, be used for exploratory purposes and as aids to interpretation of the data.

If both parametric and non-parametric measures of association applied to ordinal data yield coefficients with the same significance levels, there may therefore be a justification for using the more powerful multivariate analytical techniques.

Both Kendall's tau and Pearson's product moment correlation coefficients were used as measures of association in the CUBS Study. The significance levels of coefficients were checked for congruency. If highly congruent, the data was then subjected to multivariate analysis. It is believed that the greater insight provided by use of multivariate analytical techniques as exploratory devices and as aids to data reduction and interpretation more than outweighs the inaccuracies introduced as a result of violation of the strict assumptions underlying their use.

Factor analysis was used: (a) to identify possible multi-dimensionality of data in scale construction (see Appendix B); (b) to identify underlying dimensions of a collection of measures and; (c) for purposes of data reduction. Partial correlations were used to observe the possible effects of third variables on the strength and significance of observed relationships and multiple regression was used to identify the major contextual predictors of bureaucratic characteristics.

Data collected in the CUBS Study was statistically analysed using the "Statistical Package for Social Sciences" (SPSS), (Nie et al, 1975), on the University of London CDC 6600 machine.

2.8 SUMMARY

An account of the research methodology is presented in this Chapter. A random sample of 45 companies was selected from the electrical engineering industry in the South East of England. The sample was shown to be representative of industry subsectors in the population. Data was collected by means of structured interviews and reasons were advanced for the choice of this method. The interviewees were all senior executives of the companies concerned. Drawing upon the published interview schedules and a thorough search of literature, a questionnaire was designed and tested in a pilot study of 5 companies. The modified version of the questionnaire was used in the remaining 40 companies. Also a brief account of the measurements and scales and the statistics used in the study is presented.

PART B

A CRITICAL REPLICATION AND EXTENSION OF THE ASTON AND NATIONAL STUDIES

CHAPTER III

STRUCTURAL AND CONTEXTUAL VARIABLES

3.1 INTRODUCTION

Max Weber's formulation of structural characteristics of organisations (1947) has strongly influenced organisation theorists. Hall (1963), following the suggestions of Gouldner (1950) and Udy (1959) that the Weberian ideal attributes of bureaucratic organisations do not exist on a present-absent basis, classifying organisations as bureaucratic or non-bureaucratic, selected six of the attributes of bureaucratic organisations most frequently advanced by organisation theorists. The six attributes are:

(1) A division of labour based upon functional specialisation.

(2) A well defined hierarchy of authority.

(3) A system of rules concerning the rights and duties of positional incumbents.

(4) A system of procedures dealing with work situations.

(5) Impersonality of interpersonal relations.

(6) Promotion and selection for employment based upon technical competence.

Scales were constructed to measure the extent of the presence of each of these six attributes in organisations and he showed that they ranged along a continuum, rather than being either present or absent, and that bureaucracy may be viewed in general as a matter of degree rather than of kind. By using the same six measures Hall and Tittle (1966) devised a scale of bureaucratisation

by scalogram analysis and suggested that this provided a more total approach to the study of organisations and that organisations could be compared with respect to degree of bureaucratisation.

Pugh et al (1963) also developed a conceptual framework for classification of organisations in terms of structural characteristics. By isolating the variables which made up Weber's formulation of bureaucracy, they hypothesised six primary dimensions of structure. These dimensions were treated as variables and they suggested that each organisation could fall at any point along the continuum of the particular dimension and a profile of organisation structure could be constructed by considering the position of the organisation along each of the dimensions. The organisations with similar characteristics would then form clusters, each of which represents a different form of bureaucracy, as opposed to the twofold classification of bureaucratic-non bureaucratic.

The six hypothesised dimensions were (1) specialisation; (2) standardisation; (3) formalisation; (4) centralisation; (5) configuration; and (6) flexibility. This conceptual framework led to the development of a detailed list of variables and associated scales to measure the above mentioned characteristics (Pugh et al 1968, 1969a). The scales were constructed from collections of items and the search for items was guided by the use of the generalised description of the activities of organisations given by Bakke (1959). These scales sought to measure objective organisational features rather than subjective views of the respondents, in contrast to the type of measures used in studies of Hall (1963), and Hage and Aiken (1967).

Data was collected on a sample of 52 work organisations in the English Midlands and the multivariate analysis of the data on structural characteristics led them to propose that:

" There are four empirically established dimensions of organisation structure: structuring of activities, encompassing standardisation, formalisation, specialisation and vertical span; concentration of authority, encompassing autonomy, centralisation, percentage of workflow superordinates and standardisation of procedures for selection and advancement; line control of workflow, encompassing subordinate ratio, formalisation of role performance recording, percentage of workflow superordinate and standardisation of procedures for selection and advancement; and relative size of supportive component, encompassing percentage of clerks, vertical span and percentage of non-workflow personnel." (Pugh et al, 1968: 89)

They also hypothesised that contextual variables, such as origin and history, ownership and control, size, charter, technology, location and resources would be predictors of organisation structure (Pugh et al, 1963). These measures of context were also operationalised, scales were constructed and used as predictors of structural dimensions (Pugh et al, 1969a).

The full range of scales developed by Pugh et al (1968, 1969a) were used by Hinings and Lee (1971) to replicate their findings for a sample of nine manufacturing companies in Coventry, and Child (1972a, 1973a), who collected data from a national sample of 82 organisations.

The use of the detailed measures discussed above as an instrument for measuring the structure and context of organisations has the

disadvantage of requiring a long interviewing time and subsequent cost of data processing and analysis. Inkson et al (1970a) developed an abbreviated set of measures from the original scales devised by Pugh et al (1968, 1969a) bearing in mind that:

(1) A measuring instrument should be technically sound as well as convenient to administer; and

(2) The abbreviation should not jeopardise the technical soundness of the measuring instrument.

From the set of scales measuring dimensions of structure and context, subsets were selected which correlated highly with the original set and which were also easy to administer. The subsets were selected for two dimensions of structure: structuring of activities and concentration of authority and for two major contextual variables of workflow integration (a measure of technology) and dependence. The abbreviated measures were correlated with the original full scores by using the data of the original study (Pugh et al, 1968, 1969a) to test the accuracy of representation. (Table 3.1.1)

Table 3.1.1 Results of Inkson's analysis

	Correlations with full scores	Mean item analysis value
Workflow integration	0.98	0.96
Dependence	0.91	0.84
Structuring of activities	0.97	0.71
Concentration of authority	0.93	0.83

(Source: Inkson et al, 1970a: 320)

The abbreviated measures were then used in a study of 40 organisations and although the unidimensionality of measures was established in the original study, item value analysis [1] was carried

(Note (1) - Item Value Analysis is discussed in detail in Appendix B)

out for the fresh data and the scales proved to be unidimensional (see above). The abbreviated measures were used in subsequent studies by Hickson et al (1974); Reimann (1973); McMillan et al (1973) and others as an instrument for measurement of structural and contextual characteristics.

From the time of the original publications of Pugh et al, a number of researchers have put forward arguments pointing to the weaknesses of some of the measures used in their study: Child (1972a: 168) points out the sensitivity of the centralisation scaling method to the status of the organisation; Child and Mansfield (1972: 384-388) in a re-examination of workflow integration, a composite measure made up of five separate scales used by Pugh et al (1969a) as a measure of technology, found that the measure was not unidimensional and that the different pattern of correlations obtained between the scales suggested that a multidimensional view of the technology scale may repay further exploration; and Mindlin and Aldrich (1975) suggested that the dependence measure used by Pugh et al (1969a) only measured the extent of dependence of the organisation on the parent organisation and not on other organisations.

Despite these criticisms, the work of Pugh et al (the Aston Studies) remains a seminal, rigorous attempt to study the organisational, structural and contextual characteristics and its numerous replications have provided good evidence that the measures developed by them are useful.

In order to replicate the Aston Studies' findings on the relationship between organisational structural characteristics and

their contextual correlates, the abbreviated measures developed by Inkson et al (1970a), together with some measures of configuration used in the Aston and other studies, were adopted. However, some of the abbreviated measures were modified to allow for suggestions made by Child (1972a), Child and Mansfield (1972), and Mindlin and Aldrich (1975). These will be discussed where appropriate.

In addition, a number of other structural and contextual variables were introduced to extend the findings of the Aston Studies and to test hypotheses put forward by other organisational theorists. These measures include organisational complexity based on Child (1973a) and structural complexity based on the seminal work of Chandler (1962) and a new measure of technology based on the conceptual framework developed by Perrow (1967). In devising this last measure, consideration was given to the alternative formulations of Woodward (1958); Harvey (1968); Zwerman (1970); Keller et al (1974); Pugh et al (1969a); Hickson et al (1969); and Child and Mansfield (1972).

The aim of this Chapter is therefore to present different definitions of operational measures of organisational structure and context used by organisational theorists in earlier empirical studies, to critically evaluate these measures, and propose modifications where necessary, as well as to introduce new measures to further extend the findings of earlier studies on the relationships between structural variables and their contextual correlates. Sections 3.2 and 3.3 deal with major structural variables used in the CUBS Study where new measures of organisational complexity and configuration are presented. The contextual variables are discussed in Section 3.4 together with the new measure of technology of design and development. A summary of the Chapter is presented in Section 3.5.

3.2 ELEMENTS OF STRUCTURE

3.2.1 Functional Specialisation (ASPEC)

Specialisation is concerned with the division of labour within the organisation, the distribution of official duties among a number of positions (Pugh et al, 1968: 72). The functional specialisation measure reflects the extent of specialisation among sixteen activities which were assumed to be present in all work organisation (excluding the workflow activities)[1]. An activity is specialised if the organisation has at least one full time employee (not in the line of command) who performs that function and no other function. No account is taken of the number of specialists or their status within the organisation. Each specialism was scored as a dichotomous item having values of one if present or zero. This measure replicates exactly that used by Pugh et al (1968) and Inkson et al (1970a).

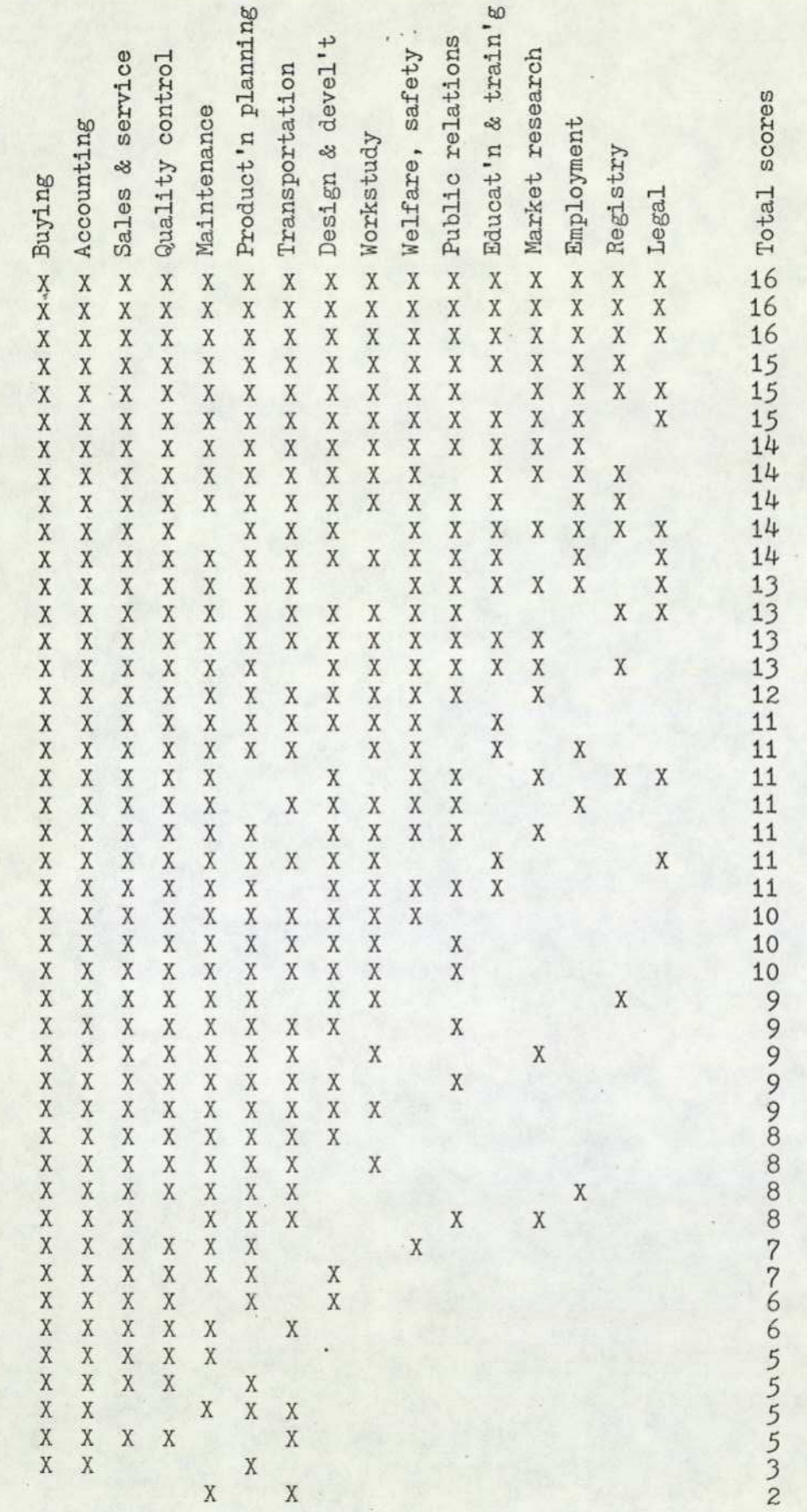
In order to observe the distribution of particular specialisms with respect to the total specialisation scores as measured by the summation of individual positive responses, a Guttman scale[2] of specialisation items was constructed (Fig. 3.2.1.1). The pattern is approximately triangular, therefore from a knowledge of the total specialisation score one can approximately determine the existence of particular specialisms. For example, a total specialisation of nine (Fig. 3.2.1.1) indicates the existence of specialisations nos. 8, 10, 2, 12, 9 and 11, and a combination of (14, 13, 15) or (4, 14, 1) or (4, 13, 3) or (4, 14, 13). Since 4 and 14 appear

(Note (1) - See Table 3.2.1.1 for the list of functions.
Note (2) - Guttman scale is discussed in detail in Appendix B)

Table 3.2.1.1 Items included in the Functional Specialisation Measure

Function 1	Public relations and advertising
Function 2	Sales and services
Function 3	Transport
Function 4	Employment
Function 5	Training
Function 6	Welfare and security
Function 7	Buying and stock control
Function 8	Maintenance
Function 9	Accounts
Function 10	Production control
Function 11	Inspection
Function 12	Methods
Function 13	Design and development
Function 14	Organisation and methods
Function 15	Legal
Function 16	Market research

Figure 3.2.1.1 Guttman Scale for Functional Specialisation



most frequently in the combinations of the three remaining specialisms, one can include 4 and 14 in the list and the ninth specialism may be one of 13, 15, 1 or 3. As is shown in the case of the alternative measure of specialisation (discussed in Appendix B in relation to scaling models) which is a more detailed breakdown of the measure presented here, the departures from the perfect triangular pattern may be due to the influence of several factors on the development of a particular specialism.

In order to test further the unidimensionality of the measure, item value analysis was carried out on the data, and Brogden coefficients(3) were calculated for each of the 16 specialisation items. The values of the coefficients obtained are shown at the bottom of Fig. 3.2.1.1. These values are high for each specialism except transportation. The mean item analysis value obtained is 0.8105, which is quite high, suggesting that a unidimensional view of the measure is acceptable.

Principal component analysis of the data on functional specialisation resulted in five factors accounting for 72.5 per cent of the variance in data (Table 3.2.1.2). In total, 14 of the 16 functions had high loadings on the first factor (11 with loadings above 0.5, two above 0.4 and one nearly 0.4). Four functions had loadings of above 0.5 on the second factor. These included functions 2 and 12 which had their highest loadings on the first factor.

(Note (3) - Please see Appendix B for tests of unidimensionality of scales developed from multi-point items.)

Table 3.2.1.2 Principal Component Analysis of Functional Specialisation Items (Unrotated)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Fun. 1	.66*	-.23	-.04	-.13	-.15
Fun. 2	.61*	.54	.14	-.26	.30
Fun. 3	.60*	-.32	-.28	.01	-.10
Fun. 4	.25	-.33	.42	.44	.45*
Fun. 5	.63*	-.37	-.16	.25	.38
Fun. 6	.68*	-.29	-.06	.24	.02
Fun. 7	.77*	-.27	-.07	-.10	-.06
Fun. 8	.47	.76*	-.21	.23	.02
Fun. 9	.30	-.16	.71*	-.06	-.02
Fun. 10	.47	.76*	-.21	.23	.02
Fun. 11	.39	.23	.06	-.59*	-.49
Fun. 12	.59*	.50	.16	.34	.31
Fun. 13	.65*	-.04	.49	.04	-.22
Fun. 14	.65*	.06	.21	-.30	-.36
Fun. 15	.57*	-.27	-.33	-.26	-.15
Fun. 16	.55*	-.33	-.35	-.05	.20
% of total variance	33.0	16.1	9.3	7.4	6.7

* Highest loading for the specialisation item which was at least significant beyond the 0.01 level.

From the varimax rotated principal components (Table 3.2.1.3), it may be seen that functions 1, 3, 5, 6, 7, 14, 15 and 16 load highly on the first factor, functions 2, 8, 10 and 12, the four functions with high loadings on the unrotated factor 2, also load highly on the rotated second factor. Functions loading highly on other factors have in some cases high loadings on a number of factors.

As a further check, principal component analysis with iterations was also undertaken. The factor pattern matrix after oblique rotation (Table 3.2.1.4) resulted in a similar pattern of loadings on the factors. Although functions 2 and 12 do not load highly on the second factor, they have high loadings on the fourth factor which is highly correlated with the second factor ($r = 0.34$, $p < 0.05$).

Since functions 2, 8, 10 and 12 exist in almost all cases (Figure 3.2.1.1), this collection of functions may be called the minimum functional specialisation requirement for manufacturing organisations and factor 2 may be called the minimum functional specialisation factor. In order to obtain a clearer picture of the pattern of association between individual functions, these four functions were eliminated and the data on the remaining 12 functions was subjected to principal component analysis with iterations and the factors after oblique rotation are shown in Table 3.2.1.5. It can be seen that functions 1, 3, 5, 6, 7, 15 and 16 which had highest loadings on the first factors of the two previous patterns obtained after varimax and oblique rotations load very highly on the first factor. Functions 9, 11, 13 and 14 load highly on the second factor and the first and second factor are highly correlated ($r = 0.41$, $p < 0.01$).

Table 3.2.1.3 Principal Component Analysis of Functional Specialisation (Varimax Rotation)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Fun. 1	.65*	.10	.32	.07	-.02
Fun. 2	.14	.87*	.26	-.07	.04
Fun. 3	.73*	.00	.05	.13	.03
Fun. 4	.07	-.05	.23	.01	.84*
Fun. 5	.66*	.12	-.04	.03	.56
Fun. 6	.64*	.06	.16	.24	.33
Fun. 7	.75*	.15	.30	.06	.07
Fun. 8	.05	.79*	-.14	.51	-.04
Fun. 9	-.01	.00	.74*	-.05	.26
Fun. 10	.05	.79*	-.14	.51	-.04
Fun. 11	.10	.08	.18	.86*	.03
Fun. 12	.15	.85*	.29	-.15	.00
Fun. 13	.28	.17	.71*	.27	.14
Fun. 14	.41	.28	.60*	.13	-.26
Fun. 15	.75*	.05	.07	-.03	-.19
Fun. 16	.72*	.10	-.10	-.09	.17
% of total variance	23.8	18.42	12.36	9.38	8.63

* Highest loading for the specialisation item which was at least significant beyond the 0.01 level.

Table 3.2.1.4 Principal Component Analysis of Functional Specialisation (Oblique Rotation)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Fun. 1	.60*	-.04	.19	-.01	-.07
Fun. 2	.01	-.15	.07	-.80*	.01
Fun. 3	.68*	-.06	-.00	.08	.01
Fun. 4	-.00	.32	.22	.01	.53*
Fun. 5	.58*	-.02	-.15	-.08	.57
Fun. 6	.54*	-.09	.11	.00	.27
Fun. 7	.69*	-.01	.16	-.09	.05
Fun. 8	-.04	-.90*	-.18	-.24	-.03
Fun. 9	-.04	.08	.50*	-.09	.13
Fun. 10	-.04	-.90*	-.18	-.24	-.03
Fun. 11	.05	-.50*	.24	.15	.02
Fun. 12	.00	-.00	.09	-.93*	-.00
Fun. 13	.14	-.14	.68*	-.10	.09
Fun. 14	.36	-.06	.47*	-.20	-.30
Fun. 15	.71*	.05	-.02	-.02	-.14
Fun. 16	.65*	.04	-.14	-.04	.10
sum of squared loadings	3.05	1.96	1.03	1.76	0.86

* Highest loading for the specialisation item which was at least significant beyond the 0.01 level.

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	-				
Factor 2	-.21	-			
Factor 3	.29+	-.14	-		
Factor 4	-.24	.34+	-.16	-	
Factor 5	.20	.02	.17	.01	-

\+ significant at 0.05 level

Table 3.2.1.5 Principal Component Analysis of 12 Specialisation Items (Oblique Rotation)

	Factor 1	Factor 2	Factor 3
Fun. 1	.53*	.26	-.09
Fun. 3	.66*	.02	-.02
Fun. 4	.06	.19	.56*
Fun. 5	.73*	-.11	.46
Fun. 6	.58*	.17	.20
Fun. 7	.66*	.24	-.01
Fun. 9	-.09	.49*	.17
Fun. 11	.05	.34*	-.01
Fun. 13	.04	.81*	.08
Fun. 14	.23	.60*	-.31
Fun. 15	.66*	.01	-.19
Fun. 16	.69*	-.12	.04
sum of squared loadings	3.00	1.59	0.74

* Highest loading for the specialisation item which was at least significant beyond the 0.01 level.

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3
Factor 1	-		
Factor 2	.41++	-	
Factor 3	.07	.12	-

++ significant at 0.01 level

The above analysis indicates that the sixteen different functions used in measurement of functional specialisation comprise two subsets; first a set of functions which are almost always present in manufacturing organisations (functions 2, 8, 10 and 12) and, second, a set consisting of the remaining twelve functions which determine the extent of specialisation.

The sum of binary scales for these twelve functions, although not strictly a unidimensional measure of specialisation, may reasonably be viewed as unidimensional, because the two factors on which eleven of the twelve functions have their highest loadings are highly correlated. A scale of functional specialisation may, then, be constructed as a summation of scores on each of the twelve functions. However, functions 2, 8, 10 and 12, although existing in almost all of the cases make additional contributions to the discriminatory power of the measure. This justifies their inclusion in the functional specialisation measure. The scale of functional specialisation will be formed by the summation of the individual scores on each of the sixteen specialisms, as by Pugh et al (1968). The Kuder-Richardson formula-20 provided a reliability coefficient of 0.8012. This measure is called (ASPEC) to indicate that it is the Aston measure of functional specialisation.

3.2.2 Functional Specialisation: Alternate Form (ESPEC)

By separating the individual functions which represent the broader areas of activities defined as functional specialisation, discussed in the previous section, an alternative measure was constructed. For example, Specialisation 13, namely Methods (Assess and devise ways of producing the output), was treated as four separate individual

items: Workstudy, Industrial Engineering, Operational Research and Rate Fixing. This resulted in a measure comprising 31 individual specialisation items. The same procedure of scoring used for functional specialisation was applied to this measure. In the case of each item, the respondents were asked whether there was at least one full time employee in the organisation performing each of the individual specialist functions whilst performing no other function. Each item of specialisation was scored as a dichotomous item, having values of one or zero depending on whether the respondent endorsed the existence of the particular specialism in the organisation.

The scaling procedure for this measure is discussed in Appendix B in relation to the application of various scaling models for multi-item measures. The data on this measure was subjected to scalogram analysis, item analysis and multivariate analysis. It was demonstrated that the measure may be assumed to be unidimensional, having a mean item analysis value of 0.7597 and a reliability coefficient, KR - 20 of 0.8994, and that a scale of functional specialisation may be constructed by a simple summation of the individual item scores. This measure will be referred to as ESPEC throughout this study. The major reason for its development was to get a more detailed insight into the development of various specialisms and also to be able to make finer distinctions between companies as to the extent of functional specialisation.

3.2.3 Complexity

Hage (1965: 294) proposed that:

"Complexity, or specialisation in an organisation is measured by

> the number of occupational specialities included and the length of training required by each. The greater the number of occupations and the longer the period of training required, the more complex the organisation."

In a later work, they measured complexity as the number of occupational specialities, degree of professional training and the amount of professional activity of specialists (Hage and Aiken, 1967: 80). Hall, Hass and Johnson (1967: 905 - 906) took a broader definition of complexity, based on division of labour, number of hierarchical levels and the spatial dispersion of the organisation.

In an attempt to gain better understanding about the relationship of size (measured as log-number of employees) and structural characteristics of bureaucratic mode of control (standardisation, formalisation and decentralisation), Child (1973a: 176 - 185) proposed that complexity, defined as overall role specialisation, functional specialisation and range of specialised expertise applied to organisational activities acted as an intervening factor. The measure used by Child (1973a) for assessing expertise was the level of specialist qualifications held by members of seven non-workflow functions. These functions were: R&D, finance, quality control, workflow methods, maintenance, personnel and welfare.

The definition of complexity adopted in the CUBS Study is closer to that proposed by Hage and Child than to the broader definition by Hall, Hass and Johnson. The variables to be used representing complexity are: (1) functional specialisation and (2) the level and range of specialised expertise indicated by the level of professional qualification and the level and extent of academic qualification of the employees.

In order to permit replication of the Aston Studies and test further hypotheses, Child's (1973a) approach was thus used in the CUBS Study. The respondents were asked if there was at least one specialist in the company who held a recognised professional qualification in each of the following seven areas of specialisation:

	Score
R & D	1/0
Marketing	1/0
Finance	1/0
Personnel	1/0
Welfare	1/0
Workflow planning and maintenance	1/0
Stock and quality control	1/0

These seven items were scored as dichotomous items, having values of one or zero depending on whether the respondent asserted the existence of at least one specialist with the relevant professional qualification. An index of the extent of professional qualification (QUAL) was constructed by the summation of individual item scores.

The extent of academic qualification of the employees was measured for two levels which were merely the count of the number of employees with (1) H.N.C.s and first degrees (FDEGREE) and (2) with masters and higher degrees (HDEGREE).

3.2.4 Formalisation

An essential point in Weber's definition of bureaucracy, formalisation, was defined by Pugh et al (1963: 303) as:

> "The extent to which procedures and communications are written down and filed in organisations".

They conceptualised that formalisation could include:

> "(1) Statements of procedures, rules and roles (including contracts, agreements and so on) and (2) operation of procedures which deal with: (a) decision seeking (application for capital employment and so on), (b) conveying of decisions and instructions (plans, minutes, requisitions and so on) and (c) conveying information including feedback."

Hage (1965: 295) proposed that:

> "formalisation, or standardisation is measured by the proportion of codified jobs and the range of variation that is tolerated within the rules defining the jobs. The higher the proportion of codified jobs and the less the range of variation allowed, the more formalised the organisation."

In order to operationalise the definition of formalisation above, Hage and Aiken (1967: 78 - 79) developed two scales: (1) job codification, representing the degree to which job descriptions are specified and (2) rule observation, representing the degree to which job occupants are supervised in conforming to the standards specified by job codification. These two scales were developed as a result of factor analysis carried out for two scales of hierarchy of authority and rules which were previously developed by Hall (1963).

Hall, Hass and Johnson (1967: 906 - 907) took a broader view of formalisation which was more in line with that proposed by Pugh et al (1963). The indicators of formalisation used in their study included the extent of formalisation of roles and authority structure,

presence of job descriptions and codification of authority structure in writing, degree of emphasis on written communication and use of established channels, number of written rules and policies, formalisation of norms and sanctions and formalisation of procedures regarding the orientation of new members and their training.

The scales constructed by Pugh et al (1968: Appendix C) to measure formalisation consisted of 55 items and sub-items and although principal component analysis of the items resulted in a first factor accounting for only 34 per cent of the variance in the data, which they called overall formalisation, and no other distinctive factor, they formulated three different scales of formalisation by grouping different sets of items. These scales were: formalisation of role definitions, information processing and recording of role performance.

The measure of formalisation used as a subscale of structuring of activities by Inkson et al (1970a) in developing the abbreviated measures of structure and context was the formalisation of role definitions referred to above. This same measure was used in the CUBS Study. It consists of a number of documents defining roles and procedures and in some cases the extent of their distribution among organisation members. The method of scoring is the same as that used by Inkson et al (1970a) and is self-evident from Table 3.2.4.1. Although the unidimensionality of the measure has been established previously, item value analysis was carried out for data in this study and the values are presented alongside scores in Table 3.2.4.1. This resulted in a mean item value of 0.6863 and the reliability coefficient calculated was 0.8846.

Table 3.2.4.1 Formalisation Scale

	Score	Item Analysis Value
Organisation chart	0/1	0.7786
Organisation chart given to chief executive (1), C.E. + one other executive (2), C.E. + most department heads (3)		0.7786
Written union contracts	0/1	0.4418
Written policies	0/1	0.6938
Written research programme reports	0/1	0.7238
Written operating instructions	0/1	0.6938
Written manuals of procedures	0/1	0.5188
Written production plans	0/1	0.4505
Written job description for direct worker	0/1	0.6402
Written job description for line superordinate	0/1	0.7648
Written job description for staff	0/1	0.8151
Written job description for chief executive	0/1	0.5661
Number of information booklets 0,1,2,3,4+		0.8712
Information booklet given to none;	0	0.8712
to few employees;	1	
to many employees;	2	
to all employees:	3	

3.2.5 Centralisation

Hage (1965: 295) proposed that:

> "Centralisation, or hierarchy of authority, is measured by the proportion of occupations or jobs whose occupants participate in decision making and the number of areas in which they participate. The lower the proportion of occupations or jobs whose occupants participate and the fewer the areas of decision making in which they participate, the more centralised the organisation."

Two measures of centralisation were developed (Hage and Aiken, 1967: 77 - 78). The first was based on the extent of participation of employees in decision making in relation to allocation of organisational resources and the second was a measure of the extent of reliance on the hierarchy of authority of individuals with respect to their own work decisions. This second measure was based on the factor analysis of two scales of hierarchy of authority and rules formulated by Hall (1963).

Pugh et al (1968: 76 - 78) defined centralisation as concerning the locus of authority to make decisions affecting the organisation. From a list of 37 decisions applicable to work organisations, they developed a scale of centralisation by identifying the lowest position on the hierarchy of the organisation which had the authority to make each individual decision. Scores ranging from 5 to zero were allocated depending on the position of the decision maker on the hierarchy of authority from the chief executive to direct worker.

Child (1972a: 167 - 168) found that the mean score on centralisation for companies in the National sample was lower than that for the organisations in the Aston Study. In fact, the mean in the former case fell below the range of scores obtained in the latter case.

Child stated that:

> "some of the marked difference can be attributed to the contrasting basis of sampling employed in two studies, because the method of scoring centralisation is sensitive to the status of the organisational units selected for study."

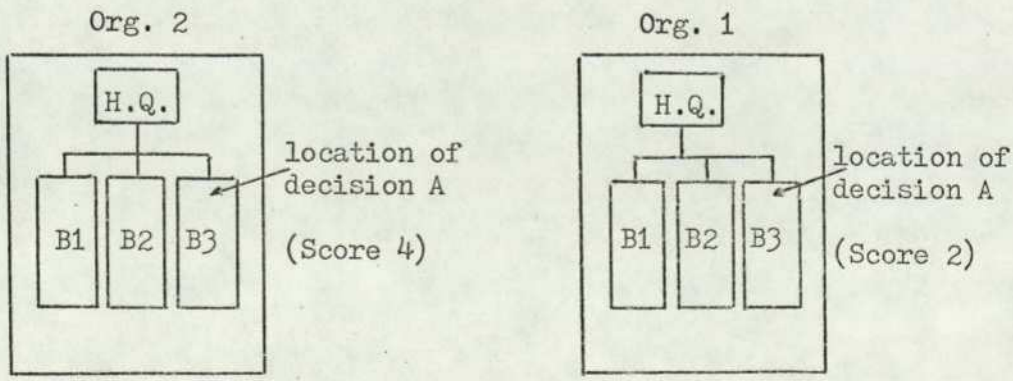
The Aston sample of organisations contained 20 branches, whilst there were only 3 branches in the National sample and the number of employees in these branches was above 2,400. He went on to say that:

> "In the twenty Aston branch organisations, branch managers who were usually departmental or site heads, were scored as chief executives, as were the heads of the whole units. This procedure tends to give branches relatively high scores on overall centralisation, for a given reply on locus of decision making. If decision making on a selected set of items were located at precisely the same level among a collection of identical organisations, the mean score on overall centralisation obtained from a mixed sample comprising branches in some cases and whole units in others would therefore be higher than that obtained from a sample entirely comprising whole units."

and he gave a hypothetical example demonstrating the above argument (Child, 1972a: 168).

This may be illustrated by considering two identical organisations (in the sense of the position of authority to make a particular decision) with branches (Fig. 3.2.5.1). If the sample consisted of organisations 1 and 2, the average score for decision A would be 2, but if the sample consisted of organisation (1) and branch (3) of organisation (2), then the average score on the same decision would be

Figure 3.2.5.1 - Measuring Centralisation



3, using the method of scaling developed in the Aston Study. It may be argued that this is proper because the units of analysis are organisation (1) and branch (3) of organisation (2) - and the branch is more centralised in the sense that most of the decisions are made by its chief executive. None the less, it does indicate that the mean centralisation within a sample is indeed dependent on the composition of the sample, and will tend to be higher where more branches are included, even though the corporate bodies of which they are members may be no more centralised than others.

Inkson et al (1970a) used autonomy, a measure developed by Pugh et al (1968: 78), as an indicator of the extent of centralisation. This measure is based on a count of the number of decisions which the organisation has to refer to the headquarters or the parent organisation and measures the extent of autonomy in decision making of the organisational unit. The decision items included in this measure were a subset of 23 decisions from the 37 decisions forming the centralisation scale, selected on the basis of their discriminatory power between organisations as to whether the decisions were taken inside or outside the organisation. Each decision was scored as a dichotomous item, having values of one or zero, depending on whether the decision was taken inside the organisation, or had to be referred to levels higher than the chief executive of the unit of analysis.

However, the use of autonomy as a measure to determine the extent of centralisation can be highly dangerous for a sample of organisations comprising a large proportion of independent units, since the scores obtained for most independent units in the sample would be expected to be

identical [1], regardless of the dispersion of the locus of decision making. The very large negative correlation between centralisation and autonomy which led Inkson et al (1970a) to adopt this measure as an indicator of decentralisation, could have been due to the existence of a large number of branches in the sample studied by the Aston group.

Based on the aforegoing discussion, autonomy was not used as the sole measure of the extent of centralisation of decision making in the CUBS Study. The 23 decision items selected by Pugh et al (1968) to measure autonomy of organisations were used to develop a scale of centralisation (Appendix A). The same scaling procedure as developed by Pugh et al (1968) was used. For each decision item, respondents were asked: "Who is the last person whose assent must be obtained before legitimate action is taken, even if others have subsequently to confirm the decision?" The scores given were:

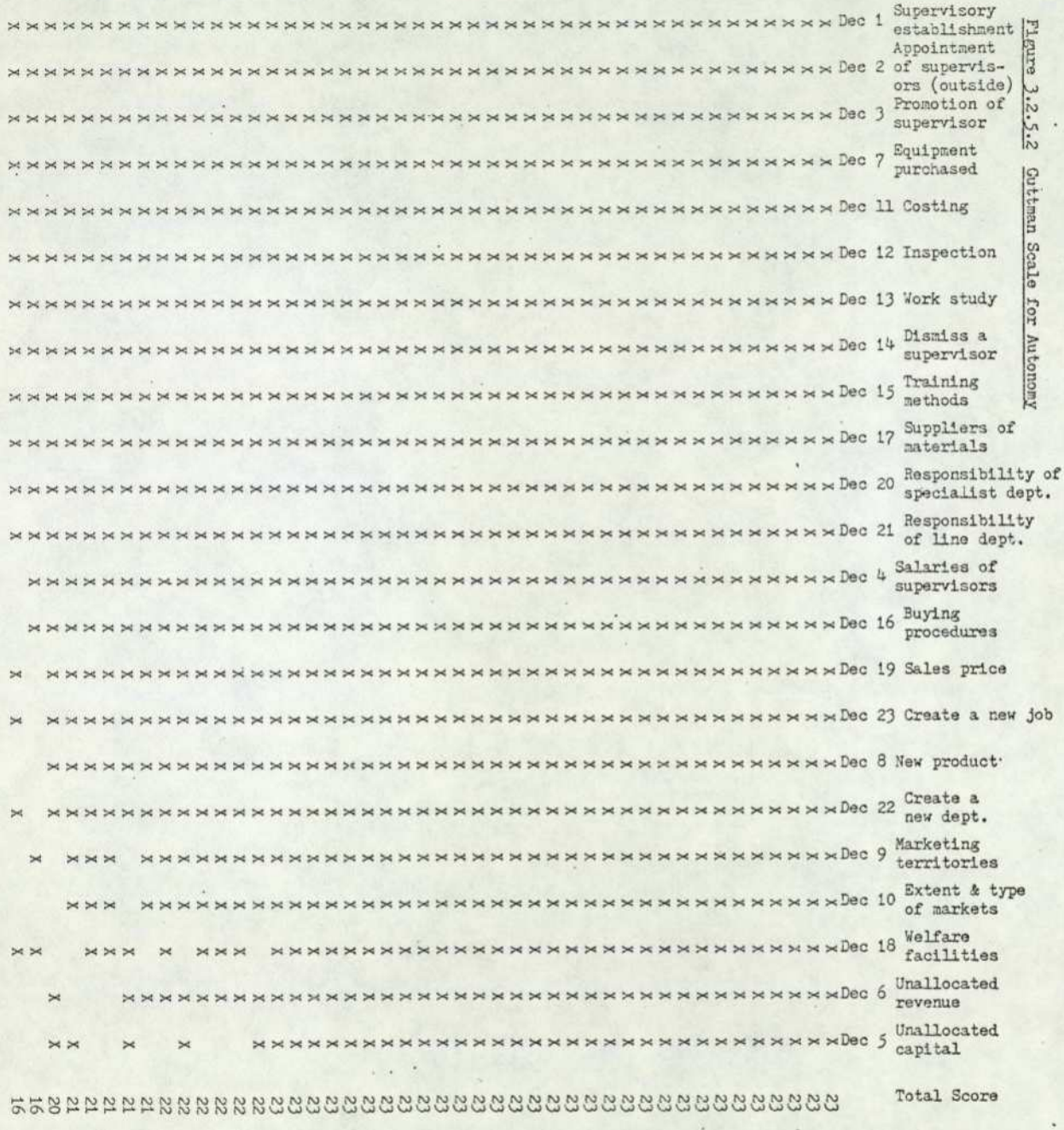
Score	Level	Example
5	Above C.E.	Board of the group
4	Whole unit	Managing Director
3	All workflow activities	Production Manager
2	Workflow subunit	Plant Manager
1	Supervisory	Foreman
0	Operating	Direct worker

Because decisions relating to costing, inspection and workstudy

(Note (1) - Independent units with owner managers would all score as 23 on autonomy. However, some private independent companies with non-executive board may score less than 23.)

of operations were taken within the organisations, but some respondents were unable to specify the exact hierarchical position of the decision takers, only 20 of the 23 decision items were used to develop the scale of centralisation, AC. Reliability coefficient alpha for the scale AC, using the 20 decision items, was 0.910. With exception of decision 18, all other item-total correlations were statistically significant beyond 0.05 level. Exclusion of decision 18 raised the reliability coefficient to 0.9553. The scale AC was accepted as unidimensional and was formed by summation of scores on each of the 20 decision items.

A scale of autonomy was also constructed from the data on the same 23 decisions. A score of one was allocated for each decision, if taken inside the company and a score of zero, if the decision had to be referred to the headquarters or the parent company. A Guttman pattern of the data (Figure 3.2.5.2) indicates that the first decisions to be referred to a level above the chief executive are decisions on unallocated expenditure on capital and revenue items. As the autonomy of the company decreases, decisions about welfare facilities, extent and type of markets aimed for, marketing territories covered, creation of new departments and new product development are referred to the levels above the chief executive. The least autonomous companies did not have the authority to make decisions with respect to creation of new jobs, sales price of the end product, buying procedures and salaries of supervisory staff.


Dec 1 Supervisory establishment
Dec 2 Appointment of supervisors (outside)
Dec 3 Promotion of supervisor
Dec 7 Equipment purchased
Dec 11 Costing
Dec 12 Inspection
Dec 13 Work study
Dec 14 Dismiss a supervisor
Dec 15 Training methods
Dec 17 Suppliers of materials
Dec 20 Responsibility of specialist dept.
Dec 21 Responsibility of line dept.
Dec 4 Salaries of supervisors
Dec 16 Buying procedures
Dec 19 Sales price
Dec 23 Create a new job
Dec 8 New product
Dec 22 Create a new dept.
Dec 9 Marketing territories
Dec 10 Extent & type of markets
Dec 18 Welfare facilities
Dec 6 Unallocated revenue
Dec 5 Unallocated capital
Total Score
16 16 20 21 21 21 21 22 22 22 22 23 23 23

3.3 CONFIGURATION

"Configuration is the shape of the role structure" (Pugh et al, 1968: 78). In order to determine the shape of the role structure a number of measures are necessary, each representing a particular aspect of the structure. The measures used to indicate the differences in configuration between companies in the CUBS Study have been used in the Aston and numerous other studies previously. However, a definition of the measures and scaling procedure will be discussed.

3.3.1 Height

Vertical span of control, or height, was measured by a count of the number of job positions along the tallest line of command from the chief executive to the direct worker inclusive of both.

3.3.2 Span

Chief executive's span of control was measured by a count of the number of subordinates who report directly to the chief executive.

3.3.3 Ratio

Subordinate ratio was measured as the average number of direct workers per first line supervisor. Both "span" and "ratio" measure lateral span of control.

3.3.4 A/P Ratio

The proportion of the employees engaged in non-direct jobs has been the subject of numerous studies. However, different definitions of non-direct employment have been used (Child, 1973c: 328 - 331).

Non-direct employment is defined in the CUBS Study as the total number of employees minus total number of direct or production workers with no supervisory responsibility. This is different to the measure of supportive employment used by Child (1973c: 336 - 337), in that the CUBS measure of A/P ratio does not include the managers of direct employees or production areas of work in the diviser.

The ratio of non-direct/direct employment as defined above is calculated and used in the subsequent analysis of the data as an indicator of the relative size of administrative support.

3.3.5 Complexity of Overall Administrative Structure

Chandler (1962), in his classic study of evolution of large scale enterprises in the U.S.A., noted that adoption of diversified product market strategy by the large companies was accompanied by adoption of more complex administrative structures. Following his work, Scott (1971), Stopford (1968), Wrigley (1970), Channon (1973) and Rumelt (1974) have related changes in strategy to movement along an ordinal scale, starting from a one man business and moving through the functional to the product and geographical divisional structure as a means of coping with greater complexity of diversified businesses. Although this categorisation is rather crude, it has been successfully used by these researchers. The scale progressively

shows greater extent of structural complexity. Use of measures of configuration noted above may well be supplemented by such measure of organisational complexity. The measure adopted in this study to represent the overall complexity of administrative structure is based on that of Rumelt (1974), but extended to accommodate greater variation of structural type proposed by Fouraker and Stopford (1968). The scale is ordinal and structural types are scored as follows:

	Score
Owner manager	0
Functional structure	1
More elaborate functional structure (with sales/service divisions)	2
Holding company structure	3
Semi-multi-divisional structure (multi-divisional but lacking a well defined general office)	4
Multi-divisional structure	5
More elaborate multi-divisional (world-wide product/ world partitioned geographical structures)	6

3.4 ELEMENTS OF CONTEXT

3.4.1 Age

Age has been used as a contextual variable affecting the structure of organisations by Hall (1963: 38) and Pugh et al (1969a: 94) and in other studies in relation to, for example, management style by Khandwalla (1974a). It is also used in the CUBS Study as a contextual variable measured by the age of company in years at the time of interviewing.

3.4.2 Size

Size of the organisation measured as the total number of employees has been used in the study of organisations in relation to its effects on the elements of structure and degree of bureaucratisation by Hall (1963); Hall and Tittle (1966); Hall, Hass and Johnson (1967); Blau (1970); Pugh et al (1969a); Child (1973a) and by others replicating the work of the Aston group. In addition to the number of employees, Pugh et al (1969a: 97 - 98) used net assets employed by the organisations. However, the correlation obtained between these two measures of size was high ($r = 0.78$) and using the logarithm of the two variables raised the level of correlation to 0.81. Hence they used the logarithm of the number of employees to represent the size of the organisation in their analysis. Child (1973a: 169 - 170) used number of employees, number of sites, net assets and sales turnover as the measure of size

and the correlations obtained between these variables, except net assets were again high. He attributed the low correlations between net assets and the other three measures to the existence of 27 service organisations in the National sample. The removal of the service organisations from the sample raised the level of correlation between numbers employed and net assets to 0.86.

In relating the size of the organisation (normally measured as the total number of employees) to other organisational characteristics, Pugh et al (1969a); Child (1973a) and others have consistently used the logarithm of the number of employees. Kimberley (1976: 583) stated that:

> "There are three basic rationales for use of log transform: (1) reducing the variance in the distribution of the values of size across observations; (2) testing a hypothesis of curvilinearity of relationship between size and one or more structural variables; and (3) testing a theory in which size is related to other variables in a multiplicative fashion".

Of the three the first is the most common. The implicit justification for use of log transformation is that when the values of one variable are highly skewed as is often the case with size, the magnitude of its resulting correlations with other variables can be strongly affected by the extreme scores. Also, the distribution which results from a log transformation more closely approximates the normality assumption which underlies multivariate analysis. He further argued that although the justifications are statistically accurate, many users of the log transform of size fail to appreciate or discuss the theoretical implications of the relationships found between size and other variables, for in using log of size in correlation and multivariate analyses one is assuming a curvilinear relationship between size and other variables included in the relationships.

In the CUBS Study size was measured as the total number of full time employees and both the natural number and the logarithm of size were used in the statistical analysis.

3.4.3 Size of the Parent Organisations

Pugh et al (1969a: 98) used total number of employees in the parent organisation as a contextual variable due to its anticipated effects on the structural variables. For the same reason this measure was also used in the CUBS Study as a contextual variable. For reasons advanced earlier, the logarithm of the number of employees in the parent organisation is used in the analysis.

3.4.4 Technology

Numerous attempts have been made by organisational theorists to develop operational measures of technology of the organisation. Woodward (1958), in her study of 100 manufacturing firms in South East England, introduced a classificatory scheme for technology. She developed a ten point scale based on a classification of dominant methods of production which she called the scale of technical complexity, meaning the extent to which the production process is controllable and its results predictable. This ten point scale may be classified under the main headings of: small batch and unit production, large batch and mass production and process production. The work of Woodward was later replicated by Zwerman (1970). Harvey (1968: 249) argued that the technical complexity scale as developed by Woodward (1958) could be viewed as a scale of technical simplicity:

"it is after all the frequent emergence of problems calling for

innovation that characterises unit rather than process production." He grouped the firms in his study on a continuum of technical diffuseness to technical specificity and used the number of product changes as a measure of technical diffuseness - technical specificity.

Taking a different approach, Thompson (1967: 14 - 24) identified three varieties of technology: (1) long linked, where the output of one segment is the input of another and so on; (2) mediating, concerning the linking of various sectors which wished to be interdependent; and (3) intensive technology, signifying that a variety of techniques are drawn upon to achieve a change in some specific object.

Yet another view was taken by Charles Perrow (1967: 195), who defined technology as:

> "The action that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make a change in that object."

He considered two aspects of technology to be directly related to organisation structure: (1) the number of exceptional cases encountered in work and (2) the type of search behaviour undertaken by individuals when exceptions occurred. This afforded a fourfold classification of organisations in terms of technology. Based on this concept of technology, Hage and Aiken (1969: 368) measured technology as the extent of routineness of work for a sample of 16 health and welfare organisations.

These different approaches were to some extent combined by Hickson et al (1969: 380 - 384) who proposed that the concept of technology has three facets: (1) materials technology, concerning the characteristics of the materials used in the workflow as conceptualised by

Thompson (1967) and Perrow (1967); (2) knowledge technology concerning the characteristics of knowledge used in the workflow (Perrow, 1967) and (3) operations technology concerning the techniques used in workflow activities, Pugh et al (1963:310), Woodward (1958) and Thompson (1967).

Hickson et al (1969) defined the concept of operations technology as, "equipping and sequencing of activities in the workflow" and proposed that it consisted of a number of subconcepts: (1) the extent of automation of the equipment used; (2) the extent of rigidity of the sequence of operations and (3) the specificity of evaluation of operations. The scale of technology developed in accordance with the above definition consisted of five subscales of workflow rigidity, automaticity mode and range, interdependence of workflow segments and specificity of evaluation of operations, which were highly intercorrelated (mean intercorrelation 0.46). A unidimensional scale called workflow integration was formed by the summation of scores on the five subscales.

They also argued that the category headings in Woodward's technical complexity scale were not ordered in terms of the degree of control and predictability of the production process, but in terms of the units of throughput. They adapted her technical complexity scale by further classifying the definitions of the categories and called it a scale of production continuity.

Child and Mansfield (1972) also used the two scales of workflow integration and production continuity in an attempt to replicate the work of Hickson et al (1969). However, their analysis resulted in a different pattern of correlations among the five subscales of workflow integration. The mean intercorrelation of the subscales was 0.2 and

specificity of evaluation of operations and interdependence of workflow segments were not related to the other three measures which remained interrelated. They also developed another measure based on Woodward's concept of technology to make it applicable to service as well as manufacturing organisations and they called it throughput continuity. They concluded that the differential pattern of association of subscales of workflow integration suggested that a multidimensional view of technology may repay further exploration.

This approach is at variance with that of Inkson et al (1970a) who used automaticity mode and range as an abbreviated measure of technology, due to the high correlations between these two measures and other measures of workflow integration. Hickson et al (1974: 69 - 70), using abbreviated measures of structure and context, justified the narrower scale on the argument that:

> "The inconsistency of the interrelationships among the several scales of technology originally devised by Pugh et al (1969a) leads to the use of a single automaticity characteristic separately."

Indeed they abandoned automaticity range, and used only automaticity mode, despite the fact that Child and Mansfield (1972: 386) had found that automaticity mode had weaker correlations than automaticity range with the structural variables.

Hickson et al's (1974: 69 - 70) reason may well have been that the intercorrelation of automaticity mode with other subscales of workflow integration was higher than that of automaticity range.

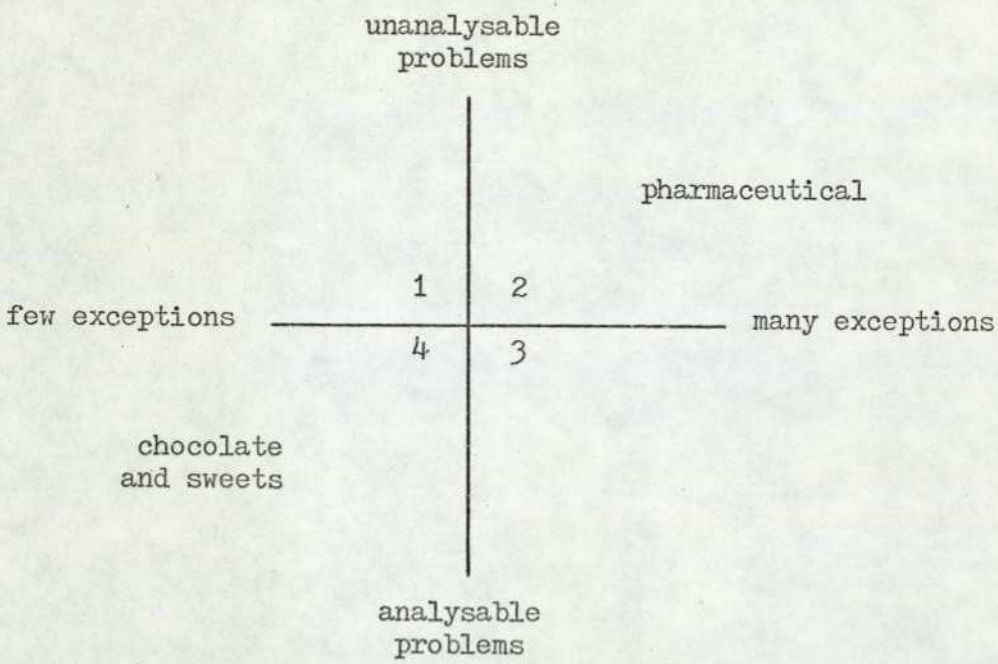
The concept of technology formulated and operationalised by Hickson et al (1969), correctly named as operations technology, only deals with one aspect of technology, that of the complexity of the equipment used in the manufacture of products (automaticity mode and range), and the complexity of the manufacturing process (the interdependence of workflow segments and workflow rigidity). In the case of manufacturing industries, especially the electrical engineering industry, design and development constitute a major part of the "technical core", to use the term originally put forward by Thompson (1967). Developing a measure of technology of design and development may further the understanding of the relationships between technological, structural , situational and managerial characteristics of the manufacturing organisations. The concept of technology proposed and defined by Perrow (1967: 195 - 196) based on the extent of occurrence of exceptional situations and the type of search behaviour undertaken by the individual may be used to obtain a classification of organisations in terms of the technology of the design and development stage of the technical core.

Child and Mansfield's (1972: 389 - 391) analysis of the relationship between technology and structure revealed that the companies in two industries, chocolate and sweets and pharmaceuticals, were similar to each other in terms of technology (workflow integration and production continuity) whilst they were different in terms of structural characteristics (specialisation, standardisation, etc.). They stated that:

> "if the difference between industries on structural variables in fact largely reflects technological differences between these industries, then it follows that the measure of technology

used is not strong enough."

Comparison of the companies in the two industries on technology of design and development using Perrow's fourfold classification would place the chocolate and sweet companies in Cell 4, and the pharmaceutical companies in Cell 2, since the process of development of different types of sweets would involve few exceptional situations and the problems would be analysable, whereas the development of different types of drugs would involve many exceptional situations and lead to more unanalysable problems and a more exploratory search behaviour.



Although the technology of the manufacturing process is the same in both cases, the technology of development is different, resulting in a more complex end product in the case of companies in the pharmaceuticals industry. It may well be that the complexity of design and development technology reflected by the position of the companies in Perrow's fourfold classification, is related to structural

characteristics, in particular the complexity of the organisation rather than the technology of the manufacturing process. Consequently both aspects of technology were used in the CUBS Study.

Automaticity mode and range are used as a measure of operations technology due to their high correlations with the workflow integration measure (Hickson et al, 1969; Child and Mansfield, 1972). Amber and Amber (1962: 2) provided a classificatory measure of automation of equipment based on the degree to which energy and information are provided by machine rather than man. This was a six point classification and organisations were scored on this scale by use of two measures: (1) Automaticity mode or the degree of automation of the bulk of equipment and (2) Automaticity range: the position on this scale of the most automatic piece of equipment used in the workflow.

Scale	Score
Hand tools and manual machines	0
Powered machines and tools	1
Single cycle automated and self-feeding machines	2
Automated repeat cycle machines	3
Self-measuring and adjusting feedback machines	4
Computer-controlled cognitive machines	5

A measure of technology of design and development was obtained based on the position of the organisation on the fourfold classification proposed by Perrow (1967). This was judged by the researcher purely on the basis of the information obtained in the interviews on the types of products developed. The extent of occurrence of exceptional situations and the type of search behaviour undertaken was assessed based on this information. Hence, the classification was on subjective basis.

The scores were allocated as follows:

Position of Organisation	Score
Cell 4	1
Cell 3	2
Cell 1	3
Cell 2	4

This ordinal scale obviously reflects increasing complexity of the technology of development within the firms.

Two further operational measures of technology also deserve to be mentioned, although these appeared in the literature too late to influence the development of scales for the CUBS Study. These are Khandwalla's (1974b) mass output orientation scale and Reimann's (1977) two dimensional technology scale, both based on Woodward's classificatory scheme of technology. Khandwalla (1974b) stated that Woodward's (1958) technical complexity scale and Hickson et al's (1969) workflow integration measure were applied to the dominant technology of the organisations in their samples and, since many organisations existed which used several rather than one type of technology, this resulted in a serious problem. In developing his scale of technology he compiled a list of five types of technology similar to that used by Woodward (1958). These were: custom, small batch, large batch, mass production and continuous production technologies. Measuring the extent of use of each of the five major technologies in the manufacturing processes of the firms on a seven point ordinal scale, he constructed his mass output orientation scale by a weighted summation of the responses. The weights varied from 1 for custom to 5 for process technologies.

Reimann (1977) proposed that a two dimensional view of technology would resolve some of the discrepencies in the findings of empirical studies using a measure of technology. He measured technology along two independent dimensions of mass production and technical change. His mass production dimension was similar to Khandwalla's (1974b) in

that he used the same five technology categories and the same weighting systems. However, he criticised Khandwalla's rating scheme for its dependence on management's perceptions and the fact that the sheer number of technologies used would result in higher mass output orientation scores. In place of the subjective rating, he weighted the proportions of output processed by each type of technology from one to five.

> "The proportions of output had to add up to 100 thus eliminating the danger of disproportionate impact on the final score by the mere number of technological forms which seems to be inherent in Khandwalla's seven point rating method." (Reimann, 1977: 554)

Reimann's mass production scale, although limiting the disproportionate impact discussed above suffers from the same very serious problem as Khandwalla's in that equal technology scores would be obtained for organisations using different combinations of forms of technology.

Criticising the use of a measure of technological change such as that used by Harvey (1969) for its dependence on the definition of product change adopted by the firm, Reimann (1977) used the arithmatic average of the average rates of productivity (output per man hour) change over ten years for industries under which the firms' major product lines were classified. Although Reimann claimed that the majority of the firms in his sample fell under one or two industrial classification categories, the measure itself would have no general applicability and would be inappropriate in the case of companies with diversified product ranges.

3.4.5 Number of Operating Sites

There are a priori reasons for expecting the number of operating sites to influence an organisation's structure. Consequently the number, used in the Aston Studies to reflect the extent of geographical dispersion of organisational activities, was established for each company

in the CUBS sample and used as a variable in subsequent analysis.

3.4.6 Dependence

The dependence of an organisation reflects its relationships with other organisations in its social environment, such as suppliers, customers, competitors, labour unions, management organisations and political and social organisations (Pugh et al, 1969a: 104).

Pugh et al (1969a) conceptualised dependence as (1) dependence on the parent organisation measured as: size of the organisation relative to the size of its parent organisation; status of the organisation in relation to its parent organisation; and the degree of organisational representation on policy making bodies; (2) the number of specialisations contracted out by the organisation to the parent organisation or other organisations, for example, management consultants; (3) dependence on other organisations operationalised as: integration with suppliers; response in output volume to customer influence; type of link with customers; dependence of the organisation on its largest customers and the dependence of the largest customers on the organisation; and (4) a measure representing the extent to which trade unions were accepted as relevant to the activities of the organisation. The five measures representing the dependence of the organisation on other organisations were formed into a single measure which they called "Vertical Integration". All these measures, except that for the trade unions correlated highly with the size of the parent organisation rather than the size of the organisation. The Aston

researchers stated that:

> "This pattern lends support to the view that these measures are tapping aspects of the dependence of the organisation, particularly, its dependence on external resources and power." (Pugh et al, 1969a: 107)

Two other contextual variables: impersonality of origin and public accountability of the owning group demonstrated similar correlations. These two measures, together with relative size, status, organisational representation on policy making bodies, number of specialisations contracted out and vertical integration, were used as a measure of dependence. Principal component analysis of the above seven measures resulted in a first factor explaining 55 per cent of the variations in the data with all measures except vertical integration having loadings of above 0.7. However, the final dependence scale used in their study was formed by a weighted sum of the four measures:

(1) Size of the organisation relative to size of the parent organisation.
(2) Status of the organisation relative to its parent organisation.
(3) Organisational representation on the policy making bodies.
(4) Number of specialisations contracted out.

Mindlin and Aldrich (1975) stated that the dependence measure developed by Pugh et al (1969a) measured the extent of dependence of the organisation on its parent organisation and not on other organisations and that although the vertical integration (measuring the relation of the organisation with its suppliers and customers) had some effect on the dependence score due to the method of calculation of weights for the four measures to be included in the final dependence

scale, the four measures used, apart from the number of specialisations contracted out which partly measures the relation of the organisation with other organisations, only reflected the relations of the organisation with its parent organisation. They also stated that it is necessary to make a distinction between the two types of dependence, on the parent organisation and on other organisations due to the different resources sought from these two sources.

Clearly the measure of dependence developed by Pugh et al does not conform to their definition of dependence referred to at the beginning of this section, since it does not take into account the relations of the organisation with a whole range of other organisations on which it may be dependent. Inkson et al (1970a) used relative size, status, impersonality of origin and public accountability of the owning group as an abbreviated measure of dependence. McMillan et al (1973) and Hickson et al (1974) used the first three of the above measures as an indicator of dependence in their studies.

The same criticism is also applicable to the above measures of dependence since they clearly measure the extent of dependence of the organisation on its parent organisation and not on other organisations. This view is adopted in the CUBS study. The three measures used by Hickson et al (1974) were used to represent the extent of dependence of the organisation on its parent organisation. Public accountability of the owning group is excluded since it only represents the dependence of the parent organisation on its social environment and not the dependence of the organisation itself.

Subscale definitions and scales are:

Subscale	Score
Impersonality of Origin (ORIGIN)	
Personal foundation (i.e. founded by a person or persons, not by an existing organisation)	0
Foundation by an existing organisation	1
Status of Organisation Unit (STATUS)	
Principal unit	0
Subsidiary unit (with legal identity)	1
Head branch (with H.Q. on the same location)	2
Branch	3
Size Relative to the Size of the Parent Organisation (RELSIZE) - measured as the total number of employees in the organisation, expressed as a percentage of the number of employees in the ultimate owning group and categorised as:	
Over 90% of owning group	0
30 - 90% of owning group	1
5 - 29% of owning group	2
Under 5% of owning group	3

Table 3.4.6.1 shows the correlations between each subscale and the dependence measure obtained as the sum total of the subscale scores.

Table 3.4.6.1	Kendal's Tau	Pearson's zero order product moment coefficient
ORIGIN	0.6117	0.6326
STATUS	0.7829	0.9032
RELSIZE	0.8717	0.9443

All significant at 0.001

The item-total correlations obtained are high and all are significant at 0.001 level. Therefore, a scale of dependence on parent organisations was constructed by the addition of the scores on the three subscales.

3.5 SUMMARY AND DISCUSSIONS

As was mentioned at the outset of this Chapter, to permit replication of the Aston Study findings on the relationships between the structural variables and their contextual determinants, most of the measures used in the CUBS Study were those due to Pugh et al (1968, 1969a) and abbreviated measures due to Inkson et al (1970a). These included - (1) structural measures: functional specialisation, formalisation, autonomy, vertical and lateral spans of control, subordinate and A/P ratios; and (2) contextual measures: size, age, parent company size, technology, number of operating sites and dependence.

Although item analysis of specialisation items resulted in a mean item analysis value of 0.8105 and the reliability coefficient KR - 20 of the specialisation scale (ASPEC) was 0.8012, principal component analysis of items resulted in two clusters: (1) a collection of four specialisms called minimum specialisation and (2) a collection of 12 specialisms called functional specialisation. However, in view of the high mean item analysis value and reliability coefficient and for consistency with the Aston Studies, functional specialisation as a collection of the 16 specialisms was used as an exact replication of the scale used in the original Aston Studies. An alternative form of the measure (ESPEC) was also developed by separating the individual specialisms which represented broader areas of specialisation defined in functional specialisation (ASPEC). This measure was also unidimensional and had a mean item analysis value of 0.7597 and a reliability coefficient KR - 20 of 0.8994.

Formalisation of role definitions, one of the three scales developed by Pugh et al (1968) was used as an exact replication of that proposed by Inkson et al (1970a) as an abbreviated measure of formalisation. This measure was also unidimensional with mean item analysis value of 0.6863 and the reliability coefficient alpha was 0.8846. To further extend the Aston Studies and in particular to test the relationships between organisational complexity and bureaucratic mode of control (see Chapter 4), three measures of complexity were used: (1) QUAL, an ordinal scale reflecting the extent of professional qualifications of office holders in seven non-workflow areas adopted from Child (1973a); (2) number of first degree holders and (3) number of higher degree holders. The latter two measures were used to reflect the extent of academic qualifications of employees in the organisation.

Autonomy, as an abbreviated measure of centralisation proposed by Inkson et al (1970a) was rejected as inappropriate and a scale of centralisation was constructed using a subset of 20 of the 37 decision items used by Pugh et al (1968) to measure centralisation and the same scoring method was used. This measure was believed to be unidimensional with a reliability coefficient alpha of 0.910. Autonomy was, however, used more properly just to reflect independence from higher organisations.

Of the measures of organisational configuration, vertical and lateral spans of control, subordinate ratio and A/P ratio were defined and used as in the original Aston Studies. In addition, an archetypal, ordinal scale of structural complexity based on the seminal work of Chandler (1962) was developed. This measure will be

used to extend the Aston Studies by relating it to degree of bureaucratisation and also to construct a bridge between the organisational behaviour and strategy/structure schools of research.

Contextual variables measured were: age, size, parent company size, technology, number of operating sites and dependence. The measures of technology used were automaticity mode and range due to Inkson et al (1970a). In addition, an ordinal scale of complexity of design and development based on Perrow's (1967) conceptualisation of technology was developed. This scale will be used in testing hypotheses on the relationships between technology and organisational complexity (see Chapter 5).

Dependence measured by summation of scores on three subscales of status, impersonality of origin and relative size, an abbreviated version of the measure of dependence developed by Pugh et al (1969a), as correctly criticised by Mindlin and Aldrich (1975), only reflects the dependence of the organisation on its parent organisation. In this context it is used together with other contextual variables in a multivariate design as a predictor of structural characteristics (see Chapter 5). The structural variables will be used in a critical replication and extension of the Aston Study findings on the dimensions of organisational structure in Chapter 4. The contextual variables will be used in correlation and multivariate analysis in an attempt to identify contextual determinants of structural characteristics in Chapter 5.

CHAPTER IV

DIMENSIONS OF ORGANISATIONAL STRUCTURE

A CRITICAL REPLICATION

4.1 INTRODUCTION

In Chapter 3, discussing the conceptualisation and development of scales for measurement of structural characteristics of organisations, it was shown that Udy (1959), Hall (1963), the original Aston Studies of Pugh et al (1963, 1968, 1969), and others, drawing upon the concept of bureaucracy advanced by Weber (1947), developed scales measuring specialisation, standardisation, formalisation, centralisation and configuration. It was also shown that by this means they broke the unitary Weberian ideal type into separate measurable constituents and were able to explore the extent to which the characteristics of ideal did co-exist in practice.

The Aston Studies were replicated by Hinings and Lee (1971) and Child (1972a) and extended to studies of relationships with contextual variables measuring size, technology, dependence, location, character, ownership, origin and history by Pugh et al (1969a), Hickson et al (1969), Child and Mansfield (1972) and Child (1973a). Child (1973b) also included organisational behaviour in his study. The scales were abbreviated by Inkson et al (1970a) and used by Reimann (1973) and McMillan et al (1973) among others. Similar research was undertaken in trade unions and professional associations by Donaldson and Warner (1972, 1974), public bureaucracies by Greenwood and Hinings (1974) and Churches by

Hinings et al (1976).

These studies reinforced the Weberian concept by showing functional specialisation, role specialisation, standardisation and formalisation to be strongly, positively statistically significantly correlated. However, Pugh et al (1968) questioned the Weberian concept of decentralisation of decision making authority within a bureaucratic system, suggesting independence between centralisation and measures of structuring. Child (1972a) on the other hand challenged this finding. In his sample "centralisation of decision taking" was found to be related negatively to structuring in a way that conforms closely to Weber's description of the bureaucratic mode of control. Centralisation with an economy of systems should be seen as an alternative to indirect control of decentralised decision taking by means of procedures, paper work, specialists and employment of qualified staff. Certainly, Child's case is convincing and perhaps for this reason little research apart from minor extensions by Donaldson et al (1975) have sought to resolve the inconsistency between the Aston and National Studies. In each case they re-examined sub-samples of the original Aston data. Neither found any support for Child's claim that the reason for the discrepancy lay in lack of homogeneity in the Aston sample. The issue remains to be settled.

Drawing upon the Weberian ideal, Hage (1965) argued that complexity and centralisation are negatively correlated, where complexity is defined as specialisation of tasks plus length of training required by the task. The Aston researchers, Pugh et al (1968), adopted role specialisation as a measure of structuring, but did not consider length of training. Professional training, and academic

qualifications are clearly related to the Weberian ideal. Weber himself wrote (1947 p.p. 328 - 40):

> "the rules which regulate conduct of an office may be technical rule or norms. In both cases, if their application is to be rational, specialised training is necessary...only a person who has demonstrated an adequate technical training is qualified to be a member of the administrative staff...and...is eligible for appointment to official positions."

There is value, therefore, in measuring the extent to which qualified persons fill managerial and technical positions and relating this to the degrees of formalisation, specialisation, and centralisation. In this way Weber's (1947 p.p. 328 - 40) assertion that "bureaucratic administration means fundamentally the exercise of control on the basis of knowledge." may be tested.

While Weber (1947) believed bureaucracy to be applicable to a wide range of business, military, social and political entities, he suggested that it typified the larger and more complex organisations (Greth and Mills, 1958: 204 - 45). Size of organisation, a contextual variable considered in the next chapter, was considered by the Aston researchers but complexity was not tackled directly. Pugh et al (1968) introduced a set of variables to measure configuration, including the chief executive's span of control, vertical span (height) of workflow hierarchy, and ratios relating to number of direct workers to supervisors and non-workflow personnel, among others. One may reasonably argue that such measures capture much of organisational complexity, as well as providing a full description of the shape of the hierarchical pyramid of official posts fundamental to the concept of bureaucracy, for the longer the vertical chain of command and the wider the chief executive's span of control, the greater the complexity of organisational structure may be assumed to be. It is possible, however, to envisage situations where very wide lateral spans of

control by the chief executive do not indicate structural complexity, as in some owner managed small businesses, or where fairly high vertical spans are found in relatively simple structures.

Use of measures of the pyramidal shape could well be supplemented, therefore, by other measures of organisational complexity. Such measures exist in the 'ideal types' of organisational structure stemming from Chandler's seminal work (1962) on strategy and structure. Scott (1971), Stopford (1968), Wrigley (1970), Channon (1973) and Rumelt (1974) have undertaken valuable research using very simple categories of organisational structure, such as 'functional', 'functional with subsidiaries', and 'product divisional' (Rumelt, 1974). Whilst such categorisation is relatively crude, it has been effective, and can be relatively easily extended to allow for a finer ordinal scale. Such a scale of complexity of structural type both supplements the configuration scales used by the Aston researchers and may be used to link their approach with the strategy/structure school. Grinyer et al (1978) have already found a statistically significant inter-correlation between size of company, lateral span of control of the chief executive, and number of hierarchical levels in the company and a simple four point ordinal scale ranging functional structures (low) to combined geographical and product divisional structures (high) but made no attempt to relate these to measures of bureaucracy.

The aim of this chapter is thus to complete four related tasks. First, to replicate some of the Aston Study of dimensions of organisational structure to determine whether the Aston and National Study findings are equally valid for this specific sample. Second,

to extend the analysis of bureaucracy to include qualification of employees, the second aspect of what Hage (1965) has called complexity. In particular, the hypothesis that use of more formally qualified office holders is associated with greater specialisation and formalisation will be tested. As shown above, Weber considered use of qualified staff as a fundamental aspect of bureaucracy which meant that it was a strategy of knowledge based control. Third, to extend the analysis of organisational configuration by use of an ordinal scale based on the 'ideal type' of the strategy/structure school based on Chandler (1962). This ordinal scale is both a further measure of organisational complexity which allows test of Weber's proposition that bureaucracy is particularly associated with complex organisations and provides an important bridge between the bureaucracy orientated and strategy/structure studies of organisational characteristics. Fourth, to resolve the controversy over centralisation and its independence from measures of structuring associated with bureaucracy.

Replication and extensions of the Aston Study findings are presented in Sections 4.3, 4.4, and 4.5. In Section 4.6, the controversy over the centralisation issue is addressed and new indices of centralisation are developed. Section 4.7 presents the results of multivariate analyses of structural variables using the new centralisation indices. A summary of results and conclusions are presented in Section 4.8.

4.2 SCALES

In Chapter 3, detailed description of operational measures of structural characteristics developed by organisation theorists was presented. Reference will here be made to the specific measures used in the CUBS Study. To permit replication of the Aston Studies, the measures adopted were mostly those due to Pugh et al (1968) or their abbreviated versions due to Inkson et al (1970a).

The measure of functional specialisation adopted was an exact replication of that used in the original Aston Study of Pugh et al (1968). The measure of formalisation was formalisation of role definitions due to Inkson et al (1970a). Although the unidimensionality and reliability of these two measures were established by Inkson et al (1970a), these were checked again and proved to be unidimensional and the reliability coefficients were high (Sections 3.2.1 and 3.2.4).

Complexity was defined in a number of different ways by organisation theorists (Section 3.2.3). The measure adopted (QUAL) was an exact replication of the scale used by Child (1973a). In addition, level of academic qualifications was measured by the count of the number of first and higher degree holders.

The Pugh et al (1968) measure of centralisation has been subjected to a number of attacks. The scale measures location of decisions by adding scores reflecting the hierarchical level of each of 37 decisions. Inkson et al (1970a) abbreviated scales used autonomy, based on the number of subsets of the 23 of the 37 decisions most likely to be referred to a higher level as a proxy for centralisation. Child (1972a:171) argued persuasively that "the supposed relationship between centralisation and autonomy

is in large degree tautological and is also influenced by differences in the basis of sampling". He also suggested that the strong negative correlation found by Pugh et al (1968) between centralisation and autonomy could have been due to the large number of branches in this sample. Hence, the abbreviated measure of centralisation was rejected as inappropriate. Twenty of the 23 decisions forming the autonomy scale which were applicable to all organisations were therefore used and scores allocated along the lines proposed by Pugh et al (1968) to represent the extent of centralisation of decision taking (Section 3.2.5). The autonomy scale (Pugh et al, 1968) was adopted as a measure of independence from higher organisations without modifications.

Measures of configuration, such as lateral and vertical spans of control, subordinate ratio and administrative production ratio (A/P ratio), adopted from Pugh et al (1968), were supplemented with a measure of structural complexity based on Chandler (1962) (please see Section 3.3.5).

4.3 CORRELATION ANALYSIS OF STRUCTURING, COMPLEXITY AND CONFIGURATION

Table 4.3.1 shows the result of correlation analysis for all the 45 companies in the full CUBS sample, together with results of the correlation analysis of the Aston's original Study of 46 diverse work organisations (Pugh et al, 1968) and the National Study of 82 organisations (Child, 1972a). The correlations shown in Table 4.3.1 for the Aston and National samples are from Child (1972a:169). Five of the companies in the full CUBS sample had service operations. Removal of these gave a sample which was analysed separately to allow comparison with relationships found by Hinings and Lee (1971) and Pugh et al (1968) for their Coventry and Aston Study 'manufacturing only' subsamples and are presented in Table 4.3.2 where statistically significant, together with those of the Coventry and Aston 'manufacturing only' subsamples (Hinings and Lee, 1971: 88, 89).

In making comparisons, apart from differences in operational definitions of the scales used in the CUBS Study and those of the original Aston Studies which have already been discussed in Chapter 3, differences between the samples in terms of industrial representation and status of the organisations included must be borne in mind.

The Aston sample consisted of 46 organisations in the Midlands, both of manufacturing and service types, and drawn from different industries. The service subsample included organisations in public, distributive and professional services. With respect to organisational

TABLE 4.3.1 Correlation coefficients for measures of structuring, complexity and configuration.

		1	2	3	4	5	6	7	8	9	10	11	12
1. Chief executive's span of control	C												
	A	-											
	N												
2. Subordinate ratio	C	-											
	A	-	-										
	N	-											
3. Vertical span of control	C	37**	-										
	A	-	-	-									
	N	-	-28*										
4. Administrative/production (A/P) ratio	C	33**NP	-	-									
	A	-	-50***	-	-								
	N	-	-45***	-									
5. Type of structure (SHAPE)	C	43**	-	56***	33**N	-							
6. Qualifications	C	22N*	-	57***	26N*	-	-						
7. First degree holders	C	32*	-	35**	-	-	34**	-					
8. Higher degree holders	C	36**	-	29*	-	-	28*	98***	-				
9. Formalisation	C	19N*	-	56***	28N**	38**	79***	33*	32*				
	A	32*	-	48***	46**	N/A	N/A	N/A	N/A	-			
	N	-	-	48***	-	N/A	N/A	N/A	N/A				
10. Functional specialisation	C	-	-	63***	31N**	44***	78***	38**	30*	70***			
	A	-	-	57***	58***	N/A	N/A	N/A	N/A	57***	-		
	N	-	-	51**	-	N/A	72***	N/A	N/A	69***			
11. Autonomy	C	-	-27N*	-	-	-	-	-19N*	-	-	-		
	A	-	-	-	-32*	N/A	N/A	N/A	N/A	-	50***	-	
	N	-	-	-	-	N/A	N/A	N/A	N/A	-	-		
12. Centralisation	C	-	-	-46***	-	-29*	-52***	-50***	-37**	-43**	-63***	B	
	A	-	-	-28*	-40**	N/A	N/A	N/A	N/A	-	-64***	-79***	-
	N	-	41***	-41***	-	N/A	N/A	N/A	N/A	-53***	-28*	-42***	

Notes

*	Significant at 0.05 level.
**	Significant at 0.01 level.
***	Significant at 0.001 level.
N	Pearson's product moment correlation produced no statistically significant coefficients. The correlation shown is Kendall's tau.
-	Denotes that the coefficient was not statistically significant.
NP	The product moment correlation between A/P ratio and chief executive's span of control was not statistically significant but Kendall's tau was highly significant. As this indicates a tendency to a monotonic but not linear relationship the Kendall's tau figure of 0.33 is shown in this table.
N/A	Not applicable. This measure was not used by the Aston or National Studies.
C	The City University Business School (CUBS) Study.
A	The Aston Study.
N	The National Study.
B	The coefficient was 0.31, which was significant at the 0.05 level, until the one branch company was removed when it became insignificant.

Figures shown are the first two significant. Decimal points omitted.

TABLE 4.3.2 Correlation coefficients for measures of structuring, complexity and configuration. Manufacturing companies only.

		1	2	3	4	5	6	7	8	9	10	11	12
1. Chief executive's span of control		-											
2. Subordinate ratio	C	-											
	A	-	-										
	H	-											
3. Vertical span of control	C	36*	-										
	A	38*	-	-									
	H	-	-										
4. Administrative/production (A/P) ratio	C	36**NP	-	25*NP									
	A	-	-	30*	-								
	H	-	-59*	-									
5. Type of structure (SHAPE)	C	42**	-	57***+	30*N	-							
6. Qualifications	C	32*	-	64***	37**	30*	-						
7. First degree holders	C	35*	-	37*	-	-	36*	-					
8. Higher degree holders	C	40**	-	30*	-	-	29*	98***	-				
9. Formalisation	C	21N*	-	60***	31*	42**	82***	34*	30*				
	A	44**	-	37*	38*	N/A	N/A	N/A	N/A	-			
	H	-	-	76***	68*	N/A	N/A	N/A	N/A				
10. Functional specialisation	C	-	-	66***	30*	46**	79***	41**	32*	71***			
	A	-	-	66***	63***	N/A	N/A	N/A	N/A	77***	-		
	H	-	-	80**	76**	N/A	N/A	N/A	N/A	86**			
11. Autonomy	C	-	-26*N	-	-	-	-	-24**NP	-	-	-	-	
12. Centralisation	C	-	-	-50***	-	-34*	-52***	-49**	-37**	-43**	-68***	B	
	A	-	-	-42**	-35*	N/A	N/A	N/A	N/A	-	-66***	N/V	-
	H	-	-	-	-	N/A	N/A	N/A	N/A	-	-81**	N/V	
	N	N/V	N/V	N/V	N/A	N/A	N/A	N/A	N/A	-72***	-59***	N/V	

NOTES

* Statistically significant at .05 level

** Statistically significant at .01 level

*** Statistically significant at .001 level

\+ Confirmed by Kendall's tau (.455 which is statistically significant at the .001 level).

N Pearson's coefficient was not significant but Kendall's tau, which is strictly more appropriate, was and is thus shown above.

NP Pearson's product moment coefficient was not statistically significant in this case but Kendall's tau was. This suggests that the assumptions of normality and linearity assumed by the Pearson test were not valid and Kendall's has therefore been shown.

B The coefficient was significant, at about -.27, until the one branch company was removed when it became insignificant.

N/V Not available.

N/A Not applicable.

Figures shown are the first two significant. Decimal points omitted.

C The City University Business School (CUBS) Study.

A Aston Study.

H Coventry Study (Hinings and Lee, 1971).

N National Study.

status as defined in Section 3.4.6 the sample consisted of 8 principal units, 18 subsidiaries, 4 head branches and 16 branch units (Pugh et al, 1969a: 104 - 105). The National sample consisted of 82 organisations, six industrial sectors were represented including two service industries of insurance and advertising. The sample consisted overwhelmingly of whole units, i.e. principal units and subsidiaries with legal identities and only three branches (each of which had over 2,400 employees). The sample in the Hinings and Lee study (the Coventry sample) consisted of only nine manufacturing organisations in engineering and electrical goods. As in the case of the National sample, all were principal units or subsidiaries with legal identity.

The sample of companies in this study was all drawn from the electrical engineering industry in South East England and is thus more narrow. However, in terms of status, it is similar to that of the National and Coventry sample in that all companies but one are principal units or subsidiaries with legal identity. Only five of the companies are manufacturing and service companies, the remaining 40 are only manufacturing companies.

Unless indicated to the contrary in the footnotes, all the coefficients in Tables 4.3.1 and 4.3.2 are product moment. Strictly, correlations involving the ordinal configuration scale, SHAPE, should be non-parametric as argued forcefully by Siegel (1956) but Labovitz (1970) has demonstrated the suitability of the product moment coefficient where linearly equidistant, sequential numbers are applied to ordered categories especially where the number of ranks is large.

Because tests using the product moment correlation coefficient have greater discriminatory power there is some advantage in their use where suitable. This is especially so where, as in this part of the study, all but one scale are ratio, interval or of linear equidistant nature. Hence in the CUBS Study both parametric and non-parametric correlation coefficients were calculated. The latter were found to be the same in direction and very close in size and significance to the former. Consequently, product moment correlation coefficients have been used throughout, except where the underlying assumptions of normality and linearity were called into question.

From both Tables 4.3.1 and 4.3.2 it may be seen that the CUBS Study found the same high level of positive correlation between overall formalisation and functional specialisation as did the earlier Aston and National Studies. Number of specialist, full time tasks and the extent to which written procedures and documents are used are clearly very strongly associated. For instance, in the full CUBS Study 49% of the variance in formalisation was accounted for by functional specialisation, and vice-versa. The earlier findings of Pugh et al (1968) and Child (1972a) in this respect are clearly valid beyond their own samples.

Formalisation and functional specialisation were also found in the CUBS Study to be strongly correlated with qualifications supporting the Weber's (1947) proposition that appointment of the technically qualified to official posts is a further aspect of bureaucracy. Whilst all three measures of complexity, or qualification, were positively correlated with formalisation and functional specialisation, 'qualifications' was strongly conspicuous. This was to be expected

because the number of first degree and higher degree holders employed is likely to be strongly related to both size of company and the nature of its business, whilst 'qualifications', which measure the proportion of seven functions or staff posts in which at least one employee held a recognised professional qualification is a better measure of this aspect of bureaucracy. 67% and 62% of the variance in qualifications could be explained by formalisation and functional specialisation respectively. The association of use of trained, professionally qualified personnel and written procedures, written documents, and specialist office holders is established for the CUBS sample far beyond any reasonable doubt.

Relationships between the measures of structural configuration found by the CUBS, Aston and National Studies are broadly similar in so far as comparison is possible(1). Subordinate ratio, for instance, was found to be largely unrelated to other variables of configuration, and was uncorrelated with formalisation, functional specialisation, or qualifications. Chief executives' span of control was found by both the CUBS and Aston (manufacturing only sub-sample) Studies to be positively, statistically significantly correlated with the vertical span or height of the hierarchy of organisational posts. The level of the coefficients is small, however, no more than 13% of the variance in each being attributable to the other. One interesting aspect to emerge from the CUBS Study, but not the others, is that the ratio of administrative to direct production staff is positively correlated with the chief executive's span of control. It would appear that the electrical

(Note (1) - Due to differences in samples with respect to manufacturing/service dichotomy.)

engineering industry differs from wider samples of UK companies in this respect.

Results of the CUBS Study confirm the explanatory power of the ordinal scale for complexity of organisational type. Chief executive's span of control, vertical span or height, and administrative/production (A/P) ratio are all highly statistically significantly correlated with the scale for both the full and manufacturing only samples. Admittedly, the size of the coefficients is such that the proportions of variance in these measures accounted for by the ordinal are relatively small, but the relationship is clear.

The strong correlations between vertical span and formalisation and functional specialisation found by the Aston and National Study are repeated in the CUBS Study for both the full and manufacturing only samples. For instance, 31% of variance of formalisation and 40% of that of functional specialisation in the full CUBS sample may be attributable to height of the organisational structure. Similarly 32% of the variance in the qualifications scale may be attributable to vertical span. Weber's (1947) proposition that a greater number of levels of the organisational hierarchy is associated with bureaucracy is strongly borne out.

Although of smaller size, the positive coefficients for SHAPE and formalisation and functional specialisation are still highly statistically significant, although the relationship with qualifications is significant for the manufacturing only sample alone. These results, too, tend to support Weber's contention that bureaucracy is found

particularly in complex organisations. It is not surprising that divisionally structured companies resort more to bureaucratic role specialisation and written procedures and documents than, for instance, simple functional organisations at the other end of the structural scale. Both casual observation and intuition suggest that bureaucracy is a natural pattern, or strategy (Child, 1972a), of control over subordinate organisational units.

Results for the A/P ratio tend to confirm the earlier results of the Aston as opposed to the National Study. Although the correlations are smaller, the positive correlation found between A/P ratio and formalisation and functional specialisation are in agreement with those of the Aston and Coventry Studies. In the CUBS Study, A/P ratio is also positively related to the extent of professional qualifications, indicating that use of trained specialists tends to be associated with a relatively high proportion of administrative staff. This underlines one of the costs of bureaucracy.

As with the earlier Aston and National Studies then, the CUBS Study finds a strong association between formalisation, functional specialisation and vertical span. Moreover, it confirms the high positive correlation found by Child (1973a) between functional specialisation and qualification of office holders, and extends this to show that the latter is positively correlated with formalisation and negatively with centralisation too. Thus, the CUBS Study provides strong support for Weber's contention that more technically qualified persons are employed as office holders in bureaucracies, implying a strategy of control by knowledge. It also finds the linkage he suggested between measures of bureaucracy and organisational complexity.

4.4 RELATIONSHIP BETWEEN CENTRALISATION AND OTHER MEASURES OF STRUCTURE

Table 4.3.1 shows that negative correlations are found in all three studies between centralisation and vertical span of control, formalisation, and functional specialisation. However, the size of the correlations are substantially different in every case for one of the samples. The results of the CUBS Study agree with those of the National Study for vertical span and formalisation and with the Aston Study in the case of functional specialisation. In the Aston Study, the correlation for formalisation was too weak to be statistically significant. As already stated, Child (1972a: 171) attributed this to the heterogeneity of the Aston sample in terms of status, in particular to the existence of large numbers of branches and the method of scoring of centralisation:

> "The negative correlation obtained may have been reduced by an inflated scoring for centralisation given to branches whose scores on formalisation remained almost at the level of their equivalent whole units. In short given a higher degree of consistency in sampling by organisational status, the strength of the relationship between formalisation and centralisation may not be so weak as the Aston team concluded". (Child, 1972a: 171)

Donaldson and Aldrich (1975) independently tried to resolve this issue by re-analysing the Aston data. Donaldson presented descriptive statistics for structural variables for two subsamples of the Aston sample. The first subsample was formed by excluding the 18 branch units and the second by excluding the 8 governmental organisations. He reported that apart from a slightly reduced mean for the non branch subsample, the exclusion of branches on the one hand and governmental

organisations on the other hand did not affect the distribution of the variables. As may be seen from Table 4.4.1, size of the correlation between overall centralisation and formalisation in fact increased to -.34 and this correlation is significant beyond 0.05 level. However, this result was not achieved by controlling for status but for the type of organisational activity (non business units).

Aldrich excluded all governmental organisations and formed four subsamples, each consisting of a different status group. He did find some differences between the mean and standard deviations of the subsamples. A part of the table relating to formalisation and centralisation is reproduced here:

		Formalisation		Centralisation	
		Mean	S.D.	Mean	S.D.
Branches	(10)	25.50	9.90	138.10	15.18
Head branches	(4)	34.00	13.39	132.50	10.41
Subsidiaries	(20)	28.45	13.05	129.35	11.28
Principal units	(10)	23.00	12.36	129.30	8.03
Total:	(44)	27.00	12.25	131.61	11.70

Correlating centralisation of decision making with structural variables produced different correlations for the three subsamples[1]. The differences were most pronounced for the correlations with formalisation (Table 4.4.1). The results of Donaldson and Aldrich's

(Note (1) - Head branches were excluded due to small number of cases.)

Table 4.4.1 Product Moment Correlation Coefficients of Centralisation with Five Structural Variables

	Donaldson			Aldrich		
	Aston Total (46)	Non Branch (30)	Non Cov. (38)	Branch (8)	Subs. (18)	Principal Unit (8)
Functional specialisation	-64***	-50**	-59***	-56	-50*	-45
Overall role specialisation	-53***	-42*	-47**	-38	-44*	-27
Standardisation	-27	-24	-25	-26	-18	-30
Formalisation	-20	-21	-34*	-73*	-15	-14
Standardisation for selection, etc.	30*	-12	01	30	-25	07

* $p < .05$

** $p < .01$

*** $p < .001$

Note: decimal points omitted.

analysis do not support Child's suggestion that a more homogenous sample with respect to status would result in stronger negative correlations. One should bear in mind, however, that the small number of cases involved makes drawing strong conclusions undesirable. However, the differences in the size of the correlations for the subsamples to some extent explain the very low correlation obtained for the whole sample.

Removal of the service companies from the Aston and CUBS samples increased the size of the coefficients between centralisation and vertical span of control, formalisation and functional specialisation, but, as may be seen from Table 4.3.2, for the Aston sample, the correlation between formalisation and centralisation remained statistically insignificant. Similarly, Hinings and Lee (1971) found in their sample of 9 Coventry firms that the level of negative correlation was not significant although their sample size was too small for very much weight to be placed on their results.

This difference between the Aston and National Studies is important because Pugh et al (1968) were led to reject the linkage between decentralisation and bureaucracy proposed by Weber. Autonomy was, in their sample, very strongly correlated with both specialisation and centralisation. As a result, their factor analysis yielded a bipolar factor with heavy loading on centralisation and autonomy, as well as somewhat lower loading on functional specialisation. This was orthogonal to the factor for structuring. Hence the Aston researchers concluded that centralisation and structuring, including formalisation and specialisation, are independent. Child (1972 a)

disputed this result and upheld the Weberian ideal. The results of the Aston, National and CUBS Studies taken together lend some support for Child's suggestion that the independence between structuring and centralisation found in the Aston Study was attributable to the strong negative correlation between centralisation and autonomy due to inclusion of a large number of branches in the Aston sample. As may be seen from Table 4.3.1, the highest correlation between autonomy and centralisation was found in the Aston sample, which included a large number of branches. The coefficient for the National sample, although statistically significant, was lower and the coefficient for the CUBS sample became insignificant when the only branch company was excluded from the analysis.

From Table 4.3.1 it may be seen that correlation coefficients obtained in the CUBS Study are consistent with those of Child (1972a) rather than Pugh et al (1968). Centralisation is found to be highly statistically negatively correlated with all the interrelated measures of bureaucracy, namely vertical span, qualifications, formalisation and functional specialisation, but is not significantly correlated with autonomy. In this last respect the CUBS results differ from Child's (1972a) for he found a statistically significant, negative correlation. Again the CUBS coefficients for autonomy suggest, like Child's (1972a), that the linkage the Aston researchers found between autonomy and centralisation is not significant beyond their sample. The correlation analysis, then, supports Child's rejection of the Aston findings on the relationships between decentralisation and other measures of bureaucracy.

4.5 REPLICATION : MULTIVARIATE ANALYSIS

As was shown earlier[1] principal component analysis of the data on structural variables collected in the Aston Study resulted in four mutually independent components which they called: structuring of activities, concentration of authority, line control of workflow and relative size of supportive component. Due to the pattern of loadings of the variables on the first two dimensions and their mutual independence (Table 4.5.1), Pugh et al (1968) proposed that the Weberian concept of bureaucratic control, associating structuring of activities with decentralisation, did not hold. An ideal type would no longer be useful and organisations could be classified in a number of different ways along these structural dimensions. Using the first three dimensions, they proposed a sevenfold classification of organisations (Pugh et al, 1969b).

Child (1972a) replicating the Aston Study of dimensions of organisational structure undertook multivariate analysis of the National data. Based on the unrotated principal component solution, he stated that the profile of the main structural factors was similar in the case of the Aston and National samples (Table 4.5.2):

> "In both studies, the first factor is dominated by variables contributing to structuring of the activities and the proportion of total variance accounted for is almost identical. The second and third factors obtained from the National data also correspond closely to the third and fourth Aston factors, line control of work flow and relative size of supportive component." (p. 172)

The unrotated and varimax rotated National factors, however, differed with respect to loadings of centralisation. In the unrotated solution, centralisation had a loading of -.59 on the first factor which contained high loadings for the main structural variables and a loading of -.46

(Note (1) - Please see Section 3.1)

Table 4.5.1 Principal Component Analysis of Selected Structural Variables obtained from the Aston Sample (Graphic Rotation, N=46)

Scale Title	Factor I Structuring of activities	Factor II Concentration of authority	Factor III Line control of workflow	Factor IV Relative size of supportive component
Standardisation	0.89	-0.01	-0.21	0.10
Role specialisation	0.87	-0.33	0.01	-0.13
Formalisation	0.87	0.14	-0.21	0.17
Traditionalism	-0.41	0.18	0.32	-0.02
Chief executive's span	0.42	0.23	-0.07	-0.03
Functional specialisation	0.78	-0.47	-0.21	-0.17
Non-workflow personnel (%)	0.58	-0.43	0.06	0.41
Legal specialisation	0.51	0.25	0.31	-0.43
Vertical span	0.69	0.03	0.08	-0.54
Clerks (%)	0.40	-0.09	0.42	0.67
Recording of role performance	0.69	-0.05	-0.64	0.13
Subordinate ratio	-0.05	-0.19	-0.80	-0.06
Standardisation-selection, etc.	0.40	0.59	0.50	0.09
Workflow superordinates (%)	-0.23	0.60	0.50	-0.22
Centralisation	-0.33	0.83	0.01	0.21
Autonomy of the organisation	0.10	-0.92	0.00	-0.13
Variance (%)	33.06	18.47	12.96	8.20

Table 4.5.2 Principal Component Analysis of Selected Structural Variables: Factors (Unrotated) Obtained from National Sample. (N = 82)

Structural Variables	Factor 1	Factor 2	Factor 3	Factor 4
Standardisation	.92	-.11	.03	.07
Formalisation	.90	.09	.09	.14
Role Specialisation	.88	-.26	.05	-.07
Functional Specialisation	.86	-.31	.14	-.04
Recording Role Performance	.79	-.25	.03	.23
Vertical Span	.66	.13	-.32	-.11
Centralisation	-.59	-.46	.18	.26
Standardisation, Selection, etc	.50	.31	.11	.27
Legal Specialisation	.32	.30	-.27	-.52
Chief Executive's Span	.12	.18	.52	.20
% Non-Workflow Personnel	.05	.34	.73	-.15
% Clerks	-.21	.60	.47	.06
Subordinate Ratio	-.19	-.81	.15	-.14
% Workflow Superordinates	-.06	.50	-.59	.41
Autonomy of the Organisation	.22	.23	.08	-.66
Traditionalism	-.30	-.09	-.07	-.41
% of Total Variance	32.4	13.5	10.4	8.5

Table 4.5.2 (continued) Principal Component Analysis of Selected Structural Variables: Factors (Varimax Rotation) Obtained from National Sample. (N = 82)

Structural Variables	Factor 1	Factor 2	Factor 3	Factor 4
Standardisation	.92	.06	.08	.14
Formalisation	.89	.20	-.11	.10
Role Specialisation	.89	-.13	.11	.18
Functional Specialisation	.89	-.22	-.01	.08
Recording Role Performance	.85	-.03	.06	-.13
Vertical Span	.57	.26	.05	.24
Centralisation	-.43	-.44	.02	-.57
Standardisation, Selection, etc	.48	.39	-.15	.02
Legal Specialisation	.15	.17	-.08	.58
Chief Executive's Span	.15	.06	-.22	.02
% Non-Workflow Personnel	.04	-.15	-.87	.11
% Clerks	-.26	.25	-.68	.03
Subordinate Ratio	-.04	-.78	.32	-.18
% Workflow Superordinates	-.15	.83	.27	-.13
Autonomy of the Organisation	.07	-.07	-.10	.75
Traditionalism	-.36	-.18	.36	.43
% of Total Variance	32.4	13.5	10.4	8.5

on the second factor containing high loadings for variables representing line control of workflow. The varimax rotated factors resulted in significant negative loadings for centralisation on three of the four factors. The size of the loading on the first factor with high loadings on the main structural variables was reduced to -.43, the loading on the second factor reduced to -.44 and a high loading of -.57 was obtained on the fourth factor which also had a high loading of 0.75 for autonomy.

Child rejected the varimax solution in favour of the unrotated solution, on the grounds that the independence of centralisation from structuring variables was primarily derived from the relationship between centralisation and autonomy and that the meaning of this relationship was subject to doubt. He also stated that the unrotated solution was of major conceptual interest in that the analysis provided for:

> "A single factor which represented the configuration of all the more important structural variables: specialisation, standardisation, formalisation, centralisation and vertical span. This particular configuration accords closely with Weber's conceptualisation of bureaucracy, specially if vertical span is accepted as an indicator of hierarchy." (Child, 1972a: 173)

The negative loading of centralisation on the first factor increased when service organisations were removed and he suggested that the Weberian model may be particularly descriptive of structural forms of manufacturing organisations. To further explore this and test the applicability of these earlier findings in the UK electrical engineering industry, the data on the 12 structural variables used in the CUBS Study was subjected to principal component analysis. Table 4.5.3 shows the unrotated solution. Eight of the 12 variables load highly on the first factor which accounts for 35.45 per cent of the variation in the data. These are major

Table 4.5.3 Principal Component Analysis of Structural Variables (Unrotated) (N = 45)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.35*	.33*	.58***	.02
Ratio	.04	.20	.12	.05
Height	.72***	-.14	.25	-.18
AP Ratio	.09	-.20	.18	.01
Shape	.57***	.10	.35*	-.47**
Formal	.73***	-.32*	.10	.19
Aspec	.82***	-.36*	-.00	-.02
Qual	.78***	-.40**	.01	.36*
F Degree	.73***	.63***	-.24	.08
H Degree	.66***	.68***	-.18	.13
Autonomy	.10	-.09	-.39*	-.15
AC	-.68***	.17	.52***	.25
% of total variance	35.45	12.56	9.13	4.17

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

variables of structuring, comprising vertical span of control, overall administrative structure, formalisation, functional specialisation, level of professional qualification, number of employees with first and higher degrees and centralisation of decision making. Centralisation of decision making has its highest loading on this first factor. This supports Child's conclusion that higher structuring of activities is associated with higher decentralisation of decision making. The second, third and fourth factors explain 12.56, 9.13 and 4.17 per cent of the variation in the data. The factor model in total accounts for 61.31 per cent of the total variance.

The varimax rotated principal components (Table 4.5.4) are in most respects remarkably similar to those obtained in the earlier studies. The first factor has high positive loadings for vertical span of control, specialisation and formalisation and a high negative loading for centralisation, all significant beyond the 0.01 level. In addition, the qualification scale has a high positive loading on this factor also significant beyond 0.01 level. Hence, like both the Aston and National Studies, the first factor clearly represents structuring of activities, or bureaucracy. It is of particular interest in this respect that the aspect of bureaucracy newly added loads highly on this factor. The second and third factors are, however, somewhat different, because of new configuration (shape of overall administrative structure) and qualification (first and higher degree holders) scales introduced.

The number of employees with the first and higher degrees, a part of the complexity measure discussed in Section 3.2.3, loads highly on the second factor. The emergence of this pattern is not

Table 4.5.4 Principal Component Analysis of Structural Variables (Varimax Rotation) (N = 45)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.16	.26	.41**	.55***
Ratio	-.04	.16	.05	.18
Height	.55***	.13	.56***	-.00
AP Ratio	.19	-.17	.09	.08
Shape	.22	.17	.75***	.07
Formal	.80***	.11	.19	-.03
Aspec	.78***	.11	.36*	-.24
Qual	.94***	.13	.04	-.07
F Degree	.23	.94***	.21	-.07
H Degree	.18	.95***	.17	.02
Autonomy	.01	.07	-.01	-.44**
AC	-.43**	-.30*	-.26	.69***
% of total variance	23.55	17.38	11.30	9.08

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

surprising due to the nature of the sample. Companies in the CUBS sample were selected from 8 different sectors of the electrical engineering industry with varying degrees of R&D activities and employment of personnel with high academic qualifications varies according to the level of R&D activities in the companies. This factor will be called the complexity of operations factor.

Span of control of the chief executive, vertical span and overall administrative structure have high loadings significant beyond 0.01 level on the third factor. This clearly represents the overall shape or configuration of the organisations and is called the configuration factor.

The fourth factor is characterised by high positive loadings for span control of chief executive and centralisation, and high negative loadings for autonomy. This is similar to the fourth factor of the National Study after varimax rotation (Table 4.5.2), in that centralisation and autonomy have opposite high loadings on this factor.

The very similarity of the results of the Aston, National and CUBS Studies, given the wide differences in sample composition, suggest that the relationships considered are very general. As already suggested, the basic difference lies in the relationships between centralisation, formalisation and autonomy, which Child (1972a) has suggested are based on the higher proportion of branches in the Aston sample. In the study of Pugh et al (1968), of 46 organisational units, 4 were head branches, and 16 branches. In contrast, Child's 82 units were overwhelmingly principal units or subsidiaries with

legal identity, only three being branches. The CUBS sample of 45 companies had only one branch and in this respect was considerably closer to the National than the Aston one. Study of the CUBS data supported Child's contention that inclusion of a large number of branch units in the Aston sample could have explained their result. Analysis of the full CUBS sample showed, initially, a correlation of 0.31 between autonomy and centralisation. Once the single branch was removed, the coefficient fell to a statistically insignificant 0.14.

To remove possible distortion by inclusion of the one branch unit, factor analysis of the CUBS data was undertaken again for the 44 legal entities (principal units and subsidiary companies). The unrotated principal components (Table 4.5.5) were very similar to those for the full sample, but the rotated factors showed an important difference as may be seen from Table 4.5.6.

Factor 1, which accounts for 28.64% of the total variance again clearly represents structuring or bureaucracy. However, the loadings in each case are increased, in particular, that of centralisation (-0.71951 significant beyond the 0.001 level). In addition, overall administrative structure (shape) loads highly on this factor (significant beyond 0.01 level). The second factor again represents first and higher degree holders and the third factor is characterised by the variables of configuration. Autonomy also attains a high loading of -0.40676 on this factor. This is due to inclusion in the sample of autonomous private units with relatively simple structures. Also some of the largest, most complex organisational units were technologically advanced subsidiaries of major groups.

Table 4.5.5 Principal Component Analysis of Structural Variables (Unrotated), All Companies With Legal Identity. (N = 44)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.35*	.32*	.65***	.05
Ratio	.06	.19	.12	-.19
Height	.72***	-.16	.30	-.29
AP Ratio	.07	-.21	.20	.24
Shape	.53***	.06	.28	-.13
Formal	.75***	-.34*	.02	.16
Aspec	.81***	-.37*	-.00	.06
Qual	.77***	-.38*	-.04	.19
F Degree	.73***	.61***	-.22	.04
H Degree	.67***	.69***	-.17	.17
Autonomy	-.00	-.02	-.40**	.12
AC	-.67***	.14	.50***	.31
% of total variance	35.31	12.60	9.75	3.50

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Table 4.5.6 Principal Component Analysis of Structural Variables (Varimax Rotation), All Companies With Legal Identity. (N = 44)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.08	.30	.71***	.23
Ratio	-.03	.09	.23	-.16
Height	.71***	.07	.46**	-.09
AP Ratio	.13	-.09	.05	.35*
Shape	.41**	.21	.42**	-.01
Formal	.78***	.16	.02	.24
Aspec	.87***	.14	.03	.15
Qual	.83***	.16	-.05	.25
F Degree	.31*	.90***	.09	-.21
H Degree	.20	.96***	.10	-.10
Autonomy	.02	.10	-.40**	-.05
AC	-.71***	-.23	.25	.44**
% of total variance	28.64	17.13	10.18	5.19

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

The most important difference is that the linkage between centralisation and autonomy is broken. Centralisation alone loads highly on the fourth factor which accounts for 5.19% of the total variation. This is a further departure from the result obtained by Pugh et al (1968) and Child (1972a). Of the 83.499% of the variance of centralisation explained by the first four factors, the first factor, structuring or bureaucratisation, accounts for a massive 62%. The second and third factors account for a mere 6% and 8% respectively and the remaining 24% is accounted for by the fourth factor on which centralisation alone has a statistically significant loading. Hence this analysis demonstrates convincingly the dominance of the association between decentralisation and other aspects of Weber's ideal type bureaucracy. The emergence of the fourth factor indicates that over 20% of the variation of centralisation is not explained by its association with the variables included in the factor model and that other variables such as ownership and control, management style and environmental conditions, may be influencing the extent of centralisation of decision making in the companies.

Discussion so far has been confined to only those variables loaded on the factors at the 0.01 level of significance or less. Other variables are, however, loaded on the factors at the 0.05 level. In order to relax the orthogonality condition which imposes an analytical constraint on the formation of the clusters, the principal components rotated to produce the orthogonal factor of Table 4.5.5 were rotated obliquely (Table 4.5.7). Again factor one emerges as structuring or bureaucratisation and factor two as first and higher degree holders. These two factors are significantly, positively, correlated at the 0.05 level. Factor three emerges reasonably as

Table 4.5.7 Principal Component Analysis of Structural Variables (Oblique Rotation), All Companies with Legal Identity. (N = 44)

Factor Pattern Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
Span	-.02	.33*	.65***	.28
Ratio	-.03	.07	.24	-.15
Height	.73***	-.05	.44**	-.11
AP Ratio	.11	-.06	.03	.34*
Shape	.38***	.15	.38*	-.00
Formal	.75***	.09	-.04	.23
Aspec	.85***	.05	-.02	.13
Qual	.79***	.09	-.12	.23
F Degree	.14	.90***	-.01	-.11
H Degree	-.00	1.01***	-.03	.01
Autonomy	.00	.11	-.41**	-.04
AC	-.76***	-.08	.25	.47**
sum of squared loadings	3.20	2.01	1.07	0.59

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	-			
Factor 2	.33*	-		
Factor 3	.06	.17	-	
Factor 4	.12	-.19	.06	-

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Significance levels are based on those of the structure matrix.

configuration of the overall administrative structure at one pole, and autonomy at the other. The fourth factor again represented centralisation. Although the loadings were increased, the dimensions suggested are exactly the same as those indicated by the variomax solution. Clearly the results of the analysis are stable.

Multivariate analysis of the CUBS data therefore confirmed the importance of the structuring factor or dimension found by Pugh et al (1968) and Child (1972a), and the extent to which office holders have professional qualifications and the complexity of the overall administrative structure also load heavily on this factor. Centralisation was found to be very heavily, negatively, loaded on the same structuring factor, as in Child's National Study (1972a). A second, independent, factor contributing to centralisation was also found, and a third representing the configuration of the organisational structure. With Child (1972a), the CUBS Study supports the Weberian concept of an association between written procedures, documents, and qualified persons holding specialised offices with clearly specified roles, and decentralisation of the locus of decision taking. Bureaucracy is, then, a strategy of knowledge-based control that permits such decentralisation.

4.6 A DEEPER ANALYSIS OF CENTRALISATION

Child's (1972a) proposition as to the reasons for the inconsistency of the results obtained in the Aston and National Studies with respect to the relationship between centralisation and other variables of structure and Donaldson and Aldrich's (1975) attempts to resolve the problem have been considered in detail in Section 4.4. Mansfield (1973) raised a methodological question over the adequacy of the Aston measure of centralisation. He stated that each centralisation item was a measure of vector quantity and that the low mean item analysis value of 0.41 obtained for the overall centralisation measure in the Aston Study suggested that the overall scale could not be considered as a vector quantity but the summation of a number of vectors and that it would make more sense if it was not regarded as a total but as an average of the extent to which the locus of decision making was centralised over a range of decisions (1973: 485). Although he raised the question of the inadequacy of the use of overall centralisation measure, he did not take it any further. He stated that, "the measure is accepted pending further evidence on reliability and construct validity".

Clearly the very low mean item analysis value obtained in the case of Aston's measure of centralisation indicates that multi-dimensional scaling would be more appropriate and that algebraic summation of a number of vectors with different directions would not be justified. To construct a measure of centralisation by algebraic summation of individual decision vectors, only the vectors with common underlying characteristics or in other words with the same direction should be included. The use of a unitary measure of

centralisation with low mean item analysis value could have affected the results of the correlations between centralisation and other structural variables, notably formalisation and standardisation reported in the original Aston Study of Pugh et al (1968).

Indeed, Greenwood and Hinings (1976: 153) reported that:

> "The Aston group themselves realised this and carried out two further analyses of the centralisation items. One was a principal component analysis to see whether groupings of items with a higher reliability could be found - none were. A second analysis divided the decision items into three pools: those relating to the whole organisation, those affecting subunits, and those the individual. A mean Brogden-Clemens coefficient was worked out for each subset, and they were .64, .60 and .59 respectively. This suggests that much greater reliability can be obtained from viewing centralisation as a set of subscales."

Greenwood and Hinings (1976) followed this approach in their study of local authority departments. They subjectively divided the centralisation items into four decision categories relating to personnel, use of resources, role execution and external relations and reported that they were largely unrelated. They also subjectively grouped items in the standardisation scale to represent standardisation of procedures with respect to each of the four decision areas. With the exception of centralisation of role execution, other centralisation subscales were unrelated to their respective standardisation subscales.

As was shown earlier (Section 3.2.5), the scale of centralisation[1] used in the CUBS Study had a high reliability coefficient alpha of 0.910 and that with the exception of decision 18, item-total correlations for all other decision items were at least significant beyond 0.05 level. Exclusion of decision 18 raised the reliability coefficient alpha to 0.9553. On the basis of this the centralisation scale was assumed to be unidimensional and the composite scale was

(Note (1) - For a complete list of items considered for the centralisation scale, see Table 4.6.1.)

Table 4.6.1 Description of Each Decision Item

Dec. 1	:	Supervisory establishment.
Dec. 2	:	Appointment of supervisory staff from outside the establishment.
Dec. 3	:	Salaries of supervisory staff.
Dec. 4	:	Promotion of supervisory staff.
Dec. 5	:	To spend unallocated or unbudgeted money on capital items.
Dec. 6	:	To spend unallocated or unbudgeted money on revenue items.
Dec. 7	:	Type and brand of new equipment.
Dec. 8	:	To determine a new product or service.
Dec. 9	:	To determine marketing territories covered.
Dec. 10	:	To determine the extent and type of markets.
Dec. 14	:	Dismissing a supervisor.
Dec. 15	:	Training methods to be used.
Dec. 16	:	Buying procedures.
Dec. 17	:	Suppliers of raw materials to be used.
Dec. 18	:	Welfare facilities to be provided.
Dec. 19	:	To determine the sales price of products.
Dec. 20	:	To alter responsibilities and areas of work of specialist departments.
Dec. 21	:	To alter responsibilities and areas of work of line departments.
Dec. 22	:	To create a new department.
Dec. 23	:	To create a new job.

used in the analysis.

Existence of a separate factor representing centralisation when the principal components were rotated led to questioning of the unidimensionality of the centralisation scale. Further investigation revealed that, although the reliability coefficient alpha was high, there were wide differences in the pattern of inter-item correlations. This suggested that factor analysis of item scales might yield interesting clusters.

Principal component analysis of the decision items resulted in a first factor accounting for 37.92% of the variation in the data. With exception of decisions 18, 5 and 6 the significance of loadings for other decision items were beyond the 0.001 level (Table 4.6.2). The varimax rotated factors (Table 4.6.3) with a number of multiple loadings for decisions 14, 15, 17, 18, 20 and 21 indicated that oblique rotation may produce more meaningful clusters. The factor pattern matrix after oblique rotation with associated factor correlation is shown in Table 4.6.4. Decision 18 was excluded and principal component analysis was carried out for the remaining 19 decision items. Table 4.6.5 shows the factor pattern matrix after oblique rotation and the associated factor pattern correlation. The same pattern of loadings was obtained. However, there were changes in the size of the correlations between factors (illustrated schematically in Figure 4.6.1). Five factors or groups of decisions emerged from this analysis. These are listed in Table 4.6.6. Factor 1 clearly represents production; factor 2 marketing; factor 3 financial (expenditures); factor 4 personnel and buying and factor 5 organisational change decisions.

Table 4.6.2 Principal Component Analysis of 20 Decision Items (Unrotated)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Dec. 1	.80***	-.20	-.06	-.18	-.10
Dec. 2	.72***	-.28	-.19	-.18	-.24
Dec. 3	.75***	-.12	-.37*	-.17	-.08
Dec. 4	.72***	-.14	-.39**	-.14	.22
Dec. 5	.32*	.21	.46**	-.47**	.04
Dec. 6	.39**	.37*	.43**	-.39*	.11
Dec. 7	.68***	-.04	-.05	-.24	-.00
Dec. 8	.59***	.55***	-.02	.07	.07
Dec. 9	.51***	.45**	-.23	.35*	.16
Dec. 10	.51***	.64***	-.25	.19	.07
Dec. 14	.65***	-.41**	-.02	.07	.19
Dec. 15	.54***	-.32*	.07	.20	-.05
Dec. 16	.58***	-.32*	.20	.22	.43**
Dec. 17	.75***	-.33*	.15	.06	.23
Dec. 18	.22	-.19	.52***	.32*	-.01
Dec. 19	.56***	.36*	.20	.07	.15
Dec. 20	.72***	-.03	.06	.20	-.23
Dec. 21	.54***	.20	-.15	-.00	-.16
Dec. 22	.57***	.09	.32*	.27	-.51**
Dec. 23	.74***	.11	.10	-.14	-.28
% of total variance	37.92	9.99	6.99	5.46	4.50

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Table 4.6.3 Principal Component Analysis of 20 Decision Items

(Varimax Rotation)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Dec. 1	.75***	.13	.27	.20	.20
Dec. 2	.81***	.03	.15	.04	.22
Dec. 3	.82***	.25	.12	.01	.02
Dec. 4	.73***	.30*	.31*	.01	-.19
Dec. 5	.12	.01	.02	.75***	.08
Dec. 6	.07	.22	.08	.77***	.02
Dec. 7	.61***	.19	.18	.27	.07
Dec. 8	.20	.72***	.04	.28	.12
Dec. 9	.14	.79***	.15	-.05	.05
Dec. 10	.17	.86***	-.05	.07	.04
Dec. 14	.52***	.05	.60***	-.00	.06
Dec. 15	.38**	.04	.44**	-.06	.32
Dec. 16	.22	.13	.80***	.09	.04
Dec. 17	.47***	.11	.68***	.17	.19
Dec. 18	-.13	-.06	.47**	.11	.46**
Dec. 19	.12	.52***	.24	.37*	.17
Dec. 20	.45**	.30*	.27	.06	.50**
Dec. 21	.42**	.39**	-.02	.08	.19
Dec. 22	.24	.23	.09	.12	.80***
Dec. 23	.53***	.29*	.11	.36*	.33*
% of total variance	22.04	14.43	11.74	8.71	7.95

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Table 4.6.4 Principal Component Analysis of 20 Decision Items

(Oblique Rotation)

Factor Pattern Matrix

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Dec. 1	.71***	-.03	.12	-.14	.15
Dec. 2	.84***	-.12	.16	.00	.01
Dec. 3	.82***	.12	-.05	.04	.03
Dec. 4	.67***	.21	-.30*	.02	.29
Dec. 5	.07	-.11	.01	-.78***	-.03
Dec. 6	-.03	.12	-.06	-.78***	.03
Dec. 7	.57***	.06	-.00	-.24	.09
Dec. 8	.03	.70***	.05	-.21	-.02
Dec. 9	-.04	.84***	.00	.15	.12
Dec. 10	.01	.89***	-.01	.00	-.11
Dec. 14	.42*	-.02	-.00	.05	.57***
Dec. 15	.29*	-.01	.29	.12	.36*
Dec. 16	.02	.11	-.03	-.04	.82***
Dec. 17	.32*	.02	.06	-.12	.63***
Dec. 18	-.27	-.07	.47**	-.07	.41*
Dec. 19	-.06	.49***	.10	-.31*	.18
Dec. 20	.34*	.21	.46**	.02	.12
Dec. 21	.38**	.32*	.14	-.02	-.13
Dec. 22	.15	.15	.81***	-.02	-.12
Dec. 23	.46**	.15	.26	-.30	-.02
SSL	3.60	2.54	1.41	1.59	1.91

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	—				
Factor 2	.38**	—			
Factor 3	.23	.18	—		
Factor 4	-.19	-.27	-.22	—	
Factor 5	.34*	.13	.31*	-.14	—

Notes:

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

SSL Sum of Squared Loadings

Significance levels are based on those of the structure matrix.

Table 4.6.5 Principal Component Analysis of 19 Decision Items (Oblique Rotation)

Factor Pattern Matrix

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Supervisory establishment	.67***	-.05	.13	.18	-.12
Appointing of supervisors	.84***	-.14	-.02	.02	-.16
Salaries of supervisors	.81***	.11	-.07	.04	.02
Promotion of supervisors	.68***	.21	-.05	.26	.29.
Unbudgetted capital expenditure	.07	-.12	.78***	-.02	-.02
Revenue expenditure	-.03	.11	.78***	.04	.03
Type of new equipment	.57***	.05	.22	.09	.02
New products or service	.04	.68***	.21	-.00	-.09
Marketing territories	-.02	.82***	-.14	.12	-.01
Extent and type of markets	.11	.88***	-.01	-.15	.00
Dismissing supervisors	.20	-.05	-.05	.72***	-.02
Training methods	.04	-.06	-.12	.55***	-.34
Buying procedures	-.03	.07	.05	.77***	.08
Raw material supplies	.15	-.01	.12	.73***	-.05
Sales price	-.10	.47***	.32	.22	-.11
Responsibilities of specialist departments	.22	.16	-.01	.22	-.47***

(Continued overleaf)

Table 4.6.5
Factor Pattern Matrix (cont.)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Responsibilities and work of line departments	.34***	.30	.01	-.08	-.20
Create new department	.00	.09	.05	.02	-.81***
Create a new job	.44***	.13	.29	-.00	-.25
SSL	3.05	2.39	1.58	2.20	1.25

Factor Pattern Correlations

Factor 1	-				
Factor 2	.35*	-			
Factor 3	.21	.26	-		
Factor 4	.53***	.23	.16	-	
Factor 5	-.36*	-.26	-.21	-.28*	-

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

SSL Sum of Squared Loadings

Significance levels are based on those of the structure matrix.

Figure 4.6.1 Intercorrelations between Factors Representing Decision Areas

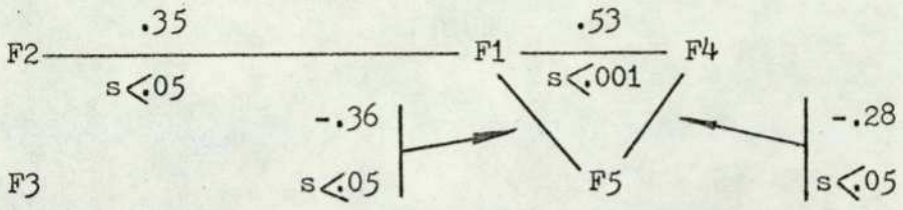


Table 4.6.6 Groups of Decision Items Suggested by Obliquely Rotated Principal Components

Factor 1 : Production Management

Supervisory establishment
Appointment of supervisory staff from outside
Salaries of supervisory staff
Promotion of supervisory staff
Type and brand of new equipment
Determining areas of work of line departments
Creation of new jobs

Factor 2 : Marketing

Determining a new product or service
Determining marketing territories covered
Determining the extent and type of markets
Determining the sales price of products

Factor 3 : Financial Control

To spend unallocated or unbudgeted money on capital items
To spend unallocated or unbudgeted money on revenue items

Factor 4 : Personnel and Buying

Dismissing a supervisor
Training methods to be used
Buying procedures to be used
Supplies of raw materials to be used

Factor 5 : Organisation Change

Altering responsibility and areas of work of specialist departments
To create a new department

Figure 4.6.1 shows that the factors representing centralisation of production, personnel and buying and organisational change decisions are highly statistically intercorrelated. Factor 2, representing centralisation of marketing decisions, although significantly related to Factor 1, is not related to Factors 3, 4 and 5 and Factor 3, representing centralisation of financial decisions is unrelated to all other factors. The analysis therefore suggests that the more strategic marketing and financial decisions are not in the same cluster as the other three decision categories which relate to general operating decisions. Five separate indices of centralisation were constructed by summation of individual decision items in each of the five clusters. A further scale representing centralisation of operating decisions was also constructed by summation of decision items forming the three clusters of production, personnel and buying and organisational change decisions. Table 4.6.7 shows the correlation coefficients between these, as well as the original measure of centralisation, and the structural variables. The extent to which the Aston centralisation scale masks differences between the group of items it comprises is obvious.

As may be seen from Table 4.6.7, the pattern of correlations is similar for D1, D4, D5 and D6. Decentralisation of production, personnel and buying and organisational change decisions is highly statistically significantly associated with vertical span of control, shape or complexity of overall administrative structure, formalisation, functional specialisation and the numbers of first and higher degree holders. In almost all cases, the correlation obtained between D6 (centralisation of operating decisions) and the structural variables is higher than those of the individual centralisation indices and higher than that of AC, the composite centralisation

Table 4.6.7 Centralisation and Measures of Structuring and Configuration. Centralisation Index

Measure	AC Aston	D1	D2	D3	D4	D5	D6
Chief executive's span of control	-	-	-	-	-	-	-
Subordinate ratio	-	-	-	-	-	-	-
Vertical span	-46***	-52***	-	-	-63***	-	-57***
Administrative/production employee ratio	-	-	-	-	-	-	-
Shape of administrative structure	-29*	-35**	-	-	-38**	-	-38**
Qualifications (professional)	-52***	-52***	-	-	-46***	-43**	-57***
First degree holders	-50***	-43**	-47**	-	-28N**	-31N**	-41**
Higher degree holders	-37**	-30*	-	-	-33N**	-22N*	-40**
Formalisation	-43**	-46***	-	-	-48***	-34*	-52***
Functional specialisation	-63***	-63***	-30*	-	-58***	-42**	-67***
Autonomy	-32*	-	-42**	-42**	-	-	-

Notes:
- * denotes significant at the 0.05 level
- ** denotes significant at the 0.01 level
- *** denotes significant at the 0.001 level
- \- denotes that the correlation was too small to be statistically significant
- N Pearson product moment correlation produced no statistically significant coefficient. The correlation shown in Kendall's tau.

(Decimal points omitted.)

Indices D1-D5 are based on factors 1-5 (see Table 4.6.6)
D6 represents centralisation of operating decisions (D1+D4+D5).

index. Autonomy is however, unrelated to these indices of centralisation. The pattern of correlations for D2 and D3, marketing and financial centralisation indices, however, indicates that with exception of a negative relationship between centralisation of marketing decisions and functional specialisation and number of first degree holders, centralisation of marketing and financial decisions is unrelated to the extent of structuring or bureaucracy.

This difference is perhaps to be expected. Production, personnel, buying and departmental responsibility decisions are operating in character. Their decentralisation in a bureaucracy is completely consistent with Weber's ideal type. The marketing decisions relate the company to its environments, and have a more fundamental impact on the fortunes of the company. Centralisation of more strategic decisions does nothing to violate Weber's propositions. Similarly, budgetary control provides a bureaucratic framework within which authority to spend is delegated safely to lower hierarchical levels. Consequently centralisation of decisions on extra-budgetary expenditure is completely consistent with use of bureaucracy as an approach to control. The highly statistically significant correlations between autonomy and centralisation of both marketing and extra-budgetary expenditure decisions again make sense intuitively. Where subsidiary companies have little autonomy, the chief executive is actively involved in accounting for both sales and financial performance to higher level management. Under these circumstances he may be obliged to refer decisions on marketing and extra-budgetary expenditure to a higher body. Even where this is not so, he is likely to retain them himself.

The highly statistically significant correlation between centralisation of marketing decisions and number of first degree holders and lack of any significant relationship with level of professional qualifications is surprising. However, examination of the CUBS data indicates that companies employing large numbers of degree holders were within the technologically more advanced sectors of the electrical engineering industry. Such graduates were employed in technical sales liaison with major clients as well as in R & D. Pricing, market sector and new product specification decisions required specialist technical knowledge in such companies. The data suggests, then, that in technologically advanced companies, the decentralisation of operating decisions associated with the bureaucratic mode of control tends to be extended to more strategic decisions.

Although the mean item total correlations for the 20 decision items (.55378) and reliability coefficient alpha (.91010) were both relatively high and the factor analysis resulted in a first unrotated factor (Table 4.6.2) with high significant loadings (beyond 0.001) for 17 of the 20 decision items, all indicating that a composite measure of centralisation would be acceptable, the different pattern of association obtained between decision groups and structuring variables indicated that much could be gained by using separate centralisation scales based on the result of oblique rotation of factor analysis.

Returning to the discussion at the beginning of this section regarding the controversy over the extent of association of centralisation with formalisation and standardisation reported by the Aston and National Studies, it can now be argued that the low negative correlation

obtained between centralisation and formalisation in the case of the Aston Study could be partly attributed to their use of a composite measure of centralisation with the very low mean item analysis value of 0.41. Even in the case of this study where the mean item analysis value and reliability coefficients were relatively high, the value of the correlation coefficient between centralisation and formalisation was increased from -.4312 to -.5206 when D6 was used instead of AC. This increase resulted from exclusion from the composite centralisation scale of the six decision items which made up the D2 and D3 centralisation indices and the fact that D2 and D3 were unrelated to formalisation.

Examination of the items making up the formalisation scale indicates that they relate to activities of a more routine than strategic nature. D1, D4 and D5 decision groups were concerned with routine operating decisions, as opposed to D2 and D3 which comprised marketing and financial decisions. The strong negative correlation between centralisation of D1, D4, and D5, but not of D2, and D3, and formalisation was, therefore, more reasonable.

4.7 MULTIVARIATE ANALYSIS OF STRUCTURAL VARIABLES USING NEW CENTRALISATION INDICES

Principal component analysis of the structural variables was undertaken for the full CUBS sample, using three newly developed centralisation indices. Table 4.7.1 shows the varimax rotated principal components. The first factor is characterised by high loadings for all the variables of structuring or bureaucracy. Vertical span of control, overall administrative structure, formalisation, functional specialisation, level of professional qualifications, all have loading significant beyond the 0.001 level. Centralisation of operating decisions (D6) also loads highly negatively on this factor (significant beyond 0.001 level).

The second factor is characterised by the number of degree holders and chief executive's span of control. The third factor is dominated by all three centralisation indices at one pole and autonomy at the other. Chief executive's span of control also attains a high loading on this factor. Ratio alone loads highly on the fourth factor. Compared to the varimax rotated principal components of the full CUBS sample using the composite centralisation index (Table 4.5.4), the centralisation of operating decisions attains a higher loading on the first factor of Table 4.7.1 and overall administrative structure (SHAPE) also attains a high loading on this factor. Both rotated solutions also have a factor entirely dominated by centralisation and autonomy.

For reasons advanced earlier, the one branch company was removed from the analysis and the varimax rotated principal components are

Table 4.7.1 Principal Component Analysis of Structural Variables (Varimax Rotation), All Companies. (N = 45)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.19	.51***	.51***	.09
Ratio	-.01	.08	.11	.88***
Height	.71***	.27	.14	-.00
AP Ratio	.19	-.08	.18	-.17
Shape	.46**	.37*	.20	-.02
Formal	.79***	.13	.02	-.09
Aspec	.89***	.11	-.15	-.01
Qual	.82***	.08	-.09	.02
F Degree	.26	.88***	-.34*	.11
H Degree	.17	.90***	-.28	.08
Autonomy	.03	-.01	-.49**	-.12
D2	-.16	-.16	.76***	-.13
D3	-.00	-.27	.55***	.00
D6	-.70***	-.08	.40**	.00
% of total variance	25.18	16.09	13.60	6.31

D2 centralisation of marketing decisions

D3 centralisation of financial decisions

D6 centralisation of operating decisions

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

shown in Table 4.7.2. The first factor again represents structuring or bureaucracy. The significant loadings are almost the same as those of Factor 1 of Table 4.7.1. However, the loading for centralisation of operating decisions is increased to -0.76584. The second factor is now characterised by number of degree holders with positive loadings and centralisation of marketing decisions with negative loadings. The third factor is bipolar, with variables of configuration and centralisation of marketing decisions at one pole and autonomy at the other. As mentioned earlier, there is no reason why taller, wider, more complex organisational structures should be associated with lack of autonomy. This is probably peculiar to the CUBS sample. The fourth factor has high loadings for A/P ratio and centralisation of financial decisions.

Oblique rotation produced the same pattern of loadings. Table 4.7.3 shows that factors 1 and 2 are highly significantly correlated ($P < 0.05$). Data for the manufacturing only subsample was also factor analysed. Table 4.7.4 shows the factor pattern matrix after oblique rotation. Compared to the oblique rotation of Table 4.7.3, the first factor again represents structuring or bureaucracy. The centralisation of financial decisions also loads highly on the second factor and the association between configuration and autonomy is also lost, indicating that this association may have no general significance.

Table 4.7.2 Principal Component Analysis of Structural Variables (Varimax Rotation), All Companies With Legal Identity. (N = 44)

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.10	.19	.66***	.19
Ratio	-.05	.12	.21	-.08
Height	.70***	.01	.45**	-.09
AP Ratio	.13	-.07	.03	.41*
Shape	.44**	.13	.50***	-.02
Formal	.81***	.15	.02	.27
Aspec	.86***	.16	.01	.11
Qual	.82***	.17	-.06	.19
F Degree	.31*	.88***	.21	-.26
H Degree	.20	.94***	.21	-.13
Autonomy	.01	.13	-.41**	-.21
D2	-.19	-.50***	.44**	.21
D3	-.08	-.34*	.18	.54***
D6	-.76***	-.11	.10	.27
% of total variance	25.27	15.73	10.21	6.27

D2 centralisation of marketing decisions

D3 centralisation of financial decisions

D6 centralisation of operating decisions

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Table 4.7.3 Principal Component Analysis (Oblique Rotation), All Companies With Legal Identity. (N = 44)

Factor Pattern Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.04	-.22	.64***	.18
Ratio	-.05	-.11	.21	-.09
Height	.76***	.09	.40*	-.12
AP Ratio	.06	.00	.01	.42**
Shape	.46***	-.07	.47***	-.04
Formal	.73***	-.14	-.06	.32
Aspec	.82***	-.10	-.06	.16
Qual	.76***	-.14	-.14	.25
F Degree	.16	-.86***	.15	-.13
H Degree	.00	-.98***	.15	.01
Autonomy	.00	-.11	-.42**	-.16
D2	-.09	.49***	.48***	.09
D3	-.10	.24	.18	.50***
D6	-.81***	-.02	.15	.25
SSL	3.28	2.13	1.37	0.79

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	-			
Factor 2	-.31*	-		
Factor 3	.04	-.04	-	
Factor 4	.12	.29*	.11	-

D2 centralisation of marketing decisions
D3 centralisation of financial decisions
D6 centralisation of operating decisions
SSL Sum of Squared Loadings
* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

Significance levels are based on those of the structure matrix.

Table 4.7.4 Principal Component Analysis (Oblique Rotation),

All Manufacturing Companies, Less the Branch Company (N=39)

Factor Pattern Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
Span	.08	-.09	.80***	.05
Ratio	-.05	-.07	.12	.47***
Height	.70***	-.00	.25	.05
AP Ratio	.36*	.25	.17	-.48***
Shape	.40***	-.16	.35***	-.07
Formal	.85***	.05	.04	.04
Aspec	.85***	-.12	-.05	-.08
Qual	.87***	.01	.06	.05
F Degree	.21	-.89***	.22	.14
H Degree	.08	-.91***	.29	.11
Autonomy	-.18	-.22	.07	-.44***
D2	-.13	.56***	.42**	-.09
D3	.01	.52***	.06	.13
D6	-.78***	.19	.33*	.01
SSL	3.70	2.41	1.30	0.72

Factor Pattern Correlations

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	-			
Factor 2	-.17	-		
Factor 3	.18	-.00	-	
Factor 4	-.01	-.04	-.03	-

D2 centralisation of marketing decisions
D3 centralisation of financial decisions
D6 centralisation of operating decisions
SSL Sum of Squared Loadings
* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

Significance levels are based on those of the structure matrix.

4.8 SUMMARY AND DISCUSSION

Earlier research by Pugh et al (1968), Inkson et al (1970a), Hinings and Lee (1971) and Child (1972a) has established strongly the positive intercorrelation of vertical span of control, formalisation, and functional specialisation, and to this extent empirically validated associations suggested by Weber's (1947) analysis of bureaucracy. The results of the CUBS Study both confirmed the generality of the correlations found by these earlier studies by finding them to be strong within a sample of companies in the U.K. electrical engineering industry, and extended the analysis as had Child (1973a) by inclusion of the extent to which specified offices or posts were filled by professionally qualified persons. Weber (1947) himself stressed this aspect of bureaucracy, which led him to talk of it as "the exercise of control based on knowledge," and the strong positive correlation between this new measure and the dimensions of structuring or bureaucracy introduced by Pugh et al (1968) provides further support for his descriptive model.

Relationships between decentralisation and measures of structuring have been the focus for substantial disagreement between the earlier researchers. The Aston researchers, including Pugh et al (1968), Inkson et al (1970a), Hinings and Lee (1971) and Donaldson et al (1975) have found no significant negative correlation between centralisation and formalisation as a measure of structuring and rejected the association of decentralisation with measures of structuring. Child (1972a) produced contrary results and argued powerfully for decentralisation as an aspect of bureaucracy as a potent strategy for control. CUBS results support Child (1972a). Decentralisation of the

locus of decision taking is highly statistically significantly negatively correlated with vertical span or height, employment of professionally qualified office holders, formalisation, and functional specialisation, and is an important element of the structuring or bureaucracy factor produced by multivariate analysis. This is true both for the full sample of companies and the sample of "manufacturing only" companies. Hage's (1965) proposition that companies with more professionally qualified office holders tend to be more decentralised is also supported. Moreover, the nexus between autonomy and centralisation which led Inkson et al (1970a) to use the autonomy scale as a proxy for centralisation in their abbreviated scales is too weak for the CUBS sample to be statistically significant, suggesting that this relationship found by the Aston researchers has restricted validity outside their sample. Use of "autonomy" to measure "centralisation" is obviously dangerous.

The extended analysis of centralisation revealed that the centralisation scale used in the Aston and National Studies itself masked considerable differences when applied to the CUBS data. In particular, decentralisation of production, personnel, buying and design of departmental responsibilities was associated with the structuring of activities or bureaucracy, but that of marketing and financial control decisions was not. The latter tended to be decentralised, however, in companies with relatively more autonomy and in the case of marketing decisions in technologically sophisticated companies employing more first degree holders. These extended findings on decentralisation further refine, but do not detract from the empirical support given to Weber's (1947) model. The strength of bureaucracy as what Child (1972a) has called a

strategy of control is that it permits the safe delegation, or decentralisation, of operational decisions to appropriate, lower hierarchical levels, whilst allowing the centre or higher hierarchical levels to retain control via procedural devices like budgetary control. Had the results been different with respect to financial control, there would have been grounds for doubting the efficiency of bureaucracy as a "strategy for control". Nor does the lack of decentralisation of major marketing decisions in bureaucracies create difficulties. Writers on bureaucracy have focused on operational decisions, on the whole, and it is in their decentralisation that its essence lies. This is in no way inconsistent with retention of more strategic decisions on markets by senior management. Bureaucracy permits safe delegation of operational decisions to lower hierarchical levels by constraining their scope on the one hand and ensuring professional competence of office holders on the other. Wider, strategic decisions can perhaps only be taken at or near the top, where the constraints have been loosened and management have wider vision. Indeed, the whole of the bureaucratic framework could be conceived as a means of ensuring efficient implementation by lower levels of such strategic decisions.

As indicated above, and found earlier by Pugh et al (1968) and Child (1972a), the vertical span was one of two clusters of scales associated with structuring or bureaucracy. In the CUBS Study, this scale is itself positively, highly significantly, correlated with two of the other Aston type measures of configuration, span of control of the chief executive and administrative production employees ratio. Neither Pugh et al nor Child (1972a) found such a significant association, although it was found by Grinyer et al (1978)

in a parallel study to that reported here. Addition of a seven point scale measuring complexity of organisational structure, and ranging from one man ownership and management at one extreme to multinational product divisional structure at the other, provided additional insight. Not only was this scale highly statistically significantly, positively, correlated with the chief executive's span, the vertical span, and the A/P ratio, it was also positively, highly significantly correlated with professional qualifications, formalisation, and functional specialisation, and just significantly, negatively, with centralisation. When operating decisions alone were considered in later analysis, the coefficients became much stronger and highly statistically significant.

Results with respect to the new scale for structural complexity confirm Weber's contention that bureaucracy typifies more complex organisations. Grinyer et al (1978) have also shown that size and a similar ordinal scale of structural complexity are significantly, positively correlated. Addition of the ordinal scale for structural complexity has, as suggested in the introduction, another value too. Chandler (1962), Scott (1971), Stopford (1968), Wrigley (1970), Channon (1973) and Rumelt (1974) have all suggested that diversification of business activities is accompanied by adoption of more complex organisational structures, and in particular divisional structures. Stopford (1968) and Rumelt (1974) have supported their cases for multinational and U.S.A. companies respectively with results of statistical analysis. Channon (1975) does likewise for U.K. service industries and Grinyer et al (1978) also find a highly significant, positive correlation between degree of diversification and ordinal scale for structural complexity. To date such research has been unrelated to the parallel

study of organisational theorists.

Results of this chapter suggest the proposition that as companies diversify, and adopt more complex organisational structures, they tend also to structure their activities more or to become more bureaucratic. Bureaucratic procedures and functional specialisation are an obvious means to control diverse divisional or subsidiary activities, this has indeed been suggested by some earlier researchers like Channon (1973), but without statistical evidence. The relationship established in this chapter between the ordinal scale for structural complexity and formalisation, functional specialisation and decentralisation, provides the missing link. Direct relationships between degree of diversification and bureaucratisation will be explored and statistically tested in Chapter 7.

In summary, results of this chapter provide support for the main findings of Pugh et al (1968) with the exception of those on centralisation and autonomy, and in this respect joins Child (1972a) in his defence of the bureaucratic ideal type of Weber. Moreover, using the concepts of Hage (1965), the Weberian proposition that office holders are professionally or technically qualified in a bureaucracy was tested and supported. Extent to which office holders are qualified is strongly positively correlated with centralisation as suggested by Hage (1965). Further analysis showed, however, that the relationships applied to centralisation of operating rather than strategic marketing or financial control decisions. The separate centralisation indices based on grouping the more homogenous centralisation items revealed differences which were otherwise masked by the composite heterogenous scale. Finally, by addition of an ordinal scale for structural

complexity, not only was the Weberian proposition that bureaucracies are typical of complex organisation confirmed empirically, but a bridge to the strategy/structure school was also constructed.

CHAPTER V

CONTEXTUAL DETERMINANTS OF ORGANISATION STRUCTURE

5.1 INTRODUCTION

Recent empirical studies of contextual, i.e. situational, determinants of structural characteristics of organisations have mainly focused on a few selected contextual variables. In many cases detailed attention has been directed to one contextual variable at the expense of ignoring others. This approach has resulted in the development of theories which are clearly inadequate for explaining variations in organisational structure in relation to its context. In most studies using correlation analyses not only have the contextual variables considered in isolation accounted for less than 50 per cent of the variation in the structural characteristics, but also the relationships established in this way may have been spurious and attributed to other contextual variables ignored by the models.

The theories developed, known as contingency theories, may be divided into three categories on the basis of the contextual variables considered:

(1) those emphasizing the importance of organisational size as determinant of structural characteristics (Weber, 1947; Blau, 1970; Pugh et al, 1969a; and Child, 1973a);

(2) those regarding technology as determinant of structure (Woodward, 1958; Perrow, 1967; Harvey, 1968; Hage and Aiken, 1969; and Zwerman, 1970);

(3) those considering the environmental conditions as major determinants of structural variation (Burns and Stalker, 1961; Lawrence and lorsch, 1967).

Amongst the empirical studies of contextual determinants of structural characteristics, the work of Pugh et al (The Aston Study) and Child (The National Study) stand out in that Pugh et al (1969a) considered a wide range of contextual variables, such as size, technology, dependence, charter, ownership and control, etc., as predictors of organisational structure, and Child (1975) extended the range of contextual variables to include a measure of environment. In particular, he investigated the effect of environmental variability together with size and technology on the structure of the organisation.

The evidence in support of size as a predictor of organisational structure is overwhelming. Weber (1947) defined bureaucracies in the context of large organisations. Blau (1970), Pugh et al (1969a), Hinings and Lee (1971), Child (1973a), and all empirical studies using the Aston's abbreviated schedule (Inkson et al, 1970a; Hickson et al, 1974; and McMillan et al, 1973), have established a strong relationship between the size of the organisation measured as total number of employees and structural charateristics of vertical span of control, specialisation, formalisation, standardisation and decentralisation(1). Although in all cases the correlations between size and structural variables considered were highly

(Note (1) - The abbreviated studies only used specialisation and formalisation, but these were shown to be highly correlated with other measures of structure (Inkson et al, 1970a).

statistically significant in most cases no more than 50 per cent of the variation in the structural characteristics has been explained by its association with organisational size, clearly indicating that other contextual variables contribute to variations in structure, over and above the effects of size.

The evidence in support of the technological imperative is, however, controversial. Although Woodward (1958) found a linkage between technology of the organisation and a number of structural variables[2], and Zwerman (1970) replicated her findings, the detailed study of Hickson et al (1969) and its subsequent replication by Child and Mansfield (1972) threw doubts on the validity of this theoretical model. The latter researchers reported that, although workflow integration (their measure of operations technology) and production continuity (a modified version of Woodward's (1958) technology scale) were both related to a number of structural variables, the relationships were largely attributable to the effects of organisational size. Hickson et al (1969) concluded that operations technology only affects the structural characteristics linked with the workflow and therefore its influence on structure varies according to size. In smaller organisations the structure will be more dominated by technology, whereas in larger organisations the effects will be limited to configurational variables centred on the workflow and will not affect the more remote administrative structure. Child and Mansfield's (1972) replication also provided some support for this alternative explanation.

Although operational measures of technology (3 - see overleaf)

(Note (2) - Woodward (1958) mainly considered configurational variables (Section 5.5).)

and structure have greatly varied between studies considering the technological imperative, the findings clearly suggest that operations technology has little, if any, effect on the structural characteristics of organisations, in particular the extent of bureaucratisation. When workflow integration was used in addition to size as a predictor of structuring of activities[4], the percentage of variance explained increased from 48 to 56 per cent (Pugh et al, 1969a).

As was mentioned earlier (Section 3.4.4), Child and Mansfield (1972) reported differences between structural profiles of organisations in the two industries of chocolate and sweets and pharmaceuticals, which had the same technologies (measured on the workflow integration and production continuity scales). Organisations in these two industries, however, differ greatly in terms of technology of design and development. In the case of manufacturing organisations, technology of design and development may have a greater effect on the structural characteristics, in particular, organisational complexity (specialisation and levels of professional and academic qualifications), than the operations technology. It is hypothesised that, allowing for the effects of size, complexity of design and development technology is positively associated with organisational complexity. There is, therefore, value in developing a measure of technology of design and development and relating it to structural characteristics. In this way the above hypothesis

(Note (3 previous page) - Please see Sections 3.4.4 and 5.5.

(4) - The major structural dimension established by Pugh et al (1968).)

may be tested and, if sustained, a greater proportion of variance in structural characteristics may be explained using size and technology of design and development as independent variables. Thus a scale of complexity of design and development technology based on Perrow's (1967) conceptualisation of technology was developed. This is a four point ordinal scale, representing in an increasing direction the complexity of the design and development technology (see Section 3.4.4).

The aim of this chapter is, firstly, to replicate some of the findings of the Aston Studies on the contextual determinants of structure of organisations. Secondly, to evaluate whether the claims of the size determinism school of thought or the technological imperative school hold true for the CUBS sample of companies. Thirdly, to extend the range of contextual variables by inclusion of the design and development technology measure and to test whether addition of this new measure reduces the unpredicted structural variance in a multivariate design using size, operations technology, age, dependence, parent company size and charter as other independent variables.

Section 5.2 provides a brief description of contextual variables used in the CUBS Study. The inter-relationships between contextual variables are discussed in Section 5.3. Size of the organisation, as a determinant of structure, is considered in Section 5.4 and the results of the CUBS Study are compared with those of advocates of the size determinism school of thought. Findings of the CUBS Study on the relationships between operations technology and structural variables, together with those of other studies considering

technology as a determinant of organisation structure, are presented in Section 5.5. Design and development technology and its contextual and structural correlates are discussed in Section 5.6. Relationships of dependence, a contextual variable considered in the Aston Studies as a predictor of centralisation, with other structural variables, are presented in Section 5.7. Section 5.8 relates to the analysis of the relationships between other contextual variables such as company age, number of operating sites, etc. and structural variables. Results of multiple regressions of structural variables on contextual variables including the new measure of technology are presented in Section 5.9. A summary and discussion of the results of this chapter is presented in Section 5.10.

5.2 SCALES

Details of definitions and operational measures of organisational context developed and used by organisation theorists were presented in Section 3.4. Here, reference will only be made to contextual variables used in the CUBS Study. To permit replication of the Aston Studies, most of the measures used are the abbreviated measures due to Inkson et al (1970a).

Size of the organisation and of the parent organisation was measured as the total number of employees respectively. For reasons advanced earlier (Section 3.4.2), the measures used in the analysis were the logarithms of respective numbers of employees. Age was measured in years from the date of foundation to the time of the interview.

As was shown in Section 3.4.4, numerous measures of technology have been developed. Automaticity mode and range, two of the sub-scales of operations technology (workflow integration) developed by Pugh et al (1969a) were used in the CUBS Study. Both measures were shown to be highly significantly correlated with the workflow integration measure and were used as an abbreviated measure of technology by Inkson et al (1970a). A new measure of technology of design and development based on Perrow's (1967) conceptualisation of technology was developed. This is a four point ordinal scale representing in an increasing direction the complexity of design and development technology, starting from situations where the design and development technology is characterised by occurrence of a few exceptional situations which are analysable (score of 1)

and leading to situations where the technology is characterised by occurrence of many exceptional situations, which are also unanalysable (score of 4).

As indicated earlier, the Aston's measure of dependence has been subjected to criticism. Mindlin and Aldrich (1975) argued that although Pugh et al (1969a) set out to develop a measure reflecting the dependence of the organisation on other organisations in its environment, the items included in their final operational measure of dependence merely reflected the extent of dependence of the organisation on its parent organisation(1). The abbreviated measure of dependence used by Inkson et al (1970a) included four of the subscales of the original dependence measure. McMillan et al (1973) and Hickson et al (1974) adopted three of the four subscales used by Inkson et al (1970a). The subscales were: relative size, status and impersonality of origin and the dependence measure was formed by addition of scores on the subscales. The same criticism applies to the abbreviated measure of dependence(1). This measure was, however, used in the CUBS Study to represent the dependence of the organisation on its parent organisation. Two other contextual variables were used in the CUBS Study: charter, representing type of operations (manufacturing, score of 1 and manufacturing and service, score of 2) and NSITE, representing count of number of sites operated by the organisations.

(Note (1) - For details please see Section 3.4.6.)

5.3 CORRELATION ANALYSIS OF CONTEXTUAL VARIABLES

Table 5.3.1 shows the correlation coefficients between the contextual variables for the full CUBS sample[1]. As was indicated in the case of structural variables (Section 4.3), both Pearson's and Kendall's correlation coefficients were calculated. In almost all cases, the correlations were very close in size and significance levels. The correlations shown in Table 5.3.1 are product moment coefficients unless indicated to the contrary in the footnotes. Both size (total number of employees) and logarithm of size were correlated with contextual variables. As may be seen (Table 5.3.1), in each case the size of the correlations with the logarithmic transformation was greater, indicating curvilinear relationships between size and contextual variables[2]. Logarithm of total number of employees is from here onwards used in discussion of the relationships between company size and other variables.

As may be seen from Table 5.3.1, company size is highly statistically significantly correlated with age, impersonality of origin, status, relative size, dependence, number of operating sites, automaticity range and parent company size. The correlations indicate that larger companies in the CUBS sample tend to be older, impersonally founded, lower in status and relative

(Note (1) - The relationships between the new measure of technology of design and development and contextual and structural variables are discussed in Section 5.6.

(2) - Prior to the use of log transformation, scattergrams were checked and revealed curvilinear logarithmic relationships between size (total number of employees) and these contextual variables.)

Table 5.3.1 Correlation coefficients for contextual variables used in the CUBS study

	1	2	3	4	5	6	7	8	9	10	11	12
1. Size	-											
2. Log. size	70***	-										
3. Age	26*	30*	-									
4. Impersonality of origin	35**	39**	-23^{N}*(-40)	-								
5. Status	35^{N}***	40**	-	54***(46)	-							
6. Relative size	18^{N}*	18^{N}*	-	37**(31)	88***(88)	-						
7. Dependence	25^{N}**	35**	-	62***(56)	94***(94)	95***(96)	-					
8. Number of operating sites	-	31*	-	26*	23*N	-	25*	-				
9. Automaticity mode	-	-	-	-	-	-	-	-	-			
10. Automaticity range	34*	66***	-	41**	36**	34*	41**	18*N	-	-		
11. Charter	-	-	-	-	-	-	-	63***(67)	-29*(-29)	-	-	
12. Log. parent company size	31*	58***	-	49***(35)	77***(73)	82***(86)	84***(83)	33*	-	56***(29)	-	-

Notes to Table 5.3.1

N = 44, the one branch company was excluded from all the analysis presented in this chapter due to extreme values on dependence and its constituent items for this company.

N Pearson's product moment correlation was not statistically significant, but Kendall's tau was. The correlation shown is Kendall's tau.

* Significant beyond 0.05 level

** Significant beyond 0.01 level

*** Significant beyond 0.001 level

Figures shown in brackets are partial correlations controlling for log size.

size[3] and more dependent on their parent companies. The larger companies also tend to have larger parent companies, greater numbers of operating sites and rate higher on the automaticity range scale.

The positive correlations with impersonality of origin, status, relative size, dependence and parent company size was expected, since the CUBS sample included small independent private companies and large subsidiaries[4]. Private independent companies would score lowest on each of these measures.

Company size was unrelated to automaticity mode (degree of automation of the bulk of the equipment in the workflow) and highly statistically significantly correlated with automaticity range (degree of automation of the most automatic piece of equipment). Due to the narrow industrial representation and the nature of the end products manufactured, the degree of automation of the bulk of the equipment used in the workflow was expected to be the same and low for the majority of the companies. In fact, for 74.4% of the companies, the most frequently used pieces of equipment in the workflow were either hand tools or powered tools. The lack of any significant relationship with automaticity mode may have been due to uniformity of scores, although there is no reason why company size should be related to

(Note (3) - For definition of status and relative size, please see Section 3.4.6.

(4) - Of the 14 private independent units 86 per cent had less than 400 employees, as opposed to 27 per cent of subsidiaries. There was only one branch company in the CUBS sample, which was, however, excluded from the analysis of this chapter. For details, see Appendix C.)

the degree of automation of the bulk of the equipment.

As was shown earlier (Section 3.4.6), dependence and its constituent items were highly statistically positively inter-correlated. Again as expected, these measures correlated strongly with parent company size, since independent companies were amongst the smaller companies in the CUBS sample. These relationships were also unaffected by changes in organisational size, as shown by partial correlations(5) controlling for the effects of company size.

The positive correlation obtained between number of operating sites and automaticity range and those obtained between the two measures and dependence and its constituent items, and parent company size, were largely attributed to their relationships with company size. Partial correlations with exception of a statistically significant positive relationship between automaticity range and parent company size resulted in no other significant correlations.

The positive relationship between number of operating sites and charter (a nominal scale representing the manufacturing - manufacturing and service dichotomy) indicates that manufacturing and service companies tend to have greater numbers of operating sites than manufacturing only companies. The size of this correlation was unaffected when company size was partialled out. Grinyer et al (1978), in a study of strategy and structure in 48 U.K.

(Note (5) - Figures in brackets in Table 5.3.1 are partial correlations controlling for logarithm of size.)

companies also established such a relationship.

The statistically significant negative correlation between charter and automaticity mode also remained significant when size was partialled out, indicating that manufacturing only companies had a higher degree of automation in their workflow than manufacturing and service companies, where the manufacturing part of their operations basically involved assembly of parts, and their main emphasis was on selling and servicing the products sold to customers.

Age of the company was negatively correlated with impersonality of origin and this relationship also remained statistically significant when size was partialled out, indicating that impersonally founded companies tended to be younger. This could be specific to the electrical engineering industry, in that the younger, more recently founded companies tend to be set up by existing organisations, as opposed to individuals.

5.4 ORGANISATIONAL SIZE

As was mentioned earlier (Section 5.1), contingency models of organisational structure developed by organisation theorists have each tended to emphasize the importance of a single contextual variable as determinant of organisational structure. It was also mentioned that amongst the contextual variables considered, size of the organisation enjoys greater support from the recent empirical studies. In the following presentation, evidence in support of this model will be evaluated in the light of the findings of the CUBS Study.

5.4.1 Relationships between Size and Bureaucratic Characteristics of Organisations

Arguments in favour of size as determinant of organisation structure date back to Weber (1947), who defined bureaucratic characteristics in the context of large organisations. The original Aston Studies (Pugh et al, 1969a), and their subsequent full scale replications (Hinings and Lee, 1971; Child, 1973a), found highly statistically significant correlations between organisational size and operational measures of bureaucracy: vertical span of control, specialisation, formalisation, standardisation and decentralisation. Aston Study replications using the abbreviated schedule due to Inkson et al (1970a) also established a strong linkage between organisational size and abbreviated measures of structure: functional specialisation and formalisation of role definitions. All these researchers used logarithm of the total number of employees in correlation analysis and showed that a better linear

fit with structural variables was obtained by using the logarithm of total number of employees as a measure of size.

As was shown in Section 3.4.2, although logarithmic transformation of highly skewed data[1] is statistically warranted, the theoretical implications of such transformation should not be ignored. The better linear fit obtained between organisational size and structural characteristics reported by these researchers clearly indicates that the relationships are curvilinear and that the structural variables considered are logarithmic functions of total number of employees. Indeed, this has been noted by a number of researchers. Blau (1970) showed that increases in organisational size resulted in structural differentiation and empirically demonstrated that structural differentiation was a logarithmic function of size, whereby increases in size brought about increases in structural differentiation at a decelerating rate of increase. He proposed that:

> "The advancing differentiation to which an increasing number of employees gives rise intensifies the need for co-ordination in the organisations, and this need restrains the further development of differentiation, which is reflected in the declining marginal influence of increasing size on differentiation." (Page 207)

Child (1973a), comparing the relationships between organisational size and structural variables reported by Blau and Schoenherr (1971) and Pugh et al (1969a), with his own results of the National Study, showed that there was a great deal of

(Note (1) - Distribution of size obtained in cross-sectional surveys is generally highly skewed.)

similarity between the shape of the curves representing structural characteristics of vertical span of control, functional specialisation and overall role specialisation, in that they were all logarithmic functions of size. For this reason, scattergrams of all structural variables used in the CUBS Study against size (total number of employees) were examined. The plots indicated that vertical span of control, specialisation, formalisation, qualification and decentralisation were logarithmic functions of total number of employees.

Table 5.4.1.1. shows the correlations between log size and structural variables for the full and 'manufacturing only' samples of the CUBS, Aston and National Studies. As may be seen, there is a remarkable similarity between the three studies, in that the same pattern of strong correlations is obtained between log size and bureaucratic characteristics of vertical span of control, formalisation, specialisation and decentralisation. In each case, the sizes of the correlations found in the CUBS Study are larger than those of the Aston and National Studies. This may be due to inclusion of a relatively larger number of service organisations in the Aston and National samples, as may be seen from Table 5.4.1.2.

Table 5.4.1.1 Correlation coefficients between size and structural variables

		Full samples		Manufacturing only samples
		Size (total number of employees)	Size (logarithm of total number of employees)	Size (logarithm of total number of employees)
1. Chief executive's span of control	C	30*	30*	35*
	A		32*	29
	N		15	36*
2. Subordinate ratio	C	27*N	27*N	26*N
	A		05	04
	N		-13	-23
3. Vertical span of control	C	66***	74***	75***
	A		67***	77***
	N		65***	63***
4. Administrative/ production (A/P) ratio	C	-01	18SN	25*N
	A		36*	53**
	N		-13	-06
5. Number of indirect employees	C	66***	95***	96***
	N		96***	-
6. Type of structure (SHAPE)	C	62***	58***	60***
7. Qualifications	C	44**	72***	76***
8. First degree holders	C	67***	75***	78***
9. Higher degree holders	C	30*	53***	56***
10. Formalisation	C	45***	69***	70***
	A		55***	67***
	N		58***	69***
11. Functional specialisation	C	47***	84***	85***
	A		67***	75***
	N		61***	65***
12. Autonomy	C	11	00	-01
	A		09	23
	N		18	10
13. Centralisation	C	-50***	-62***	-63***
	A		-39**	-47**
	N		-58***	-74***
14. Centralisation of marketing decisions	C	07	-18	-18
15. Centralisation of financial decisions	C	06	-08	-09
16. Centralisation of operating decisions	C	-63***	-68***	-68***

Notes to Table 5.4.1.1

Full samples:

C CUBS sample N=44
A Aston sample N=46
N National sample N=82

Manufacturing only subsamples:

C CUBS sample N=39
A Aston sample N=31
N National sample N=40

Source: Child and Mansfield (1972: 378-379)

N Pearson's product-moment correlation was not significant but Kendall's tau was. The figure shown is Kendall's tau.

S Strongly suggestive at 0.1 level

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

Decimal points omitted. One tail test of significance.

Table 5.4.1.2 Distribution of Organisations in the Three Samples by Type of Activity

	Manufacturing		Manufacturing and Service		Service		Total
	No.	%	No.	%	No.	%	No.
CUBS	40	88.8	5	11.2			45
Aston	31	67.4			15	32.6	46
National	40	48.8	15	18.3	27	32.9	82

This seems to be confirmed by the correlations for the manufacturing only samples where the differences between the size of correlations for the three studies are greatly reduced. For all three studies, the correlations found between log size and variables of structure are consistently larger for the manufacturing only samples. Child (1973a) also noted this increase in the size of correlations and attributed this partly to the possible bias of the structural measures (the Aston schedule) towards manufacturing organisations. Results of the CUBS Study are, therefore, in close agreement for both the full and manufacturing only samples with those of the Aston and National Studies. For the 'manufacturing only' samples, the correlations found between log size and structural variables, and consequently the percentages of variance in these measures explained by size, are even more stable. For instance, in all three studies, approximatly 49 per cent of variation in formalisation is explained by size. Child (1973a) also showed that the same pattern of stable correlations was obtained between log size and structural variables across a number of studies with differences in sample composition in terms of type of organisational activities. (Table 5.4.1.3 shows the

correlations between log size and a number of comparable structural variables.)

The pattern of correlations found in the CUBS Study therefore indicates that larger companies tend to be taller, more specialised, more formalised, and that in these companies authority to take decisions is delegated to levels further down the hierarchy. In other words, the correlations indicate that larger companies are more structured or bureaucratised. Thus the CUBS findings in this respect provide additional empirical support in favour of size as a major determinant of organisational structure.

As may be seen from Table 5.4.1.1, company size is also highly statistically significantly correlated with all three measures of complexity or qualification, and with the ordinal scale of complexity of organisational type. Professional qualifications (QUAL) and overall complexity of administrative structure (SHAPE) were shown in Chapter 4 to be highly statistically significantly correlated with measures of bureaucracy considered in the Aston Studies: vertical span of control, specialisation, formalisation and decentralisation. Qualifications also loaded highly on the major dimension of structuring or bureaucracy in a principal component analysis of structural variables and was shown to be a further aspect of bureaucracy. The highly statistically significant correlations between log size and these two measures of bureaucracy therefore provide further support for Weber's (1947) contention that bureaucracy typifies the larger and more complex organisations.

Table 5.4.1.3 Product Moment Correlations of Structural Variables with Size of Organisation (logarithm of the number of employees)

Source: Child (1973a: 170)

	CUBS		NATIONAL		ASTON		COVENTRY	LABOUR UNIONS	U.S. EMPLOYMENT SECURITY AGENCIES
	Total	Manuf.	Total	Manuf.	Total	Manuf.	Manuf.		
	N=44	N=39	N=82	N=40	N=46	N=31	N=9	N=7	N=53
Functional specialisation	84	85	61	65	67	75	84	73	55
Overall documentation	69	70	58	69	55	67	83	70	-
Overall centralisation	-61	-63	-58	-74	-39*	-47*	-64*	-62*	-
Vertical span	74	75	65	63	67	77	82	74	73
Significance levels	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001 *P<0.005	P<0.001 *P<0.003	P<0.005 *P<0.05	P<0.05 *P<0.08	P<0.001

Table 5.4.1.1 shows that, although size is significantly correlated with centralisation in all three studies, the correlation for the Aston Study is significantly smaller than those for the CUBS and National Studies. Child (1973a: 171) attributed this to inclusion of a large number of branches in the Aston sample. However, it was shown in Section 4.6 that subscales of centralisation developed from principal component analysis of centralisation items, when related to structural variables, revealed differences which would have otherwise been masked by using a composite centralisation scale. The use of the composite centralisation scale with the very low mean item analysis value of 0.41 in the Aston Study, however, could have resulted in the lower correlations.

The three separate indices of centralisation of marketing, financial (expenditure) and operating decisions also correlate differently with organisational size (Table 5.4.1.1). Decentralisation of operating decisions is highly statistically significantly associated with organisational size, but decentralisation of marketing and financial (expenditure) decisions is not. The correlations therefore indicate that in larger companies only operating decisions are more decentralised and delegated to lower hierarchical levels.

This pattern of correlations with company size was expected, since it was shown that (Section 4.6) marketing and financial decisions were not in the same clusters as the operating decisions. It was also shown that decentralisation of marketing and financial decisions was unrelated to structuring or bureaucracy, whereas decentralisation of operating decisions was highly statistically

significantly.

Relationships between measures of structural configuration found by the CUBS, Aston and National Studies are broadly similar, as far as comparisons are possible. For the 'manufacturing only' samples, chief executive's span of control is significantly positively ($P_{\alpha} < 0.05$) correlated with size. Subordinate ratio, using Pearson's product moment correlations was largely unrelated to organisational size. However, as shown in Table 5.4.1.1, Kendall's correlations for both the full and 'manufacturing only' samples of the CUBS Study were significant beyond 0.05 level. The positive correlations obtained indicate that larger companies tend to have larger numbers of direct workers per first line supervisor. This is interesting and supports Blau's (1970: 208) hypothesis that greater homogeneity of type of activities of direct workers in larger organisations facilitates supervision of a larger number of direct workers by each supervisor.

As was mentioned earlier, organisational size was highly statistically significantly correlated with the ordinal scale of complexity of organisational type. Correlations of the complexity of organisational type with other contextual variables indicated that a greater proportion of variance of this measure (36%) was explained by its association with organisational size rather than any other contextual variable. The use of this ordinal scale, apart from providing a linkage between the strategy/structure and organisational behaviour schools, further substantiates Weber's contention that bureaucratic characteristics are found in the larger and more complex organisations.

5.4.2 Bureaucratic Characteristics as Logarithmic Functions of Size (Total Employment)

As was mentioned earlier, scattergrams of vertical span of control, specialisation, formalisation, qualifications and decentralisation with total number of employees revealed that these variables were logarithmic functions of size measured as total number of employees. The shape of the curves and the better linear fit obtained when log transform was used (Table 5.4.1.1), indicates that a given increase in the total number of employees does not result in the same amount of increase in the extent of structuring of activities for companies in different size ranges. Although the operational definitions of structural variables used in the CUBS Study are in some cases different to the full structural measures used in the Aston and National Studies, the shape of the curves of structural variables plotted against number of employees supports the findings of these Studies. Direct comparisons with the results of the Aston and National Studies reported by Child (1973a) are only possible for vertical span of control and functional specialisation, where measures are identical. Figure 5.4.2.1 shows the graphs of vertical span of control plotted against size reported by Child (1973a) for the Aston and National data, and Blau and Schoenherr's (1971) study of employment security agencies in the U.S.A., with that of the CUBS Study superimposed as accurately as possible, using the method described by Blau and Schoenherr (1971: 64) for computing approximate regression curves. The same method was used by Child (1973a) to construct the graphs from the Aston and National data.

Figure 5.4.2.1 Regression of Vertical Span on Size of Organisations

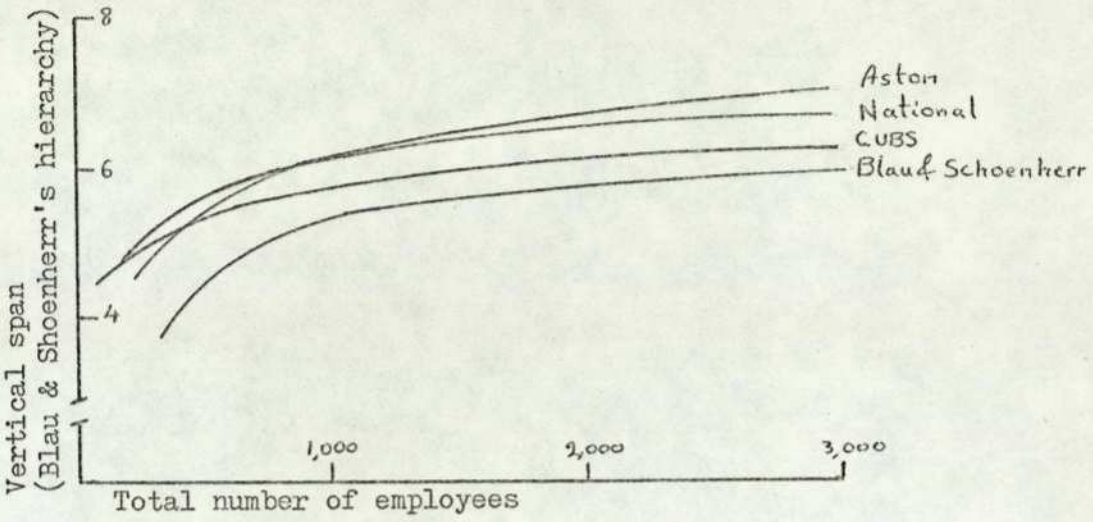
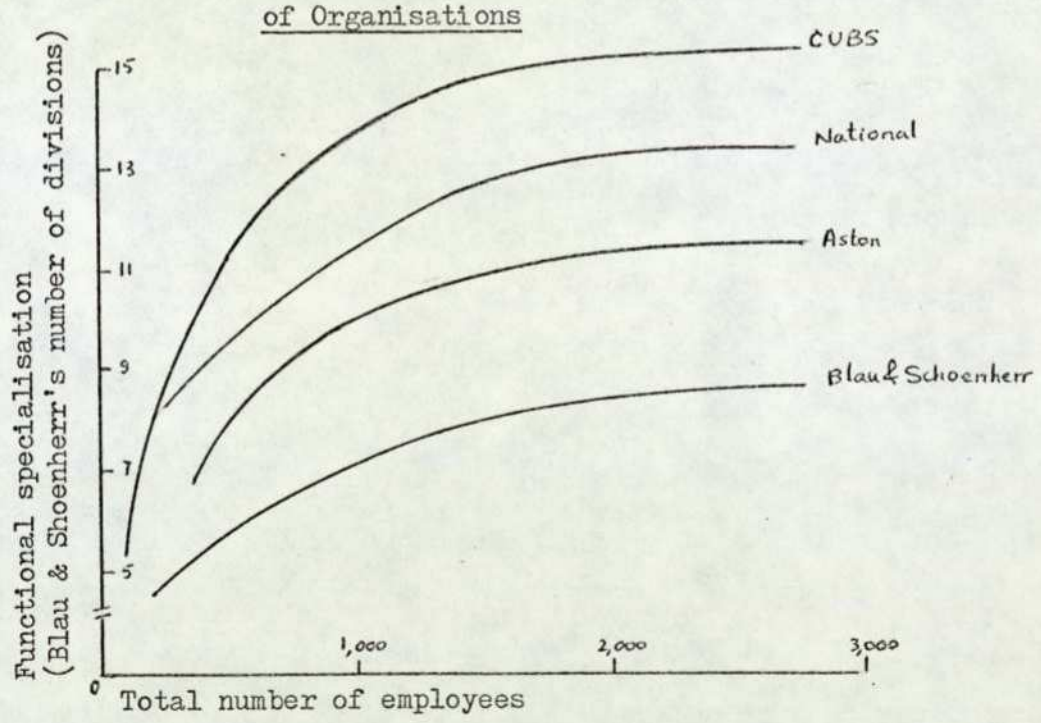


Figure 5.4.2.2 Regression of Functional Specialisation on Size of Organisations



The shapes of the curves are almost identical. Child (1973a: 172) attributed the lower levels of hierarchy for different size groups in Blau and Schoenherr's study to their exclusion of assistants or deputy managers from the scale. The curve for the CUBS Study falls in between those for the earlier studies.

Figure 5.4.2.2 shows the graphs of functional specialisation plotted against total employment for the four studies. The measure used in the Aston, National and the CUBS Studies is the same measure of functional specialisation, and that for Blau and Schoenherr's study is the number of divisions[1]. From the graphs it can be seen that for the companies in the CUBS sample the extent of functional specialisation increases at a faster rate up to the size of 1,000 employees, and is above the level of functional specialisation attained by companies in the other three studies over the whole size range. This may be due to inclusion of a relatively larger number of service organisations in the Aston and National samples. The greater extent of functional specialisation in the CUBS Study is also attributed to the industries represented. Child (1973a: 175 - 177) showed that small electronic and pharmaceutical companies in his sample were more bureaucratised than small companies in other industrial sectors represented[2] and that large electronic firms of, say 10,000 employees, were no more bureaucratic than other companies. The comparisons also indicate that the rate at which companies differentiate functional areas of activities is dependent upon

(Note (1) - Although Blau and Schoenherr's measure of number of divisions is not strictly comparable to functional specialisation, it reflects the extent of differentiation in the organisation.
(2) - Six industries were represented in Child's (1973a) samples: electronics, pharmaceutical, chocolate and sweets, insurance, daily newspapers and advertising.)

the type of industry to which they belong.

From the plot of functional specialisation against size, and reference to the scalogram constructed for the functional specialisation (Figure 3.2.1.1), it can be seen that companies employing approximately 120 employees would have at least one full time employee in each of the six functional areas of buying, accounting, sales and services, quality control, maintenance and production planning. Companies employing 250 employees would have three additional areas of specialisation: transportation, design and development and methods. Those with 500 employees would have two more areas of specialisation, namely welfare and public relations/ advertising, and those with 750 employees would have two further areas: education and training, and market research. Companies employing 1,000 employees would have one additional specialisation; employment, and companies with over 1,000 employees would have at least one specialist in each of the sixteen functional areas. The flat portion of the curve also reflects the theoretical limitation imposed by the scale used in measurement, since the specialisation items in the scale are not claimed to provide an exhaustive list of all possible areas of specialisation.

5.4.3 Size/Size of Administrative Component

Child (1973c), in his excellent paper on Parkinson's progress, reviewed thoroughly all the literature related to the empirical findings on the relationship of contextual variables to what he termed the size of the supportive component. At the outset, he stated that:

> "A serious problem in this field of research, however, is the failure to agree on a definition of a central concept. Each study has focused on the proportion of indirect employment given over to non-direct functions but these have been classified in different ways." (page 329)

Using the term "supportive component" for the sake of consistency, he stated the two opposing hypothesized relationships with organisational size which have been empirically verified:

H.1. "The larger the size of the containing organisation, the larger will be the proportion given over to its [supportive] component."

This hypothesis is empirically supported by Terrien and Mills (1955), Raphael (1967) and Hinings et al (1972). All studies were conducted on service and voluntary organisations. The argument put forward by Hinings et al (1972) in support of the hypothesis is that the nature of objectives of these types of organisations, with greater emphasis on quality and wide coverage of services than on cost effectiveness (which generates pressures for potential scale economies in support personnel), results in an increase in the ratio of supportive employment with increase in organisational size.

H.2. "The larger the size of the containing organisation the smaller will be the proportion of employees given over to supportive component."

The argument in support of this hypothesis is that economies of scale result in a decrease in the ratio of supportive employment. Melman (1951), Bendix (1956), Indik (1964), Rushing (1966) and Pondy (1969) are among the many whose studies Child has cited, which have empirically verified the hypothesis. Freeman and Kronenfeld (1972) and Mayhew (1972) reported a negative decelerating

relationship between percentage of employment and total employment, using random numbers in constructing hypothetical series, which was in agreement with the type of relationships found by an overwhelming number of empirical studies on the relationship between the ratio of supportive component and size. On this basis Child (1973c) suggested that a better approach would be to use the actual number of total employees in the supportive component and to partial out total employment as an alternative method for standardisation across the sample of organisations with different numbers of employees. This approach was also adopted in the CUBS Study. Both total number of indirect employees and the logarithm of the total number of indirect employees were used in the correlational analysis. The highest correlation occurred between the total number of employees and total number of indirect employees ($r = 0.9897$, $P_{\alpha} < .001$). Therefore, 98 per cent of the variation in the size of the supportive component is explained by variations in the total employment. For the 'manufacturing only' subsample, the size of the correlation is slightly higher ($r = 0.9902$). These correlations are in close agreement with findings of Child (1973c), in that he also reported a very high correlation of 0.96 between total employment and total indirect employment.

It is not surprising, therefore, that Pearson's product moment correlation between log size and the ratio of indirect/direct employment was insignificant in the CUBS Study. However, for the 'manufacturing only' sample, Kendall's tau resulted in a significant positive correlation ($P_{\alpha} < 0.05$). Table 5.4.1.1 shows that, unlike the National Study, where the correlation between log size and A/P ratio was insignificant (using Pearson's r), the CUBS Study result indicates that larger companies tend to

have larger proportions of employees engaged in indirect activities. This is in close agreement with the positive correlation between the two measures in the Aston Study. The first hypothesis above is, therefore, supported by the CUBS findings. This result may, however, be peculiar to the CUBS sample, in that the larger manufacturing companies in the CUBS sample were from the more technologically advanced sectors of the electrical engineering industry, where a large proportion of employees are engaged in research and development activities.

In summary, the results of the CUBS Study reported here further add to the substantial weight of evidence in support of size as a major determinant of organisational structure. Among the contextual variables considered in the CUBS Study, company size correlated more significantly with each of the measures of bureaucracy: vertical span of control, specialisation, formalisation, qualifications, complexity of overall administrative structure, and decentralisation of operating decisions (Table 5.4.1.1). However, with exception of vertical span of control, qualifications and functional specialisation, less than 50% of the variation in other structural characteristics is explained by their association with organisational size. The large percentages of unpredicted structural variation clearly indicate that organisational size cannot be regarded as the sole, but is a major, determinant of bureaucratic characteristics.

5.5 TECHNOLOGY

As was mentioned in Section 5.1, the evidence in support of the second contingency model emphasising technology as determinant of organisational structure is controversial. Organisation theorists have defined technology and structure of the organisation in a number of different ways and developed operational measures which they have subsequently used in describing the relationships between technology and structural characteristics of organisations. Details of the various concepts of technology and their associated operational definitions were presented in Section 3.4.4. In this section, empirical evidence for and against the technological imperative advanced by organisation theorists will be evaluated in the light of the findings of the CUBS Study.

5.5.1 Arguments For and Against the Technological Imperative

Three main conceptualisations of technology stand as having been accepted by other students of organisations who have produced replications. Among the three, Woodward (1958) and Perrow (1967) proposed that the nature of technology had a great influence in the determination of structural characteristics of organisations. Woodward's classification of 100 manufacturing organisations in South Essex, on the basis of what she called the "technical complexity" scale, revealed different structural patterns for firms in the unit, mass and process production categories. The structural characteristics considered by Woodward were, however, mainly configurational, such as lateral and vertical spans of control, A/P ratio and subordinate ratio. She reported the

following relationships:

(1) The number of levels of authority in the management hierarchy increased with technical complexity.

(2) The span of control of the first line supervisor on the other hand reached its peak in mass production and then decreased.

(3) Labour costs decreased as technology advanced.

(4) The ratio of indirect labour and of administrative and clerical staff to hourly paid workers increased with technical advance.

(5) The proportion of graduates among the supervisory staff engaged on production also increased.

(6) The span of control of the chief executive widened considerably with technical advance.

(7) No relationship was found between the size of the firm and technical complexity.

Woodward also found that firms at both ends of the technical complexity scale were more likely to be characterised by organic management systems than the firms in the middle range of the scale. She also asserted that an optimum fit existed between technology and structure and that the better the fit, the more successful the firm would be.

Harvey (1968), classifying the 43 industrial firms in his sample along his technical diffuseness - specificity scale, based on the number of product changes in the past ten years, reported that the number of specialised sub-units, the number of levels of authority, the ratio of managers and supervisors to total personnel and the amount of programme specification tended to increase with increase in technical specificity. However, his findings on

technology/structure relationships as defined above must be considered with caution, since his measure of technology was entirely dependent on the definition of product/product change adopted by the responding firms. Zwerman (1970), replicating the work of Woodward (1958) on a sample of companies in Minneapolis, reported that:

> "The findings of the English study were rather strongly confirmed in this replication. The differences in the sample and setting provide a basis for viewing the observed relationships as being generalisable to a rather wide range of industrial settings". (1970: 147)

Lex Donaldson (1976) in a paper critically appraising the empirical studies of technology/structure relationships compared the findings of Woodward and Zwerman on the technology/structure/performance relationships. He stated that although in Zwerman's study the findings on the relationships between three structural variables of spans of control of the first line supervisor, span of control of the chief executive and the ratio of supervisory to non-supervisory personnel and technology replicated the technology/structure relationships found by Woodward, they could not be viewed as replicating the technology/structure/performance relationships. Therefore, he concluded:

> "The Zwerman's study should contrary to Zwerman's interpretation, be regarded as disconfirming Woodward's set of universal generalisations about technology, structure and performance." (page 265)

Acknowledging the fact that differences in terms of performance between very successful and less successful firms was greater in the Woodward's sample than the Zwerman's sample, Donaldson stated that if the technology/structure effect on performance was as strong as Woodward suggested, the effects should still be visible

in Zwerman's sample.

Perrow (1967) proposed that technology conceptualised along two dimensions relating to the extent of occurrence of exceptional situations encountered in the work and the type of search behaviour undertaken when exceptions occurred, was related to the structure of organisations. He defined the structure of the organisation as the form of the interaction between individuals and groups conceptualised in terms of control and co-ordination and extent of inter-dependence.

Hage and Aiken (1969), adopting Perrow's concept of technology, developed a scale measuring the extent of routineness of work, and in their study of 16 health and welfare agencies, found that the routineness of technology was positively related to centralisation and formalisation and negatively related to the level of professional training of the staff. They found no relationships with size of the organisation. This is, however, one of relatively few studies using Perrow's concept of technology. Lynch (1974) who has used the concept in a study of libraries, has attributed this to the difficulty in operationalisation of the concept.

Hickson et al (1969) have argued that technology is not an important determinant of organisational structure, especially when viewed in comparison to other contextual variables, such as the size of the organisation. In relating their measure of technology, "workflow integration", to structural variables, they reported that workflow integration was related to role and functional specialisation, standardisation, role performance recording

and subordinate ratio for their whole sample, but in each case the correlations were overwhelmed by those between organisation size and these variables[1] (Table 5.5.1.1). For their manufacturing only subsample, workflow integration was not correlated to these structural variables and a few of the positive correlations which existed were again overwhelmed by correlations with size. Their production continuity measure, which was a modified version of the Woodward technical complexity scale, correlated positively with some structural variables, but when the effects of size were controlled for by use of partial correlations, the correlations became insignificant[2] (Table 5.5.1.2). However, Hickson et al (1969) found some relationships between the two technology measures and some job-count variables of configuration.

Comparison of their results with Woodward's on the common configurational variables revealed that, apart from the ∩ shaped relationship with subordinate ratio, none of the other relationships with configurational variables reported by Woodward

(Note (1) - Table 5.5.1.1 shows the correlations between automaticity mode and range, two of the subscales of workflow integration used in the CUBS Study as measures of operations technology, with structural variables, together with correlations between workflow integration and the same structural variables for the full Aston and National samples. (Please note: the structural variables shown are not the full range of variables considered in the Aston Studies.)

(2) - Table 5.5.1.2 shows the correlations between automaticity mode and range and structural variables for the CUBS 'manufacturing only' sample, together with correlations between workflow integration and production continuity, and the same structural variables for the Aston and National 'manufacturing only' samples. As in Table 5.5.1.1, the structural variables shown are not the full range of variables considered in the Aston Studies.)

Table 5.5.1.1 Correlations between measures of operations technology and structural variables for full samples

	CUBS (N=44)				ASTON (N=46)				NATIONAL (N=82)		
	Size (log number of employees)	Automaticity mode	Automaticity mode (size partialled out)	Automaticity range	Automaticity range (size partialled out)	Size (log number of employees)	Work flow integration	Work flow integration (size partialled out)	Size (log number of employees)	Work flow integration	Work flow integration (size partialled out)
1. Chief executive's span of control	30*	06	03	10	-16	32*	06	03	15	05	02
2. Subordinate ratio	27*N	03	01	22*N	-01	05	35**	35**	-13	14	18
3. Vertical span of control	74***	02	-08	44**	-10	67***	09	04	65***	17	02
4. Administrative/ production (A/P) ratio	18SN	-13	-14	-25	-39**	36**	34**	33**	-13	-17	-15
5. Number of indirect employees	95***	12	11	56***	-27*	-	-	-	-	-	-
6. Type of structure (SHAPE)	58***	-02	-09	19	-30*	-	-	-	-	-	-
7. Qualifications	72***	21	20	61***	26*	-	-	-	-	-	-
8. First degree holders	75***	10	04	68***	38*	-	-	-	-	-	-
9. Higher degree holders	53***	00	-05	57***	35*	-	-	-	-	-	-
10. Formalisation	69***	19	17	45***	00	55***	17	16	58***	10	-05
11. Functional specialisation	84***	15	32E*	60***	11	67***	44**	53***	61***	41***	34**
12. Autonomy	00	33**N	21	19	25	09	22	21	18	-14	-19
13. Centralisation	-62***	-08	-03	-55***	-24	-39**	-16	-21	-58***	13	34**
14. Centralisation of marketing decisions	-18	-15	-14	-34*	-30*	-	-	-	-	-	-
15. Centralisation of financial decisions	-08	27*	28*	-25	-26*	-	-	-	-	-	-
16. Centralisation of operating decisions	-68***	-12	-07	-52***	-13	-	-	-	-	-	-

Notes to Table 5.5.1.1

N Pearson's product moment correlation produced no statistically significant coefficient. The correlation shown is Kendall's tau.

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

E Functional specialisation (ESPEC)

Source: Child and Mansfield (1972: 378-379)

Table 5.5.1.2 · Correlations between measures of operations technology and structural variables for manufacturing only samples

	CUBS (N=39)					ASTON (N=31)						NATIONAL (N=40)			
	Size (log number of employees)	Automaticity mode	Automaticity mode (size partialled out)	Automaticity range	Automaticity range (size partialled out)	Size (log number of employees)	Work flow integration	Work flow integration (size partialled out)	Production continuity	production continuity (size partialled out)	size (log number of employees)	Work flow integration	Work flow integration (size partialled out)	Production continuity	Production continuity (size partialled out)
1. Chief executive's span of control	35*	21*N	12	25	00	29	-09	-20	08	-07	36**	43**	39**	34*	30*
2. Subordinate ratio	26*N	02	00	27*N	02	04	02	01	-09	01	-23	-21	-18	02	-11
3. Vertical span of control	75***	-00	-10	52***	-07	77***	15	-13	51**	26	63***	06	-04	-19	04
4. Administrative/ production (A/P) ratio	25*N	09	08	-01	-19	53**	22	07	22	-03	-06	18	19	04	04
5. Number of indirect employees	96***	17	31*	69***	-08	-	-	-	-	-	-	-	-	-	-
6. Type of structure (SHAPE)	60***	00	-06	31*	-22	-	-	-	-	-	-	-	-	-	-
7. Qualifications	76***	17	16	54***	-04	-	-	-	-	-	-	-	-	-	-
8. First degree holders	78***	07	00	68***	24	-	-	-	-	-	-	-	-	-	-
9. Higher degree holders	56***	05	00	54***	23	-	-	-	-	-	-	-	-	-	-
10. Formalisation	70***	20	19	45**	-13	67***	04	-23	27	-07	69***	12	01	-27*	-25
11. Functional specialisation	85***	17	33**	63***	24	75***	19	-06	34*	-02	65***	19	15	-17	16
12. Autonomy	-01	09	08	-17	-24	23	02	-04	-07	-19	10	-15	15	-15	07
13. Centralisation	-63***	-01	05	-54***	-15	-47**	-05	11	00	28	-74***	-10	06	22	05
14. Centralisation of marketing decisions	-18	-09	-08	-24	-15	-	-	-	-	-	-	-	-	-	-
15. Centralisation of financial decisions	-09	40**	41**	-23	-25	-	-	-	-	-	-	-	-	-	-
16. Centralisation of operating decisions	-68***	-09	-04	-55***	-11	-	-	-	-	-	-	-	-	-	-

Notes to Table 5.5.1.2

N Pearson's product moment correlation produced no statistically significant coefficient. The correlation shown is Kendall's tau.

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

E Functional specialisation (ESPEC)

Source: Child and Mansfield (1972: 378-379)

were replicated. Referring to the differences in the size of the organisations in the two samples, they concluded that:

> "Structural variables will be associated with operations technology only where they are centred on the workflow. The smaller the organisation, the more its structure will be pervaded by such technological effects; the larger the organisation, the more these effects will be confined to variables such as job-counts of employees on activities linked with workflow itself, and will not be detectable in variables of the more remote administrative and hierarchical structure." (Hickson et al, 1969: 394 - 395)

Child and Mansfield (1972) attempted a full scale replication of the Aston findings on technology/structure relationships. Their results generally supported the findings of Hickson et al (1969) (Table 5.5.1.1). The results of the National Study with respect to production continuity measure were, however, different to those of Hickson et al, but they attributed this to the limited variability of the National sample on this measure. Another contrast with the Aston Study was that of a positive correlation between chief executive's span of control and the two measures of technology for the manufacturing only subsample, which was in support of Woodward's findings (Table 5.5.1.2). Child and Mansfield also found some relationships between the two technology measures and job count measures of configuration. However, the only consistent relationship between the two studies was that of a positive correlation between the percentage employed in transport and dispatch and the two technology measures.

In order to test Hickson et al's (1969) revised technology/structure hypothesis, Child and Mansfield compared the correlations between workflow integration and structural variables for a subsample of 13 smallest organisations with those for the remainder

of the sample. They reported that there was some support for the hypothesis. The correlation with centralisation was greatly increased and those with role and functional specialisation and standardisation were moderately increased for the subsample of small companies. However, there were no significant differences in the size of the correlations with configurational variables. Since configurational variables are the structural variables studied by Woodward, this seems to contradict the hypothesis of Hickson et al, which was developed as a way of reconciling the differences between the Aston and the South Essex study on the technology/structure issue.

Khandwalla (1974b) and Reimann (1977) attempted a further operationalisation of Woodward's technical complexity scale by allowing for the possibility of use of more than one type of technology in manufacturing organisations. They related this technology measure to structural characteristics similar to those used in the Aston and National Studies. However, their scale of technology suffers from a limitation of resulting in the same technology score for firms using a different combination of technologies, as was discussed in Section 3.4.4.

It is evident from the studies presented here that differences in terms of definition of technology and structure adopted in different studies makes comparisons extremely difficult. However, in so far as the four studies of Woodward, Zwerman, Hickson et al and Child and Mansfield adopted the same technological

concept and similar operational definitions of technology and measured certain common structural characteristics, the weight of the evidence is against the technological imperative, since although Zwerman replicated the technology/structure relationships found by Woodward, Hickson et al (1969) and Child and Mansfield (1972) found no relationships and Child and Mansfield's analysis of the technology/structure relationships for the 13 smallest companies in their sample revealed no relationships at all.

In accordance with this argument, Stanfield (1976) drew attention to two problems associated with studies of technology/structure relationships: (1) generalising the findings of the study by drawing conclusions about variables not measured and; (2) a failure to draw boundaries between measures defining technology and structure. He gave specific examples of both situations in the work of theorists and suggested two solutions to the problem; conceptual disaggregation and rationalisation:

> "Thus in report of studies involving only very limited selection of technological and structural variables, it would be more appropriate for the researcher to draw conclusions only in terms of the specific variables instead of inferring a relationship between technology and organisational structure. A more general conclusion could only be drawn if one has examined the relationships among what he could reasonably take to be the full range of variables in technology and structure. Even then one should take into account the ambiguity in drawing the line between technology and structure. ... writers on sociotechnical systems to rationalise their categorisation of variables either by setting forth or by citing classification theories suitable for their research purposes. Such a classification theory would delimit boundaries between technology and structure in relation to five areas of overlap discussed above. For example writers could give reasons for placing people or leadership style under technology or structure. At present it is difficult to find a rationalised system of categorising variables as technological versus structural". (Pages 491 - 492)

5.5.2 Comparison of CUBS Results on Technology/Structure Relationships with Earlier Major Studies

Stanfield's (1976) criticism of earlier studies on technology/structure relationships clearly has some validity. Since automaticity mode and range, just two of the subscales of workflow integration developed by Pugh et al (1969a), were used in the CUBS Study as measures of operations technology, only a limited direct comparison of the results of the CUBS Study may be made with those of the earlier Aston and National Studies. Correlations between log size, automaticity mode and range and structural variables used in the CUBS Study, together with correlations between log size, workflow integration and structural variables for the Aston and National Studies are shown in Table 5.5.1.1. Table 5.5.1.2 shows the respective correlations for the 'manufacturing only' samples of the three Studies.

As may be seen from Tables 5.5.1.1 and 5.5.1.2, for the full CUBS sample automaticity mode was only correlated with autonomy and centralisation of financial decisions, and for the 'manufacturing only' sample with chief executive's span of control and centralisation of financial decisions. The positive correlation obtained with autonomy has no general significance and does not hold for the 'manufacturing only' sample.

The positive correlation with centralisation of financial decisions for both the full and 'manufacturing only' samples indicates that, where the degree of automation of the bulk of the equipment is higher, financial decisions tend to be more centralised.

This may be attributed to the greater importance of decisions regarding unbudgeted expenditure on capital items in companies with more automated technologies, due to greater inter-connectedness of the manufacturing processes and higher capital costs, characteristic of highly automated technologies.

Partial correlations controlling for log size indicate that, apart from the positive correlation between automaticity mode and centralisation of financial decisions, which remains statistically significant, a positive correlation is found between automaticity mode and the more refined measure of functional specialisation (ESPEC) for both the full and 'manufacturing only' samples. This suggests that, once allowance is made for the effects of size, companies with more automated manufacturing technologies tend to have greater numbers of areas of specialisation. For the 'manufacturing only' sample, number of indirect employees was also positively correlated with automaticity mode when size was partialled out ($P_{\alpha} < 0.05$), indicating that, after allowing for the effects of company size, manufacturing companies with more automated manufacturing technologies tend to employ larger numbers of indirect employees.

Freeman (1973), referring to Thompson's (1967) proposition that organisations seek to insulate their core technologies from uncertainty produced by diverse and changeable environments, proposed that, assuming the insulation was achieved by administrators, then:

> "The more the organisation seeks to provide their core technologies with the stability necessary for a closed system logic, the more administrative intensity they will display". (page 758)

He argued that the need to insulate the core technology from the environment increased with the increasing mechanisation of the production system. This seems a reasonable explanation and, indeed, the greater number of indirect employees and greater extent of functional specialisation for companies with higher degree of automation in their workflow may be attributed to greater attempts on the part of these companies to insulate their core technologies, since a disruption at one point in their systems is more likely to bring about a total stoppage of work than in the companies where the level of automation of their production equipment is lower.

Child (1973c) argued that it would not be sensible to hypothesise on the association between complexity of operations (defined as low scores on workflow rigidity and automaticity scales) and an aggregate measure of supportive employment. Thus he proposed that:

> "as complexity of operations increases, the larger will be the proportion of total employment given over to planning and control activities closely associated with the workflow, but the smaller will be the proportion given over to maintenance and similar support activities." (p. 334)

Moreover, he made a distinction between technological complexity and capital intensity and their anticipated effects on the relative size of the supportive component and put forward a second hypothesis:

> "The greater the capital intensity of an organisation, the larger will be the proportion of its total employment given over to supportive personnel".

He further argued that in some industries capital intensity may be associated with smooth non-complex production systems.

If capital intensity and technological complexity are so related, then one could argue that the less complex the technology or the more

automated the production system (reflected by high scores particularly on the automaticity mode scale) the greater the proportion of employment given over to supportive component.

The hypothesis on capital intensity was not supported in the National Study and Child (1973c) also reported an insignificant partial correlation(3) between automaticity mode and number of non-workflow personnel. However, as was shown above, companies in the CUBS sample with higher automated plants tended to employ larger numbers of indirect employees. This result, however, is in support of Child's hypothesis.

Automaticity range, however, correlated differently with structural variables for both the full and the 'manufacturing only' samples. For both samples automaticity range was highly statistically significantly correlated with all measures of structuring or bureaucracy but in almost all cases, log size correlated more significantly with these structural variables. When size was partialled out, eight correlations remained statistically significant for the full CUBS sample. However, these correlations have no general significance and are due to inclusion of the five manufacturing and service companies in the full CUBS sample. These companies, in relation to the 'manufacturing only' companies, scored lower on automaticity range, qualifications and number of first and higher degree holders and higher on the ratio of and the total number of indirect employment. Manufacturing and service companies also had more complex overall administrative structures, due to the nature of their operations, than their 'manufacturing only' counterparts. For the 'manufacturing only' sample, all the correlations between

(Note (3) - size partialled out.)

automaticity range and structural variables became insifnificant when size was partialled out.

The results of the CUBS Study for the 'manufacturing only' sample, in so far as comparisons are permitted by the common use of automaticity mode and range, support findings of the Aston and National Studies. Automaticity mode was not related to any of the structural variables common to the three studies and although automaticity range was related to a number of structural variables, the correlations became insignificant when size was partialled out.

Direct comparisons with Woodward's findings are not permissible due to differences in measurement of technology. However, in so far as increases in the degree of automation of the production equipment are inherent in Woodward's technical complexity scale, and that automaticity mode represents this characteristic, a limited comparison may be made. With this qualification in mind, it may be said that there is a very limited support for Woodward's findings, in that the number of indirect employees increased with the increase in the degree of automation of the production procedures.

Table 5.5.2.1 shows the correlations of automaticity mode and structural variables for 13 companies in the CUBS sample with less than 200 employees. The correlations with configurational variables provide no support for Hickson et al's (1969) revised technology/ structure hypothesis. This is in accordance with the findings of Child and Mansfield (1972). The correlations, however, suggest .

Table 5.5.2.1 Correlations between automaticity mode and structural variables for companies with less than 200 employees

(N=13)

	Automaticity mode
1. Chief executive's span of control	08
2. Subordinate ratio	31
3. Vertical span of control	-24
4. Administrative/production (A/P) ratio	-14
5. Number of indirect employees	12
6. Type of structure (SHAPE)	-08
7. Qualifications	36
8. First degree holders	18
9. Higher degree holders	-10
10. Formalisation	47*
11. Functional specialisation (ESPEC)	30
12. Autonomy	-81***
13. Centralisation (AC)	36
14. Centralisation of marketing decisions	32
15. Centralisation of financial decisions	70**
16. Centralisation of operating decisions	21

Notes:

* significant at 0.05 level

** significant at 0.01 level

*** significant at 0.001 level

that companies with more automated manufacturing technologies tend to have greater formalisation, qualifications and specialisation, and that in these companies marketing and financial decisions tend to be more centralised. However, only the correlations with formalisation and centralisation of financial decisions are statistically significant. The correlations also indicate that the non-autonomous companies tend to have more automated technologies. As was mentioned earlier, this may be attributed to higher capital costs of operating highly automated technologies.

In summary, the CUBS results indicate that operations technology measured as automaticity mode and range is largely unrelated to structural characteristics and in this way CUBS results are in close agreement with those of the Aston and National Studies and provide further empirical evidence against the technological imperative. The correlation analysis of the 13 smallest companies in the CUBS sample indicated, as had Child and Mansfield's (1972) analysis of the 13 smallest companies in the National sample, that although operations technology was related to a number of structural variables, no relationships were found with configurational variables, measures of structure used by Woodward (1958), and therefore provide no support for Hickson et al's (1969) alternative hypothesis on technology/structure relationships put forward to reconcile differences between the Aston and South Essex Studies' findings.

5.6 TECHNOLOGY OF DESIGN & DEVELOPMENT: A NEW APPROACH

As was discussed in Section 3.4.4, Perrow (1967) set out to develop a measure of technology for the whole organisation and provided a four fold classificatory scheme on the basis of type of technology conceptualised along two dimensions, relating to the extent of occurrence of exceptional situations encountered in the work and the type of search behaviour undertaken when exceptions occurred. Defining the structure of the organisation as the form of interaction between individuals and groups, conceptualised in terms of control and co-ordination and the extent of inter-dependence, he compared the differences in structural characteristics of technical and supervisory[(1)] functional areas for organisations falling into the four technology categories. However, he cautioned that the technology of the planning and design functions in the case of organisations classified as routine in terms of technology of technical and supervisory functions may in some cases be non-routine due to their product environment (the term he used to represent the relationship between the organisation and its environment). Therefore, his four fold classification did not provide a unique measure by which the technology of all major areas of organisational activities could be described.

The lack of any strong associations between operations' technology and other structural variables after allowing for the effects of size, reported by the Aston (Hickson et al, 1969) and National (Child and Mansfield, 1972) Studies, and the differences

(Note (1) - See his definitions of technical and supervisory functions (Perrow, 1967: 199).)

in the structural characteristics of organisations with the same production continuity[2] and workflow integration[3] scores, reported by Child and Mansfield, promoted the thought that the technology of design and development may have greater associations with structural characteristics of organisations.

It is reasonable to assume that companies with highly complex design and development technologies have different structural arrangements in terms of complexity (functional specialisation, level of professional qualification and levels of academic qualification), systems of control, co-ordination, communication and decision making, compared to companies with simple design and development (D & D) technologies. The measure of technology of D & D[4] used in the CUBS Study was based on Perrow's (1967) conceptualisation of technology. This is a four point ordinal scale representing in an increasing direction the complexity of design and development technology.

Table 5.6.1 shows the correlations between D & D technology and other contextual variables used in the CUBS Study for both the full and 'manufacturing only' samples. As may be seen, company size is highly statistically significantly correlated with D & D technology. This was expected due to resource requirements of

(Note (2) - A measure of technology developed by Hickson et al (1969) to further clarify the measure of technical complexity developed by Woodward (1958).

(3) - The measure of operations' technology developed by Pugh et al (1969a).

(4) - For details, please see Section 3.4.4.)

Table 5.6.1 Correlations between design and development technology and other contextual variables for both the full (N=44) and manufacturing only samples (N=39) of the CUBS study

	D & D technology	Size partialled out	D & D technology	Size partialled out
1. Size	29**N	NA	32**N	NA
2. Log size	43**	NA	46**	NA
3. Age	-	-	-	-
4. Impersonality of origin	34*	-	43**	31*
5. Status	27*	-	43**	28*
6. Relative size	27*	-	43**	36*
7. Dependence	32*	-	49***	39**
8. Number of operating sites	-	-	46**	-
9. Automaticity mode	-27**N	-	-30**N	-
10. Automaticity range	54***	38**	53***	32*
11. Charter	-	-	NA	NA
12. Log parent company size	41**	-	56***	39**

Notes:
- N Pearson's product moment correlation produced no statistically significant coefficient. The correlation shown is Kendall's tau.
- * Significant at 0.05 level
- ** Significant at 0.01 level
- *** Significant at 0.001 level
- NA Not applicable

operating and maintaining highly complex D & D technologies in terms of capital and technical manpower, which can only be provided in the context of large organisations.

It was shown in Section 5.3 that larger companies in the CUBS sample tended to be impersonally founded, lower in status, lower in relative size and more dependent on their parent organisations. Larger companies also had greater numbers of operating sites, larger parent companies and rated higher on the automaticity range scale. Given the positive correlation of complexity of D & D technology with size, the pattern of other correlations obtained between D & D technology and these variables was therefore largely as expected. When size was partialled out, only the correlation with automaticity range remained statistically significant for the full sample, indicating that companies with more complex D & D technologies tend to utilise some equipment with a higher degree of automation(5). As may be seen from Table 5.6.1, D & D technology was highly statistically significantly negatively correlated with automaticity mode, indicating that companies with more complex D & D technologies tend to have less automated manufacturing technologies.

The pattern of correlations for the 'manufacturing only' sample was almost identical to that of the full CUBS sample. However, the correlations were in each case more significant. Partial correlations indicate that, controlling for the effects of size, private independent companies tend to have less complex D & D technologies. This may well be due to demands of highly complex technologies in terms of both

(Note (5) - Primarily computer controlled testing machines.)

finance and manpower.

Table 5.6.2 shows the correlations between D & D technology and structural variables for both the full and 'manufacturing only' samples of the CUBS Study. For both samples, the pattern of correlations of D & D technology with structural variables is similar to those of automaticity range (please see Tables 5.5.1.1 and 5.5.1.2), in that D & D technology is highly statistically significantly correlated with almost all the measures of structuring or bureaucracy. This is no doubt due in part at least to the effects of size. However, when size was partialled out, functional specialisation, qualifications and number of degree holders remained statistically significantly correlated with D & D technology for the full sample. For the 'manufacturing only' sample, the correlations with A/P ratio and decentralisation (composite scale) also remained statistically significant(6), indicating that 'manufacturing only' companies with more complex D & D technologies also tended to be more decentralised and have larger proportions of indirect employees. This latter relationship is consistent with the larger number of degree holders in these companies. The pattern of partial correlations contrasts markedly with those of automaticity range, in that all correlations between automaticity range and structural variables became insignificant when size was partialled out and were attributed to the effects of company size. Clearly the new variable, complexity of D & D technology, has some predictive power.

(Note (6) - The partial correlation with qualification did not, however, reach the 5 per cent significance level and the coefficient for functional specialisation was only strongly suggestive.)

Table 5.6.2 Correlations between design and development technology and structural variables for the full (N=44) and manufacturing only sample (N=39) of the CUBS study

	D & D technology	Size partialled out	D & D technology	Size partialled out
1. Chief executive's span of control	29*	-	31*	-
2. Subordinate ratio	-	-	-	-
3. Vertical span of control	35*	-	35*	-
4. Administrative/ production (A/P) ratio	-	-	41*	39*
5. Number of indirect employees	40**	-	45**	-
6. Type of structure (SHAPE)	-	-	-	-
7. Qualifications	47***	26*	48***	-
8. First degree holders	68***	60***	73***	66***
9. Higher degree holders	63***	53***	60***	46**
10. Formalisation	41**	-	41**	-
11. Functional specialisation (ASPEC)	49***	26*	51***	26S
12. Autonomy	-	-	-	-
13. Centralisation (AC)	-44**	-	-48***	-28*
14. Centralisation of marketing decisions	-	-	-	-
15. Centralisation of financial decisions	-	-	-	-
16. Centralisation of operating decisions	-42**	-	-45**	-
	N=44		N=39	

Notes for Table 5.6.2

S Strongly suggestive at 0.1 level

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

Functional specialisation, qualification and number of first and higher degree holders were used as measures of organisational complexity (Section 3.2.3). The pattern of correlations therefore supports the hypothesis put forward in Section 5.1 that:

> "regardless of effects of company size, the greater the complexity of design and development technology, the greater the extent of organisational complexity."

5.7 DEPENDENCE ON PARENT ORGANISATION

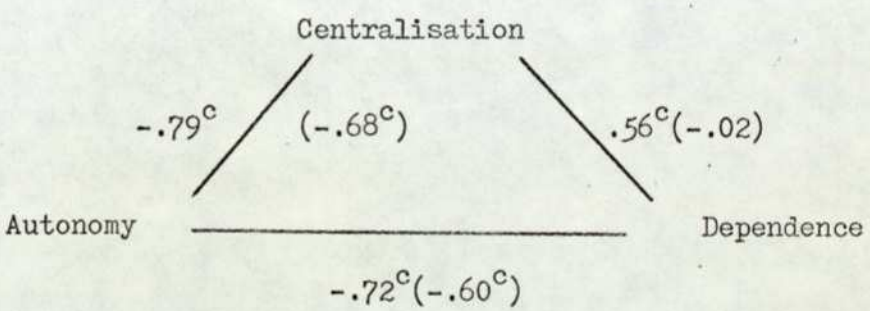
As was discussed in Section 3.4.6, although Pugh et al (1969a) set out to develop an operational measure representing the dependence of the organisation on other organisations, the items included in the final construction of their scale of dependence merely reflected the relationships of the organisation with its parent organisation. The four items included were: (1) number of specialisations contracted out; (2) organisation's representation on group's policy-making bodies; (3) relative size of the focal organisation in the group; and (4) status of the focal organisation in the group. In their subsequent analysis of contextual/structural relationships, dependence only correlated with the concentration of authority dimension ($r = 0.66$). The concentration of authority dimension obtained as a result of principal component analysis of structural variables was characterised by high loadings on the variables of centralisation, autonomy and standardisation of procedures for selection and advancement. However, the scale representing the concentration of authority was constructed by weighted sum of standardised scores for two of the variables: centralisation with a weighting of +1, and autonomy with a weighting of -2 (Mindlin and Aldrich, 1975: 385). Dependence correlated positively with centralisation of decision making ($r = +.57$) and negatively with autonomy ($r = -.72$).

The negative correlation between dependence and autonomy is expected due to the inherent relationship between the two measures, since independent organisations are by definition autonomous.(1 - see overleaf) The size of the negative correlation, however, depends on sample

composition with respect to status of organisations. The Aston sample with 8 independent units, 18 subsidiaries, 4 head branches and 16 branches, resulted in a very high negative correlation between dependence and autonomy. Since autonomy and centralisation were highly correlated in the Aston sample ($r = -.79$), the high correlation between dependence and centralisation was expected. Using the Aston correlation coefficients, partial correlations were calculated (Fig. 5.7.1). It can be seen that controlling for the effects of autonomy, the correlation between dependence and centralisation in the Aston sample completely disappears ($r = -.02$). Therefore the very high positive correlation between dependence and centralisation reported by Pugh et al (1969a) may be nothing but the result of the negative correlation between autonomy and dependence (an inherent relationship) and the negative correlation between autonomy and centralisation (a sample specific relationship[2]).

Figure 5.7.1 Pearson's Product Moment Correlation Coefficients between the three Measures of Autonomy, Centralisation and Dependence

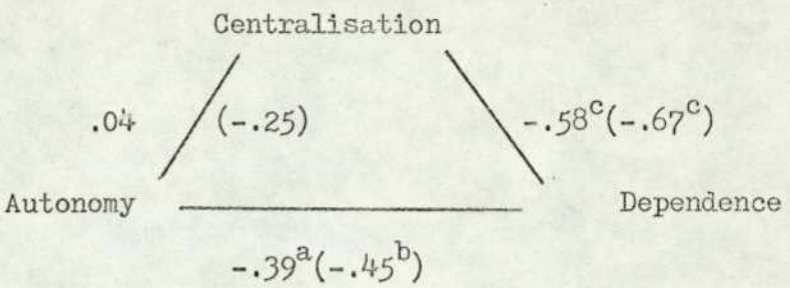
Aston sample: N=46



(Note (1) - However, private independent companies with non-executive boards of directors may be non-autonomous, as was the case for one company in the CUBS sample.

(2) - See Chapter 4.)

CUBS sample: N=39



Notes: Figures in brackets are partial correlations between two variables with the third variable held constant.
a significant at 0.05 level.
b significant at 0.01 level.
c significant at 0.001 level

As may be seen from Tables 5.7.1 and 5.7.2, for both the full and 'manufacturing only' CUBS samples, dependence and its constituent items were statistically significantly, negatively correlated with autonomy, with the exception of impersonality of origin, which was unrelated to autonomy for the full CUBS sample. It may also be seen that, contrary to Aston Study findings, dependence and its constituent items were highly statistically negatively correlated with the composite centralisation scale and with the centralisation of marketing and operating decisions. For both samples, these correlations remained statistically significant when size was partialled out. The partial correlations indicate that, even allowing for the effects of organisational size, more dependent companies in the CUBS sample tend to be more decentralised.

Tables 5.7.1 and 5.7.2 also show that dependence, impersonality of origin and status are highly statistically, significantly, positively correlated with most other measures of structuring or bureaucracy. However, with the exception of correlations for impersonality of origin, most of these correlations are attributable to the effects of organisational size. Yet, when size was partialled out,

Table 5.7.1 Correlations between dependence and its constituent items and structural variables for the full CUBS sample (N=44)

	Impersonality of origin	Impersonality of origin (size partialled out)	Status	Status (size partialled out)	Relative size	Relative size (size partialled out)	Dependence	Dependence (size partialled out)
1. Chief executive's span of control	-	-	-	-	-	-	-	-
2. Subordinate ratio	-	-	23*N	-	-	-	-	-
3. Vertical span of control	29*	-	-	-27*	-	-	-	-
4. Administrative/production (A/P) ratio	26*	-	-	-	-	-	-	-
5. Number of indirect employees	37*	-	35*	-	-	-	-	-
6. Type of structure (SHAPE)	-	-	27*	-	23*N	-	19*N	-
7. Qualifications	47***	30*	34*	-	-	-	32*	-
8. First degree holders	47**	30*	44**	-	38**	31*	46**	31*
9. Higher degree holders	38**	-	19*N	-	-	-	-	-
10. Formalisation	45***	27*	33*	-	-	-	30*	-
11. Functional specialisation (ASPEC)	46***	27*	35*	-	-	-	32*	27*E
12. Autonomy	-	-	-21*N	-21§	-25**N	-25§	-24*N	-24§
13. Centralisation (AC)	-55***	-43**	-55***	-42**	-45**	-39**	-56***	-46**
14. Centralisation of marketing decisions	-28*	-	-46***	-43**	-45**	-42**	-47***	-44**
15. Centralisation of financial decisions	-	-	-	-	-19*N	-	-	-
16. Centralisation of operating decisions	-58***	-47***	-52***	-37**	-38**	-30*	-51***	-40**

Notes to Table 5.7.i

N Pearson's product moment correlation was not statistically significant. The correlation shown is Kendall's tau.

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

§ Kendall's rank partial correlation coefficient

E, Functional specialisation (ESPEC)

Table 5.7.2 Correlations between dependence and its constituent items and structural variables.
Manufacturing only sample (N=39)

	Impersonality of origin	Impersonality of origin (size partialled out)	Status	Status (size partialled out)	Relative size	Relative size (size partialled out)	Dependence	Dependence (size partialled out)
1. Chief executive's span of control	-	-	-	-	-	-	-	-
2. Subordinate ratio	-	-	32**N	-	-	-	-	-
3. Vertical span of control	31*	-	18*N	-	-	-	23*N	-
4. Administrative/production (A/P) ratio	45**	43**	-	-	-	-	-	-
5. Number of indirect employees	40*	-	39*	-	-	-	-	-
6. Type of structure (SHAPE)	-	-	30*	-	26*N	-	22*N	-
7. Qualifications	46**	27*	39**	-	-	-	35*	-
8. First degree holders	46**	-	52***	32*	44**	39*	51***	38*
9. Higher degree holders	45**	31*	30*	-	-	-	32*	-
10. Formalisation	47***	30*	35*	-	-	-	32*	-
11. Functional specialisation (ASPEC)	47***	29*	40**	29*E	32*E	-	36*	31*E
12. Autonomy	-20*N	-20§	-35*	-38**	-37*	-38**	-39**	-41**
13. Centralisation (AC)	-55***	-43**	-58***	-44**	-47***	-41**	-58***	-48**
14. Centralisation of marketing decision	-23*N	-	-49***	-46**	-47**	-45**	-49***	-46**
15. Centralisation of financial decision	-	-	-	-	-	-	-	-
16. Centralisation of operating decision	-59***	-48***	-56***	-41**	-41**	-33*	-55***	-43**

Notes for Table 5.7.2

N Pearson's product moment correlation produced no statistically significant coefficient. The correlation shown is Kendall's tau.

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

§ Kendall's rank partial correlation coefficient

E Functional specialisation (ESPEC)

dependence remained statistically significantly correlated with functional specialisation (ESPEC) and the number of first degree holders, indicating that, after allowing for the effects of size, more dependent companies in the CUBS sample also tend to have greater functional specialisation and a larger number of first degree holders.

The partial correlations with impersonality of origin indicate that, even after allowing for the effects of size, impersonally founded companies tend to have higher A/P ratio, higher formalisation, specialisation, qualifications, number of degree holders and that in these companies operating decisions tend to be delegated to lower levels of the hierarchy. The higher degree of structuring or bureaucracy for the impersonally founded organisations may reflect the influence of parent company structure, which in the case of large parent companies would tend to be more highly bureaucratic, on the structure of the subsidiaries.

As was shown at the beginning of this section, the positive correlation found in the Aston sample between dependence and centralisation could be attributed to the correlation between autonomy and centralisation and should not be generalised beyond their specific sample. Indeed, analysis of the CUBS data reported above showed that, whilst dependence was negatively correlated with autonomy, it was also negatively correlated with centralisation, even after controlling for organisational size. The analysis also suggested that impersonally founded organisations tend to be more structured or bureaucratic.

5.8 RELATIONSHIPS BETWEEN OTHER CONTEXTUAL VARIABLES AND ORGANISATIONAL STRUCTURE

Relationships of contextual variables of major theoretical importance with structural variables have been the subject of discussion in the preceding sections. However, as was discussed in Section 5.2, a number of other contextual variables used in the Aston Studies (company age, number of operating sites, charter and parent company size) were also used in the CUBS Study. The relationships between these and structural variables will be discussed in this section.

Tables 5.8.1 and 5.8.2 show the correlations between these contextual variables and structural variables for the full and 'manufacturing only' samples of the CUBS Study respectively. As may be seen, for both samples, number of operating sites and parent company size were highly statistically significantly correlated with all the measures of structuring or bureaucracy: vertical span of control, formalisation, specialisation, qualifications and decentralisation of operating decisions.

Number of operating sites was also significantly correlated with first and higher degree holders for the 'manufacturing only' sample and parent company size was significantly correlated with numbers of degree holders for both the full and 'manufacturing only' samples. The patterns of correlations of number of operating sites and parent company size were almost the same as those for size of the organisational unit itself. However, in nearly all cases, log size correlated more significantly with the structural variables than

Table 5.8.1 Correlations between age, number of operating sites, charter and parent company size with structural variables.

Full CUBS sample (N=44)

	Age	Age (size partialled out)	Number of operating sites	Number of operating sites (size partialled out)	Charter	Charter (size partialled out)	Parent company size	Parent company size (size partialled out)
1. Chief executive's span of control	-	-	-	-	-	-	-	-
2. Subordinate ratio	26*N	-	-	-	-	-	-	-
3. Vertical span of control	-	-	27**N	-	-	-	44***	-
4. Administrative/ production (A/P) ratio	-	-	86***	88***	64***	64***	-	38*
5. Number of indirect employees	-	-33*	37**	29*	19*N	55***	53***	-
6. Type of structure (SHAPE)	-	-	35**	-	22*N	25+	35*	-
7. Qualifications	-	-	24*N	-	-	-	52***	-
8. First degree holders	-	-	-	-	-	-	60***	31*
9. Higher degree holders	-	-	-	-	-	-	33*	-
10. Formalisation	-	-	25*	-	-	-	45***	-
11. Functional specialisation (ASPEC)	-	-27*	35**	-	-	-	55***	-
12. Autonomy	-	-	-	-	-40**	-40**	-	-
13. Centralisation (AC)	-	26*	-22*N	-	21*N	26*	-60***	-38*
14. Centralisation of marketing decisions	-	26*	-	-	-	-	-40**	-37*
15. Centralisation of financial decisions	-	-	-	-	30*	29*	-	-
16. Centralisation of operating decisions	-	27*	-29**N	-	-	-	-58***	-31*

Notes to Table 5.8.1

N Pearson's product moment correlation was not statistically significant but Kendall's tau was statistically significant. The correlation shown is Kendall's tau.

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.005 level

\+ Partial rank order correlation

Table 5.8.2 Correlations between age, number of operating sites and parent company size with structural variables. Manufacturing only sample (N=39)

	Age	Age (size partialled out)	Number of operating sites	Number of operating sites (size partialled out)	Parent company size	Parent company size (size partialled out)
1. Chief executive's span of control	-	-	47***	34*	-	-
2. Subordinate ratio	30*	-	26*N	-	22*N	-
3. Vertical span of control	-	-	51***	-	51***	-
4. Administrative/production (A/P) ratio	-	-	22*N	-	38*	36*
5. Number of indirect employees	-	-41**	62***	-	55***	-
6. Type of structure (SHAPE)	-	-	57***	30*	37**	-
7. Qualifications	-	-27*	53***	-	55***	-
8. First degree holders	-	-	52***	-	64***	35*
9. Higher degree holders	-	-	55***	-	41**	-
10. Formalisation	-	-	59***	-	48***	-
11. Functional specialisation (ASPEC)	-	-33*	56***	-	57***	-
12. Autonomy	-	-	-	-	-	-26*
13. Centralisation (AC)	-	33*	-51***	-	-63***	-41**
14. Centralisation of marketing decisions	19*N	32*	-	-	-42**	-46**
15. Centralisation of financial decisions	-	-	-	-	-	-
16. Centralisation of operating decisions	-	32*	-58***	-25S	-61***	-34*

Notes for Table 5.8.2

N Pearson's product moment correlation was not statistically significant but Kendall's tau was statistically significant. The correlation shown is Kendall's tau.

S Strongly suggestive at 0.1 level

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

these two measures. This pattern of correlations was expected, since number of operating sites is itself a measure of organisational size and was statistically significantly correlated with log size[1] ($r = .31$, $P_{\alpha} < .05$). Also the larger companies in the CUBS sample were shown to have larger parent companies (Table 5.3.1).

For the full sample, when size was partialled out, number of operating sites remained statistically significantly correlated with only A/P ratio and number of indirect employees. It was expected that, once allowance was made for the effects of size, number of operating sites would remain correlated with number of indirect employees, since the greater complexity of relationships and tasks in companies with greater number of operating sites would be expected to increase the problems of co-ordination and control. Child (1973c), using the above argument, hypothesised a positive relationship between the two measures which was supported by the National data. However, the partial correlations for the CUBS sample have no general significance and are due to inclusion in the full CUBS sample of the five manufacturing and service companies, which had relatively larger numbers of operating sites and smaller proportions of production workers. The partial correlation coefficients for the 'manufacturing only' sample were not statistically significant. For this 'manufacturing only' sample, however, number of operating sites remained statistically

(Note (1) - Number of operating sites correlated more significantly with log size for the 'manufacturing only' sample, since manufacturing and service companies on average tended to have larger numbers of operating sites and their inclusion in the full sample reduced the size of the correlation.)

significantly correlated with chief executive's span of control and overall administrative structure (SHAPE). Although the correlation with decentralisation of operating decisions is not significant at the 0.05 level, it is strongly suggestive, and makes intuitive sense. It might make sense that, regardless of size, companies with a greater number of operating sites should tend to delegate more routine operating decisions to lower hierarchical levels in the company, perhaps to the individual operating sites.

The positive correlations between number of operating sites and complexity of the overall administrative structure (SHAPE) and chief executive's span of control are interesting[2]. These two measures were shown in Chapter 4 to be highly statistically significantly positively correlated with vertical span of control. For convenience, these correlations, together with partial correlations controlling for log size, are shown below for the 'manufacturing only' sample:

	1	2	3	4
1. Chief executive's span of control.	-			
2. Vertical span.	0.36(0.16)	-		
3. Shape.	0.42(0.28)	0.60(0.25)	-	
4. Number of operating sites.	0.47(0.34)	0.51(0.04)	0.57(0.30)	

(Partial correlation coefficients are shown in brackets. Correlations of 0.26 and above are significant at or beyond the 0.05 level, one tail test.)

(Note (2) - A highly significant positive correlation was also found between number of operating sites and a similar ordinal scale for structure, in a parallel study at the City University, by Grinyer et al (1978).)

Since number of operating sites may also be considered as a configurational variable, the results of the zero order and partial correlations indicate that companies with more complex overall administrative structures tend to be taller, wider and have larger numbers of operating sites, and that the relationships hold, regardless of the effects of organisational size. This further supports the usefulness of the ordinal scale of complexity of overall administrative structure (SHAPE), introduced in Chapters 3 & 4.

As for the number of operating sites, the correlations between parent company size and bureaucratic characteristics, with the exception of decentralisation of operating decisions, become insignificant when size is partialled out. Partial correlations, however, indicate that, allowing for the effects of size, companies with larger parent organisations tend to have larger A/P ratios and number of first degree holders, and that in these companies marketing, as well as operating decisions, tend to be more decentralised. Private independent companies in the CUBS sample had smaller parent companies(3) relative to subsidiaries, and also tended to have less complex design and development technologies(4) (see Table 5.6.1). The positive

(Note (3) - CUBS sample was composed of small private independent units and larger subsidiaries. For private independent companies, parent company size = company size.

(4) - Especially for the 'manufacturing only' sample, design and development correlated highly statistically significantly with all measures of dependence and log parent company size. These correlations remained significant when size was partialled out. Design and development technology also correlated highly with A/P ratio and number of first degree holders. These correlations also remained significant when size was partialled out.)

correlations between parent company size and A/P ratio and number of first degree holders may partly be attributed to transfer of practices due to membership of larger organisations and partly to the greater complexity of design and development technologies of companies with larger parent organisations. When the effects of size and design and development technology were both controlled for by partial correlations, these correlations became insignificant.

Child (1973c: 336) hypothesised that:

"if an organisation belongs to a larger group, and as the size of that group increases, the proportion of its total employment given over to supportive personnel will increase."

As was mentioned above, although the relationship between A/P ratio and parent company size may be partly attributable to the effects of membership of larger organisation, and therefore partly support Child's hypothesis, once allowance was made for the effects of size, no relationship was found between number of indirect employees and parent company size. It must also be mentioned that analysis of National data (Child, 1973c) also resulted in an insignificant partial correlation between parent company size and number of non-workflow personnel and support for Child's hypothesis was only found in a multiple regression of hypothesised determinants of supportive employment.

The significant negative correlations with decentralisation of operating and marketing decisions indicate that, allowing for the effects of size, companies which are members of other organisations tend to delegate the authority for marketing and operating

decisions to lower hierarchical levels.

As may be seen from Tables 5.8.1 and 5.8.2, company age was significantly correlated with only the subordinate ratio for the full sample. For the 'manufacturing only' sample company age was also positively correlated with centralisation of marketing decisions. When size was partialled out the coefficient with subordinate ratio became insignificant. However a number of significant correlations then appeared with structural variables. Once the effect of size was removed, company age was significantly negatively correlated with number of indirect employees and functional specialisation, and positively correlated with centralisation of marketing and operating decisions for the full sample. For the 'manufacturing only' sample, "qualifications" was also negatively correlated with company age. The pattern of correlations indicates that, allowing for the effects of size, older companies tend to have smaller numbers of indirect employees, lower numbers of staff functions filled by qualified staff, less functional specialisation, and that in these companies marketing and operating decisions tend to be more centralised.

As was shown earlier (Section 5.7), partial correlations indicated that, allowing for the effects of size, personally founded companies tended to be less bureaucratic than impersonally founded companies. It was also shown (Section 5.3) that older companies in the CUBS sample tended to be personally founded and that this relationship was significant when size was partialled out. Therefore, the pattern of partial correlations obtained between company age and these structural variables may be attributed to their relationship with impersonality of origin.

This pattern of correlations may, therefore, be peculiar to the CUBS sample of companies.

Table 5.8.1 shows that charter is significantly correlated with A/P ratio, number of indirect employees, overall administrative structure, autonomy and centralisation of financial decisions. These correlations remained significant when size was partialled out. The positive correlations with A/P ratio and number of indirect employees are due to definition of the measures(5). Manufacturing and service companies also had more elaborate overall structures than their 'manufacturing only' counterparts(6). The relationship with autonomy is specific to the CUBS sample(7) and the positive correlation with centralisation of financial decisions may be due to the nature of the decisions, since it would be reasonable to expect that in 'manufacturing only' companies, investment decisions largely involve plant and tend more often, therefore, to be taken at a line (production) level.

In summary, the results of the analysis in this section indicated that number of operating sites and parent company size were related to all variables of bureaucracy. However, in many

(Note (5) - For manufacturing and service companies with substantial service operations, only production workers were included in the measure of direct employment.
(6) - A relationship also found by Grinyer et al (1978) in their parallel study using a sample of 48 companies from a variety of industries.
(7) - This correlation is due to existence of a manufacturing and service company with an autonomy score of 16 (mean score on autonomy for the full sample: 22.39).)

cases, the correlations were attributable to the effects of size. Number of operating sites, itself a configurational variable was highly statistically significantly correlated with three other configurational variables of lateral and vertical spans of control and complexity of overall administrative structure, which were themselves shown in Chapter 4 to be interrelated. Moreover, the correlations between these variables remained significant when the effects of size were allowed for using partial correlations. In addition, number of operating sites remained negatively correlated with decentralisation of operating decisions. Once the effects of size were allowed for, parent company size remained significantly correlated with A/P ratio, number of first degree holders and decentralisation of marketing and operating decisions. However, these results may be attributed partly to transfer of practices due to membership of larger organisations and partly to the greater complexity of design and development technology of companies with larger parent organisations. Company age was shown to be statistically significantly correlated with subordinate ratio, complexity of overall administrative structure and centralisation of marketing decisions. However, once allowance was made for the effects of size, these correlations became insignificant. In addition, a number of other significant correlations appeared, which might be attributed to the relationship between company age, size and impersonality of origin peculiar to the CUBS sample. Finally, manufacturing and service companies were shown to have more complex overall administrative structures than their 'manufacturing only' counterparts. This results confirms a similar finding of a parallel study in the City University of a multi-industry sample by Grinyer et al (1978).

5.9 MULTIVARIATE PREDICTION OF BUREAUCRATISATION AND ORGANISATIONAL COMPLEXITY

Vertical span of control, overall administrative structure, qualifications, functional specialisation, formalisation and decentralisation of operating decisions were shown in Chapter 4 to represent the extent of bureaucratisation. Number of first and higher degree holders, together with specialisation and qualifications, were considered as aspects of organisational complexity(1). In this section a multivariate prediction of bureaucratic characteristics is attempted. Step-wise multiple regression was used taking in turn each of the above bureaucratic characteristics as dependent variables and the seven contextual variables of size, age, dependence, number of operating sites, automaticity mode, automaticity range and parent company size as independent variables(2). Multiple regressions were also carried out after adding the technology of design and development measure to the list of independent variables in order to test the explanatory power of this newly-devised ordinal scale. In each multiple regression the F value to enter a variable into the model was given a minimum value of 2.0 and to remove a variable the F value was set at 1.5.

Company size was the only significant predictor of vertical span of control or height of the hierarchy, professional qualifications and formalisation of role definitions. In each case no other contextual variable entered the model. The percentage of variance explained by company size was 57% for vertical span of control;

(Note (1) - Please see Section 3.2.3.
(2) - The analysis is only carried out for the 'manufacturing only' sample.)

58% for qualifications; and 49% for formalisation of role definitions (Table 5.9.1).

Both company size and number of operating sites were predictors of overall administrative structure (SHAPE). As may be seen from Table 5.9.1, company size accounted for 35% of the variation in overall administrative structure and addition of the number of operating sites, although not statistically significant, accounted for a further 6%. Therefore, in total, company size and number of operating sites explained 41% of the variance of shape. Beta coefficients and their significance levels are shown below. Neither regression coefficient was significant at the 5% level.

		Beta Coefficient	Significance Level
(1)	Company size	.384	.081
(2)	Number of operating sites	.321	.142

Company size was also the most important predictor of functional specialisation and accounted for 73% of the variance. Age, although not statistically significant, added a further 3% to the variance explained by size alone. Therefore, in total 76% of the variation in functional specialisation was explained by the model containing size and age. As may be seen below, the beta coefficient for age is negative. This is consistent with the results of correlation analysis in the last section, in that, after allowing for size, the older companies tend to have lower levels of functional specialisation.

Table 5.9.1 Multiple regression analysis of bureaucratisation and organisational complexity . Manufacturing sample (N=39).

	F value to enter or remove a variable	Significance level	Multiple R	R square	R square change	Simple R	Overall F	Significance level
Vertical span of control								
1. Size	31.56	.000	.75	.57	.57	.75	31.56	.000
Overall administrative structure (SHAPE)								
1. Size	12.95	.001	.59	.35	.35	.59	12.95	.001
2. Number of operating sites	2.32	NS	.64	.41	.06	.57	7.99	.002
Qualification								
1. Size	32.54	.000	.76	.58	.58	.76	32.54	.000
First degree holders								
1. Size	38.01	.000	.78	.61	.61	.78	38.01	.000
2. Dependence	3.80	.063	.82	.67	.05	.51	23.13	.000

First degree holders								
1. Size	38.01	.000	.78	.61	.61	.78	38.01	.000
2. Design and development technology	18.11	.000	.88	.78	.17	.73	41.60	.000
Higher degree holders								
1. Size	11.02	.003	.56	.31	.31	.56	11.02	.003
2. Number of operating sites	2.16	NS	.61	.37	.06	.55	6.85	.005
Higher degree holders								
1. Design and development technology	13.21	.001	.60	.36	.36	.60	13.21	.001
2. Size	4.44	.046	.68	.46	.10	.56	9.77	.001
Formalisation								
1. Size	22.63	.000	.70	.49	.49	.70	22.63	.000
Functional specialisation (ASPEC)								
1. Size	64.59	.000	.85	.73	.73	.85	64.59	.000
2. Age	2.76	NS	.87	.76	.03	.11	36.04	.000

Functional specialisation (ESPEC)								
1. Size	106.97	.000	.90	.82	.82	.90	106.97	.000
2. Automaticity mode	2.84	NS	.91	.84	.02	.22	59.02	.000
3. Dependence	2.54	NS	.92	.85	.01	.46	42.82	.000
Centralisation of operating decisions								
1. Size	20.43	.000	.68	.46	.46	-.68	20.43	.000
2. Dependence	5.28	.031	.75	.56	.10	-.55	14.67	.000

	Beta Coefficient	Significance Level
(1) Size	.911	.000
(2) Age	-.180	.110

As for functional specialisation (ASPEC), company size emerged as the most important predictor of the more refined measure of functional specialisation (ESPEC). However, automaticity mode and dependence,in addition to size,emerged as predictors in place of age, but the significance levels for these two variables did not even reach the 10% level. They added merely 2% and 1% respectively to the 82% already explained by company size (Table 5.9.1) and had low beta coefficients (see below).

	Beta Coefficient	Significance Level
(1) Size	.840	.000
(2) Automaticity mode	.140	.102
(3) Dependence	.140	.125

Company size was again the most important predictor of centralisation of operating decisions, the last aspect of bureaucracy considered. Forty-six per cent of the variation in centralisation of operating decisions was explained by company size and a further 10% by dependence on parent organisation (Table 5.9.1). The beta coefficients were both negative and significant (see below). This suggests that the Aston researchers might have been right in arguing that dependence is a predictor of centralisation but the sign is, of course, opposite to that they suggest.

		Beta Coefficient	Significance Level
(1)	Size	-.551	.001
(2)	Dependence	-.342	.031

The multiple regression carried out adding the new measure of technology of design and development did not alter the composition of independent variables in the models presented above. This suggests that, after all, introduction of this new scale has little predictive value a far as measures of bureaucracy are concerned.

Step-wise multiple regression was also carried out using number of first and higher degree holders as dependent variables and the seven elements of context as independent variables. As for bureaucratic characteristics, multiple regressions were repeated adding the new measure of technology of design and development to the list of independent variables.

As may be seen from Table 5.9.1, company size and dependence emerged as predictors of number of first degree holders. Company size accounted for 61% of the variance and a further 5% was accounted for by dependence. Technology of design and development, when added to the existing list of independent variables, replaced dependence as the predictor of number of first degree holders and accounted for a greater percentage of variance (17%) in addition to that explained by size. The overall precentage of variance explained increased from 67 to 78 per cent by the introduction of design and development technology. As may be seen below, whereas company size influences the number of degree holders to a considerably greater extent than dependence, design and development

technology has approximately the same predictive influence. Moreover, the regression coefficient for design and development technology is highly statistically significant.

		Beta Coefficient	Significance Level
(1)	Size	.689	.000
(2)	Dependence	.253	.063
(1)	Size	.569	.000
(2)	Design and development technology	.465	.000

For number of higher degree holders, company size and number of operating sites emerged as predictors accounting in total for 37% of the variance. Of the 37%, 31% was explained by size and 6% by the number of operating sites. As for the first degree holders, the introduction of design and development technology into the list of independent variables resulted in a different model containing size and design and development technology. Although company size still remained a significant predictor of the number of higher degree holders, design and development technology was the more important predictor. The total percentage of variance explained by the model increased from 37 to 46 per cent of which 36% was explained by design and development technology. Approximately the same amount of variation explained by size and number of operating sites was explained by design and development technology alone.

As may be seen below, whereas the regression coefficients for the model with size and number of operating sites were not even significant at the 0.1 level, they were highly statistically significant for the model containing design and development technology and size.

		Beta Coefficient	Significance Level
(1)	Size	.354	.116
(2)	Number of operating sites	.319	.115
(1)	Design and development technology	.429	.021
(2)	Size	.364	.046

In summary, company size was shown to be the most important predictor of all measures of bureaucracy. In addition to size, a number of other contextual variables also emerged as predictors of certain aspects of bureaucratisation. Number of operating sites emerged as predictor of overall administrative structure; company age as predictor of functional specialisation (ASPEC); automaticity mode and dependence as predictors of functional specialisation (ESPEC) and dependence as predictor of decentralisation of operating decisions. With the exception of dependence, which explained 10% of the variation in decentralisation of operating decisions, in addition to the percentage explained by size, the percentages of variance explained by other contextual variables were in each case less than 10%.

Technology of design and development did not emerge as a predictor of bureaucratic characteristics. However, it was the most important predictor of the number of higher degree holders and also emerged as a significant predictor of the number of first degree holders after company size. The results of the multiple regression, therefore, provide additional support for company size as the major predictor of the extent of structuring or bureaucratisation, and underline the importance of the new scale, D&D technology, as a predictor of aspects of organisational complexity. The latter clearly makes intuitive sense. More complex D&D technologies demand employment of more graduates and, in particular, higher degree holders whose qualifications may be redundant in low technology companies.

5.10 SUMMARY AND DISCUSSION

As was mentioned in the introduction to this chapter, a number of proponents of contingency models of organisational structure emphasised the importance of a single contextual variable as a determinant of structure, and that among the contextual variables considered by researchers, size had received the greatest empirical support.

Advocates of the size determinism school of thought, Blau (1970), Pugh et al (1969a) and Child (1973a) have empirically established strong linkages between organisational size and structural characteristics of bureaucratisation. These relationships have also been replicated by all other empirical studies following the Aston tradition (Inkson et al, 1970a; Hickson et al, 1974; and McMillan et al, 1973).

Results of the CUBS Study reported in this chapter further supported the argument in favour of size as a major determinant of organisational structure. For both the full and the 'manufacturing only' sample, company size was highly statistically significantly correlated with vertical span of control, formalisation, functional specialisation and decentralisation, and also with other aspects of bureaucracy introduced in the CUBS Study: qualifications, overall administrative structure (SHAPE) and decentralisation of operating decisions. As in the case of the Aston Studies, the correlations for the 'manufacturing only' sample were more significant. For both samples, correlations with logarithm of size were stronger, indicating logarithmic relationships between size and

bureaucratic characteristics, thus confirming the decreasing marginal influence of size on structure as proposed by Blau (1970). The highly significant correlations with qualifications and overall administrative structure further supported Weber's (1947) contention that bureaucracies typified the larger and more complex organisations.

Although company size correlated highly statistically significantly with overall decentralisation (the composite scale AC), it correlated more significantly with decentralisation of operating decisions and was unrelated to decentralisation of marketing and financial decision taking. This pattern of correlations was, however, largely expected, since marketing and financial decisions were shown in Chapter 4 not to be in the same clusters as the operating decisions. It was also shown that decentralisation of marketing and financial decisions were unrelated to structuring or bureaucracy, whereas decentralisation of operating decisions was highly statistically significantly.

In support of Blau's (1970: 208) hypothesis that greater homogeneity of type of activities of direct workers in the larger organisations resulted in higher subordinate ratios, company size was statistically significantly positively correlated with subordinate ratio for both the full and 'manufacturing only' samples. For both samples, size was also positively significantly correlated with chief executive's span of control.

Company size explained 98% of the variation in the size of the supportive component and correlated significantly positively

with the ratio of indirect/direct employment. This latter relationship, however, may be peculiar to the CUBS sample in that larger companies tended to operate in the more technologically sophisticated sectors of the electrical engineering industry, employing large numbers of degree holders, included in the measure of indirect employment, who were primarily involved in design and development of innovations.

Evidence in support of technology as determinant of organisational structure is, however, controversial. Although Woodward (1958), Perrow (1967), Harvey (1968), Hage and Aiken (1969) and Zwerman (1970) argued for technology as a major determinant of organisational structure, Hickson et al (1969) claimed that technology was not an important predictor of organisational structure, especially when viewed in comparison to other contextual variables, such as size. They proposed that, "variables of operations technology will be related only to those structural variables centered on the workflow". Thus, technology would influence structure to a greater extent in the smaller organisations than the larger ones, where the effects of size will prevail. Their claim was substantiated by Child and Mansfield's (1972) analysis of the 13 smallest organisations in the National sample. Discrepancies between the findings of studies on the technology/structure relationships are largely attributed to wide differences between the studies on operational definitions of technology and structure. However, in so far as the four studies of Woodward (1958), Zwerman (1970), Hickson et al (1969), and Child and Mansfield (1972) measured certain common structural characteristics and used similar measures of operations technology, the weight of

evidence is against the technological imperative.

Results of the CUBS Study, for the 'manufacturing only' sample, in so far as comparisons are valid with the Aston and National Studies, due to use of automaticity mode and range (subscale of workflow integration used in the Aston Studies as the operational measure of technology) further support their findings. Automaticity mode was unrelated to all structural variables common to the Aston and National Studies and although automaticity range was significantly correlated with a number of structural variables, the relationships were largely attributed to the effects of size. However, a number of relationships with structural variables were found in the CUBS Study. Automaticity mode was significantly correlated with centralisation of financial decisions and, when size was partialled out, it was significantly correlated with the number of indirect employees and the more refined measure of functional specialisation (ESPEC). These correlations make intuitive sense and lend support to Freeman's (1973) argument that the need to insulate the core technology from the environment increases with increasing mechanisation of the production system, since it would be reasonable to assume that the greater number of indirect employees and greater functional specialisation in companies with more automated production systems is due to greater attempts on the part of these companies to insulate their core technologies from the environment.

Correlation analysis of the 13 smallest companies in the CUBS sample revealed, as had Child and Mansfield's (1972) analysis of the 13 smallest companies in the National sample, that although operations technology (automaticity mode) was related to a number

of structural variables, no relationships were found with configurational variables, measures of structure used by Woodward, and in this way led to the rejection of Hickson et al's (1969) alternative hypothesis on technology/structure relationships put forward to reconcile differences between the Aston and the South Essex Studies' findings.

Differences between the structural profiles of the companies in the two industries of chocolate and sweets, and pharmaceuticals reported by Child and Mansfield (1972), which had the same operations technology, but clearly differed in terms of design and development technology, prompted the thought that the structural differences may be attributed to differences in design and development technology. Design and development technology would also be expected to have greater influence on structural characteristics of organisations than the operations technology, in particular on organisational complexity.

It was hypothesised that, regardless of size, companies with more complex design and development technologies would have greater organisational complexity (functional specialisation, qualifications and first and higher degree holders). Using a four point ordinal scale, based on Perrow's (1967) conceptualisation of technology, representing in an increasing direction the complexity of design and development technology, this hypothesis was tested and supported. For both the full and 'manufacturing only' samples, complexity of design and development technology correlated highly statistically significantly with all measures of structuring or bureaucracy - and with the numbers of first and higher degree holders. When size

was partialled out, the correlations with functional specialisation, qualifications and numbers of first and higher degree holders remained statistically significant. For the 'manufacturing only' sample, the correlation with decentralisation (composite scale) also remained statistically significant.

Dependence was claimed by the Aston group (Pugh et al, 1969a) to be the major predictor of concentration of authority dimension, resulting from their principal component analysis of structural variables. The independence of the concentration of authority from the structuring of activities dimension in the Aston Study was questioned in Chapter 4 and was shown to be attributed to the very high correlation between centralisation and autonomy, a specific characteristic of the Aston sample. This same specific characteristic also resulted in emergence of dependence as the major predictor of concentration of authority. The scale used by the Aston researchers in correlation analysis, representing the concentration of authority dimension, was based on a weighted summation of standardised scores on centralisation and autonomy. Dependence correlated highly statistically significantly with both autonomy and centralisation. This latter relationship was, however, shown to be attributable to the strong negative correlation between autonomy and centralisation, a relationship specific to the Aston sample. Partial correlations controlling for autonomy resulted in an insignificant correlation between dependence and centralisation.

For the CUBS Study, where the correlation between autonomy and centralisation was not statistically significant, dependence,

contrary to the Aston Study findings, correlated significantly negatively with centralisation. This relationship remained significant, even when size was partialled out. However, as expected, dependence correlated significantly negatively with autonomy. Therefore, the Aston group's claim that dependence predicts greater concentration of authority is only valid as far as autonomy is concerned. Indeed, dependence and its constituent items correlated significantly with decentralisation of marketing and operating decisions and also with most other structural variables. The correlations with decentralisation of marketing and operating decisions also remained significant when size was partialled out. However, most of the other correlations were attributed to effects of size. Partial correlations indicated that, allowing for the effects of size, the more dependent companies in the CUBS sample tended to be more decentralised and specialised, and also employed larger numbers of first degree holders. Partial correlations also indicated that impersonally founded companies tended to be more structured or bureaucratic.

The nexus found in Chapter 4 between the configurational measures of lateral and vertical spans of control and complexity of overall administrative structure (SHAPE) was extended by addition of the number of operating sites. Number of operating sites, which may itself be considered as a configurational variable, was highly statistically significantly correlated with all three measures. Furthermore, most of the correlations between the four variables remained significant when size was partialled out. This result further emphasised the value of the ordinal scale of complexity

of overall administrative structure (SHAPE), and showed that companies with more complex overall administrative structures tended to be wider, taller and have larger numbers of operating sites.

Results of the multiple regression of bureaucratic characteristics and organisational complexity on contextual variables revealed that size was the most important predictor of the extent of bureaucracy. It was the only significant predictor of vertical span of control, qualifications and formalisation, and explained 57, 58 and 49 per cent of the variation in these measures. Size and number of operating sites emerged as predictors of the overall administrative structure and together accounted for 41 per cent of its variation. Size and age emerged as predictors of functional specialisation (ASPEC) and size, automaticity mode, and dependence as predictors of ESPEC, explaining 76 and 85 per cent of the variation of these measures respectively. Size and dependence were both significant predictors of decentralisation of operating decisions and in total explained 56 per cent of its variation. With exception of dependence, which explained 10 per cent of the variation in decentralisation of operating decisions, in addition to that explained by size, other contextual predictors of bureaucratic characteristics only explained very small percentages of the variance. Complexity of design and development only emerged as predictor of numbers of first and higher degree holders. It replaced dependence as the predictor of number of first degree holders and explained a greater percentage of variance (17%) in addition to that explained by size alone (61%). Complexity of design and development technology was, however, the most

important predictor of the number of higher degree holders and, together with size, accounted for 46 per cent of the variation of this measure.

ADDENDUM TO CHAPTER 5: A CRITICAL REVIEW OF THE COMPARATIVE STUDY BY HICKSON ET AL (1974)

As indicated in Chapter 3, Inkson et al (1970a) developed an abbreviated set of scales[(1)], based on the detailed scales of Pugh et al (1968, 1969a), to represent the major structural dimensions and their contextual predictors identified in the original Aston Study. The two sets of abbreviated measures were:

Structure		
Functional specialisation and Formalisation of role definitions	To represent:	Structuring of activities dimension
Autonomy of the organisation	To represent:	Concentration of authority dimension

Context		
Size		Size
Automaticity mode Automaticity range	To represent:	Workflow integration
Relative size Status Impersonality of origin	To represent:	Dependence on other organisations

The abbreviated measures were selected because of their high correlations with original full scales; their conceptual relevance; and their ease of use (Inkson et al, 1970a: 319).

Comparing the results of their survey of 40

(Note (1) - For full details, please see Chapter 3.)

organisations in the English Midlands with those of the original Aston Study, they stated:

> "The results of the replication suggests that the patterns previously established are, in fact, stable and recurring organisational phenomena in the population studied."

Following their study, a number of researchers have used the Aston abbreviated schedule. Table A1 shows the Pearson's product moment correlations for contextual/structural variables for three such studies of manufacturing organisations where information was available in the published literature, together with correlation coefficients for the 39 'manufacturing only' companies of the CUBS sample. The correlations presented are based on data collected on a sample of 21 manufacturing companies in Ohio, U.S.A., by Schewiter(2), 25 manufacturing companies in Britain, a sub-sample of 40 companies studied in the original replication by Inkson et al (1970a), and 25 manufacturing companies in Canada by McMillan (McMillan et al, 1973). The table is a part of that produced by Hickson et al (1974), where they undertook a comparative analysis of the results of the three studies of U.S., U.K. and Canadian samples.

It may be seen that correlation coefficients between company size and functional specialisation and formalisation are consistent across the four studies. The positive correlations are

(Note (2) - Inkson et al (1970b) provide for a comparison between British and American companies and McMillan et al (1973) for a comparison of sample characteristics between British, American and Canadian companies.)

Table A1 Correlation Coefficients (Pearson) between Contextual and Structural Variables for Four Studies Using the Aston's Abbreviated Schedule

		Formalisation	Functional Specialisation	Autonomy
SIZE	U.S.	48*	82***	37
	U.K.	45*	79***	01
	Canada	49**	49**	-38*
	CUBS	70***	85***	-01
PARENT CO. SIZE	U.S.	45*	52*	-02
	U.K.	60***	49**	-30
	Canada	32	23	-56**
	CUBS	48***	57***	-21
DPEENDENCE	U.S.	11	00	-54**
	U.K.	57**	02	-60***
	Canada	31	14	-42*
	CUBS	32*	36*	-39**
AUTOMATICITY MODE	U.S.	24	42*	27
	U.K.	16	13	-31
	Canada	06	13	-17
	CUBS	20	17	09

Notes: * Significant at 0.05 level
** Significant at 0.01 level
*** Significant at 0.001 level

Source: Hickson et al (1974)

significant beyond at least the 0.05 level. Causal relationships cannot be inferred using cross-sectional data, as the case is for all the samples, however, it is evident from all these studies that larger company size is associated with greater formalisation and functional specialisation, as in the Aston and National Studies. The correlations in the case of the Canadian sample are smaller than those for the other samples. Hickson et al (1974: 70) attributed this to the smaller range of scores for the Canadian companies on these measures. Parent company size is also positively correlated with formalisation and functional specialisation. The correlations in the case of the Canadian sample, however, do not reach the 5 per cent significance level. This was again attributed by Hickson et al to the narrow range of scores for the Canadian companies.

Comparing the correlations of size and parent company size with formalisation and functional specialisation across the three studies, Hickson et al (1974: 72) stated that:

> "There is probably some difference here between formalisation and specialisation. Specialisation correlates most highly with size, but formalisation correlates as much or more with parent size. It may be speculated that though the growth of an organisation increases both specialisation and formalisation it has greatest, perhaps prior, effect on specialisation". (Implying that specialists come first then generate documentation.) "But becoming a part of a big parent group has its primary effect on formalisation, by imposed conformity to recording procedures uniform to all units in the same group."

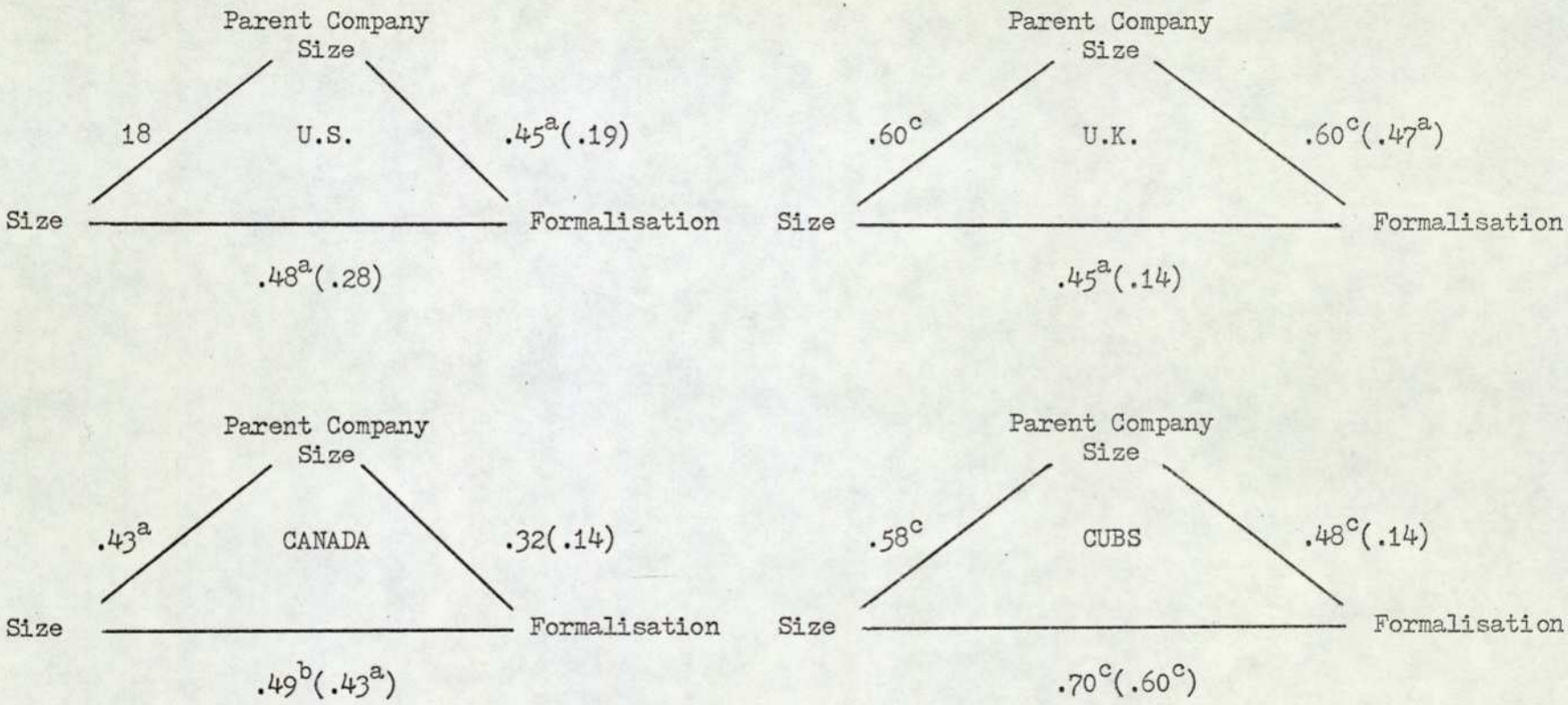
In making this statement, Hickson et al (1974) were possibly influenced by the fact that the coefficient between company size and formalisation was considerably lower than that between latter and parent size for the U.K. sample, whilst the reverse was true for functional specialisation. There is, too, considerable intuitive appeal in their argument. However, taken together, the

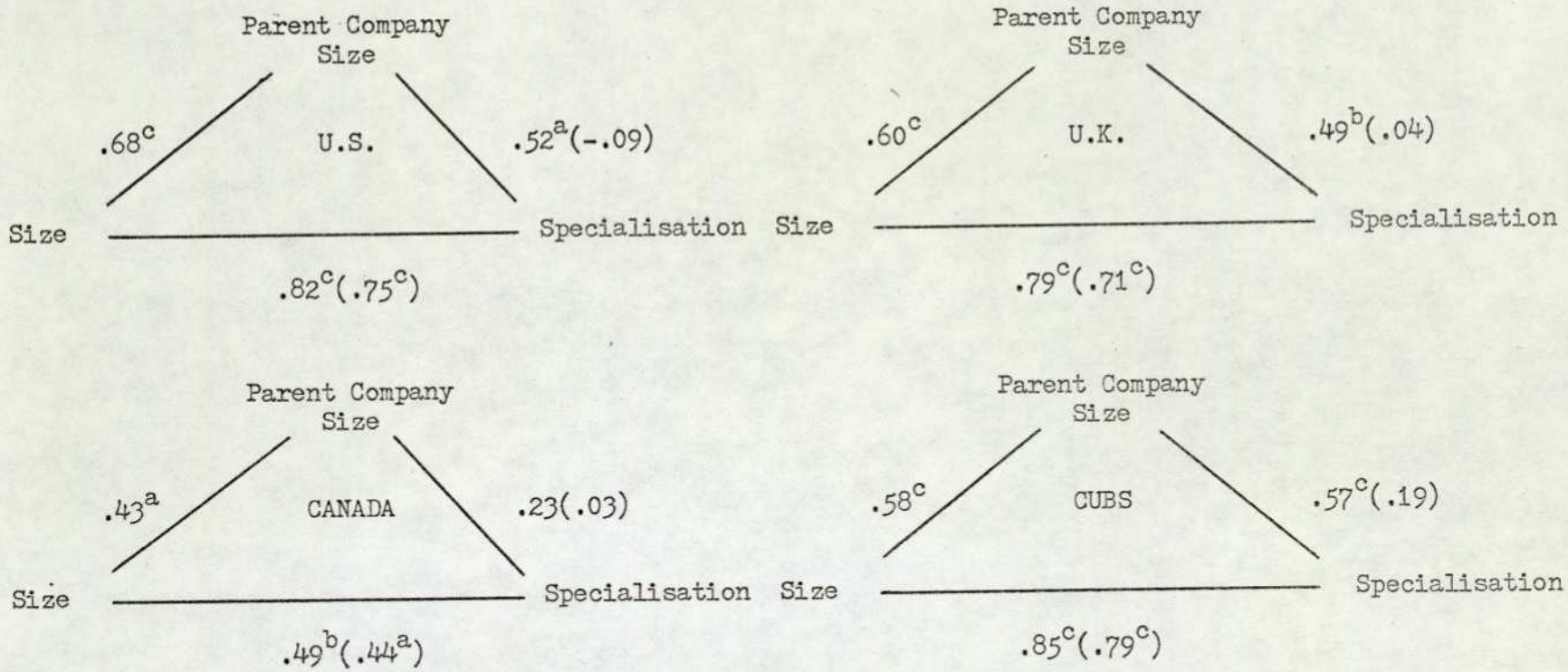
four studies compared in Table A1 provide little empirical support for the proposition. Coefficients between functional specialisation and company (unit) size are greater than those with parent company size in all studies, so this aspect of the argument is unaffected. On the other hand, for formalisation too, the coefficients for correlation with company size are higher than those for parent company size in three of the four studies, and considerably higher in the CUBS and Canadian studies. Moreover, when partial correlations are calculated on the basis of correlations provided in table, allowing for the effects of size, the correlations between parent company size and formalisation and specialisation both become insignificant, except for the"U.K." sample, where the correlation between parent company size and formalisation remains significant beyond 0.05 level. The partial correlation coefficients in Figure A1 show convincingly that, in all but the"U.K." sample, the relationships between parent company size and <u>both</u> formalisation and specialisation are attributable to company size, but not vice versa. Commenting on the relationships with autonomy, Hickson et al (1974) stated:

> "Seen across all three studies, autonomy has a curious set of relationships with size. With size of the organisation, the relationship is positive in the U.S., drops to nothing in Britain, but becomes negative in Canada: paralleling this the relationship with size of parent organisation is negligible in the U.S., becomes negative in Britain, and strongly negative in Canada". (The correlations between size and size of parent organisation are positive and fairly consistent.) (Page 73)

Earlier analysis of correlates of autonomy, and the importance of sample composition suggest that there is in fact nothing curious about the size of the correlations between company size and autonomy. The size of the correlations depends upon the distribution of company size within each status

Figure A1 Pearson's Product Moment Correlation between Size, Parent Company Size, Specialisation and Formalisation for the Four Studies





Notes: Figures in brackets are partial correlations holding the third variable constant.

a Significant at 0.05 level

b Significant at 0.01 level

c Significant at 0.001 level

category included in the sample, since small and large independent units would be expected to have a score of 23 on autonomy and large subsidiaries would also be expected to have a score of 23. It is only the small subsidiaries and branch units which would be non-autonomous. The differences between the correlations of parent company size and autonomy are due to the differences between the correlations of size with autonomy and parent company size across the three studies. Controlling for the effects of size, partial correlations between parent company size and autonomy are stable and consistent across all studies, all negative and significant beyond the 0.05 level.

Table A1 shows that the correlations between dependence and autonomy are negative and significant beyond 0.05 level across all four studies. As was discussed in Chapter 4, this is an inherent relationship due to the definitions of the two measures. However, the strength of the correlations depends on the distribution of the two variables. As may be seen from Table A2, the mean score for autonomy and dependence is not significantly different between the US, UK and the Canadian samples. The highest correlation is, therefore, obtained for the "UK" sample which has the widest range on both variables (Table A3). In contrast, companies in the CUBS sample are significantly more autonomous and less dependent. The CUBS sample also has the narrowest range on both variables, thus resulting in a lower correlation of -0.39.

The positive correlation ($P_{\alpha}<0.01$) between dependence and formalisation for the "UK" sample remains significant ($P_{\alpha}<0.05$) when size is partialled out, but in the case of the CUBS sample, the correlations between dependence and formalisation and functional specialisation become insignificant when size is partialled out.

Table A2 t Test and p Values for Dependence and Autonomy for each set of data

	Autonomy		Dependence	
	t	p	t	p
US/UK	1.07	NS	0.15	NS
US/CANADA	1.39	NS	0.17	NS
US/CUBS	7.87	<0.01	1.50	NS
UK/CANADA	0.25	NS	0.00	NS
UK/CUBS	4.68	<0.01	1.94	<0.05
CANADA/CUBS	4.62	<0.01	2.22	<0.05

Table A3 Mean, standard deviation and range of the selected measures of structure and context for the four studies

(Source: Hickson et al, 1974)

		Mean	Standard Deviation	Range
FORMALISATION	U.S.	14.4	3.5	7-20
	U.K.	10.8	4.5	2-19
	Canada	14.3	3.8	7-20
	CUBS	11.7	5.1	3-20
FUNCTIONAL SPECIAL-ISATION	U.S.	11.0	4.0	3-16
	U.K.	11.5	2.3	7-16
	Canada	13.0	1.8	10-16
	CUBS	10.3	3.7	2-16
AUTONOMY	U.S.	17.9	3.5	11-21
	U.K.	19.2	4.4	7-23
	Canada	19.5	4.0	6-23
	CUBS	22.6	0.8	20-23
SIZE	U.S.	5,150	8,400	250-25,000
	U.K.	2,650	4,000	250-18,200
	Canada	500	350	200-1,200
	CUBS	1,306	2,880	35-17,000
PARENT CO. SIZE	U.S.	50,000	144,500	250-575,000
	U.K.	33,350	43,550	300-120,200
	Canada	5,000	7,000	600-30,200
	CUBS	29,073	51,948	50-202,000
DEPENDENCE	U.S.	3.8	2.4	0-7
	U.K.	3.7	2.0	0-7
	Canada	3.8	1.2	2-6
	CUBS	2.8	2.0	0-5
AUTOMATICITY MODE	U.S.	2.2	0.7	1-3
	U.K.	2.0	0.6	1-3
	Canada	2.2	0.9	1-3
	CUBS	1.4	1.2	0-5

The lack of any association between automaticity mode and the three structural variables shows that the degree of automation of the bulk of the equipment is unrelated to these structural variables. This further supports the Aston group's findings that operations' technology, as represented by the workflow integration scale or the automaticity mode, a subscale of workflow integration, is not related to bureaucratic characteristics of organisations.

The comparisons indicate that although the four samples of companies were selected from different industrial societies, the relationships between the contextual and structural variables considered were consistent, especially those between company size and formalisation and functional specialisation, and between dependence and autonomy.

However, as suggested earlier, there are two major problems associated with the use of the abbreviated schedule. The first stems from the assumption that autonomy represents the extent of centralisation of decision making. This assumption was shown in Chapter 4 to be invalid for the purpose of generalisation beyond the specific sample in question. The second problem is associated with the generalisation of the meaning of the scale of dependence to cover the dependence of the organisation on suppliers, customers and other organisations in the environment and its subsequent use as a predictor of the extent of centralisation of decision taking.

As was discussed in Section 3.4.6, the items which were used in the original Aston Study to construct the scale of dependence were selected on the basis of the strength of their loadings on

the first factor resulting from the principal component analysis of all items which were thought by the Aston group to represent the extent of dependence of the organisation on other organisations including suppliers and customers. The greater strength of the loadings for items included in the final scale primarily defining the relationship of the organisation with its parent organisation, as opposed to items defining the relationships with other organisations, is a sample specific result, since the Aston sample included only eight independent units (17%) and the remaining 38 companies were either subsidiaries, head branches or branches where the relationships with group would be expected to be more important than relations with outsiders (Mindlin and Aldrich, 1975: 388).

The adoption of the abbreviated measures of centralisation and dependence by Inkson et al (1970a) on the basis of the strength of the correlations of the abbreviated scale with full measures is, therefore, a generalisation of the relationships specific to the Aston sample. The same criticism applies to all other studies using the abbreviated measures of centralisation and dependence. It was shown in the CUBS Study (Chapter 4), that centralisation and autonomy were unrelated and that dependence, although negatively related to autonomy, was negatively related to the extent of centralisation of decision making, contrary to the Aston findings. Negandhi and Reimann (1973), who used the abbreviated measure of dependence(3) but measured centralisation as the extent

(Note (3) - They applied public accountability measures to the focal organisation.)

of participation in decision making in a sample of 30 manufacturing companies in India, also found that dependence was positively correlated with decentralisation. It must be stressed, however, that this argument does not question the validity of use of measures of autonomy and dependence, as long as they are used to represent what they measure. The objection is to their use as proxies for other variables on the basis of the findings of the original Aston Study which would appear to be highly dependent on peculiarities of the sample composition.

PART C

BUREAUCRACY, MANAGEMENT

STYLE AND STRATEGY

CHAPTER VI

MANAGEMENT STYLE

6.1 INTRODUCTION

Prior to emergence of contingency management approach, the classical and then the behavioural theorists tended to advocate one type of management system for all organisations, regardless of their internal and external settings. The classical managment theorists, like Taylor (1947) and Fayol (1949), were most concerned with tasks, structure and economic efficiency. The behavioural theorists mostly emphasised the importance of human factors and interpersonal relationships (Mayo, 1957). The contingency approach to management of organisations promoted the view that the type of management style suitable to a particular organisation is contingent upon the internal setting and external environmental conditions in which the organisation operates.

Burns and Stalker (1961), in their in-depth study of 20 manufacturing firms in the electronics and textile industries in Britain, identified two distinctly different approaches to management, which they called mechanistic and organic. Mechanistic management was characterised by high differentiation or functional specialisation, precise role definitions and a hierarchical structure of control, authority and communications, whilst organic management was characterised by continual adjustment and re-definition of individual tasks, and a network structure of control, authority and communications. They proposed that the type of

management system adopted was influenced by the rate of change of market and technological conditions in the environment and that a good fit between the environment and the managment system adopted resulted in better economic performance. The mechanistic system was found to be appropriate to stable market and technological conditions, and the organic management system appropriate to changing market and technological conditions. They also suggested that the two systems represented the extreme poles of a continuum and that, depending on the rate of change of environmental conditions, organisations may have management systems with some characteristics of both systems (Burns and Stalker, 1961: 120 - 122).

Woodward (1965) suggested that the pattern of organisation - structure and management system adopted varied according to technology. She proposed that the fit between technology and type of management system adopted also resulted in better performance. In her study of 100 firms in South Essex, the firms in both the 'unit and small batch' and 'continuous process' technology categories adopting organic management systems, and the firms in the 'mass production' technology category adopting mechanistic management systems, were among the more successful.

The concept of mechanistic-organic management systems acquired a great deal of importance and has been used in a number of empirical studies which followed the work of Burns and Stalker (1961). Keller et al (1974) measured management systems for a sample of 44 companies in continuous production in the U.S.A. by using a Likert type questionnaire based on the work of Duncan (1971), Hall (1963) and Galbraith (1970). The factor analysis of the management

system items resulted in three factors, which they named: impersonal hierarchy, group decision making and rules for decision making. The results of this study confirmed Woodward's (1965) assertion that adoption of organic management system[1] in companies with process production technology was associated with higher economic performance.

Lansley et al (1974) regrouped the items in the list of characteristics of mechanistic-organic management systems given by Burns and Stalker (1961) into three separate groups, which they called: control, integration and environmental orientation. They argued that, based on their observation of the real situation in companies, Burns and Stalker's characteristics could not be usefully reduced to a single dimension. Using the first two dimensions of control and integration, they developed a fourfold classification:

> "Using this approach a fourfold typology emerges. The Burns and Stalker's mechanistic type represents the situation in which control is high but integration is low. The organic type involves high integration and low control. The remaining two categories - high control, high integration and low control, low integration have been labelled respectively, bureaucratic and anarchic." (P. 470)

Lansley et al (1974) also measured the extent of task/people orientation of top management of the 50 firms in their sample[2]. The results of their study indicated that for the firms in the printing industry, the successful firms were characterised by bureaucratic

(Note (1) - Characterised by a de-emphasis on impersonal hierarchy, emphasis on group decision making and de-emphasis of rules for decision making.)

(Note (2) - 25 firms in the printing industry
25 firms in the building industry.)

structures and task oriented management styles and that among the building firms with more diverse tasks and environmental conditions, those with high task/high people orientation in style and structures appropriate to the task and degree of required control were among the better performers.

A parallel development in the identification of different management systems, of which there has been a number of replications, is the work of Likert (1961, 1967). He postulated four systems of management: (1) exploitive authoritative; (2) benevolent authoritative; (3) consultative; and (4) participative group. He defined the characteristics of these systems in terms of leadership, motivation, communication, interaction, influence, decision making, goal setting and control processes. The questionnaire measuring the management systems along these dimensions is known as Likert's organisational profile.

Likert's organisational profile has been used to measure managment systems of organisations in numerous studies. Butterfield and Farris (1974) administered the questionnaire to a sample of employees in Brazilian development banks and attempted to test the reliability and factor structure of Likert's organisational profile.

A more comprehensive approach toward identification of management systems is the recent empirical study of 103 Canadian firms by Khandwalla (1974a, 1977). Following the statement of Krech, Crutchfield and Ballachey(1962: 402) that: "the ideology of a group consists of common beliefs, common values and common norms", he stated that the members of the top management tend to

develop what may best be described as an ideology and that if ideology is the invisible network of values, beliefs and norms, the management style is its visible, operating manifestation (Khandwalla, 1977: 394). He thought of the management style as a critical mediating factor between the organisation's environment and its strategy for growth and survival.

Based on the identification of various management systems by theorists, Khandwalla (1977) conceptualised eight different management systems and developed scales for their measurement. The eight management systems being: the mechanistic and organic styles (Burns and Stalker, 1961); the participative, human relations-oriented style (Likert, 1961, 1967); the political, power-oriented, autocratic style (McGregor, 1960); the seat of the pants, judgment-oriented, intuitionist style and the planning-oriented, technocratic style (Lindblom, 1959); the conservatively adaptive style and the risk-taking, innovation-oriented, entrepreneurial style (Mintzberg, 1973). He suggested that most managment systems found in organisations would be a combination of these styles. He considered a number of environmental factors, together with age and size of the firms, as determinants of management styles. However, the results of his study indicated that the same situational factors gave rise to adoption of different styles: "given the situational factors, the choice among management styles is circumscribed but not eliminated", (Khandwalla, 1977: 426). Relating the management styles adopted by the firms operating under different environmental conditions to measures of economic performance, he further identified certain combinations of styles associated with high economic performance.

A review of the current state of research indicates that the studies on the contingency approach to management of organisations clearly suffer from a number of limitations:

(1) The consideration of the relationships between internal contingencies and management systems adopted by companies has been limited to one or two factors only. (Woodward (1965), Keller et al (1974): technology and Khandwalla (1974a): size and age);

(2) There are very few empirical studies to date relating organisational structural variables to management style, for example, Negandhi and Reimann (1974) investigated the relationship between management concern for task environment agents and the extent of decentralisation; and

(3) Apart from Khandwalla's work, only a few studies have investigated empirically the relationships between environmental conditions and the type of management systems adopted (Lawrence and Lorsch , 1967; Negandhi and Reimann, 1974; Boseman and Jones,1975).

These limitations may be overcome by considering a wider range of internal and external contingencies in relation to management systems adopted in organisations.

The aim of this chapter is therefore to develop empirically a set of scales on which different styles of management may be measured and to relate these to a wider range of contextual and structural characteristics, which have been considered in Chapters III, IV and V.

Khandwalla's work on the measurement of management systems,

providing a more comprehensive approach than other empirical studies, was adopted in the CUBS Study, with a number of modifications. The scales used for measurement of management style are presented in Section 6.2. Section 6.3 provides an analytical approach to identification of the underlying dimensions of management systems by use of factor analysis. The final scales used in the CUBS Study are presented in Section 6.4. The relationships between structural characteristics and management styles adopted by companies are discussed in Section 6.5 and the contextual correlates of management systems are considered in Section 6.6. A summary and discussion of the results of this Chapter is presented in Section 6.7.

6.2 SCALES

Khandwalla's (1974a) measures of management style were based on an intuitive grouping of a number of seven point Likert type scales. Each scale represented characteristics of two opposing styles at the extremities and the respondents were asked to indicate the position on each scale describing most accurately the management style adopted in their company. The following are examples of two of the six scales developed to measure the mechanistic versus the organic styles:

Tight control of operations through sophisticated control systems	1	2	3	4	5	6	7	Loose, informal control; emphasis on norm of cooperation
Strong emphasis on always following formally laid down procedures	1	2	3	4	5	6	7	Strong emphasis on getting things done even if this means disregarding formal procedures

Scores on the six scales were aggregated, a high score representing organic management style and a low score representing mechanistic management style. Similar procedures were used to obtain scores for companies on other management style dimensions.

Khandwalla's conceptualisation of management styles and the scales developed for their measurement offer a comprehensive approach to the evaluation of management style of companies. However, his method of scoring somewhat limits the choice of the respondents in describing the management style of their companies. The following

two examples of the four scales developed for measurement of technocratic, planning, versus seat of the pants, intuitionist styles, clearly illustrate the limitation:

Great reliance on specialised, technically trained personnel	1	2	3	4	5	6	7	Great reliance on experience and common sense in decision making
Heavy reliance on formal management training programmes	1	2	3	4	5	6	7	Heavy reliance on apprenticeship and learning by hard knocks

The extremities of the scales are not mutually exclusive. In a company where there is equal emphasis on the conditions described by the extremities of the two scales, the respondents would be forced to choose the midpoint of the scale and this would tend to distort the results.

The operational definitions of the management styles developed by Khandwalla (1974a) were used in the CUBS Study. However, in view of the above argument, the scales were separated to correct the limiting effect. The two scales considered above were changed to:

Perceived extent throughout the organisation of:

(1) Reliance on specialised, technically trained personnel in decision making.

(2) Reliance on experience and common sense in decision making.

(3) Reliance on formal management training programmes.

(4) Reliance on apprenticeship and learning by hard knocks.

The scores allocated were: (1) very little; (2) little;

(3) some; (4) quite a lot, and; (5) a great deal. This method of scoring would enable the respondent in a company with great reliance on Conditions 1 and 2 to score 5 on both and the respondent in a company with differences in the extent of reliances on Conditions 1 and 2 to be scored accordingly. Khandwalla's (1974a) questionnaire also contained items typified by:

> "In attempting organisational change, do management: implicitly or explicitly threaten members of the organisation with serious consequences of resisting management orders:
>
> Seldom used 1 2 3 4 5 6 7 Used very extensively"

Questions of this type were scored on a five point scale as follows: (1) never; (2) rarely; (3) sometimes; (4) most times, and; (5) always. This procedure would give consistency to the scoring of the questions on management style. The wording of the questions was also modified where necessary.

A total of 44 items were generated and used for measurement of management style. These are presented in Appendix A, together with the scoring procedure.

6.3 DIMENSIONS OF MANAGEMENT STYLE

In order to determine the underlying dimensions of management style, the data on the 44 variables was subjected to principal component analysis with and without iteration and varimax, equimax and oblique rotated solutions were obtained. Due to the existence of a few variables with approximately equal multiple loadings on a number of factors, slightly different clusters of variables (chosen on the basis of highest loadings) were obtained. Principal component analysis with iteration resulted in 15 factors with eigenvalues greater than unity, explaining 80.8 per cent of the total variation in the data, which were subsequently retained for rotation. Table 6.3.1 shows the resulting factor pattern matrix after oblique rotation (oblimin technique, $\delta = 0$). The oblique rotation was preferred since the orthogonality condition attached to the varimax and equimax rotated solutions imposed an analytical constraint on the formation of clusters. The variables marked by * in Table 6.3.1 had highest loadings, which were at least significant beyond 0.05 level on the corresponding factors of the structure matrix. The factor pattern matrix shown illustrates more clearly the clustering of the variables. Clusters of variables selected on the basis of their highest loadings on the structure matrix are shown in Table 6.3.2. As may be seen, there is a certain degree of overlap between the analytical grouping of the variables and the intuitive grouping by Khandwalla.

Table 6.3.1 Principal Component Analysis of Management Style Items (Oblique Rotation, δ=0, N=45)

FACTOR PATTERN MATRIX

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15
Style 1	-.04	.16	.64*	-.03	-.21	.05	.12	-.27	.17	.04	.00	-.05	.12	.06	.05
Style 2	-.05	.13	.01	-.08	.12	-.06	.08	-.07	-.14	.10	.02	.80*	-.03	-.03	.05
Style 3	-.01	-.06	.12	-.77*	.06	.02	-.03	-.16	.08	-.16	-.17	.07	.05	.00	.11
Style 4	.04	.33	-.36	.31	-.10	.09	.10	.08	-.05	.17	.31	.08	.34*	-.08	.03
Style 5	-.11	.08	.13	-.05	.43	.12	-.04	-.09	-.02	.36	.00	-.47*	.00	-.03	.29
Style 6	.18	.02	-.26	-.07	-.16	.10	-.00	.17	.05	-.49	.06	.41*	.12	.06	-.01
Style 7	-.09	-.03	-.19	-.72*	-.12	-.06	.08	.03	-.06	.17	.13	.00	.05	.01	.00
Style 8	.14	.12	.21	.20	.16	-.07	.31	-.08	-.11	-.59*	-.03	-.21	.03	-.07	-.08
Style 9	.21	.79*	.07	.00	.10	.05	-.06	.02	.09	-.01	-.03	.11	-.00	-.02	.03
Style 10	.12	-.57*	-.29	-.04	.17	-.06	.29	.24	-.04	.21	.22	-.17	-.08	.30	-.09
Style 11	-.08	.27	-.02	-.15	-.29	-.05	.11	.57*	-.00	-.29	.00	-.16	.01	-.25	.08
Style 12	.05	.09	-.09	-.02	.62*	-.16	-.02	-.34	-.02	.05	.10	-.11	.01	-.08	-.00
Style 13	-.03	.47*	.18	.05	-.11	.06	.21	.23	.27	.12	.09	.10	.08	.04	.09
Style 14	.12	-.10	-.08	-.20	.25	-.04	.25	-.46*	-.05	.03	-.11	-.13	-.15	.13	.28
Style 15	.05	-.14	.23	-.00	.04	.11	.05	.32*	.17	-.15	.12	.36	.00	-.12	.11
Style 16	.23	-.03	.21	-.21	.22	.01	-.06	.38*	.32	-.12	.20	-.05	-.25	.01	.08
Style 17	-.06	.11	-.02	.02	.01	-.06	.06	-.07	.03	-.02	.02	-.03	.04	.75*	.01
Style 18	-.04	.28	-.17	.03	.11	-.05	.10	-.03	.05	.11	.10	.29	.42*	-.26	-.24
Style 19	-.16	.74*	-.03	.12	.12	-.15	.08	.03	-.08	-.03	.04	-.02	-.08	.17	-.01
Style 20	.17	.16	-.28	.03	-.17	.23	.13	.05	.11	.12	-.15	.01	-.56*	.06	-.20
Style 21	.05	.40*	.08	-.35	.19	.10	-.41	.12	.01	-.14	.08	.07	-.03	.13	-.10
Style 22	.13	.11	.63*	.10	.04	.04	.11	.17	.01	.01	.15	.01	.01	.07	.04
Style 23	.03	.08	.10	-.03	-.10	.01	.75*	.01	.03	-.07	.07	.22	.02	.19	-.01
Style 24	-.04	.03	-.06	-.01	.05	-.05	.16	-.00	.77*	-.04	.06	-.12	-.04	-.06	-.05
Style 25	.31	-.05	-.00	-.18	-.02	.05	.38*	-.05	.04	-.04	-.12	-.17	.44	-.03	-.14
Style 26	-.05	.01	.10	-.04	-.05	.20	.02	-.20	.24	.07	.71*	.15	.09	.04	-.21
Style 27	-.08	-.07	.07	-.09	.14	-.02	.48	-.00	.24	-.04	-.52*	.01	-.18	.05	-.10
Style 28	.00	.01	-.09	.11	.06	-.19	-.02	.68*	-.03	.08	-.12	.03	-.04	.06	.07
Style 29	.00	-.27	-.08	.21	.26	-.19	-.07	-.16	.38*	-.09	.05	-.06	.08	-.15	.21
Style 30	-.34*	.03	-.07	.19	.11	.15	-.04	-.06	.03	-.29	-.29	-.09	.32	.14	-.02
Style 31	-.00	-.15	.11	.03	-.11	.86*	.10	-.07	-.10	-.00	-.07	-.05	.14	.00	.08
Style 32	-.12	.12	-.17	.03	-.01	.71*	-.19	-.15	.04	-.34	.26	-.07	-.26	.02	.09
Style 33	-.94*	-.03	-.03	-.03	.00	.02	.11	.02	.04	.02	-.01	.14	-.16	.01	.02
Style 34	-.21	-.01	.08	-.04	.10	.74*	-.03	-.03	-.02	.23	.05	.09	-.21	-.27	-.06
Style 35	-.60*	.07	.07	-.04	.13	.27	-.03	.09	-.07	.12	.05	-.21	.20	-.05	-.22
Style 36	-.65*	-.03	-.01	-.21	-.15	.04	-.30	.00	-.02	.01	.11	-.22	.25	.04	-.16
Style 37	.02	.11	-.11	-.14	-.10	-.00	-.06	-.03	.01	-.00	.03	.08	.03	.03	.77*
Style 38	-.02	.12	-.23	.02	.46*	.40	-.03	-.01	.08	-.04	-.15	-.07	.11	.11	-.05
Style 39	.06	-.06	.16	.15	.10	.15	.10	.16	-.07	.04	-.12	-.04	-.00	-.00	.68*
Style 40	.10	-.12	.23	-.19	.13	.04	.06	.15	-.13	.10	.10	.01	-.11	.42*	.08
Style 41	.09	.04	.20	.16	-.19	.01	-.12	.09	.55*	.29	-.04	-.09	.25	.17	.26
Style 42	.02	.06	.22	-.11	-.15	.02	-.27	-.03	.67*	.09	-.04	.22	-.06	.23	-.13
Style 43	-.05	.07	.01	.12	.84*	-.01	-.01	.14	-.01	-.03	-.12	.18	.06	.17	-.00
Style 44	.06	.09	-.08	.04	-.04	.27	-.06	.00	-.11	.25	-.47*	.04	.17	-.23	-.03
Sum of squared loadings	2.27	2.49	1.80	1.84	2.24	1.91	1.79	1.86	1.98	1.28	1.62	1.77	1.48	1.42	1.71

Note: * Highest loading of each item which was at least significant beyond the 0.05 level on the corresponding factor structure matrix.

Table 6.3.2 Principal Component Analysis of Management Style Items (Oblique Rotation) (N=45)

(Note: For all items marked by (§), positive loading represents high scores on the scale: Never 1 - - - 5 Always: and for the remainder of the items, positive loading represents high scores on the scale: Very little 1 - - - 5 A great deal.

* The item was excluded from the scale, since it was not conceptually a part of the cluster.)

Factor 1	Participative/Non-Participative (A)	Position of decision items on Khandwalla's (1974a) intuitive grouping
Loading	The extent to which the following decisions are taken by the board, committees of the board or other important meetings of company personnel.	
+ve	(1) Level of operation of products or services*.	
+ve (§)	(2) Capital budgeting.	
+ve (§)	(3) Entry into new fields of business activity.	
+ve (§)	(4) Acquisition of other companies.	Participative, human relations oriented style.
	(Coeff. alpha: 0.869)	

Factor 2 — Mechanistic/Organic

Loading	The extent of top management emphasis on:
+ve	(1) Following the formally laid down procedures.
-ve	(2) Getting things done even if it means ignoring formal procedures.
+ve	(3) Use of quantitative methods in decision making.
+ve	(4) Highly structured channels of communications.
+ve	(5) Formal authority in decision making.

(Coeff. alpha: 0.753)

Mechanistic/organic

Factor 3 — Technological Leadership

Loading	The extent of top management emphasis on:	
+ve	(1) Technological leadership and innovation.	Innovation oriented, risk-taking, aggressive style.
+ve	(2) Reliance on technically trained personnel in decision making.	Technocratic planning oriented style.

Factor 4	Risk Taking	
Loading	The extent of top management emphasis on:	
+ve	(1) Bearing high risks to obtain high rates of return on investment.	Innovation oriented, risk taking, aggressive style.
+ve	(2) Undermining major competitors.	

Factor 5	Aggressively Adaptive	
Loading	The extent of top management emphasis on:	
+ve	(1) Adapting freely to changing circumstances without too much concern for past experience.	Mechanistic/organic.
+ve (§)	(2) In attempting organisational change, the extent to which top management implicitly or explicitly threaten members of the organisation with consequences of resisting management orders.	Arbitrary, power oriented, autocratic styles.

Factor 5
(continued)

+ve (§)	(3) In attempting to resolve conflict between different groups in the organisation, the extent of use of arbitration procedures. (Coeff. alpha: 0.703)	Arbitrary, power oriented, autocratic styles.

Factor 6 — Participative/Non-Participative (B)

Loading — The extent to which the following decisions are made by the board, committees of the board or other important meetings of the company personnel.

+ve (§)	(1) R & D of new products and services.	Participative, human relations oriented style.
+ve (§)	(2) Product mix, distributive channels, advertising and promotion.	
+ve (§)	(3) Entry into new markets.	
	(Coeff. alpha: 0.805)	

Factor 7 — Traditional

Loading	The extent of top management reliance on:	
+ve	(1) Experience and common sense in decision making.	Seat of the pants, judgment oriented, intuitionist style.
+ve	(2) Learning by apprenticeship and by hard knocks.	

Factor 8 — Conservative (Decision Making and Change)

Loading	The extent of top management emphasis on:	
+ve	(1) Holding fast in the face of change to management practices found successful in the past.	Mechanistic/organic.
-ve	(2) Supporting situational expertise in decision making, even if it means ignoring formal authority.	Mechanistic/organic.
+ve	(3) Requiring throughout the company the same approaches to dealing with subordinates.	Mechanistic/organic.

Factor 8
(continued)

+ve	(4) Requiring throughout the company the same approaches to planning on-going and new activities and use of management services.	Mechanistic/organic.
+ve (§)	(5) The extent to which decisions taken by the board may be described as cautious, one step at a time adjustment to the problem.	Conservative

(Coeff. alpha: 0.626)

Factor 9 — Training Orientation

Loading		
+ve	(1) The extent of top management reliance on formal management training programmes.	Participative, human relations orientation.
+ve (§)	(2) The extent to which board decisions may be described as active searching for big new opportunities, large decisions despite the uncertainty of the outcome*.	Innovation oriented, risk taking, aggressive style.

Factor 9
(continued)

+ve (§)	(3) In attempting organisational change the extent to which top management emphasises provision of training of those involved in the new methods and procedures required by change.	Participative, human relations orientation.
+ve (§)	(4) In attempting to resolve conflict and for improving coordination, the extent to which top management emphasises provision of human relations training for managers to make them understand better their colleagues and subordinates and help them communicate more efficiently.	"

(Coeff. alpha: 0.752)

Factor 10 — Cooperation with Competitors

Loading		
+ve	(1) The extent of top management emphasis on cooperative co-existence with major competitors.	Conservative

Factor 11		Informal, Autocratic	
Loading	The extent of reliance on:		
-ve	(1)	Written communications within a consciously designed information system for control of operations (including computer based systems).	Mechanistic/organic.
+ve	(2)	Spontaneous, informal communications for control of operations.	Mechanistic/organic.
+ve (§)	(3)	The extent of use of authority by top management in conflict resolution.	Arbitrary, power oriented, autocratic.
		(Coeff. alpha: 0.473)	
Factor 12		Conservative (Growth)	
Loading	The extent of top management emphasis on:		
+ve	(1)	Marketing true and tried products and avoidance of heavy R & D costs.	Conservative
-ve	(2)	Growth through external financing.	Conservative.

Factor 12
(continued)

+ve	(3) Growth through internally generated funds. (Coeff. alpha: 0.689)	Conservative.

Factor 13 — Risk Aversion

Loading	The extent of top management emphasis on:	
+ve	(1) Avoiding high risks at a cost of achieving only a moderate ROI.	Conservative.
+ve	(2) A bird in the hand emphasis on immediate future.	Seat of the pants.
-ve	(3) Restriction of flow of important information.*	Mechanistic/organic.

Factor 14		Planning Orientation	
+ve	(1)	The extent of top management emphasis on long-term planning of goals and strategy.	Technocratic, planning orientation.
+ve (§)	(2)	The extent of use of outside experts to investigate problems and propose changes.	Arbitrary, power oriented, autocratic.

Factor 15		Human Relations Orientation	
Loading			
+ve (§)	(1)	In attempting organisational change, the extent to which top management involves fully those likely to be affected in every stage of the change programme.	Participative, human relations oriented.
+ve (§)	(2)	Explain concepts underlying change to those affected by it.	"

In order to reduce the number of factors and investigate their inter-relationships, 15 scales were constructed by summation of scores of the variables in each of the clusters. The items with negative loadings were reverse scored before addition. The newly constructed variables were subjected to principal component analysis. Results of the varimax and oblique rotations were very similar and the obliquely rotated factors were virtually uncorrelated. The varimax rotation, however, produced more distinct clustering of the variables. Table 6.3.3 shows the varimax rotated principal components. The first six factors account for 44.6 per cent of the total variance. Apart from the highest loadings for clusters 11 and 15, which were significant at the 0.05 level, the highest loadings for other clusters were significant beyond the 0.01 level. A number of clusters also had loadings significant beyond 0.05 and 0.01 on more than one factor. The following grouping of the clusters from first stage factoring was obtained:

Factor 1 Technocratic versus seat of the pants, arbitrary, power oriented management style.

1st Stage Clusters		Significance of Loading
+MS2	Mechanistic/organic	0.01
+MS3	Technological leadership	0.01
+MS9	Training orientation	0.01
-MS11	Informal, autocratic	0.05
+MS14	Planning orientation	0.05

Table 6.3.3 Principal Component Analysis of the 15 Management Style Scales (Varimax Rotation, N=45)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
MS 1	.02	.24	-.45**	-.27	-.24	.46**
MS 2	.54**	.24	.13	-.06	.23	.19
MS 3	.62**	-.22	.04	.23	.00	.07
MS 4	-.00	-.04	.08	.03	-.66**	.02
MS 5	-.07	.05	-.48**	-.02	.28	.00
MS 6	.08	.01	-.12	-.10	-.07	.53**
MS 7	.05	.14	.09	.84**	-.08	-.18
MS 8	.25	-.09	.57**	-.06	.02	-.04
MS 9	.52**	-.09	.11	-.05	-.07	-.07
MS 10	-.00	-.02	-.07	.43**	.45**	-.12
MS 11	-.32*	-.26	-.12	.29	.16	.09
MS 12	.02	.35*	.60**	.06	-.01	-.09
MS 13	.02	.70**	.13	-.00	.28	.17
MS 14	.31*	-.18	-.20	.02	-.24	-.43**
MS 15	.14	-.37*	.09	-.06	.07	-.02
% of total variance	8.52	7.21	8.65	7.64	6.95	5.60

Notes: * Significant beyond 0.05 level

** Significant beyond 0.01 level

The grouping of clusters represents a technocratic approach to management of the organisation. Top management emphasis is on rational, technocratic approaches to planning, control, co-ordination, decision making, institution of organisational change and conflict resolution. The factor is characterised by high emphasis on technological leadership, innovation and long-term planning of goals and strategy. In decision making, top management relies heavily on specialised, technically trained personnel and use of quantitative methods.

The high emphasis on formal authority in decision making perhaps arises due to the fact that the positions of formal authority are filled by specialised, technically competent management. For control of operations, the emphasis is on following the formally laid down procedures, use of structured channels of communication and use of written communications within a consciously designed information system.

Top management also heavily relies on formal management training programmes and emphasizes training of employees in new methods and procedures required when introducing organisational change. In attempting to resolve conflict between different groups in the organisation and for improving co-ordination, the emphasis is on provision of human relations training for managers to make them understand their colleagues better and to communicate more efficiently, as well as a de-emphasis on use of authority. As will be shown in Section 6.5, this grouping of management systems characterises the management systems adopted by the more structured, bureaucratised companies in the CUBS sample.

With loadings reversed in sign, the factor represents a management system which may best be described as seat of the pants, arbitrary and power oriented, with little emphasis on long-term planning and technological leadership. In decision making, there is little reliance on technically trained personnel, use of quantitative methods and formal authority. Operations are controlled by spontaneous, informal communications. Conflict between various groups in the organisation is resolved by exercising authority on the part of top management and there is little reliance on formal management training programmes and training of employees when introducing organisational change.

Factor 2 Conservative, risk aversion versus growth oriented, risk taking style.

1st Stage Clusters		Significance of Loading
+MS12	Conservative (Growth)	0.05
+MS13	Risk aversion	0.01
-MS15	Human relations orientation	0.05

The grouping of the first stage clusters on this factor represents a conservative top management attitude towards growth and risk taking and also a non-participative, human relations orientation towards organisational change. Top management emphasis is on the immediate future, on avoiding high risks at the cost of achieving only a moderate return on investment and on marketing true and tried products, as well as avoidance of heavy research and development costs. Growth is only to be achieved through internally

generated funds and not through external financing. Organisational change decisions are rarely arrived at by full participation of employees affected by the change or by consensus seeking, democratic means.

Loadings reversed in sign describe a risk taking, growth oriented management style. The emphasis is on growth through external financing. There is less emphasis on the immediate future, marketing of true and tried products and avoiding high risks. Top management also emphasizes full participation of employees when introducing organisational change.

Factor 3 Conservative versus aggressive adaptation

1st Stage Clusters		Significance of Loading
-MS1	Participative/non-participative (B)	0.01
-MS5	Aggressively adaptive	0.01
+MS8	Conservative (decision making and change)	0.01
+MS12	Conservative (growth)	0.01

The grouping of the first stage clusters on this factor represent a conservative approach towards decision making, growth, change, methods of dealing with organisational change and conflict resolution. Top management emphasis is on growth through internally generated funds , on marketing true and tried products, and on avoidance of heavy R & D costs. Top management decision making is characterised by cautious, one step at a time adjustment to the

problem. There is high emphasis on holding on to tried management practices in the face of changing circumstances. There is also high emphasis on uniform managerial styles throughout the company with respect to dealing with subordinates and planning of on-going and new activities. In attempting organisational change, management does not resort to threatening behaviour and arbitration procedures are not used in conflict resolution. There is also a propensity for major marketing and strategic decisions to be made by an individual and not in formal meetings of senior management.

Loadings reversed in sign describe an aggressively adaptive management style. The emphasis is on growth through external financing with little emphasis on marketing true and tried products. There is high emphasis on adapting freely to changing circumstances without too much concern for past experience and managerial style with respect to dealing with subordinates and planning of activities is allowed to vary within the company. In decision making, management heavily supports situational expertise, even if it means temporarily ignoring formal authority. In attempting organisational change, management goes as far as threatening the members of the organisation with the consequences of resisting management orders and uses aribration procedures as a means of resolving conflict between aggrieved parties. Major strategic decisions are arrived at by top management participation.

Factor 4 Traditional

1st Stage Clusters		Significance of Loading
+MS7	Traditional	0.01
+MS10	Cooperation with competitors	0.01

The grouping of the two first stage clusters on this factor represents a traditional approach to the management of the organisation. Top management relies heavily on experience and common sense in decision making and on learning by apprenticeship, and emphasizes co-operative co-existence with major competitors.

Factor 5 Risk taking versus risk aversion

1st Stage Clusters		Significance of Loading
+MS4	Risk taking	0.01
-MS10	Cooperation with competitors	0.01

The grouping of the two clusters on this factor clearly represents a risk taking management style. The emphasis is on bearing high risks to obtain high rates of return on investment and on undermining major competitors. There is also a de-emphasis on co-operative co-existence with major competitors. The opposite of this clearly represents a risk averting style.

Factor 6 Participative/non-participative

1st Stage Clusters		Significance of Loading
+MS1	Participative/non-participative	0.01
+MS6	" "	0.01
-MS14	Planning orientation	0.01

The grouping of the two participative clusters on this factor represents a management system where all major strategic decisions are taken through formal participation of management at the board, committees of the board, or other important meetings of company personnel. Surprisingly, a de-emphasis on long-term planning of goals and strategy is associated with participative decision taking. The expected association would be in the positive direction. However, it is also reasonable to expect absence of any relationship between participation and long-term planning, since there is no reason for major strategic decisions not to be taken through participation of top level executives, even in companies with little emphasis on long-term planning. Examination of the correlations between scales for the three clusters indicated that top management participation in capital budgeting, entry into new fields of business activity and acquisition of other companies (cluster 1), was not correlated with long-term planning. However, cluster 2, relating to major product development and marketing decisions was negatively, although not statistically significant at the 0.05 level. One possible explanation is that major marketing decisions may be taken by the responsible top executive in companies with high emphasis on long-term planning, where alternatives may have already been evaluated

at the planning stage and presented to the executive responsible for decision taking. Another possible explanation is that high emphasis on long-term planning may not necessarily mean that the company actually engages in long-term planning.

Loadings reversed in sign represent a non-participative management style where major strategic decisions are taken by individuals.

6.4 FINAL SCALES USED IN THE ANALYSIS

In order to develop final scales representing management styles of companies, the items in the first stage clusters making up each group in the second stage factoring were pooled and subjected to tests of reliability. The pattern of inter-item and item-total correlations for five of the six factors revealed that scales constructed by summation of individual style items forming a group in the second stage factoring would be improper.

Comparison of the pattern of correlations of composite scales and items making up the scales with structural and contextual variables also revealed that a number of relationships would be masked by using the composite scales. However, scales constructed on the basis of the items in each of the first stage clusters were highly reliable(1) and the pattern of correlations of items and total scales with structural and contextual variables was consistent. Fourteen scales were constructed by summation of item scores of the first stage clusters. Cluster 10, containing one item only was excluded from the analysis.

(Note (1) - Reliability coefficient alpha was calculated for each scale and the values are shown in Table 6.3.2.)

6.5 STRUCTURAL CORRELATES OF MANAGEMENT STYLE

6.5.1 Technological Leadership and Planning Orientation Styles

Tables 6.5.1 and 6.5.2 show the correlations between structural variables considered in the CUBS Study (Chapters 3 and 4) and the management style dimensions for the full and 'manufacturing only' samples respectively. As may be seen, technological leadership and planning orientation styles have almost the same structural correlates. Vertical span of control, formalisation, functional specialisation, complexity (qualifications) and decentralisation of operating decisions are statistically significantly positively correlated with technological leadership and planning orientation styles[(1)]. This group of structural variables was shown in Chapter 4 to be highly statistically significantly intercorrelated.

Multivariate analysis of structural variables also showed that these variables represented the extent of structuring of activities or bureaucratisation. The pattern of correlations therefore indicates that technological leadership and planning orientation styles are found in companies with a greater extent of structuring or bureaucratisation. As will be shown in Section 6.6, technological leadership management style is adopted by companies in the more technologically sophisticated sectors of the electrical engineering industry. In these companies, the high emphasis on technological leadership is associated with the

(Note (1) - Although in some cases the correlations are small and do not reach the 5% significance level, they are strongly suggestive of a positive relationship. Moreover, as may be seen from Tables of partial correlations (Tables 6.5.3 and 6.5.4), most of the relationships are independent of size.)

Table 6.5.1 Correlations between structural variables and management style (N=45)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation 1	Training orientation 2	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively adaptive	Human relations orientation	Autocratic	Traditional
1. Chief executive's span of control	-	-20*N	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Subordinate ratio	-28*	-	16SN	-	-	-	-	-	33*	-30**N	-30*	-	-24*N	-	-16SN
3. Vertical span of control	15SN	18*N	22*N	-	18*N	28*	-	-	-	-	-	-	-20S	-28*	-
4. Administrative/ production (A/P) ratio	-	-39**	-	-	-	-	-	-	-	33*	-	19SN	-	-	-
5. Number of indirect employees	-	-	30*	-	-	30*	-	-	-	-	-	-	-30*	-	-
6. Type of structure (SHAPE)	-18*N	-19*N	-	-	-	-	-16SN	-	-	-	-	-	-18*N	-	-
7. Qualifications	47***	16SN	34*	-15SN	33*	40**	-	-	-	-	-	-	-	-	16SN
8. First degree holders	35**	15SN	33*	-	-	-	-	37*	-	-	-	-	-	-	22*N
9. Higher degree holders	41**	19*N	36*	-	-	-	-	-	29*N	17SN	25*N	-	-	-	-
10. Formalisation	43**	16SN	26*	-	34*	39**	-	-	20*N	-	15SN	-	-20S	-	-
11. Functional specialisation (ASPEC)	26*	20*NE	35*	-	27*	37**	-23S	-	27SE	-	-	-	-19*NE	-30*	-
12. Autonomy	-	-	-	-	-	16SN	19*N	33*N	-38**N	-	-	-23*N	18*N	-	25S
13. Centralisation (AC)	-26S	-31*	-32*	15SN	-	-	37*	-	-25S	-	-	-	-	-	-27*
14. Centralisation of marketing decisions	-	-40**	-	-	-	-	39**	-	-	24S	-	-	-	-	-27*
15. Centralisation of financial decisions	-	-	15SN	15SN	-	-	-	-	-	-	21S	23S	-	-	-30*
16. Centralisation of operating decisions	-21S	-28*	-31*	15SN	-	-	33*	-	-21*N	-	-	-18SN	-	-	-17SN

Table 6.5.2 Correlations between structural variables and management style. Manufacturing only sample (N=40)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation 1	Training orientation 2	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively adaptive	Human relations orientation	Autocratic	Traditional
1. Chief executive's span of control	-	-27*N	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Subordinate ratio	-31*	-	19SN	-	-	-	-	-	35*	-30**N	-29S	-	-30*N	-	-20SN
3. Vertical span of control	20*N	-	23*N	-	21*N	31*	-	-	-	-	-	-	-17SN	-29*	-
4. Administrative/ production (A/P) ratio	-	-	-	-	-	-	-	-	-	36*	-	-	-	-	-
5. Number of indirect employees	-	-	35*	-	-	34*	-	-	-	-	-	-	-29S	-	26*N
6. Type of structure (SHAPE)	-22S	-17SN	-	-	-	-	-18SN	-	-	-	-	-	-	-	-
7. Qualifications	41**	19*N	32*	-16SN	27S	34*	-	-	-	-	-	-	-	-	28*
8. First degree holders	31*	19SN	36*	-	-	-	-24S	30*	-	-	-	-	-	-	37*
9. Higher degree holders	46**	26*N	40*	-	-	-	-	-	30*N	-	21*N	-	-	-	32*
10. Formalisation	44**	19*N	26S	-	33*	38**	-16SN	-	21*N	-	-	-	-21*N	-	-
11. Functional specialisation (ASPEC)	27*	30*E	39**	-	27S	37*	-28S	-	29SE	-	-	-	-21SE	-30*	28*SE
12. Autonomy	-	-	-	-	-	-	16SN	28*	-32*	-	-	-	17SN	-	-
13. Centralisation (AC)	-21S	-35*	-31*	15SN	-	-	44**	-	-33*	-	-	-	-	-	-30*
14. Centralisation of marketing decision	-	-47**	-	-	-	-	48**	-	-	23S	-	-	-	-	-36*
15. Centralisation of financial decision	-	-	-	-	-	-	-	-	-	-	24S	-	-	-	-
16. Centralisation of operating decisions	-21S	-30*	-31*	15SN	-	-	38**	-	-32*	-	-	-17SN	-	-	-22S

Notes for Tables 6.5.1 and 6.5.2

SN Pearson's correlation was not suggestive at 0.1 level but Kendall's tau was suggestive at this level.

S Both Pearson's and Kendall's correlations suggestive at the 0.1 level. The coefficient shown is Pearson's r.

*N Pearson's correlation was suggestive at 0.1 level and Kendall's tau was significant at the 0.05 level.

* Both Pearson's and Kendall's significant at 0.05 level. The coefficient shown is Pearson's r.

** Both Pearson's and Kendall's significant at 0.01 level. The coefficient shown is Pearson's r.

E Aston's measure of functional specialisation produced no statistically significant correlations. However, the more refined measure (ESPEC) produced a significant correlation.

Table 6.5.3 Partial correlations between structural variables and management style, controlling for Log. size (N=45)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation 2	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively adaptive	Human relations orientation	Autocratic	Traditional
1. Chief executive's span of control	-	-22N	-	-	-	-	-	-	-	-	-	-	-	-
2. Subordinate ratio	-31*	-	-	-	-	-	-	31*	-28N	-29*	-	-22N	-	-21N
3. Vertical span of control	-	-	-	-	-	-	-	-	-	-	-	-	-27*	-
4. Administrative/ production (A/P) ratio	-	-40**	-	-	-	-	-	-	33*	-	19N	-	-	-
5. Number of indirect employees	-42**	-56***	-34*	-	-	-	-	-	42**	-	46**	-52***	-	-
6. Type of structure (SHAPE)	-37*	-30*	-23S	-	-26*	-	-	-	-	-	-	-	-	-23S
7. Qualifications	58***	-	-	-23S	26*	-	-	-	-	-	-	-	-	-
8. First degree holders	44**	-	-	-	-	-	32*	-	-	-	-	-	-	-
9. Higher degree holders	43**	23S	-	-	-	-	-	30N	26N	28*	-	-	-	-
10. Formalisation	51***	-	-	-	26*	-	-31*	20N	24S	24S	-	-	-	-
11. Functional specialisation (ASPEC)	34*	27*E	-	-	-	-30*	-22S	31*E	31*	-	37**	-26*E	-36*	-
12. Autonomy	-	-	-	-	-	20N	32*	-30*	-	-	-24S	18N	-	24S
13. Centralisation (AC)	-26S	-29*	-	25S	-	41**	-	-	-	-	-	-	-	-
14. Centralisation of marketing decisions	-	-38**	-	-	-	38**	-	-	23S	-	-	-	-	-24S
15. Centralisation of financial decisions	-	-	-	-	-	-	-	-	-	-	-	-	-	-28*
16. Centralisation of operating decisions	-21S	-25S	-	27*	-	39**	-	-25S	-	-	-28*	-	-	-

Table 6.5.4 Partial correlations between structural variables and management style, controlling for Log. size.

Manufacturing only sample (N=40)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation 2	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively adaptive	Human relations orientation	Autocratic	Traditional
1. Chief executive's span of control	-	-30*	-	-	-	-	-	-	-	-	-	-	-	-
2. Subordinate ratio	-34*	-	-	-	-	-	-	33*	-28N	-29S	-	-28N	-	-30S
3. Vertical span of control	25S	-	-23S	-	-	-	-	-	-	-	-	-	-28S	-
4. Administrative/ production (A/P) ratio	-	-	-	-	-	-	-	-	38*	-	-	-	-	-
5. Number of indirect employees	-47**	-51***	-26S	-	-	-	-	-	29S	-	46**	-55***	-	-
6. Type of structure (SHAPE)	-34*	-32*	-	-	-	-	-	-	-	-	-	-	-	-35*
7. Qualifications	53***	-	-	-25S	-	-	-34*	-	-	-	-	-	-	-
8. First degree holders	39*	-	-	-	-	-27S	-	-	-	-	-	-	-	-
9. Higher degree holders	50***	22N	-	-	-	-	-	30N	-	21N	-	-	-	-
10. Formalisation	53***	-	-	-	25S	-	-36*	19N	-	-	-	-18N	-	-
11. Functional specialisation (ASPEC)	37*	38*	-	-	-	-37*	-25SE	38*SE	-	-	35*	-	-36*	-
12. Autonomy	-	-	-	-	-	16N	26S	-34*	-	-	-	-	-	-
13. Centralisation (AC)	-	-32*	-	23S	-	49**	27S	-30*	-	-	-	-	-	-
14. Centralisation of marketing decisions	-	-45**	-	-	-	47**	-	-	-	-	-	-	-	-32*
15. Centralisation of financial decisions	-	-	-	-	-	-	-	-	-	23S	-	-	-	-
16. Centralisation of operating decisions	-	-26S	-	26S	-	43**	26S	-30*	-26S	-	-30*	-	-	-

Notes for Tables 6.5.3 and 6.5.4

S Strongly suggestive at 0.1 level.

* Significant at 0.05 level.

** Significant at 0.01 level.

*** Significant at 0.001 level.

N Rank order partial correlation coefficients. Since the distribution is not known, no significance levels are given.

E Alternative measure of functional specialisation (ESPEC) produced a more significant coefficient.

employment of a larger number of first and higher degree holders who are primarily engaged in design and development of innovations. The nature of activities of these companies requiring technical expertise on the part of the decision makers has resulted in delegation of decision making authority by top management to qualified technical experts with local knowledge of the situation. Khandwalla (1977), in his study of Canadian firms also reported that the technocratic, planning orientation management style was adopted by companies with high degrees of R & D activity operating in technologically sophisticated environments.

The association between high reliance on technically trained personnel in decision making and the bureaucratic structure of these companies is clearly consistent with the concept of bureaucracy as a strategy of knowledge-based control, advanced in Chapter 4, emphasising specialisation, professionalisation and delegation of authority for taking operating decisions by specialists with required levels of expertise.

As indicated above, Tables 6.5.1 and 6.5.2 also show that the planning orientation management style is also found in more bureaucratic companies. An orientation towards long-term planning, itself an aspect of formality and bureaucracy, is associated with development of greater areas of functional specialisation, existence of greater proportions of professionally qualified office holders and decentralisation of operating decisions. In these companies, delegation of decision making authority is also extended to major marketing decisions with long-term planning providing a framework within which these decisions may be made.

As to the relationships with configurational variables, the negative correlation between chief executive's span of control and planning orientation style suggests that, where there is an emphasis on control and coordination through formal planning, chief executives tend to have fewer people reporting directly to them. The negative relationship between the overall administrative structure and both technological leadership and planning orientation styles is, however, surprising. Corporate planning, for instance, is an appropriate coordinative device for divisionally structured companies. One possible explanation for this divergence from expected relationships is that in companies with high emphasis on technological leadership, research and development and production line management assume very important roles. With R & D and production represented at board level, there may be a tendency towards maintaining a functional, as opposed to divisional structure, so that R & D could be carried out on a larger scale than would otherwise be possible in a divisionalised structure. The negative correlation between technological leadership style and subordinate ratio is in the expected direction. Companies adopting a technological leadership style in the CUBS sample were primarily engaged in design and manufacture of highly technologically complex equipment. In these companies, there are fewer direct workers per first line supervisor to provide for a closer supervision due to high cost and complexity of the end product.

The seat of the pants, intuitive style, the opposite of the technological leadership and planning oriented style tends to be adopted by companies with relatively low degrees of formalisation,

functional specialisation and qualifications, where even the authority for taking operating decisions is retained by the higher echelons of management. In the next section it is shown that these companies are in the technologically unsophisticated sectors of the electrical engineering industry.

6.5.2 Risk Taking and Risk Averting Styles

The structural correlates of the risk taking management style are almost the same as those of the technological leadership and planning orientation styles, i.e. companies adopting a risk taking management style tend to have highly bureaucratic structures. Referring to the table of correlations between management styles and contextual variables in the next section (Table 6.6.1), it may be seen that the risk taking management style is adopted by the larger companies in the CUBS sample(1). Since company size was shown to be the most important predictor of the extent of structuring or bureaucratisation (see Section 5.10), the significant correlations between risk taking management style and extent of bureaucratisation may be due to their relationship with company size. When size was partialled out, all of the significant correlations became insignificant, indicating that the association between bureaucratic structure and adoption of a risk taking management style was solely attributed to the effects of company size (Tables 6.5.3 and 6.5.4).

The risk taking management style scale measures the extent to

(Note (1) - Pearson's correlation between log size and risk taking management style, r = 0.41 significant at 0.003 level.)

which top management takes high risks to obtain high rates of return on investment and undermines major competitors. The greater availability of resources and greater economic power of larger organisations places them in a more favourable situation to commit resources to high risk projects and to undermine the major competitors.

The size of the correlation between the risk taking and risk averting management styles and the lack of any statistically significant relationships between the risk averting management style and the bureaucratic characteristics of companies indicates that the two scales, although statistically significantly correlated ($r' = -0.26$ $P_{\alpha} \leq 0.05$) are not exactly opposites. Closer examination of the data indicated that a number of smaller, less bureaucratic companies placed little emphasis on both the risk taking and risk averting styles. These companies either did not evaluate risk, or were operating in low risk situations.

Table 6.5.1, however, indicates that the risk averting style is negatively correlated with professional qualifications and positively with centralisation of financial and operating decisions. Although these correlations are not significant at the 0.05 level, they strongly suggest that companies adopting a risk averting style tend to have fewer posts filled by professionally qualified staff and also have a more centralised decision making structure. As may be seen from Table 6.6.1 (next section), the risk averting style tends to be adopted to a greater extent by the manufacturing and service companies than by the 'manufacturing only' companies. Also the negative correlations with impersonality of origin and status

strongly suggest that this style is more likely to be adopted by personally founded, principal units, which were shown in Section 5.3 to be smaller and less bureaucratic. Examination of the data also indicated that, although smaller, less bureaucratic companies were in general risk averters, there were some which were not. This may well explain lack of any significant association with the bureaucratic characteristics.

6.5.3 Training Orientation Style

Training orientation management style representing: (1) high emphasis on formal management training programmes; (2) high emphasis on training employees in methods and procedures required by change; and (3) high emphasis on human relations training for managers to improve co-ordination and communications, also tends to be adopted by the more structured companies. Tables 6.5.1 and 6.5.2 show the correlations for two scales, training orientation 1 and 2. Although the pattern of correlations of structural variables with the two scales are almost the same, the size of the correlations with the scale, training orientation 2, and consequently the significance levels, are higher. This scale was constructed by eliminating item 2 from the training orientation scale 1. Although all the three items were highly statistically significantly inter-correlated and the reliability coefficient alpha was 0.752 , item 2, emphasis on training employees in methods and procedures required by change, was largely uncorrelated with all structural variables.

From Table 6.6.1 (next section), it may be seen that the training orientation management style tends to be adopted by larger companies. This, of course, is expected, since some of the larger companies have their own training programmes. Since size of the company was shown to be the most important predictor of the extent of structuring, the relationship between variables of structure and training orientation may be attributed to the effects of company size. As may be seen from Table 6.5.3, the statistically significant correlations between

vertical span of control, administrative intensity, functional specialisation and training orientation were largely attributable to the effects of size. However, the partial correlations between formalisation and qualifications and training orientation remained statistically significant(1), indicating that over and above the effects of size, training orientation management style is more likely to be adopted in companies with greater formalisation of role definitions and in companies with higher proportions of professionally qualified staff. This is interesting in that it shows greater professionalism to be associated with greater emphasis on management training programmes. This is again consistent with the argument advanced in Chapter 4, and derived from Weber (1947) and Child (1972a), that bureaucracy is a strategy of knowledge based control. An emphasis on occupancy of official posts by qualified persons is likely to lead to stress on continued training.

6.5.4 Conservative Styles

Although the two scales of conservatism, first stage factoring clusters 8 and 12, are statistically significantly correlated ($r = 0.31$, $P_{\alpha} < 0.05$), their structural correlates are very different. The first conservative scale, reflecting a conservative top management philosophy towards decision making, change and managerial processes, tends to be adopted by companies with lower degrees of bureaucratisation. As may be seen from Table 6.6.1, the older companies, private independent units and companies operating in the

(Note (1) - Both partial correlations were 0.26 and significant at the 0.05 level. However, for the 'manufacturing only' sample, the correlations, although positive, do not reach the 5% significance level.)

technologically unsophisticated sectors of the electrical engineering industry tend to adopt this conservative management style. In these companies, with low degrees of formalisation and functional specialisation, control is achieved by centralised decision taking. Major strategic decisions, as well as routine operating decisions, are taken by the very top echelons of management or by the owner-managers themselves. Top management emphasis is on cautious decision making, holding to tried management practices in the face of changing circumstances and uniform management styles with respect to dealing with subordinates and planning of activities. Concentration of operating decision taking on top management may be assumed to leave less capacity for dealing with changed practices and uniform management styles facilitate implementation of centrally taken decisions.

The correlations also indicate that the less cautious, more adaptive management style represented by low scores on this scale tend to be adopted in the more bureaucratic companies with more complex overall structures. Companies adopting this style of management tend to be younger, impersonally founded, part of a larger organisation, with larger numbers of operating sites and having more sophisticated design and development technologies. In these companies, due to the nature of operations and the overall complexity of organisational structure, top management allows managerial styles with respect to dealing with subordinates and planning of on-going and new activities to vary between departments. The high emphasis on supporting situational expertise in decision making is associated with greater delegation of authority for taking operating as well as major strategic decisions to the lower

levels of management with situational expertise. This finding is of particular interest in that it contradicts the typothesis of Burns and Stalker (1961). Bureaucracy tends to have been associated with a mechanistic style in the literature. The CUBS Study has shown, however, that this association does not apply with respect to general approaches to decision taking, management practices, and unformity of management styles. Clearly, the concept of "mechanistic" style requires refinement, for all its components are not unidimensional.

Tables 6.5.3 and 6.5.4, however, show that, once allowance is made for the effects of size, the adaptive style is only associated with greater specialisation and decentralisation of operating as well as marketing decision taking. This result, however, does not undermine the importance of the association between greater structuring and adoption of an adaptive style.

The second conservative style, reflecting high emphasis on marketing of true and tried products and avoidance of heavy R&D costs, as well as growth through internally generated funds and a de-emphasis on growth through external financing, is, however, unrelated to the extent of bureaucratisation. This lack of relationship indicates that bureaucratic as well as non-bureaucratic organisations could equally adopt a conservatively oriented growth strategy, or rely on a strategy of growth based on external financing. This is again somewhat at variance with the results of Burns and Stalker (1961). Number of first degree holders and autonomy of the company are, however, correlated with this style of management. The positive correlation with autonomy indicates that autonomous companies tend to rely more on this strategy of growth than non-autonomous companies

to whom external financing for growth may be more readily available through their parent companies. There is, however, no immediately obvious reason why companies with higher numbers of degree holders should adopt this style of management. Examination of the correlations between items making up this scale and contextual variables indicated that the larger companies tend to rely less on external financing. Since company size and number of degree holders are strongly related , this positive correlation may be attributable to effects of size. Once allowance is made for the effects of size, this correlation ceases to be significant (Table 6.5.4).

Partial correlations, however, indicate that a number of relationships with bureaucratic characteristics emerge. This is particularly so in the case of the manufacturing organisations. Although partial correlations with only qualifications and formalisation are significant beyond the 0.05 level, the pattern of associations suggests that once allowance is made for the effects of size, the more structured companies tend to rely less on a conservatively oriented growth strategy. These results are, then, consistent with those for the first measure of conservatism.

6.5.5 Participative Styles

As was shown in Section 6.3, the first stage factor analysis resulted in two separate participative factors which clustered on the same factor at the second stage factor analysis. The first participative scale reflects the extent to which decisions on capital budgeting, entry into new fields of business activity and acquisition of other companies are taken by the board, committees of the board or other important meetings of the company personnel. Table 6.5.5.1 shows the percentages of companies in which these decisions were either most times, or always, taken by participation of top management. As may be seen, in over 80 per cent of the companies, these major decisions were almost always taken in this way. Indeed, in over 68% the decisions were always taken by the board, committees of the board, or other important committees.

Table 6.5.5.1 Frequency Distribution of the Items of Participative Style 1

Decision	Most Times %	Always %	Total %
Capital budgeting	19.5	68.3	87.8
Entry into new fields of business	15.4	71.8	87.2
Acquisition of other companies	5.9	76.5	82.4

Because of this distribution of companies between the points of the ordinal scale, it was thought unlikely that strong correlations would emerge. The very fact that they did is of interest. Initial expectations that more participative decision taking in these areas of capital budgeting, new businesses, and acquisitions, would be associated with more areas of specialisation, more qualifications, and decentralisation of decision taking were confirmed, although the coefficient for specialisation was highly suggestive, rather than statistically significant ($0.05 < P_{\alpha} < 0.10$). Formalisation too, a further aspect of bureaucracy, was statistically significantly, positively correlated with this first scale for participation. Moreover, these relationships are independent of size.

The highly statistically significant correlation between autonomy and participative decision taking may well be related to the correlations between dependence and its constituent items and bureaucratic characteristics. Within the CUBS sample,(1) possibly within the UK electrical engineering industry, autonomous units tended to be independent, dependent organisational units tended to be of larger size and also subsidiaries of larger corporations(2). It was also shown that such companies tend to have complex design and development technologies, employ more degree holders, and are also more bureaucratic(3). The linkage between autonomy and participation might, therefore, fit in well with this pattern of relationships and those reported in the last paragraph. Moreover, it is possible to advance intuitively persuasive, if hypothetical,

(Note (1) - Please see Section 5.7, Tables 5.7.1 and 5.7.2
(2) - Please see Section 5.3, Table 5.3.1
(3) - As in Note (1).)

explanations. Within the independent, autonomous, organisational units, the chief executive, sometimes owner-manager, without much professionally qualified support might well tend to retain decision taking on such critical issues himself. Within a technologically more advanced, larger, subsidiary company employing professional staff and operating within the parent's bureaucratic system, however, the chief executive is likely to find security in participative decision taking, which spreads responsibility and also promotes fuller examination of the issues. This is particularly important because of the need to refer some key decisions upwards for authorisation, e.g. some major capital budgets, and the tendency for parents to control subsidiaries on the basis of financial budgets and profit targets. Moreover, the need to refer decisions upwards means a loss flexibility, which places a greater importance on the initial decisions being well explored. The partial correlation with autonomy, controlling for size, which is significant beyond the 0.05 level (see Tables 6.5.3 and 6.5.4) gives more support for this alternative explanation.

Examination of the correlations between the items making up the scale and structural variables indicated that, although the three items were negatively correlated with centralisation, (the Aston scale, AC), and centralisation of operating decisions, only the correlation for decisions on capital budgeting was statistically significant beyond the 5 per cent level. It had again been expected that decentralisation would be correlated with adoption of a participative management style, since it is an integral part of participative ideology. The results indicate that in companies where capital budgeting involves

participation of management, there tends to be a greater extent of delegation of decision making authority. It is possible that a participative approach to capital budgeting decisions may have facilitated greater delegation of authority, but more likely that the high level, participative meetings are an integrating mechanism to bring together managers with considerable discretionary authority and knowledge about their own specialised areas of activities to participate in the formulation of capital budgets. (4)

Khandwalla (1977: 510) also found a statistically significant correlation between participative management style and de-centralisation of decision making, even after allowing for the effects of company size and environmental factors. He also reported that participative management style was adopted by larger organisations in his Canadian sample. This latter relationship is not, however, found in the CUBS Study. Direct comparison of results with Khandwalla's on this scale are not, however, permissable, since the variables which in the CUBS Study were grouped under training orientation and human relations orientation styles were included in his participative style scale.

For completeness, mention is made of the possible correlation between participative style 1 and subordinate ratio, which seems to defy adequate explanation. This may be due to a chance distribution of the data, or the peculiarity of the sample.

(Note (4) - Furthermore, the partial correlations with functional specialisation and decentralisation, controlling for size are statistically significant beyond the 0.05 level (see Table 6.5.4).)

The second participative style reflects the extent to which major product development and marketing decisions are taken by the board, committees of the board or other important meetings of the company personnel. Table 6.5.5.2 shows the frequency distribution of these decision groups.

Table 6.5.5.2

	Percentage of responses in each category				
Decision	Never	Rarely	Sometimes	Most times	Always
Product mix, distributive channels, advertising and promotion		14.6	12.2	36.6	36.6
R & D of new products or services		2.6	10.3	33.3	53.8
Entry into new markets	7.3	2.4	2.4	19.5	68.3

Here again, in at least over 70 per cent of the companies, these decisions were almost always taken by top management participation. This was expected, since decisions taken in these areas would considerably affect the operation of all major functional areas in any organisation, especially the manufacturing organisations.

Marketing decisions were considered in Chapter 4, where the emphasis was on identification of structural characteristics associated with greater delegation of decision taking authority. It was shown that (Section 4.6), although operating decisions

tended to be decentralised in the more structured, bureaucratic companies, major marketing decisions tended to be decentralised only in companies with higher numbers of degree holders and greater functional specialisation, as well as in companies with a relatively greater degree of autonomy. It was also shown that decentralisation of marketing decisions was unrelated to the extent of structuring.

As may be seen from Tables 6.5.1 and 6.5.2, adoption of a participative decision taking approach with respect to major product development and marketing decisions is unrelated to the extent of structuring of the companies. There is no monotonic relationship between aspects of organisational complexity and structuring and extent of such participation. However, when companies were grouped into those with high, medium and low degrees of structuring on the basis of a few selected measures of structure (functional specialisation, formalisation and qualifications), visual inspection suggested a higher emphasis on participation (scale 2) among companies in both the highly structured and the least structured categories, than those with medium degrees of structuring (Table 6.5.5.3).

Table 6.5.5.3 Cross Tabulation of Total Score on Participative Style 2 and Degree of Structuring

Degree of Structuring	Score for Participative Style (2)									
	15	14	13	12	11	10	9	8	7	6
High	57.1	28.3				14.3	14.3			
Medium	16.7	11.0	16.7	16.7	5.5	22.2	5.5	5.5		
Low	25.0	33.3	8.3	25.0						8.3

(Figures in the matrix show the percentage of companies in each category obtaining the score.)

In the case of highly structured companies, greater differentiation between functional areas of activities perhaps necessitates decisions within committees of senior executives on new product and marketing (participative 2) as a co-ordinative, integrative mechanism. In the least structured companies, perhaps, it is the informal structure of the company which promotes greater participation of senior management in discussions and participative decision making. However, in companies with medium degrees of structuring of activities, where a greater proportion adopt a less participative management style than in the other two categories, neither of these forces may be at work. For instance, functional areas may be more interdependent. Alternatively, the operations of such companies within the CUBS sample may have made less participation of marketing decisions appropriate. Without further exploration, which is precluded by current time and resource constraints, such explanations must remain purely speculative. Tables 6.5.1 and 6.5.2, however, indicate that companies with higher proportions of indirect employees tend to be more participative. Partial correlations (Tables 6.5.3 and 6.5.4) also indicate that this relationship is independent of size and a significant correlation with number of indirect employees also emerges.

As may be seen from Table 6.6.1, companies in which the degree of automation of the bulk of the equipment is higher tend to adopt a less participative management style (Style 2). It is reasonable to assume that the inflexibility of the manufacturing process may well set limits on the choice of product mix and type of R & D projects undertaken. However, there is a strong suggestion that companies with more complex design and development technologies, where the inter-dependence between functional areas of research and development, finance, marketing and manufacturing would be expected to be greater, tend to adopt a more participative management style. Although the correlation between participative style and complexity of design and development technology is not quite statistically significant ($0.05 < P_{\alpha} < 0.10$), the association makes intuitive sense, for design and development technology may be expected to relate to the extent of participative, senior management decision taking on major product development and marketing decisions.

The positive correlation of 0.24 with centralisation of marketing decisions, although only statistically suggestive at the 0.1 level suggests that, where the second participative mode is used to a lesser extent, the locus of authority with respect to major product development and marketing decisions tends to be located lower down the organisational hierarchy. One would, of course, expect this from the very definition of the scale. Respondents were asked about the frequency with which such marketing and R & D decisions were taken by "the board, committees of the board, and other important meetings". A low frequency could be due, on the one hand, to personal decision taking by the chief

executive or other powerful line executive (the assumption made in use of the label "participative"). On the other hand, delegation of such decision taking to levels below senior management would also lend to a low frequency being recorded. This suggests that the observed relationship is tautological.

6.5.6 Mechanistic/Organic Styles

Lack of any statistically significant correlations between mechanistic management style and structuring of activites, centralisation of decision taking and configuration of organisational structure (Tables 6.5.1 and 6.5.2), indicates that both bureaucratic and non-bureaucratic companies may be managed along the lines which have been described in management literature as mechanistic management style. This, however, is contrary to the commonly held view that bureaucratic organisations are mechanistic, but consistent with other finding from the CUBS Study reported above (Section 6.5.4).

This somewhat negative, but important, finding is surprising. The two were expected to be closely associated, since bureaucratisation represents the extent of vertical and horizontal differentiation, existence of written role definition, rules and procedures and the mechanistic style represents top management emphasis on following the formally laid down procedures, formal authority in decision taking and use of highly structured channels of communications. Absence of a strong positive correlation seems to imply inconsistency. This led to a deeper examination of the data, on an item by item basis, and a closer interpretation of

the significance of the scales used. The commonly held view that bureaucratisation involves a mechanistic management style may be invalid. Alternatively, the scales may be inadequate or the result may be due to a characteristic of the CUBS sample which masks the true, more general, relationship.

The operational measures of the extent of bureaucratisation and mechanistic management style are different, in the sense that the former is an objective measure of structure and the latter is subjective, based on the perception of the top management. This difference could affect the results if either of the two measures do not accurately reflect the extent of structuring within the organisation. The subjective measures obtained in the CUBS Study were based solely on the perceptions of one top level executive in each organisation. However, Payne and Mansfield (1977: 146) reported no significant difference in perceptions of rule orientation, a measure crudely resembling the mechanistic management style, between different hierarchical levels within organisations. Although this does not mean that perceptions accurately reflect the climate, the congruence between perceptions of employees at different levels may be an indication of this.

If the extent of bureaucratisation is associated with mechanistic management style and the subjective measure is taken to be the more valid one, this will then throw doubts on the adequacy and usefulness of the Aston measures of bureaucracy. However, considering the true meaning of the scales and the correlations between individual items may help to clarify the situation. For example, one would expect the objective measure of formalisation of role definitions

to be associated with mechanistic management style, reflecting top management's perception of how formalised the operations and procedures are within the organisation. Examination of the correlations between formalisation of role defintions and items making up the mechanistic management style indicated that correlations with emphasis on following formally laid down procedures and getting things done, even if this necessitates ignoring formal procedures (reverse scored), although positive, were not significant at 0.05level and that only the correlation with reliance on highly structured channels of communications was significant beyond the 0.05 level.

Formalisation of role defintions measures the extent to which procedures and communications are written down and filed in organisations (Pugh et al, 1963: 303). The scale, however, does not measure the extent to which adherence to formal procedures is emphasised within organisations. It is conceivable that in a company with a large number, possibly too great, of procedures and rules there will be less emphasis on following these, or there may even be a backlash against following procedures. Also, one may envisage that organisations exist in which, although procedures and role defintions are not written down extensively, there are accepted routines, procedures, channels of communication and lines of authority which are regarded as legitimate. In

so far as formality may be defined as "conformity to rules" (Concise Oxford Dictionary), these companies may be regarded as having "implicitly formalised" procedures and rules to which the Aston measures are insensitive. Existence of "implicitly formalised" procedures may, however, be detected by subjective measures. The concept of "implicitly formalised" procedures and rules is, however, at odds with the concept of bureaucracy as conceived by Weber (1947). If one accepts Weber's definition of bureaucracy, Aston's operational measure of formalisation would be an adequate representation of this aspect of bureaucracy.

The correlations between individual items making up the mechanistic scale and variables of organisational structure indicated that in companies with greater formalisation of role definitions, functional specialisation, number of degree holders and greater delegation of decision taking authority, there tends to be greater emphasis on use of highly structured channels of communications. This makes sense in that greater complexity of relationships, due to greater bureaucratisation, may have resulted in greater reliance on use of highly structured channels of communication.

The lack of any association between the other items of the mechanistic management style and extent of bureaucratisation

also makes intuitive sense. Top management may place a great deal of emphasis on formal authority in decision taking, both in highly bureaucratic companies where decisions are delegated to lower levels of management with required level of expertise, and in the less bureaucratic companies where decision taking authority may lie only with the chief executive or the very top levels of management. The results therefore indicate that the commonly held view associating bureaucratic structures with mechanistic management style, may not hold in the case of business organisations and that adoption of a mechanistic management style may be influenced by situational factors other than the extent of bureaucratisation.

A number of studies reported in the Aston Programme III (Pugh and Payne, 1977) also provide some support for the arguments put forward here. Payne and Mansfield (1977) also showed that rule orientation was not related to the extent of bureaucratisation.

6.5.7 Aggressively Adaptive Style

Aggressively adaptive management style reflects the style adopted by management who perceive the environmental conditions as changing rapidly, as rapidly as to outdate past experiences, and therefore place high emphasis on adapting freely to changing circumstances without overmuch concern for past experiences. They see adaptation to changing circumstances as a necessity for survival. They threaten members of the organisation with the consequences of resisting management orders when introducing

organisational change and use arbitration procedures for conflict resolution.

It would be reasonable to assume that environmental conditions, or more likely, top management's perception of environmental conditions, such as turbulence, constraint, competition, uncertainty and rate of technological change, would greatly influence adoption of an aggressively adaptive management style(1). One can also envisage that both highly bureaucratic and non-bureaucratic companies may be found to be operating under a given set of environmental conditions. Therefore, the lack of any significant associations between adoption of an aggressively adaptive style and extent of bureaucratisation was largely expected. The very fact that no statistically significant relationship was found does, however, contradict the popular belief that bureaucratic organisations are necessarily more passively and slowly adaptive in style. However, as may be seen from Tables 6.5.1 and 6.5.2, there is a strong suggestion that in companies adopting an aggressively adaptive management style, operating decisions tend to be more decentralised. This makes intuitive sense in that greater delegation of decision taking authority would result in greater flexibility in terms of dealing with rapidly changing conditions. Further light is thrown on this issue when allowance is made for size (see Tables 6.5.3 and 6.5.4). The negative correlation between an aggressively adaptive management style and decentralisation of operating decisions became statistically significant at the 0.05 level. In addition, positive, significant correlations between aggressive adaptation and each of number of indirect employees and number of areas of specialisation appeared. Consequently, the partial correlations support the explanation.

(Note (1) - This aspect is to be addressed in the CUBS Study but is beyond the scope of this thesis.)

6.5.8 Human Relations Style

Human relations orientation management style, representing the extent to which top management involves fully employees affected by an organisational change in every stage of the change process formulation and implementation, is correlated with some measures of bureaucratisation. Tables 6.5.1 and 6.5.2 show that adoption of human relations orientation style is negatively correlated with vertical span of control, formalisation and functional specialisation. The correlations indicate that more of the less bureaucratic companies tend to adopt the human relations orientation style(1).

It seems that in companies with taller vertical span, i.e. greater differentiation of authority and responsibility along the organisational hierarchy and greater horizontal differentiation between various functional areas of activity, there tends to be less involvement of employees affected in discussions of organisational changes. Functional specialisation, i.e. differentiation between functional activities, may well focus effort on lateral rather than vertical communication. Moreover, the greater separation of employees directly affected by the change programme from the actual decision takers, due to greater numbers of hierarchical levels, will consequently result in a lower degree of full participation by employees directly affected.

(Note (1) - For the full sample, this style of management was also significantly negatively correlated with overall administrative structure (SHAPE), which was shown in Chapter 4 to be a further aspect of bureaucracy.)

Consider, for example, the case of a company with high degrees of vertical and horizontal differentiation attempting to introduce greater automation in the company's manufacturing operations. The decision would be expected to lie within the sphere of authority of the technical director as opposed to the manufacturing manager. Due to high impact of any such major decision on the operation of other major functional areas and in order to seek consensus, lateral communications will take place at top management level and a decision would be arrived at within the limits and constraints imposed by the finance, personnel, engineering and marketing departments. This process may well lead to lower participation of employees directly affected by introduction of the change. Here, the manufacturing manager may be the implementor of the decision taken at the top. On the other hand, lower vertical and horizontal differentiation and the more informal atmosphere of the less bureaucratic companies would promote more discussion vertically as well as laterally with respect to organisational change decisions and consequently result in greater participation of the employees affected by the change process.

Table 6.5.1 also indicates that the more autonomous companies are more likely to adopt a more human relations oriented style than the non-autonomous companies. This correlation, which is only suggestive for the 'manufacturing only' sample may, however, be due to the relationships between autonomy, dependence, and bureaucracy. Private independent units in the CUBS sample tended to be more autonomous. These companies also tended to be less bureaucratic than the dependent ones (Section 5.7).

6.5.9 Informal Autocratic Style

As may be seen from Tables 6.5.1 and 6.5.2, informal, autocratic management style, representing high emphasis on informal, spontaneous communication, de-emphasis on written communication for control of operations and high emphasis on the use of authority for conflict resolution, is significantly negatively correlated with both the vertical span of control and functional specialisation at the 0.05 level. Furthermore, as may be seen from Tables 6.5.3 and 6.5.4, these relationships are independent of company size. The correlations indicate that in companies with taller vertical spans of control, i.e. with greater vertical differentiation of authority and responsibility, greater number of areas of functional specialisation indicating greater horizontal differentiation between functional areas of activity, control of operations is achieved through written communications within a consciously designed information system. In these companies, there is little reliance on informal communications for control of operations and use of authority by top level management in resolving conflict between different groups within the organisation. These correlations make intuitive sense, since the sheer complexity of relationships between various areas of organisational activities, due to high degrees of vertical and horizontal differentiation, necessitates the use of sophisticated information systems for control of operations. Also, greater specialisation in these companies precludes use of authority for conflict resolution.

On the other hand, in companies with little vertical and horizontal differentiation, control of operations may be achieved by informal, spontaneous communications. With smaller

number of hierarchical levels, top management would be in greater contact with the rest of the organisation and hence in a more favourable situation to exercise their authority to resolve conflict between different groups in the organisation.

6.5.10 Traditional Style

The traditional orientation management style, representing high top management reliance on experience and common sense and high reliance on apprenticeship and learning by hard knocks, is statistically significantly positively correlated with number of first degree holders and negatively with centralisation scales, although the coefficient for centralisation of operating decisions is not quite statistically significant. However, for the 'manufacturing only' sample, the traditional management style is also significantly and, somewhat surprisingly, positively correlated with number of indirect employees, higher degree holders, qualifications, and functional specialisation. Also the significant negative correlation with centralisation of financial decisions becomes insignificant and therefore may not have any general significance. Referring to Table 6.6.1, it may be seen that the traditional style, contrary to expectation, tended to be adopted by the larger companies in the CUBS sample and that the correlation for the 'manufacturing only' sample is significant beyond the 0.05 level.

As may be seen from Tables of partial correlations (Tables 6.5.3 and 6.5.4), for the full sample, correlations with autonomy, decentralisation of marketing decisions, and subordinate ratio

remained suggestive at the 0.1 level. Also a negative correlation emerged with overall administrative structure (SHAPE). For the 'manufacturing only' sample, however, partial correlations with overall administrative structure and decentralisation of marketing decisions were significant at the 0.05 level.

These results are interesting, since one would expect the traditional style to be found in the smaller, less bureaucratic companies. However, these is no reason why larger, more bureaucratic companies should rely on experience and common sense, and learning by apprenticeship to a lesser extent than the smaller, less bureaucratic companies. Although all the correlations with the extent of structuring were attributed to organisational size, the partial correlations indicate that companies adopting a more traditional style tend to be more decentralised with respect to major marketing decisions, having lower subordinate ratios and less complex overall administrative structures.

6.6 CONTEXTUAL CORRELATES OF MANAGEMENT STYLES

6.6.1 Technological Leadership and Planning Orientation Styles

Tables 6.6.1 and 6.6.2 show the correlations between the contextual variables and management styles for the full and 'manufacturing only' samples of the CUBS Study. Technological leadership style, which was shown to be adopted by the more bureaucratic companies (Section 6.5.1), is significantly correlated with impersonality of origin, dependence and parent company size. The positive correlations with these variables indicate that this style of management tends to be adopted to a greater extent by companies which are part of larger organisations, rather than by private independent units. Table 6.6.1 also indicates that companies with more complex design and development technologies adopt the technological leadership style. As was mentioned earlier, Khandwalla (1977) also reported that the technological leadership style was adopted by companies operating in the more technologically sophisticated industries.

Adoption of a technological leadership style requires commitment of large sums of money and large numbers of technically qualified personnel to R & D projects. Companies which are part of larger organisations would be expected to have larger capital sums more readily available to them through their parent organisations. Therefore, they are more likely to adopt a technological leadership style than private independent units, which would have to meet the costs of maintaining a technological leadership edge in their industry, either through internally

Table 6.6.1 Correlations between contextual variables and management styles. Full sample (N=45)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively apaptive	Human relations orientation	Autocratic	Traditional
1. Log size	-	-	41**	-	32*	-	-	-	-	-	-	-	-	23S
2. Age	-	-	-	-	-	35*	26*	-	-	-	-	-	-	-
3. Impersonality of origin	39**	-	30*	-22S	22S	-28*	-	21*N	16SN	-	-	-	34*	15SN
4. Status	-	-	21*N	-23S	-	-26*	-	-	-	-	-	-19*N	33*	-
5. Relative size	-	-	-	-	-	-27*	-	-	-	-	-	-	28*	-
6. Dependence	24*N	-	-	-	-	-31*	-	-	-	-	-	-	35*	-
7. Number of operating sites	-	-	14SN	-	-	-25*N	-	21*N	-	-	-	-30**N	-	-
8. Automaticity mode	-	-	-	-21*N	39**	-	-	-20*N	-37**	-	-	-	-	-22*N
9. Automaticity range	33*	25S	41**	-16SN	32*	-	19*N	-	-31*	-	-	-	-	-
10. Charter	-	-24S	-19*N	18*N	-18*N	-	-32*	18SN	29*	-	-	-	-	-30*
11. Design and development technology	30*	24S	-	-	-	-36**	-	-	14SN	-	-	-	-	-
12. Log parent company size	30*	-	-	-	31*	-	-	-	-	-	-	-	15SN	-

Table 6.6.2 Correlation between contextual variables and management styles. Manufacturing only sample (N=40)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggresively adaptive	Human relations orientation	Autocratic	Traditional
1. Log size	-	-	43**	-	32*	-	-	-	-	-	-	-	-	31*
2. Age	-	-	-	-	-	29*	20S	-	-	-	-	-	-	-
3. Impersonality of origin	36*	-	31*	-23S	-	-43**	-26*	24*N	18SN	-	16SN	-	35*	-
4. Status	-	-	20*N	-24S	-	-35*	-	-	-	-16SN	16SN	-18SN	36*	-
5. Relative size	-	16SN	-	-	-	-38*	-	-	-17SN	-22*N	-	-	24*N	-
6. Dependence	18SN	-	-	-22S	-	-44**	-	-	-	-22*N	-	-	35*	-
7. Number of operating sites	-	-	39**	-	-	-35**N	-	22*N	-	-	-	-23*N	-	-
8. Automaticity mode	-	-	-	-16SN	36*	-	-	-	-29*	-	-	-	-	-39*
9. Automaticity range	22*N	23S	36*	-	23S	-	-	-	-32*	-	-	-18SN	-	-
10. Design and development technology	42**	-	-	-	-	-35*	-	-	21S	-	-18SN	-	-	21*N
11. Log parent company size	21*N	29*	-	-	31*	-30*	-	-	-	-	-	-	-	-

Notes for Tables 6.6.1 and 6.6.2

SN Pearson's correlation was not suggestive at 0.1 level but Kendall's tau was suggestive at this level.

S Both Pearson's and Kendall's correlations were suggestive at 0.1 level. The coefficient shown is Pearson's r.

*N Pearson's correlation was suggestive at 0.1 level and Kendall's tau was significant at 0.05 level.

* Both Pearson's correlation and Kendall's tau were significant at 0.05 level. The coefficient shown is Pearson's r.

** Both Pearson's correlation and Kendall's tau were significant at 0.01 level. The coefficient shown is Pearson's r.

generated funds or external borrowing.

Table 6.6.2, however, shows that for the 'manufacturing only' sample, technological leadership style is less significantly correlated with impersonality of origin, dependence and parent company size, and more significantly correlated with complexity of design and development technology. It was shown in Section 5.6 that companies with more complex design and development technologies tended to be impersonally founded, more dependent on their parent organisations and had larger parent organisations, and that for the manufacturing only sample these associations remained significant when size was partialled out. The pattern of correlations therefore suggests that the association between technological leadership style and these variables may be attributed to the effects of design and development technology. Partial correlations for the manufacturing only sample controlling for technology indicated that although the more dependent companies were more likely to have more complex design and development technologies, the association between dependence and adoption of a technological leadership style was not direct and could be attributed largely to the effects of design and development technology. However, partial correlations for the full sample, although not statistically significant at the 0.05 level, showed that controlling for complexity of design and development technology, dependence, impersonality of origin and parent company size remained correlated with technological leadership style. Tables 6.6.1 and 6.6.2 also show that technological leadership style is positively correlated with automaticity range. As for dependence, however, this association may be explained by the effects of design and development technology.

As may be seen from Table 6.6.1, the planning orientation style is correlated with automaticity range, charter and design development technology. The correlations although not statistically significant at the 0.05 level are strongly suggestive at the 0.1 level. The negative coefficient for charter suggests that the planning orientation style is adopted to a greater extent by the manufacturing rather than the manufacturing and service companies. For the 'manufacturing only' sample, planning orientation style is, however, significantly correlated with only parent company size. One would expect that large parent organisations would place a great deal of importance on long-term planning as an integrative mechanism for control of operations and co-ordination of activities of subsidiaries. The greater emphasis on long-term planning for companies with larger parent organisations may be a reflection of the practices and policies of the parent organisation.

6.6.2 Risk Taking and Risk Averting Styles

Tables 6.6.1 and 6.6.2 show that the larger organisations in the CUBS sample tend to adopt the risk taking management style. As was mentioned earlier, in Section 6.5.2, the greater economic power of the larger organisations places them in a more favourable situation to take risks and undermine competitors. As may be seen, impersonally founded companies, subsidiaries, companies with larger numbers of operating sites(1) and companies rating higher

(Note (1) - For the full sample the correlation was not significant at the 0.05 level, due to inclusion of manufacturing and service companies.)

on the automaticity range scale also tend to be more risk taking. However, these correlations are attributable to the effects of size. It was shown in Section 5.3 that larger companies in the CUBS sample tended to be impersonally founded subsidiaries of larger organisations, and more dependent on their parent organisations. Larger companies were also shown to have larger parent companies and rated higher on the automaticity range scale. When size was partialled out, as expected, the correlations between the risk taking style and these variables became insignificant. One valuable result of the first order partial correlations for both the full and 'manufacturing only' samples controlling for size was that company age was negatively correlated with the risk taking style ($r=-0.24$). Although the correlation does not reach the 5 per cent significance level, it suggests that, allowing for the effects of size, younger companies tend to be more risk taking than older ones. Khandwalla (1974a) also found a negative correlation between risk taking management style and the company age in his study of Canadian firms.

As may be seen from Table 6.6.1, manufacturing and service companies tend to be less risk taking than 'manufacturing only' companies. This may be attributed to the different environmental conditions under which these companies operate. One would expect that manufacturing companies with substantial service operations would be operating in less risky environments. These companies derived a large proportion of their revenues from servicing equipment already sold to the customers.

Although the correlations do not reach the 5 per cent significance level, Tables 6.6.1 and 6.6.2 also suggest that personally founded, private independent units tend to be more

risk averting. It would appear, too, that not only are manufacturing and service companies not risk takers, but that they are also risk averters. Table 6.6.1 also shows that the risk averting style is significantly negatively correlated with automaticity mode. However, this correlation has no general significance and is due to inclusion in the full sample of the five manufacturing and service companies(1), which were shown in Section 5.3 to have a lower degree of automation than the 'manufacturing only' companies(2).

6.6.3 Training Orientation Style

Tables 6.6.1 and 6.6.2 show that the training orientation style is significantly positively correlated with company size, parent company size, and automaticity mode and range. However, these correlations are largely due to effects of size. With exception of the correlation with automaticity mode, all other correlations with training orientation style became insignificant when size was partialled out(3). The association between adoption of a training orientation style and company size was expected. Larger companies, using bureaucracy as a strategy for knowledge based control, might be expected to be more oriented towards training. They can also better afford the overhead costs involved.

(Note (1) - Correlation is not significant for the 'manufacturing only' sample.

(2) - Charter was significantly negatively correlated with automaticity mode (Table 5.3.1).

(3) - See Tables 6.6.3 and 6.6.4.)

Table 6.6.3 Partial correlations between contextual variables and management styles, controlling for Log. size.

Full sample (N=45)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Traning orientation	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggresively adaptive	Human relations orientation	Autocratic	Traditional
1. Age	-	-	-24S	-	-	39**	22S	-	-	-	-	-	-	-
2. Impersonality of origin	38**	-	-	-25S	-	-27*	-	20N	20N	-	-	-	42**	-
3. Status	-	-	-	-25S	-	-25S	-	-	-	-	-	-17N	37**	-
4. Relative size	-	-	-	-	-	-26S	-	-	-	-	-	-	31*	-
5. Dependence	22N	-	-	-21S	-	-30*	-	-	-	-	-	-	40**	-
6. Number of operating sites	-	-	-	-	-	-23N	-	21N	-	-	-	-29N	-	-
7. Automaticity mode	-	-	-	-21N	39**	-	-	-20N	-36**	-	-	-	-	-23N
8. Automaticity range	36**	-	-	-26S	-	-	-	-25S	-37**	-	-	-	-	-
9. Charter	-	-24S	-19N	18N	-18N	-	-32*	18N	21*	-	-	-	-	-30*
10. Design and development technology	29*	-	-	-	-	-36**	-	-	23S	-	-	25S	-	-
11. Log. parent company size	31*	-	-	-	-	-	-	-	-	-	-	-	28*	-

Table 6.6.4 Partial correlations between contextual variables and management style, controlling for Log. size.

Manufacturing only sample (N=40)

	Technological leadership	Planning orientation	Risk taking	Risk averting	Training orientation	Conservative 1	Conservative 2	Participative 1	Participative 2	Mechanistic	Aggressively adaptive	Human relations orientation	Autocratic	Traditional
1. Age	-	-	-23S	-	-	34*	-	-	-	-	-	-	-	-28*
2. Impersonality of origin	35*	-	-	-26S	-	-42**	-37*	22N	23N	-	17N	-	43**	-
3. Status	-	-	-	-26S	-	-34*	-	-	-	-16N	17N	-	40*	-
4. Relative size	-	-	-	-	-	-37*	-	-	-	-26S	-	-	31*	-
5. Dependence	16N	-	-	-24S	-	-43**	-	-	-	-25S	-	-	41**	-
6. Number of operating sites	-	-	-	-25S	-	-27S	-	20N	-	-	-	-20N	-	-
7. Automaticity mode	-	-	-	-16N	36*	-	-	-	-29*	-	-	-	-	-42**
8. Automaticity range	20N	-	-	-25S	-	-	-	-	-42**	-24S	-	-	-	-
9. Design and development technology	43**	-	-	-	-	-34*	-	-	27S	-	-18N	-	-	-
10. Log. parent company size	23S	25S	-	-	-	-30*	-	-	-	-	28S	-	27S	-

Notes for Tables 6.6.3 and 6.6.4

S Strongly suggestive at 0.1 level.

* Significant at 0.05 level.

** Significant at 0.01 level.

N Rank order partial correlation coefficient. Since the distribution is not known, no significance levels are given.

The positive correlation with automaticity mode, which is unchanged when size is partialled out, is interesting and shows that companies with more automated manufacturing technologies place greater importance on formal management training programmes and human relations training for managers. The higher automation of the manufacturing process places greater emphasis on technical knowledge and makes costs of technical breakdowns, material shortages, labour disputes and other disruptions greater.

It was shown in Section 5.5 that companies in the CUBS sample with more automated manufacturing technologies tended to have larger numbers of indirect employees and greater functional specialisation, and this was attributed to greater efforts on the part of these companies to insulate their core technologies from the environment. The positive correlation between automaticity mode and training orientation style furthers this argument. In these companies, the high reliance on formal management training programmes and the high emphasis on human relations training is perhaps an attempt to equip managers with modern management techniques for dealing with internal and external changes and problems, and to provide for more peaceful industrial relations within the company. The reason why managers should have such training is that any external change or industrial disputes would be expected to affect the operations of such companies to a greater extent, due to high degree of interconnectedness of their manufacturing processes.

Table 6.6.1 also indicates that the training orientation style tends to be adopted to a greater extent by the manufacturing than the manufacturing and service companies. It was shown in Section 5.3 that manufacturing and service companies tended to have lower degrees of automation. Since training oriented style tends to be adopted by companies with higher degrees of automation, the significant negative correlation with charter reported above may, therefore, be attributable to this pattern of association.

6.6.4 Conservative Styles

The two conservative management styles which were shown in Section 6.5.4 to have different structural correlates also tend to be found in companies with different situational characteristics. Tables 6.6.1 and 6.6.2 show that the conservative style 1, reflecting a conservative management attitude towards decision taking, change and managerial processes tends to be adopted by personally founded older companies, private independent units, companies with relatively smaller numbers of operating sites and also by companies with less complex design and development technologies.

The association with company age makes intuitive sense in that it shows that in older companies, where management practices would be expected to be better established, management would find it harder to discontinue practices found successful in the past in the face of changing circumstances, to support situational expertise in decision taking at the cost of ignoring formal authority where relationships are well established, and to take bold decisions which could possibly endanger the existing situation. On the other hand, in younger companies where management practices may not be so well established, there would be a greater tendency to adapt to changing circumstances more readily.

The association with dependence and its constituent items is interesting and shows that in private independent units where management commitment is greater due to ownership ties, the conservative style is adopted to a greater extent, whereas in subsidiaries where management promotion is geared to economic

performance of the subsidiary and managers are not shareholders there seems to be less emphasis on the conservative style.

In companies where design and development technology is more complex, management tends to take a less conservative approach to decision taking, change and management processes. These companies may well be operating under more rapidly changing environmental conditions, in particular rapidly changing technological conditions, and management may therefore tend to be more adaptive and less conservative. Due to greater diversity of types of activities of various departments within such companies and also the companies having larger numbers of operating sites, managerial styles are allowed to vary between departments or sites to a greater extent with respect to dealing with subordinates (1).

Table 6.6.1 shows that the conservative 2 scale, reflecting high emphasis on marketing true and tried products and avoidance of heavy R & D costs, high emphasis on growth through internally generated funds and de-emphasis on growth through external financing, is significantly correlated with company age, automaticity range, and charter. The negative correlation with charter indicates that manufacturing companies tend to be more conservative than manufacturing and service companies. The correlation with automaticity range has no general significance and disappears in the case of the 'manufacturing only' sample. Table 6.6.2 shows that for the 'manufacturing only' sample, the conservative 2 style, apart from age, is negatively correlated with impersonality of origin. The correlations again indicate that the older and personally founded companies rely more heavily on marketing of true and tried products

(Note (1) - All the relationships are independent of size (Tables 6.6.3 and 6.6.4).)

and avoidance of heavy R&D costs. These companies also rely more on growth through internally generated funds, as opposed to external financing, than the impersonally founded companies, to whom external financing is more readily available through their parent organisations(2).

6.6.5 Participative Styles

Participative 1, reflecting the extent of top management participation in major strategic decisions, is significantly correlated with impersonality of origin, number of operating sites, automaticity mode and a relationship with charter is strongly suggested. The positive coefficient for charter, although not statistically significant at the 0.05 level, suggests that manufacturing and service companies tend to be more participative than the 'manufacturing only' companies. The negative correlation with automaticity mode is due to inclusion of manufacturing and service companies, and thus attributable to the effects of charter, for it ceases to be significant when they are removed. Indeed for the 'manufacturing only' companies, only impersonality of foundation and larger numbers of operating sites seem to induce more participation among senior managers with respect to major strategic decisions. These relationships are also independent of size.

Participative 2 scale, reflecting the extent of participation in product development and major marketing decisions, is also correlated positively with impersonality of origin and charter, but not quite statistically significantly for the former. In addition, for both the full and 'manufacturing only' samples, the participative 2 scale is significantly correlated with automaticity mode,

(Note (2) - The partial correlation with impersonality of origin, controlling for size, also remains statistically significant at the 0.05 level.)

and range, and a positive relationship is strongly suggested with technology of design and development. The negative correlations with automaticity mode and range indicate that where the degree of automation of manufacturing is higher, management adopts a less participative approach with respect to these decisions. As was mentioned earlier (Section 6.5.5), the inflexibility of production processes may well set limits on the choice of product mix and type of R & D projects undertaken. The positive correlation with complexity of design and development technology indicates that in companies with more complex design and development technologies, where the inter-dependence between various functional areas would be expected to be greater, a more participative style is adopted.(1)

As was mentioned earlier, Khandwalla (1974a) found that larger organisations in his Canadian sample tended to adopt the participative, human relations orientation style. The items in his participative, human relations style scale formed four different clusters of training orientation, human relations orientation, participative 1 and participative 2 scales in the CUBS Study. As may be seen from Table 6.6.1, apart from the training orientation scale, none of the other three scales are significantly correlated with organisational size. Without access to Khandwalla's data, one cannot say whether he would have found the same pattern of correlations had he developed his scales on the basis of an analytical grouping of the variables, rather than intuitively. However, the lack of any significant correlations with participative style is not unexpected, for there seems to be no obvious

(Note (1) - All relationships are independent of company size.)

reason why larger companies should be more participative than smaller ones. Indeed, it was shown in Section 6.5.5 that over 70 to 80 per cent of the companies adopted the participative management style.

6.6.6 Mechanistic/Organic Styles

As was shown in Section 6.5.6, the commonly held view that bureaucratic organisations are mechanistic was not borne out by the CUBS data. The statistical results showed no significant correlations between the mechanistic style and extent of structuring or bureaucratisation. As may be seen from Table 6.6.1, mechanistic management style is also unrelated to the contextual variables considered. However, Table 6.6.2 shows that for the manufacturing only sample mechanistic style is significantly negatively correlated with relative size and dependence. Although it was shown that more dependent companies in the CUBS sample tended to be more structured(1), the correlations indicate that these companies tend to be more organic than private independent units(2). This again substantiates the argument put forward in Section 6.5.6 that the degree of structuring or bureaucratisation may not be related to adoption of a mechanistic management style.

6.6.7 Aggressively Adaptive Style

The aggressively adaptive style was also shown in Section 6.5.7

(Note (1) - See Section 5.7.
(2) - Also see Table 6.6.4.)

to be unrelated to all measures of structuring[1]. It was proposed that adoption of an aggressively adaptive style would more probably be influenced by environmental conditions. Yet Table 6.6.1 shows that the aggressively adaptive style is unrelated to all contextual variables for the full CUBS sample. However, as in the case of the mechanistic style, results of the analysis strongly suggest that this style of management is related to a number of contextual variables among companies involved in only manufacturing. Table 6.6.2 suggests that impersonally founded companies, subsidiaries and companies with less complex design and development technologies tend to adopt the aggressively adaptive style to a greater extent than the private independent units and companies with more complex design and development technologies. These relationships are not strong enough, however, to be statistically significant at the 0.05 level, although the coefficients exceed the 0.1 level.

As was shown earlier, impersonally founded companies tended to be less conservative and more adaptive. The correlations strongly suggest that these companies are not only adaptive but aggressively adaptive. Although it was shown that companies with more complex design and development technologies tended to be less conservative and more adaptive, the correlations with aggressively adaptive style indicate that they are less aggressively adaptive. Given that a high score on the "aggressively adaptive" scale implies free adaptation to changing conditions without much emphasis on past experience, and use of threat in attempting organisational change, this negative correlation is far from surprising. Complex technology involves a heavy dependence on

(Note (1) - Only after allowance was made for the effects of size, number of indirect employees, specialisation and decentralisation of operating decisions were related to aggressively adaptive style (see Tables 6.5.3 and 6.5.4).)

past experience, whether formalised in the scientific literature or not, and culture of firms with complex D & D technologies is likely to be hostile to threatening behaviour. Moreover, the higher number of higher degree holders employed in such companies (see Section 5.6) are less likely to appeal to arbitration procedures (the third item in the scale).

6.6.8 Human Relations Orientation Style

Human relations orientation style, reflecting the extent of full participation of employees in organisational change programmes, was shown in Section 6.5.8 to be found to a greater extent in the less bureaucratic companies. It was proposed that the lower degrees of horizontal and vertical differentiation in the less bureaucratic companies permitted greater participation of lower level employees in organisational change programmes. As may be seen from Tables 6.6.1 and 6.6.2, this style of management is also negatively correlated with status and number of operating sites. The correlation with status indicates that the principal units tended to be more human relations oriented than the subsidiaries. This correlation was, however, largely expected since the independent, principal units in the CUBS sample tended to be smaller(1) and less bureaucratic than the subsidiaries(2). For reasons advanced above and in Section 6.5.8, a greater number of operating sites, also a characteristic of more complex overall structures, acts as a barrier to greater participation of lower level employees in organisational change programmes.(3)

(Note (1) - See Section 5.3.
(2) - See Section 5.7.
(3) - See also Tables 6.6.3 and 6.6.4.)

6.6.9 Autocratic Style

The informal autocratic style, however, was shown in Section 6.5.9 to be adopted to a greater extent by the less structured companies. Although more dependent companies in the CUBS sample were shown to be more structured, the correlations show that these companies tend to be more autocratic than the private independent units. Examination of the correlations between the items of the autocratic style and structural and contextual variables showed that the correlations with vertical span of control and specialisation were largely influenced by one item, reliance on written communications for control of operations, and reliance on spontaneous communications was largely unrelated to these variables. However, the correlations with dependence and its constituent items were largely influenced by reliance on spontaneous communications and use of authority for conflict resolution.

The pattern of correlations with dependence and its constituent items, and autocratic style are, however, consistent with those of the conservative and aggressively adaptive style. Therefore, more dependent companies tend to be less conservative, more adaptive and autocratic than private independent units(1).

6.6.10 Traditional Style

As was mentioned earlier, the traditional style reflecting high reliance on experience and common sense in decision taking and reliance on learning by apprenticeship, was adopted to a

(Note (1) - All partial correlations remain significant and a positive relationship with parent company size is also suggested (Tables 6.6.3 and 6.6.4).)

greater extent by the larger companies. Table 6.6.1 shows that apart from size, the traditional style is significantly correlated with automaticity mode and charter. The negative correlation with charter indicates that 'manufacturing only' companies adopt this style to a greater extent than the manufacturing and service companies. Table 6.6.2 shows that for the 'manufacturing only' companies, traditional style tends to be found in companies with more complex design and development technologies. However, this correlation may be attributed to effects of size.

The negative correlation with automaticity mode indicates that where the degree of automation of the manufacturing process is higher, management relies less on experience and common sense and also relies less on learning by apprenticeship. This may be due to higher technical expertise required for maintaining and operating more highly automated plants. Partial correlations (Table 6.6.4) indicate that, apart from automaticity mode which remains significantly correlated with traditional style, this style of management tends to be found in the younger companies.

6.7 SUMMARY AND DISCUSSION

As was mentioned in the introduction to this chapter, a number of researchers, Likert (1961), Keller et al (1974), Lansley et al (1974), Negandhi and Reimann (1974), Boseman and Jones (1975), and Khandwalla (1974a), among others, developed scales for measurement of the management styles adopted in organisations. The investigation of situational characteristics associated with different styles of management has, however, largely been neglected. A few studies have considered only a limited number of contingencies.

Khandwalla's (1974a) operational measure of management style, which was considered to offer a more comprehensive approach to evaluation of different styles of management, was adopted in the CUBS Study with a number of modifications to allow for the limiting effect due to his particular scoring procedure. Fifteen underlying dimensions of management style were identified by principal component analysis and scales were developed based on clusters of variables with highest loadings on the obliquely rotated factors which offered the clearest clustering of the variables. Second stage principal component analysis, using the fifteen scales, resulted in six management style dimensions: technocratic planning orientation style versus seat of the pants, arbitrary, power oriented style; conservative (growth) versus growth oriented, risk taking style; conservative (change) versus aggressively adaptive style; participative versus non-participative style and traditional style. There was a certain degree of overlap between the analytical grouping of the items in the CUBS Study and Khandwalla's (1974a) measures which were, however, grouped

intuitively. Results of the correlations between styles of management and structural and contextual variables indicated that a number of relationships would be masked using the scales based on the second stage factor analysis. Therefore, analysis of the CUBS data proceded using the scales based on the first stage factoring results.

The extent of structuring or bureaucratisation was shown to be related to a number of management style dimensions. Although in each case not every measure of bureaucracy was related to the styles, the correlation analysis indicated that the extent of bureaucratisation was related to technological leadership, planning orientation, risk taking, training orientation, conservative (change), participative 1, human relations orientation, autocratic and traditional styles and that it was unrelated to risk averting, conservative (growth), participative 2, mechanistic and aggressively adaptive styles.

The more bureaucratic companies tended to adopt technological leadership and planning orientation styles. It was shown that in these companies the high emphasis on technological leadership culminated in employment of larger numbers of degree holders who were primarily engaged in design and development of innovations. The association between reliance on technically trained personnel in decision taking and greater delegation of decision taking authority to lower levels of management in the more bureaucratic companies further reinforced the Weberian concept of bureaucracy as a strategy of control based on knowledge. In the companies adopting the planning orientation style, delegation of decision

taking authority was also extended to marketing decisions with long-term planning providing a framework within which these decisions were taken.

The more bureaucratic companies also tended to be risk taking and training oriented. However, the association between bureaucratisation and risk taking and training orientation was largely attributed to the effects of size. More extensive use of qualified office holders was, however, related to adoption of a training orientation style even when the effects of size were allowed for. The more bureaucratic companies also tended to less conservative with respect to decision taking and more adaptive to change.

Over 80 per cent of the companies in the CUBS sample adopted a participative style(1) with respect to major strategic decisions. The more bureaucratic companies, however, did so more than others. Although participation in major strategic decisions (capital budgeting, entry into new fields of business activity and acquisition of other companies) was associated with decentralisation, the correlation for participation in capital budgeting decisions was strongest, indicating that either participation facilitated greater delegation of decision taking authority, or, more likely, participation was used as an integrating mechanism for bringing together managers with considerable discretionary authority and knowledge about their own specialised areas of activities, to participate in formulation of capital budgets. In this respect the CUBS results agreed with Khandwalla's (1974a), in that he also found that adoption of a participative style was associated with greater delegation of decision taking authority.

(Note (1)- Within the definition in the CUBS Study, i.e. the extent to which decisions were taken by the board, committees of the board or other important meetings.)

The more bureaucratic companies were also shown to be less human relations oriented. It was argued that the greater horizontal and vertical differentiation characteristic of more bureaucratic organisations acted as a barrier to a fuller extent of involvement and participation of lower level employees in organisational change programmes. Finally, the more bureaucratic companies were shown to be less autocratic.

The correlations of structural variables with other styles of management indicated that the extent of bureaucratisation was largely unrelated to adoption of a risk averting style or an aggressively adaptive style. Adoption of these styles of management would be expected to be influenced to a greater extent by environmental conditions. Partial correlations, however, indicated that once allowance was made for the effects of size, aggressively adaptive companies tended to employ a greater number of indirect employees, had greater areas of specialisation, and that operating decisions in these companies tended to be more decentralised. The conservative (growth) style was also unrelated to the extent of bureaucratisation. Correlations, however, indicated that the more autonomous companies tended to rely more on growth through internally generated funds than the non-autonomous companies, to whom external financing would be expected to be more readily available through their parent organisation. As for the aggressively adaptive style, partial correlations, controlling for size, indicated that the more structured companies tended to rely on a conservatively oriented growth strategy to a lesser extent than the less structured ones. Although the correlations indicated that adoption of a participative style with respect to product development and marketing decisions was unrelated to the extent of bureaucratisation, it was shown that both the highly structured and the least structured companies tended to adopt a more participative style than the companies with medium degrees of structuring. Moreover, once allowance was made for the effects of size, companies adopting a more participative style tended to have a greater number of indirect

employees, and operating decisions were more decentralised in these companies.

The mechanistic style was also unrelated to the extent of bureaucratisation and therefore the commonly held view, associating bureaucratic structures with mechanistic management style, was not supported by the CUBS data.

Correlation analysis of contextual variables revealed that the styles of management adopted were greatly influenced by the context in which the companies operated. Larger companies tended to adopt the risk taking and training orientation styles. The greater economic power of the larger companies would place them in a more favourable situation to take risks and undermine competitors. Also the greater diversity of activities of larger companies perhaps induces adoption of a training orientation style.

Older companies, in which internal management practicies and external relations would be expected to be better established, tended to be less risk taking and more conservative with respect to decision taking, adaptation to change and growth.

Company's origin and extent of dependence on a larger organisation also influenced the management style adopted. Impersonally founded companies and the more dependent companies tended to adopt the technological leadership style to a greater extent than the personally founded, private independent units. Although it was shown that the association was largely due to effects of technology of design and development, there was some indication that being a part of a larger organisation to a certain extent influenced adoption of this style of management. Impersonally founded companies and the more dependent ones also tended to be less risk averting, less conservative with respect to decision taking and adaptation to change and more autocratic. In addition, impersonally founded companies also tended to adopt a strategy of growth based on

external financing. They were also more participative and more aggressively adaptive.

Dispersion of operations, measured by the number of operating sites, was related to adoption of a less conservative style with respect to decision taking and adaptation of change, and a more participative style with respect to major strategic decisions and and a less human relations oriented style. Companies with more automated manufacturing technologies tended to be more training oriented and less participative with respect to product development and marketing decisions. Adoption of these styles of managment was attributed to the inflexibility of the manufacturing technology. The greater inflexibility of manufacturing inherent in highly automated technologies would render these companies more vulnerable to external environmental changes and internal disputes. Thus the high emphasis on formal management training programmes and human relations training for managers occurs in this field. Greater inflexibility would also be expected to set limits on the type of product mix and development projects undertaken, resulting in less participation with respect to these decision areas. Companies with more automated technologies also relied less on experience and common sense in decision taking due to high technical expertise required for maintaining and operating highly automated plants.

The correlations with charter indicated that manufacturing and service companies tended to be less risk taking, more risk averting and more participative. These companies also tended to be less planning oriented, training oriented, less traditional and relied more on external financing for growth.

Companies with more complex design and development techrologies tended to adopt the technological leadership style. These companies tended to be less conservative with respect to decision taking and more adaptive, but not aggressively adaptive. This latter relationship may be due to greater organisational complexity[3] of these companies. Companies with more complex design and development technologies, where interdependence between various functional areas would be expected to be greater, were also more participative with respect to product development and marketing decisions. Parent company size also influenced the style of management adopted. Companies with larger parent companies were shown to adopt the technological leadership style to a greater extent and were also more planning oriented. These companies also tended to be more training oriented and less conservative with respect to change and management processes.

The results of the CUBS Study, therefore, indicated that the styles of management adopted are related to both organisational structure and the context within which the companies operated. Management styles adopted by companies are also expected to be greatly influenced by more general environmental conditions too. Data was collected on a variety of such conditions, to allow a number of hypotheses on relationships between structure, context, management style, and environmental turbulence, threat, competition, constraint, dependence on external parties, and rate of technological change, for instance, to be tested. Time has, however, precluded inclusion of an account of the analysis of this data here.

(Note (3) - Complexity was defined as functional specialisation, qualifications, and numbers of degree holders.)

CHAPTER VII

STRATEGY

7.1 INTRODUCTION

Tracing the historical development of 70 large corporations from 1909 to 1959, Chandler (1962) found that following a strategy of expansion in volume, geographical dispersion, and ultimately diversification into related and unrelated product market areas brought about changes in the administrative structures of the enterprises, leading ultimately to adoption of a product divisional structure. The adoption of this type of structure was seen as a response to greater administrative complexities inherent in operating in diversified product market areas.

It could be argued that the new type of administrative structure would ensure more efficient use of resources and would place the company in a more favourable situation to exploit opportunities and avoid threats inherent in changing environmental conditions.

Creation of a general office and separation of top management from day to day operations of the divisions would (a) preclude deep involvement in the affairs of the divisions, resulting in a possible bias, and hence enable the top management to review and appraise divisional performance more objectively and also afford them more time to attend to the more crucial, strategic issues and (b) delegation of operation decisions to the quasi-autonomous, decentralised, divisions whilst maintaining tight financial control

via procedural devices like budgetary control would leave the divisional management where the local knowledge about markets and technologies reside to attend efficiently to the day to day operations of the divisions. Top management could then treat diversified businesses as separate profit centres and their lack of deep involvement and possible bias would enable them to rationalise resource allocation and divert resources to the more profitable operations.

Following Chandler (1962), Scott (1971) developed a model of corporate growth. He proposed three stages of growth. Each stage was characterised by more complex product market postures which he argued would impose changes on the administrative structure. In Scott's model, structure was depicted to change from an informal personal management through functional to the product based divisional structure, the administrative structure so becoming progressively more formalised. He also suggested that, apart from increased formality of structure,there were differences in performance measurement, reward systems, control systems and sub-unit automony between different types of structures. Salter (1968) showed that there is a further stage which may be added to Scott's model: the geographically based divisional structure studied in depth by Stopford and Wells (1972), and Franko (1971).

One of the difficulties of objective research into the linkage between strategy and structure was that of obtaining an operationally adequate measure of the degree of diversification. These difficulties are explored well by Rumelt (1974). A breakthrough came when Wrigley (1970) devised a scheme for classification of

companies in terms of diversification strategy. The classification was based on the proportion of company's revenues attributable to its largest product line and the relationship between product lines in terms of markets and technology. This classification system was used by Channon (1973) in his study of strategy and structure of 100 British firms. The companies were classified into four strategic categories of single product, dominant product, related product and unrelated product. The classification system represented in an increasing direction greater complexity of product market relationships or greater diversity. He also classified the firms in his sample into three structural categories of functional, holding company and multidivisional and showed that as companies grew from a narrow product market base (single product category) by gradual diversification into widely diversified concerns (related and unrelated categories), the administrative structure also changed from a functional system and companies ultimately adopted the multidivisional structure.

Parallel studies to that of Channon (1973), Pavan (1972), Thanheiser (1972) and Dyas (1972)), also suggested an association between strategy and structure in other Western European countries too, and that it is hence independent of specific national cultures. None of these early studies, however, analysed the data statistically, relying on descriptive results and cross-classification to persuade the reader.

More recently the linkage between strategy and structure has been statistically tested in three separate studies by Rumelt (1974), Channon (1975), and Grinyer et al (1978). Rumelt (1974) found a

statistically significant positive correlation between strategy and structure using ordinal scales based on Wrigley's classification system and related both strategy and structure to financial performance. Channon (1975) replicated Rumelt's (1974) study on a sample of companies in UK service industries and found very similar results. Grinyer et al (1978) in a survey of 48 large UK companies found the same positive correlation between strategy and structure. They further showed that the strategy structure linkage was independent of other correlates of structure such as lateral and vertical spans of control and measures of size.

The work of Grinyer et al (1978), in addition to testing hypotheses on the relationships between strategy and structure and measures of financial performance, extended this school of thought by relating perceptions of top management on their environment to strategy, structure, the fit between strategy and structure and measures of financial performance. This extension was in response to Franko's (1974) observation that a number of large Western European companies adopted multidivisional structures that fitted their strategy of diversification only after their market environment became more competitive or hostile. Grinyer et al (1978) showed that although companies with a better match between strategy and structure perceived less environmental hostility, and that perceptions of environmental hostility were negatively correlated with performance, match or fit between strategy and structure was not associated with better performance.

Earlier researchers have argued that divisional structures are more structured than non-divisional ones. Staff specialists,

and capital budgeting, financial control and corporate planning systems are introduced to coordinate and control lower hierarchical levels from the head office (Berg, 1971; Channon, 1973). Although not statistically tested in any other study to date, the association between greater structuring and divisionalisation was tested in the CUBS Study by relating bureaucratic characteristics to an ordinal scale of overall administrative complexity or SHAPE[1]. This archetypal, ordinal scale was shown in Chapter 4 to be statistically significantly correlated with all measures of bureaucracy: vertical span of control, formalisation, specialisation, qualifications and decentralisation of operating decisions. Given the correlation between strategy and structure found by Rumelt (1974), Channon (1975) and more recently by Grinyer et al (1978), strategy and measures of bureaucracy are likely to be positively correlated too. This would be consistent with Chandler's (1962) argument. Decentralisation of operational decision taking and creation of a general office as a means of addressing the administrative problems inherent in diversified businesses perhaps inevitably involve constraining sets of procedures, role definitions and use of technically qualified staff. There is, therefore, a need to test the linkage between strategy and bureaucracy statistically.

Organisational behaviourists, Pugh et al (1969a), Child (1972a) and Reimann (1973) have shown that size is one of the major predictors of bureaucratic characteristics. The results of the CUBS Study reported in Chapter 5, in addition to supporting the earlier findings of other researchers that organisational size is

(Note (1) - See Section 4.3.)

strongly associated with bureaucracy, established a strong positive correlation between organisational size and complexity of the overall administrative structure. As for bureaucracy, company size would, therefore, also be expected to be related to strategy. Indeed, Chandler (1962) perceived that companies expand geographically, diversify and then move into divisional structures as they grow. However, apart from the study of Grinyer et al (1978), the relationship between size and strategy has not been statistically tested in any other study.

Other situational factors may also be associated with strategy. Apart from the parallel study at the City University Business School by Grinyer et al (1978) where size, number of operating sites, and a number of environmental variables were considered, no other study to date has tested possible relationships between strategy and contextual variables such as company size, age, dependence, number of operating sites, technology, style and the environment.

Finally, all other studies concerned with relationships between strategy and structure and extensions mentioned above have used samples of large companies usually drawn from multi-industry sample frames. The relationship between strategy and structure has not been tested on a sample where a wide range of size categories is represented, including small companies where one would expect to find owner manager, informal structures (Scott's (1971) Stage I) and large diversified companies with multidivisional structures (Scott's Stage III). This possibility is, however, afforded by the CUBS sample drawn from the Electrical Engineering Industry in

the UK, represented by companies in the size range of 45 - 17,000 employees.

As outlined above, there are wide gaps in the empirical studies relating to the strategy structure school of thought. The aim of this Chapter is, therefore, to narrow these gaps and to relate the strategy/structure and organisational behaviour schools of thought by firstly relating strategy to bureaucratic characteristics and to test statistically if diversified companies are more structured or bureaucratic. Secondly, by relating strategy to size, to test Chandler's argument that companies diversify as they grow. Thirdly, by relating other situational characteristics such as company age, dependence, number of operating sites, technology and parent company size to strategy to test if variables other than structure are related to strategy. Finally, by relating strategy to organisational style, to further extend the earlier empirical studies and to identify organisational styles associated with different degrees of diversity.

Section 7.2 outlines the scales of strategy used in the CUBS Study. The statistical results are presented in Section 7.3 and a summary of the findings is presented in Section 7.4.

7.2 SCALE OF STRATEGY

Ordinal scales based on Wrigley's (1970) classification of diversification have been used in the earlier studies of relationship between strategy and structure. This classification system is based on the proportion of company's revenues attributable to its major product line and the relationship between product lines in terms of technology and markets. Wrigley (1970) classified the firms in his sample into four strategic categories:-

(1) Single product: firms which grew by expansion of one product line such that at least 95% of sales lay within this single product area.

(2) Dominant product: firms which grew primarily by expansion of one main product line, but which in addition had added secondary activities contributing between 6 and 30% of the total sales volume. This secondary activity might be related to the primary activity.

(3) Related product: firms which grew by expansion, by means of entry into related markets, by use of related technology, by related vertical activities, or some combination of these, such that no single product line accounted for 70% of total sales.

(4) Unrelated product: firms which grew by expansion into new markets and new technologies unrelated to their original product market scope, such that no one product line accounted for 70% of total sales.

Rumelt (1974) drawing attention to the generality of the definition of product line stated that:

> "Wrigley's placement of firms like Texaco and Deere in the Dominant Product class indicates that he employed a broader concept of a 'product' than is usually meant by the term. In order to minimise any confusion over this point, a revised set of category titles was adopted: Single Business, Dominant Business, Related Business, and Unrelated Business.
>
> Underlying these categories and central to the scheme is the idea that a corporation's activities can be conceptually divided into a number of discrete businesses. A discrete business means one that could be managed independently of the firm's other activities. Since interdependencies are difficult to observe or judge in a static situation, the separability of a particular business is assessed by evaluating the degree to which its basic nature and scope could be altered without meeting constraints imposed by the firm's other businesses, and without materially affecting the operation and strategic direction of other activities." (Rumelt, 1974: 12)

After tentatively identifying a firm's largest discrete business, he asked about the effects of the following 3 strategic changes on this and other of the firm's businesses in order to evaluate the extent and type of interdependencies between the firm's businesses:-

(1) A decision to drop a product market activity or, conversely, to greatly increase its relative size.

(2) A decision to employ a different production technology or process or to use a different type of raw material.

(3) A decision to significantly alter the price, quality or service associated with the product.

Replacing product line by discrete business, he further sub-divided Wrigley's dominant category into four sub-categories of dominant vertical, constrained, linked and unrelated; the related category into related constrained and linked; and the unrelated into unrelated passive and conglomorate. By this means he devised a nine point classification of strategy.

Two scales are used in the CUBS Study to represent a company's strategy. The first is a four point, ordinal scale based on Wrigley's (1970) classificatory system. Respondents were asked to provide a list of product lines manufactured by their company and to indicate the percentage of sales attributable to their largest product line. They were also asked to indicate whether product lines were marketed through the same distributive channels and were produced by similar manufacturing technologies. Judgment had to be exercised in classifying the companies into the four strategic categories and Rumelt's guidelines (see above) for identification of a discrete business proved useful. This approach was deemed necessary in view of differences in perceptions of top management as to what constituted a product line. The scores allocated to strategic categories were as follows:

Strategic Category	Score
Single product	1
Dominant product	2
Related product	3
Unrelated product	4

A further seven point scale was also devised which reflected to a more refined degree the extent of interdependence between product lines. The dominant product category was divided into three sub-categories:-

(i) Dominant product firms where other product lines were related to the main product line in terms of both technology and market. (Similar to Rumelt's dominant constrained category.)

(ii) Dominant product firms where other product lines were related to the main product line either by technology or market. (Similar to Rumelt's dominant linked category.)

(iii) Dominant product firms where other product lines were unrelated to the main product line. (The same as Rumelt's dominant unrelated category.)

The related category was sub-divided into two sub-categories:-

(i) Related product firms where other product lines were related to the main product line in terms of both market and technology.

(ii) Related product firms where other product lines were related to the main product line either by market or technology.

The above two sub-categories are similar to Rumelt's related constrained and related linked categories. The scores were allocated on the basis of the extent of product market diversification running from one for single product to seven for unrelated product firms.

Strategic Category	Score
Single product	1
Dominant product (M&T)	2
Dominant product (M/T)	3
Dominant product (unrelated)	4
Related product (M&T)	5
Related product (M/T)	6
Unrelated product	7

Although Rumelt's guidelines for evaluation of the extent of interdependencies between product markets proved useful in classifying the companies, his definition of discrete business could not be strictly adhered to due to the relatively smaller size of companies represented in the CUBS sample. Rumelt's sample was drawn from a population of largest American enterprises where the the definition would be more appropriate. For the same reason, there were no dominant vertical companies, unrelated passive or conglomorates in the CUBS sample. Table 7.2.1 shows the number of companies in each of the categories of strategy. Also number of companies in each of the structural categories are shown.
The archetypal, ordinal scale of structure (see section 3.3.5) runs from zero for owner-manager/ informal structure, to six for worldwide product/ world partitioned geographical structure.

Table 7.2.1 Classification of the sample by strategy and structure

Based on Wrigley's (1970) classification of strategy		Based on Rumelt's (1974) classification of strategy	
Category	No. of companies in the sample	No. of companies in the sample	Category
Single product	24	24	Single product
		4	Dominant related by market & technology
Dominant product	6	1	Dominant related by market or technology
		1	Dominant unrelated
		7	Related by market and technology
Related product	11	4	Related by market or technology
Unrelated	-	-	Unrelated
Total	41	41	Total

Classification by structure

Category	No. of companies in the sample
Owner manager	4
Functional	27
Functional plus sales/ service divisions	3
Holding company	5
Semi-multi divisional	4
Multi- divisional	1
Worldwide product/ world partitioned geographical structure	1
Total	45

7.3 CORRELATES OF STRATEGY

7.3.1 Strategy, Structure and Size

Tables 7.3.1 and 7.3.2 show both Pearson's and Kendall's correlation coefficients between the two measures of strategy (based on Wrigley's and Rumelt's classifications) and structural and contextual variables for the full and the 'manufacturing only' samples in the CUBS Study respectively. Also shown are coefficients of correlation between the ordinal scale of structure and size and structural and contextual variables. Both Pearson's and Kendall's coefficients have the same level of significance in almost all cases. Furthermore, the pattern of correlations for both the full and the 'manufacturing only' samples are very similar and those for the 'manufacturing only' sample are more significant.

As may be seen from Tables 7.3.1 and 7.3.2, strategy is highly statistically significantly correlated with type of structure (beyond the 0.001 level). The strong positive correlation indicates that the linkage found between strategy and structure by Rumelt (1974), Channon (1975) and more recently by Grinyer et al (1978), all using samples of large companies, is also true for the CUBS sample where a wider range of size categories is represented(1).

(Note (1) - The range of distribution of size in the CUBS sample is 45 - 17,000.)

Table 7.3.1 Pearson's Product Moment Correlations and Kendall's Tau Correlations between Measures of Strategy, Structure and Size and Structural and Contextual Variables. Full Sample (N=45)

STRUCTURAL VARIABLES	Diversification strategy, based on Wrigley's classification	Diversification strategy, based on Rumelt's classification	STRUCTURE SHAPE	SIZE LOG
1. Chief executive's span of control	27*	28*	43**	33*
	24*N	25*N	37***N	17*N
2. Subordinate ratio	-	-	-	-
	18SN	27*N	-	25*N
3. Vertical span of control	47***	40**	56***	75***
	41***N	33**N	39***N	55***N
4. Administrative/production (A/P) ratio	-	-	-	-
	-	-	33**N	20*N
5. Number of indirect employees (log.)	54***	49**	59***	95***
	44***N	39***N	41***	79***N
6. Type of structure (SHAPE)	50***	48***	1.00	58***
	42***N	31**N	1.00	39***N

continued

7. Qualifications	36**	33*	22S	71***
	31**N	30**N	17S	57***N
8. First degree holders (log.)	51***	50***	-	76***
	31**N	28**N	-	54***N
9. Higher degree holders (log.)	46**	45**	-	53***
	36**N	29**N	-	48***N
10. Formalisation	42**	40**	38**	68***
	34***N	35***N	29**N	53***N
11. Functional specialisation (ASPEC)	44**	39**	44***	84***
	37***N	31**N	36***N	69***N
12. Autonomy	-23S	-21S	-	-
	-	-	-	-
13. Centralisation (AC)	-35*	-31*	-29*	-62***
	-30**N	-24*N	-18*N	-44***N
14 Centralisation of marketing decisions	-	-	-	-22S
	-	-	-	-19*N

continued

15. Centralisation of financial decisions	-	-	-	-
	-	-	-	-
16. Centralisation of operating decisions	-42**	-36**	-38**	-68***
	-33**N	-26**N	-20*N	-46***N
CONTEXTUAL VARIABLES				
1. Size (log.)	62***	58***	58***	1.00
	51***N	46***N	39***N	1.00
2. Age	35*	35*	29*	29*
	29**N	29**N	-	15SN
3. Impersonality of origin	-	-	-	35**
	-	-	-	28**N
4. Status	26*	29*	-	23S
	24*N	24*N	26**N	29**N
5. Relative size	21S	23S	-	22S
	15SN	-	22*N	15SN

continued

6. Dependence	22S	23S	-	29*
	-	-	16SN	21*N
7. Number of operating sites	-	-	35**	31*
	24*N	22*N	41***N	38***N
8. Automaticity mode	-	-	-	-
	-	-	-	-
9. Automaticity range	28*	26S	-	66***
	27**N	25*N	14SN	56***N
10. Charter	-	-	-	-
	-	-20*N	22*N	-
11. Design and development technology	40**	37**	-	45***
	35***N	29**N	-	31**N
12. Parent company size (log.)	40**	37**	34*	56***
	32**N	26**N	29**N	46***N

Notes to Table 7.3.1

N	Kendall's tau correlation coefficient
-	Not significant
S	Strongly suggestive at 0.1 level
*	Signiiicant at 0.05 level
**	Significant at 0.01 level
***	Significant at 0.001 level

Table 7.3.2 Pearson's Product Moment Correlations and Kendall's Tau Correlations between Measures of Strategy, Structure and Size and Structural and Contextual Variables. Manufacturing only Sample (N=40)

STRUCTURAL VARIABLES	Diversification strategy, based on Wrigley's classification	Diversification strategy, based on Rumelt's classification	STRUCTURE SHAPE	SIZE LOG
1. Chief executive's span of control	-	22S	42**	36*
	23*N	26*N	37***N	20*N
2. Subordinate ratio	-	-	-	-
	-	21SN	-	24*N
3. Vertical span of control	44**	37*	57***	76***
	38***N	30**N	46***N	57***N
4. Administrative/ production (A/P) ratio	-	-	-	-
	19SN	-	30**N	27*N
5. Number of indirect employees	61***	56***	59***	96***
	51***N	47***N	44***N	84***N

continued

6. Type of structure (SHAPE)	51***	49***	1.00	59***
	48***N	39***N	1.00	45***N
7. Qualifications	49***	45**	30*	76***
	40***N	39***N	26*N	60***N
8. First degree holders (log.)	64***	61***	25S	79***
	40***N	35**N	-	57***N
9. Higher degree holders (log.)	60***	58***	27S	57***
	50***N	42***N	17SN	50***N
10. Formalisation	49***	47**	42**	69***
	40***N	41***N	34**N	55***N
11. Functional specialisation (ASPEC)	52***	46**	46***	86***
	43***N	37***N	42***N	70***N
12. Autonomy	-	-	-	-
	-	-	-	-
13. Centralisation (AC)	-41**	-34*	-34*	-63***
	-34**N	-25*N	-29**N	-47***N

continued

14. Centralisation of marketing decisions	-	-	-	-22S
	-	-	-	-18SN
15. Centralisation of financial decisions	-	-	-	-
	-	-	-	-
16. Centralisation of operating decisions	-44**	-38*	-42**	-68***
	-36**N	-27*N	-27**N	-48***N
CONTEXTUAL VARIABLES				
1. Size (log.)	66***	61***	59***	1.00
	55***N	50***N	45***N	1.00
2. Age	41**	41**	31*	31*
	32**N	32**N	-	17SN
3. Impersonality of origin	-	-	-	35*
	-	-	-	28**N
4. Status	37**	41**	-	25S
	34**N	33**N	31**N	31**N

continued

5. Relative size	32*	33*	-	23S
	23*N	18SN	24*N	17SN
6. Dependence	32*	32*	21S	30*
	17SN	-	19*N	22*N
7. Number of operating sites	43**	44**	57***	66***
	33**N	34**N	39***N	49***N
8. Automaticity mode	-	-	-	-
	-	-	-	-
9. Automaticity range	43**	40**	31*	73***
	37***N	34**N	27**N	61***N
10. Charter	N/A	N/A	N/A	N/A
11. Design and development technology	46**	42**	-	47***
	38***N	31**N	19*N	34***N
12. Parent company size (log.)	50***	47**	36*	58***
	40***N	34**N	34**N	47***N

Notes to Table 7.3.2

N	Kendall's tau correlation coefficient
-	Not significant
S	Strongly suggestive at 0.1 level
*	Significant at 0.05 level
**	Significant at 0.01 level
***	Significant at 0.001 level

Unlike the findings of the 48 large UK companies study (Grinyer et al, 1978) where strategy was uncorrelated with all measures of size, such as turnover, capital employed and number employed, strategy and size are highly statistically significantly correlated for the CUBS sample. Moreover, company size is more strongly correlated with strategy than with structure, perhaps implying that structure follows strategy. This would be consistent with Chandler's (1962) argument that companies diversify, then adopt a multidivisional structure as they grow. Diversification as a strategy for growth leading to adoption of a multidivisional structure is also the cornerstone of Scott's (1971) stages of growth model.

The lack of any significant association between strategy and size reported by Grinyer et al (1978) may, however, be attributable to the multi-industry nature of their sample. Their sample included giants in mature industries, like coal mining and steel which were classed as single or dominant product companies. In contrast, companies in the CUBS sample were all drawn from the electrical engineering industry where diversification tends to be more a result of internal product development than acquisitions (see also Channon, 1973: 96) and where financial and technical manpower capabilities, prerequisites of internal product development, can only be provided in the context of larger organisations.

From Table 7.3.2 it may be seen that approximately 44% and 35% of the variation in strategy and structure respectively are explained by variations in organisational size, whereas only 26%

of the variation in structure is explained by strategy and vice versa. This further highlights the importance and influence of size on both strategy and structure. As expected, first order partial correlations between size and strategy, controlling for structure, ($r = .52$ $p_\alpha < .01$), although reduced in size, still remained significant. In contrast, that between strategy and structure, controlling for size ($r = .20$, $.05 < p_\alpha < .1$), ceased to be significant, but was still strongly suggestive of a positive relationship. This does not, of course, mean that the linkage between strategy and structure is unimportant, but strongly indicates the fact that size has greater influence on both strategy and structure than they have directly on each other (Table 7.3.3).

7.3.2 Strategy and Configuration

Lateral and vertical spans of control were shown in Section 4.3 to be highly statistically significantly correlated with the ordinal scale of structure (SHAPE). Multivariate analysis of the structural variables also resulted in a factor represented by the configurational variables of lateral and vertical spans of control and the ordinal scale of structure, which was consequently called the configuration factor[2]. In addition, the number of operating sites, which may itself be considered as a configurational variable, was shown in Section 5.8 to be a part of this cluster. Moreover, it was shown that the inter-relationships between these four variables were independent of effects of size. Therefore, companies with more complex overall administrative structures were not only wider and taller, but also had greater numbers of

(Note (2) - See Section 4.5.)

Table 7.3.3 Partial Correlations. Manufacturing only Sample (N=40)

STRUCTURAL VARIABLES	Partial correlations with strategy, controlling for log. size	Partial correlations with structure, controlling for log. size	Partial correlations with strategy, controlling for structure	Partial correlations with structure, controlling for strategy	Partial correlations between strategy and structure, controlling in turn for the variable shown in the row
1. Chief executive's span of control	-	28*	-	37*	58***
2. Subordinate ratio	-	-	-	-	51**
3. Vertical span of control	-	23S	-	45**	35*
4. Administrative/production (A/P) ratio	-	-	-	23S	51**
5. Number of indirect employees (log.)	-	-	44**	41**	-
6. Type of structure (SHAPE)	19	N/A	N/A	N/A	N/A
7. Qualifications	-	-28*	41**	-	44**
8. First degree holders (log.)	25S	-44**	61***	-	47**

continued

9. Higher degree holders (log.)	36*	-	56***	-	45**
10. Formalisation	-	-	35*	23S	38**
11. Functional specialisation	-	-	37*	27S	36*
12. Autonomy	-21S	-	-	21S	50**
13. Centralisation (AC)	-	-	-29*	-	43**
14. Centralisation of marketing decisions	-	-	-	-	51**
15. Centralisation of financial decisions	-	-	-	-	51**
16. Centralisation of operating decisions	-	-	-29*	-25S	40**
CONTEXTUAL VARIABLES					
1. Size (log.)	N/A	N/A	52***	39**	20
2. Age	30*	-	31*	-	44**
3. Impersonality of origin	-22S	-	-	-	51***

continued

4.	Status	29*	-	32*	-	48***
5.	Relative size	22S	-	26S	-	48***
6.	Dependence	-	-	25S	-	48***
7.	Number of operating sites	-	30*	-	45**	36*
8.	Automaticity mode	-	-	-	-	51***
9.	Automaticity range	-	-22S	33*	-	44**
10.	Design and development technology	22S	-	43**	-	49***
11.	Parent company size	19	-	39**	-	41**

Notes to Table 7.3.3

-	Not significant
S	Strongly suggestive at 0.1 level
*	Significant at 0.05 level
**	Significant at 0.01 level
***	Significant at 0.001 level
N/A	Not applicable

operating sites. These associations make a great deal of intuitive sense. Indeed, an assumption is often made in the literature that product divisional structures involve greater vertical and lateral spans of control. A greater vertical span of control, defined as the number of hierarchical levels between the chief executive and the lowest organisational level, is implied by interposing an additional, divisional level between him and the peripheral business units. Similarly, it is often assumed that a greater number of specialist staff officers report to him at the head office, thus increasing his lateral span of control. Moreover, it would be reasonable to assume that adoption of a multidivisional structure may also be a response to greater complexities and difficulties of coordination and control in companies with greater numbers of operating sites.

Given the above pattern of relationships and the strong positive correlation between strategy and structure, strategy would be expected to be positively correlated with lateral and vertical spans of control and the number of operating sites. Table 7.3.2 shows that this is indeed so. Strategy is significantly positively correlated with all three measures of organisational configuration. However, as may be seen from Table 7.3.3, these correlations may be attributed to the effects of archetypal structure for the partial correlations when controlling for type of structure are not significant.
For reasons advanced earlier, the association between structure and lateral and vertical spans of control, and number of operating sites would be expected to be independent of strategy.

Table 7.3.3 shows that first order partial correlations between structure and these variables are all significant at least beyond the 0.05 level. This suggests that the inter-relationships between the structural variables (shape, lateral and vertical spans of control and the number of operating sites) are independent of strategy, as one would expect. This in part explains the low percentage of variance of structure explained by strategy. Moreover, Table 7.3.3 shows that the linkage between strategy and structure is independent of other structural correlates of the latter. First order partial correlations between strategy and structure, controlling in turn for lateral and vertical spans of control and the number of operating sites, are all positive and significant beyond the 0.05 level.

7.3.3 Strategy and Bureaucracy

Tables 7.3.1 and 7.3.2 also show that diversification strategy is highly statistically significantly correlated with all measures of bureaucracy: vertical span of control, formalisation, specialisation, qualifications, and decentralisation of operating decisions. These variables were shown in Chapter 4 to be highly statistically significantly intercorrelated and in the multivariate analysis of all the structural variables clustered on a single factor, which was called structuring of activities, or bureaucracy. Results of Chapters 4 & 5 with respect to the associations between the ordinal scale of structure and company size with bureaucratic characteristics were seen as confirmation of Weber's contention that bureaucracies typify the larger and more complex organisations.

As may be seen from Table 7.3.2, bureaucratic characteristics are significantly positively correlated with size, strategy and structure. However, the strength of these correlations varies and is more significant for size, than strategy or lastly structure. Consequently, a greater proportion of variation in bureaucratic characteristics is explained by company size than by strategy. Similarly, strategy explains a greater proportion of variance in bureaucratic charactertistics than the ordinal scale of structure.

As expected, once allowance was made for the effects of size by deriving first order partial correlation coefficients between bureaucracy and strategy, controlling for size, the correlations

became insignificant. However, in view of the pattern of correlations, this does not mean that bureaucracy and diversification are unrelated, but that size is related to both strategy and bureaucracy more strongly. The pattern of correlations, therefore, suggests that bureaucracy is related to diversification largely via size. The same conclusion was reached with respect to the association between strategy or diversification and type of structure or divisionalisation.

The importance of bureaucracy as a strategy of control based on knowledge was stressed in Chapter 4 as a means of controlling and coordinating activities of large and complex organisations (see also Child, 1972 a). In view of the observed pattern of correlations it may be said that diversified companies adopt a bureaucratic mode of control: decentralisation of operating decisions and control by means of formalised procedural devices.

As was shown in Section 4.6, centralisation of the more strategic marketing and financial decisions was not related to bureaucracy, and as may be seen from Tables 7.3.1 and 7.3.2, they are unrelated to strategy too. This indicates that in diversified companies, the more strategic marketing and financial decisions are not decentralised. These decisions are perhaps taken by top management where constraints are loosened and management have wider vision. Indeed, diversified companies may have adopted the bureaucratic mode of control as a means of ensuring efficient implementation by lower level management of such strategic decisions.

The findings of the CUBS Study reported above provide substantial support and are in close agreement with the observations of the earlier researchers that, as companies diversify and grow from a narrow product market base (single product) to become large diversified concerns (related and unrelated product), the organisational structure becomes progressively more formalised and structured. While management of a small organisation at the single product stage is possible through an informal structure or a functional one, if larger, large diversified concerns with more complex and diverse product market postures tend to be managed through more bureaucratic, divisionalised structures. The adoption of a multidivisional structure may well be a response to greater complexities brought about as a result of growth in size and operating in a number of diverse product market areas. In diversified divisionally structured companies, the creation of a general office facilitates delegation of the more routine operating decisions to the lower hierarchical levels, whilst allowing the top management to take the more strategic decisions with respect to markets and resource allocations.

Table 7.3.2 shows that the number of first and higher degree holders is also statistically significantly positively correlated with strategy. Moreover, first order partial correlation coefficient between higher degree holders and strategy, controlling for size, remained statistically significant at the 0.05 level and the correlation with the number of first degree holders remained strongly suggestive of a positive relationship. Thus, both zero and first order correlations indicate that the more diversified companies tend to employ larger numbers of first and higher degree

holders and that this relationship is independent of size. This result was, however, expected due to the nature of industry from which the sample was drawn.

As was mentioned earlier, in the electrical engineering industry where the environment is characterised by rapid changes in the technological conditions and a high rate of new products innovation, companies tend to diversify more by internal product development based on related technologies or markets, than by acquisitions. However, conglomorates with substantial business interests in electrical engineering and electronics have grown both through acquisitions and new product developments. This is especially true of the CUBS sample of companies due to their level of business operations. First and higher degree holders in these companies are primarily engaged in design and development of new processes and products. Therefore, companies employing larger numbers of first and higher degree holders were expected to be more diversified.

7.3.4 Other Situational Correlates of Strategy

Other situational variables are also correlated with strategy. Table 7.3.2 shows that strategy is significantly positively correlated with company age, status, relative size, dependence, automaticity range, technology of design and development, and parent company size.

Company age is correlated more significantly with strategy than with either size or structure. This positive correlation,

which remains significant (beyond the 0.05 level) once allowance is made for the effects of size, indicates that older companies tend to be more diversified irrespective of size. Greater diversification by the older companies may be a response to declining rates of profits on their well established, but now mature product lines. Such maturity is likely to follow the rapid rate of technological change and fast rate of new product introductions by competitors within the industry.

The positive correlations between strategy and status, relative size, dependence, automaticity range and parent company size are largely attributable to the effects of size. The CUBS sample of companies comprised small private independent units and large subsidiaries of larger organisations(3). The first order partial correlations between strategy and these variables controlling for size, however, suggested that some of the associations may be indpendent of size. The partial correlation with status remained significant beyond the 0.05 level and those for relative size and parent company size are suggestive of a positive correlation. Private independent units scored low on these variables as opposed to subsidiaries of the larger companies. This tendency for companies belonging to larger organisations to be more diversified may be the results of absence of family ownership and management in these companies. Channon (1973), in his multi-industry study of strategy and structure, stated that in industries where family ownership and management of companies were predominant, fewer incidences of diversification were observed.

(Note (3) - See Section 5.3.)

Finally, the positive correlation between strategy and design and development technology, which also remains suggestive of a positive relationship when size is partialled out, indicates that companies with more complex design and development technologies, which also employ relatively larger numbers of degree holders, tend to be more diversified in an industry characterised by rapid rates of technological innovations.

As may be seen from Table 7.3.3, the linkage between strategy and structure is stable and independent of other correlates of strategy and structure, with the exception of size, already discussed. As for configurational variables, once allowance was made for the effects of bureaucratic and situational variables by deriving the first order partial correlations between strategy and structure, controlling in turn for each of these variables, the partial correlation coefficient between strategy and structure in each case remained significant at the 0.05 level at least.

7.3.5 Stylistic Correlates of Strategy

Tables 7.3.4 and 7.3.5 show the Pearson's and Kendall's correlation coefficients between the two measures of strategy and organisational styles for the full and 'manufacturing only' samples respectively. The coefficients with the finer scale of strategy based on Rumelt's (1974) classification guidelines are more significant for both samples. For the full sample, degree of diversification (strategy) is significantly correlated with planning orientation, risk taking, conservative (growth) and the human relations orientation styles. The sizes of the correlations, as expected, are much smaller and consequently less significant than those between strategy and either size or structure (Tables 7.3.1 and 7.3.2). All these organisational styles were shown in Chapter 6 to be either related to organisational size or degree of bureaucratisation. In view of the pattern of correlations, the relationships with strategy are expected to be largely attributable to the effects of size. The correlations, however, are consistent with possible causal explanations.

The positive correlation with the risk taking style, which is significant at the 0.05 level for both the full and 'manufacturing only' samples, indicates that the more diversified a company, the greater the extent to which it tends to adopt the risk taking style. Diversification reduces risk by spreading the portfolio of investments and it would thus be reasonable to assume that the more diversified companies with lower overall risk profiles would be better placed to take high risks to

Table 7.3.4 Pearson's Product Moment and Kendall's Tau Correlations between Measures of Strategy and Style.

Full Sample (N=45).

Organisational Style	Strategy based on Wrigley's classification	Strategy based on Rumelt's classification
1. Planning orientation	24S 16SN	28* 21*N
2. Risk taking	29* 25*N	32* 27*N
3. Conservative (growth)	21S 15SN	26S 19*N
4. Human relations orientation	- -19*N	- -28*N

Notes

N	Kendall's tau correlation coefficient
-	Not significant
S	Strongly suggestive at 0.1 level
*	Significant at 0.05 level

Partial correlations controlling for size all insignificant. Technological leadership, risk averting, training orientation, conservative (change), participative, mechanistic, aggressively adaptive, autocratic and traditional styles were unrelated to strategy and are therefore not shown in the Table.

Table 7.3.5 Pearson's Product Moment and Kendall's Tau Correlations between Measures of Strategy and Style.

Manufacturing only Sample (N=40).

Organisational Style	Strategy based on Wrigley's classification	Strategy based on Rumelt's classification
1. Risk taking	35* 30**N	37* 31**N
2. Conservative (growth)	26S 18SN	31* 19SN
3. Human relations orientation	- -17SN	- -28*N

Notes

N	Kendall's tau correlation coefficient
-	Not significant
S	Strongly suggestive at 0.1 level
*	Significant at 0.05 level
**	Significant at 0.01 level

Partial correlations controlling for size all insignificant. Technological leadership, planning orientation, risk averting, training orientation, conservative (change), participative, mechanistic, aggressively adaptive, autocratic and traditional styles were unrelated to strategy and are therefore not shown in the Table.

obtain high rates of return on investment and to undermine major competitors. As was shown in Sections 6.5.2 and 6.6.2, this style of management tended to be adopted to a greater extent by the larger, more bureaucratic companies. It was argued that the greater economic power of the larger companies would place them in a more favourable situation to commit resources to high risk projects and to undermine major competitors. Similarly, with respect to the finding that diversified companies tend to be more planning oriented, it may be argued that long range planning is a means of controlling and coordinating diversified activities (see Grinyer and Al-Bazzaz, 1979). Examination of the correlations between the two items making up this scale and strategy, however, revealed that strategy was only related to the item "use of outside experts to investigate problems and propose changes when attempting organisational change". This supports Channon's (1973) observation that adoption of the multidivisional structure as a response to greater diversification in large UK companies was primarily induced by outside consultants. This relationship may therefore be attributable to this phenomenon. The coefficient of correlation is, however, insignificant for the 'manufacturing only' sample and, therefore, may not have any general significance. However, as may be seen from Tables 7.3.4 and 7.3.5, these correlations may be attributable to the effects of size.

Somewhat surprisingly, a more conservative approach to growth is positively correlated with diversification strategy. Closer examination of data, however, revealed that only low emphasis on growth through external financing correlated significantly with

strategy (beyond the 0.05 level). It was shown in Section 6.5.4 that the larger companies tended to rely less heavily on growth through external financing. Since the larger companies were more diversified, the correlation may be attributable to the effects of size.

The human relations orientation style was shown in Section 6.5.8 to be adopted to a lesser extent by the more bureaucratic companies. It was argued that the greater vertical and horizontal differentiation characteristics of these companies precluded greater involvement of lower level employees in organisational change programmes. Also, diversification means separation of corporate management from the operating units and vice versa. The negative correlation between human relations orientation style and diversification may, however, be largely attributable to effects of size and bureaucracy.

7.4 SUMMARY AND DISCUSSION

Earlier researchers, Fouraker and Stopford (1968), Rumelt (1974), Channon (1975) and Grinyer et al (1978), using samples of large companies, established a strong positive correlation between strategy and structure and in this way provided statistical support for Chandler's (1962) observations of historical development of large US corporations, that adoption of a multidivisional structure was associated with diversification. The results of the CUBS Study reported in this Chapter both confirmed these earlier findings by showing that strategy and structure are highly statistically significantly correlated and extended the analysis by relating strategy to other structural and contextual characteristics, and, therefore, provided the bridge between the strategy/structure and organisational behaviour schools of research. Unlike earlier studies where samples of large companies were used, the CUBS sample represented a much wider spectrum of company sizes, ranging from 45 to 17,000 employees, all drawn from the electrical engineering industry. In this way, the strategy structure linkage found in the CUBS Study is in itself a further extension of the earlier findings. In addition to structure, strategy was found to be highly statistically significantly correlated with size. Moreover, company size correlated more significantly with strategy than with structure. Approximately 44% and 35% of the variations in strategy and structure were in turn explained by variations in size, whereas only 26% of the variation in strategy was explained by structure and vice versa. The greater proportion of the

variation in both these measures explained by size than by each other does not, however, deny the importance of the linkage between strategy and structure but does show that size has a greater influence on both. The nexus found between strategy, structure and size further substantiates Chandler's (1962) argument that companies diversify and adopt a multidivisional structure as they grow.

Strategy was shown to be highly statistically significantly correlated with the configurational variables of lateral and vertical spans of control and number of operating sites. However, these correlations were shown to be largely attributable to the effects of structure and were only related to strategy via structure. The strategy structure linkage was shown to be independent of these configurational variables. Furthermore, the correlations between structure and vertical and lateral spans of control and number of operating sites, which were shown in Chapter 5 to be independent of effects of size, were also shown to be independent of strategy. This finding, which was also reported by Grinyer et al (1978) on a sample of 48 large UK companies, in part explains the low percentage of variance in structure explained by strategy.

Strategy was highly statistically significantly correlated with all measures of bureaucracy: vertical span of control, formalisation, specialisation, qualification and decentralisation of operating decisions. In each case, however, company size correlated more significantly with bureaucracy than did strategy. The partial correlations between bureaucratic characteristics

and strategy indicated that, as for structure, the relationships might be attributed to size. The finding of the CUBS Study in this respect, therefore, is in agreement with the observations of earlier researchers that, as companies grow from a narrow product market base to become large diversified concerns, the organisational structure becomes progressively more formalised or structured.

Bureaucracy, as a strategy of control based on knowledge, was perceived in Chapters 4 and 5 as a means of coordinating and controlling activities of large and complex organisations. The pattern of correlations found between strategy, structure, size and bureaucracy indicates that adoption of multidivisional structures and institution of bureaucratic procedures may be seen as structural responses to greater complexities induced as a result of growth in size and greater diversity of product market scope.

The results on the relationships between strategy and decentralisation indicate that whilst decentralisation of operating decisions is statistically significantly correlated with strategy, decentralisation of the more strategic marketing and financial decisions are not. Diversified companies delegate operating decisions to lower hierarchical levels, where the knowledge about technologies and markets reside, whilst the more strategic decisions may be taken by top managment .

Number of first and higher degree holders and complexity of design and development technology were also highly statistically

significantly correlated with strategy. Moreover, these relationships were shown to be independent of size. This result was, however, expected. The electrical engineering industry is characterised by high rates of technological innovation and diversification is more likely to be a result of internal product development than acquisitions. Companies with more complex design and development technologies employing larger numbers of degree holders, who are primarily engaged in design and development of new products were, therefore, expected to be more diversified. Company age was shown to be more significantly correlated with strategy than with either size or structure. This relationship was also independent of effects of size. The greater diversification of the older companies may be attributable to declining rates of profit in their mature product lines and response to the changing pattern of competition over time.

Companies which were parts of larger organisations also tended to be more diversified. This may be attributable to the absence of family ownership and management in these companies and in this way substantiates Channon's (1973) observation that in industries where family ownership and management were predominant fewer incidences of diversification were observed. Finally, the linkage between strategy and structure, with the exception of size, was shown to be independent of all structural and contextual correlates of strategy and structure. Results on the relationships between strategy and style indicated that diversified companies tended to be more risk-taking and less human relations oriented.

PART D

CONCLUSIONS OF

CUBS STUDY

CHAPTER VIII

CONCLUSIONS

8.1 INTRODUCTION

An integrated approach to study of organisations was proposed in Chapter 1 and objectives of research relating to this thesis were set out. Research methodology, measurements and scales and statistics used were discussed in Chapter 2. Literature on elements of organisational context and structure was critically reviewed in Chapter 3 and measures of organisational complexity, organisational type, and design and development technology were introduced.

Aston Studies on dimensions of organisational structure were replicated and extended in Chapter 4 and the contraversy over the issue of centralisation was addressed. In Chapter 5, the literature relating to the two more thoroughly researched contingency theories of organisational structure: the size determinism school and the technological imperative school,was critically reviewed and evaluated in the light of the findings of the CUBS Study. The Aston Studies on contextual predictors of organisational structure were replicated and extended. Organisational style dimensions based on an analytical grouping of Khandwalla's measures were related to structure and context in Chapter 6, and, finally, the organisational behaviour and strategy/ structure schools of research were integrated by relating strategy to structure, bureaucracy, context and organisational style in Chapter 7.

8.2 MAJOR CONTRIBUTIONS TO THE BODY OF KNOWLEDGE ON ORGANISATION THEORY

The replication and extension of the Aston and National Studies on dimensions of organisational structure and their contextual predictors further reinforced the findings of these studies, extended and refined them by introduction of new measures and by contributing to resolution of contraversies over a number of issues.

CUBS results on dimensions of organisational structure showed that the same pattern of strong correlations were found between bureaucratic characteristics of vertical span of control, formalisation and functional specialisation for this specific sample drawn from the electrical engineering industry in the U.K. and extended them by inclusion of a measure of qualifications. The similarity of the findings of the CUBS Study to both the Aston and National Studies is truly remarkable, given the considerable differences in sample composition. This is important in a number of respects. First, it demonstrates the value of the original measures developed by Pugh et al (1968). Second, it shows the generality of the principal findings of the Aston and National Studies as descriptions of common tendencies. Third, it underlines the predictive power of the models they developed. This support for the earlier work is particularly timely in view of the growing tendency to reject the research methodology of the Aston and National Studies as inappropriate.

The relationship between centralisation and formalisation, an important aspect of Weber's (1947) bureaucracy, has been the major

focus of disagreement between the Aston and National Studies. Pugh et al (1968) found no relationship between centralisation and formalisation and in the multivariate analysis of Aston data, centralisation was independent of structuring. Based on these findings, they rejected Weber's ideal type bureaucracy, associating decentralisation with bureaucracy. Child (1972a), however, found that decentralisation was strongly related to all aspects of bureaucracy and although multivariate analysis of the National data also resulted in an independent concentration of authority factor, he argued that the relationship between centralisation and autonomy, which led to the emergence of this factor in both studies, was largely tautological and that decentralisation was an integral part of bureaucracy as a potent strategy of control. This issue has, however, largely been unresolved in further attempts by Donaldson and Aldrich (Donaldson et al, 1975). Correlation analysis of the CUBS data, however, showed that decentralisation was strongly related to all aspects of bureaucracy and in the multivariate analysis of structural variables was an important part of the structuring of activities factor. Moreover, the nexus found between centralisation and autonomy which led Inkson et al (1970a) to use autonomy as a proxy for centralisation was not found in the CUBS sample, suggesting that this relationship found by the Aston researchers has restricted validity outside their sample and use of autonomy, therefore, as a representation of centralisation is dangerous. In this respect, the CUBS results provide substantial support for Child's (1972a) thesis that decentralisation is an integral part of bureaucracy.

Qualifications, used by Child (1973a) as a predictor of bureaucratic control, was also shown to be a further aspect of bureaucracy, as well as a part of the structuring factor and, therefore, Weber's (1947) assertion that bureaucracy is a strategy of control based on

knowledge was substantiated. Hage's (1965) proposition that qualifications is associated with decentralisation was also, therefore, supported.

A deeper analysis of centralisation revealed that the measure was not unidimensional and that the Aston composite scale masked important differences between the items it comprised. Three separate clusters of centralisation of marketing, financial and operating decisions were identified by factor analysis and it was further shown that decentralisation of operating,but not the more strategic marketing and financial decisions,was related to bureaucracy. The more strategic decisions were, however, decentralised in companies with relatively higher degrees of autonomy. The data suggests that in a subsidiary company where top management is accountable for both sales and financial performance to a higher body, decisions on marketing and extra-budgetary expenditure are more likely to be taken by the chief executive himself, or referred to the headquarters. Marketing decisions were also more decentralised in companies with higher specialisation and larger numbers of degree holders. Companies in the CUBS sample employing larger numbers of degree holders were operating in the more technologically sophisticated sectors of industry where marketing decisions required a great deal of technical expertise. Results suggest that in these companies where such graduates were employed marketing decisions also tend to be more decentralised.

Introduction of an archetypal, ordinal scale of structural complexity permitted a link to be established between the Weber and Chandler inspired schools. This scale was shown to be strongly related to all measures of bureaucracy, supporting Weber's (1947)

assertion that bureaucracies typify large and complex organisations.

Complexity of structural type and lateral and vertical spans of control were strongly interrelated, and in the multivariate analysis resulted in the shape factor, indicating that companies with more complex overall structures tend to be both taller and wider. No such relationship was found in the Aston and National Studies[1], but found in a parallel study to this by Grinyer et al (1978). The nexus found between these configurational variables was then extended by inclusion of number of operating sites, itself a measure of organisational configuration, and it was shown that these relationships were largely independent of effects of size.

Replication of the Aston and National Studies on contextual predictors of organisational structure also further reinforced and refined the findings of these studies. CUBS results provided further support for size as a major predictor of organisational structure and in this respect are in close agreement with the findings of the advocates of the size determinism school (Pugh et al, 1969a; Blau, 1970; and Child, 1973a). Among the contexual variables considered, size correlated most strongly with all measures of bureaucracy: vertical span of control, qualifications, formalisation, functional specialisation, and decentralisation of operating decisions. However, company size was not related to centralisation of the more strategic marketing and financial decisions. Moreover, the decelerating marginal influence of size on structure, suggested by Blau (1970), was true for the CUBS sample; bureaucratic characteristics were

(Note (1) - The Aston and National Studies did not include a measure of structural type.)

shown to be logarithmic functions of size measured as total number of employees. In addition to bureaucracy, size was strongly related to configurational measures of chief executive's span of control, number of operating sites and the ordinal scale of structural complexity.

On technology, the CUBS results are in general in close agreement with those of the Aston and National Studies (Hickson et al, 1969, and Child and Mansfield, 1972) and therefore against the technological imperative (Woodward, 1958; Perrow, 1967; Harvey, 1968; Hage and Aiken, 1969; and Zwerman, 1970). Degree of automation of the manufacturing equipment was, however, related to centralisation of financial decisions, number of indirect employees and functional specialisation. The latter may be due to greater attempts on the part of these companies to insulate their core technology due to greater vulnerability of such companies to internal and externally induced disruptions. Analysis of a subsample of small companies in the CUBS Study showed, as had Child and Mansfield's (1972) analysis of a comparable subsample of the National sample, a number of relationships between technology and structural variables but no relations were found with configurational variables considered by Woodward (1958), and therefore Hickson et al's (1969) assertion that differences in size of companies in the Aston and South Essex Studies were responsible for differences in findings was rejected.

The hypothesis that design and development technology would be more closely related to structure, in particular organisational complexity, was tested and supported. The new measure of technology of design and development, based on Perrow's (1967) conceptual model,

although relatively crude, was shown to have good predictive power and was related to qualifications, functional specialisation and number of degree holders independently of size.

The Aston researchers' claim that dependence is the major predictor of concentration of authority (Pugh et al, 1969a) was not borne out in the CUBS Study and it was shown that, like autonomy, this result was specific to the Aston Study and should not, therefore, be generalised beyond their specific sample. Dependence on parent organisation as a predictor of centralisation must also be rejected.

Although size was the most important predictor, a number of other contextual variables explained a small proportion of variations in bureaucratic characteristics. Design and development technology only emerged as the most important predictor of number of higher degree holders and explained a greater percentage of variance of number of first degree holders than did dependence, whilst size remained the most important predictor of this aspect of complexity.

The strategy/structure linkage found by Rumelt (1974), Channon (1975) and more recently by Grinyer et al (1978), all using multi-industry samples of large organisations, was found to be strong within the CUBS sample of companies, ranging in size from 45 - 17,000 employees. In addition to structure, strategy was shown to be related to size. Moreover, strategy correlated more significantly with size than with structure. This is consistent with Chandler's (1962) observation that companies grow in size, diversify and then adopt a multidivisional structure.

In view of the linkages found between strategy, structure and size, and size, structure and bureaucracy, strategy and bureaucracy would be expected to be related too. This was indeed so. Strategy correlated strongly with all measures of bureaucracy. Furthermore, strategy was unrelated to decentralisation of the more strategic marketing and financial decisions. Size, however, correlated more strongly with bureaucracy than strategy or structure, suggesting that bureaucracy and type of structure are related to strategy via size. Greater bureaucratisation and adoption of a multidivisional structure might therefore be a response to growth in size and greater diversity of the product market posture. The strategy/structure and bureaucracy schools of research were thus integrated.

The nexus found between measures of organisational configuration which were shown to be independent of size were also independent of strategy. This in part explains the low percentage of variation in structure explained by strategy (Rumelt, 1974; Grinyer et al, 1978). Moreover, the strategy/structure linkage was shown, with the exception of size, to be independent of context and bureaucracy. The strategy/structure school of research was thus further extended by relating strategy to other contextual variables. Company age, membership of larger organisations and design and development technology were shown to be related to strategy.

Organisational styles adopted by companies were shown to vary considerably depending on their context and extent of structuring. The more bureaucratic companies were shown to adopt a technocratic, planning orientation style. Reliance on technically trained personnel in decision taking in the more bureaucratic companies with high degrees

of structuring and decentralisation of operating decisions further reinforces the concept of bureaucracy as a strategy of knowledge based control. Technological leadership style was adopted by companies with complex design and development technologies operating in the more technologically sophisticated sectors of industry.

The larger and the more bureaucratic companies were shown to be more risk taking and training oriented. Although the association between bureaucracy and risk taking and training orientation was via size, there were indications that greater qualifications and formality induced an orientation toward training of management and employees. Also companies with more automated technologies tended to rely to a greater extent on management training.

The highly bureaucratic and the least bureaucratic companies were shown to be more participative with respect to product development and marketing decisions, and although over 80% of companies adopted a participative approach with respect to capital budgeting decisions, the more bureaucratic companies did so more than others. The more bureaucratic companies were also shown to be less human relations oriented and also less autocratic.

Contrary to common expectations, the more bureaucratic companies were less conservative with respect to decision taking and more adaptive. These companies also relied less heavily on a conservatively oriented growth strategy. On the other hand, the older, private independent units tended to be more conservative and adopted a more conservative growth strategy.

Although one would expect from the literature that bureaucratic structure would be closely associated with mechanistic style, CUBS results indicated that both bureaucratic and non-bureaucratic companies may be managed along the lines described in management literature as mechanistic (Burns and Stalker, 1961).

Companies with more complex design and developement technologies tended to be more participative, more adaptive, but less aggressively adaptive. The CUBS results, therefore, indicate that both structure and context have a bearing on organisational style.

8.3 PRACTICAL IMPLICATIONS FOR DESIGN OF ORGANISATIONAL SYSTEMS

In interpreting the practical implications of findings of a cross-sectional study, such as the CUBS Study reported in this thesis, for design of organisational systems, one must bear in mind the limitations of such a study: (a) the statistical results only show that associations, on average, have been found between the characteristics under investigation; (b) direction of causality may be assumed but is not determined; and (c) the results may only be generalised to the population from which the sample was drawn, namely the electrical engineering industry in South East England, and may only be valid for the particular time period in which the companies were visited (1975/1976).

None the less, in designing organisations it is important to recognise that the associations found between bureaucratic characterisitics suggest that bureaucracy, as a matter of degree rather than as a stereotype, may be a structural means of assisting coordination and control but that its extent is strongly influenced by both scale and diversity of operations and somewhat less strongly by situational factors, such as technology of manufacturing and design and development.

If one makes a further assumption that the structures suggested by the pattern of associations are the result of a learning process reflecting what companies have found to work in practice, then the relationships would have prescriptive value in design of organisational structures. Departures found in practice from the structural characteristics predicted by the model could suggest that the organisational structures may be inappropriate. Similarly, those designing

new structures might find that the relationships found between context and organisational dimensions provide at least an initial set of guidelines as to organisational factors which might be viable, even if not optimal.

8.4 FURTHER RESEARCH

Further research is to continue using the CUBS Study data bank. The interrelationships between the organisational and environmental characteristics, which have been least rigorously investigated in the earlier studies, will be the major focus of further research. In addition, data on financial performance for the companies in the sample will be added to the data bank in order to investigate the relationships between the operating situations, management structures and financial performance. In particular, further research will seek to:

(1) Extend the Aston and National Studies by inclusion of a much wider range of environmental variables and to test hypotheses that organisational variables are related to them.

(2) Test a number of hypotheses relating 'stylistic' variables to these environmental variables.

(3) Test a number of hypotheses about the fit between strategy and structure, on the one hand, and environmental pressure on the other (see Grinyer, Al-Bazzaz and Yasai-Ardekani, 1978, for a discussion of these hypotheses).

(4) Find how interrelationships between measures of bureaucracy, strategy, structure, and style are affected by company and wider environmental variables.

(5) Test hypotheses about relationships between the extent of formal

planning and measures of bureaucracy, structure, strategy, style and environment.

(6) Establish relationships between measures of bureaucracy and financial performance when controlling for company and environmental variables (see Child, 1975).

(7) Establish relationships between 'style' and financial performance when controlling for company and wider environmental variables.

(8) Extend Grinyer et al's (1978) study of relationships between strategy, structure, the environment and financial performance, by inclusion of a wider range of environmental variables.

SSRC monies have been made available to permit this work during the next fifteen months.

Since the CUBS Study is the first integrating approach to study of organisations it would be useful to replicate the study using a multi-industry sample to test the generality of the findings. This would involve considerably more resources, however, than have so far been committed to continuance of the research.

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APPENDIX A: SCALES

CATEGORY: STRUCTURE

Variable Name	Basis of Scale	Allocated Value	Notes
SPAN	Number of subordinates reporting directly to the chief executive.	Natural number	After Pugh et al (1968).
RATIO	Average number of direct workers per first line supervisor.	Natural number	After Pugh et al (1968).
HEIGHT	Vertical span of control: number of job positions along the tallest line of command from the chief executive to direct workers inclusive of both.	Natural number	After Pugh et al (1968).
A/P RATIO	Total number of employees minus total number of direct workers divided by total number of employees.	Ratio	Pugh et al (1968); Child (1973c).
NUMBER OF INDIRECT EMPLOYEES	Total number of indirect employees.	Logarithm of the number	Log transformation used to reduce the variance of distribution (see: Kimberley (1976)).
SHAPE	Owner manager	0	An ordinal scale reflecting in an increasing direction the complexity of the overall administrative structure, based on the work of Wrigley(1970), Scott (1971), Stopford (1968), Channon (1973) and Rumelt (1974).
	Functional structure	1	
	More elaborate functional structure (with sales/service divisions).	2	
	Holding Company structure	3	
	Semi-multi divisional structure (multi-divisional but lacking a well defined general office).	4	

	Multi-divisional structure	5	
	More elaborate multi-divisional structure (World wide product/world partitioned geographical structure).	6	
QUAL	Respondents were asked if there was at least one specialist in the company who held a recognised professional qualification in each of the following seven areas of specialisation:		A measure of organisational complexity based on Child (1973a).
	R&D	1/0	
	Marketing	1/0	
	Finance	1/0	
	Personnel	1/0	
	Welfare	1/0	
	Workflow planning and maintenance	1/0	
	Stock and Quality control	1/0	
	Item scores were summed to give scale value.	Natural number	
FIRST DEGREE HOLDERS	Total number of first degree holders.	Natural number	Number of first degree holders and number of higher degree holders (next scale) were used to reflect the extent of complexity (also see QUAL). Log transformations were used to allow for positive skew (see Kimberley (1976).
HIGHER DEGREE HOLDERS	Total number of higher degree holders		

FORMAL	Scale was based on the following list of items:		The measure reflects the extent of formalisation of role definitions. This is an exact replication of the abbreviated version of formalisation due to Inkson et al (1970a). Mean item analysis value was 0.6863 and the reliability coefficient KR-20 was 0.8846.
	Organisation chart	0/1	
	Organisation chart given to:		
	Chief executive	1	
	C.E. and other executive	2	
	C.E. and most department heads	3	
	Written union contracts	0/1	
	Written policies	0/1	
	Written research programme reports	0/1	
	Written operating instructions	0/1	
	Written manuals of procedures	0/1	
	Written production plans	0/1	
	Written job description for direct workers	0/1	
	Written job description for line super-ordinates	0/1	
	Written job description for staff	0/1	
	Written job description for chief executive	0/1	

	Number of information booklets	1,2,3,4 +
	Information booklets given to none	0
	To few employees	1
	To many employees	2
	To all employees	3
	Item scores were summed to give scale value.	An integer in the range of 1 - 20 inclusive
ASPEC	Respondents were asked if there was at least one full time employee (not in the line of command) performing each of the following functions and no other function:	The measure reflects the extent of specialisation among sixteen activities which were assumed to be present in all work organisations (excluding the workflow activities). This is an exact replication of the measure of functional specialisation due to Pugh et al (1968). The mean item analysis value was 0.8105 and the reliability coefficient KR-20 was 0.8012.
	Public relations and advertising	
	Sales and service	
	Transport	
	Employment	
	Training	
	Welfare and security	
	Buying and stock control	
	Maintenance	
	Accounts	

	Production control Inspection Methods Design and development Organisation and methods Legal Market research Each specialism was scored as a dichotomous item having values of 1/0 and item scores were summed to give the scale value.	An integer in the range of 0 - 16 inclusive
AUTONOMY	Respondents were asked if each of the following 23 decisions were taken at levels above the chief executive of the company: 1. Supervisory establishment 2. Appointment of supervisory staff 3. Promotion of supervisory staff 4. Salaries of supervisory staff 5. To spend unbudgeted or unallocated money on capital items 6. To spend unbudgeted or unallocated money on revenue items	The measure reflects independence from a higher level organisation in terms of decision taking authority. This is an exact replication of the scale developed by Pugh et al (1968) and used in abbreviated studies as a representation of the extent of centralisation (see: Inkson et al (1970a), McMillan et al (1973) and Hickson et al (1974).

7. What type or what brand the new equipment is to be

8. To determine a new product or service

9. To determine marketing territories covered

10. The extent and type of markets to be aimed for

11. What shall be costed

12. What shall be inspected

13. What operations shall be work studied

14. Dismiss a supervisor

15. Training methods to be used

16. Buying procedures

17. Which suppliers of materials are to be used

18. What and how many welfare facilities are to be provided

19. To determine sales price of products

20. To alter responsibilities/areas of work of specialist departments

21. To alter responsibilities/areas of work of line departments

22. To create a new department

23. To create a new job

	Number of decisions which were taken within the organisation were summed to give the scale value.	An integer in the range of 0 - 23 inclusive	
CENTRALISATION (AC)	Using the 23 decision items in the Autonomy Scale respondents were asked: 'Who is the last person whose assent must be obtained before legitimate action is taken, even if others have subsequently to confirm the decision?' The scores given were:		The 23 decision items are a subset of the 37 decision items used by Pugh et al (1968) to represent centralisation and the scoring procedure is the same as that of Pugh et al. Three of the decisions (items 11, 12, and 13 were excluded from the scale AC because they were not applicable in all organisations. The reliability coefficient alpha for the 20 remaining decision items was 0.910.
	Above C.E. (eg. Board of the group)	5	
	Whole unit (eg. managing director)	4	
	All workflow activities (eg. production manager)	3	
	Workflow sub-unit (eg. plant manager)	2	
	Supervisory (eg. foreman)	1	
	Operating (eg. direct worker)	0	
	Scores on each of the decision items were summed to give the scale value.	Integer	
CENTRALISATION OF MARKETING DECISIONS	Cluster of 4 decision items:		Principal component analysis (oblique rotation) of 19 of the 20 decision items (decision 18 being excluded due to very low communality) resulted in 5 factors relating to marketing, financial, production, personnel and buying and organisational change decisions respectively. The latter 3 factors were statistically significantly
	8. To determine a new product or service	0 - 5	
	9. To determine marketing territories covered	0 - 5	
	10. The extent and type of markets to be aimed for	0 - 5	

	19. To determine the sales price of products	0 - 5	inter-correlated. The factor representing centralisation of financial decisions was not correlated with any of the other factors and the factor representing centralisation of marketing decisions was only correlated ($P < 0.05$) with the factor representing centralisation of production related decisions. Thus three separate centralisation scales were constructed representing centralisation of marketing, financial (expenditures) and operating decisions.
	Scores on the 4 decision items were summed to give the value of the scale.	Integer	
CENTRALISATION OF FINANCIAL DECISIONS	Cluster of 2 decision items:		
	5. To spend unbudgeted/unallocated money on capital items	0 - 5	
	6. To spend unbudgeted/unallocated money on revenue items.	0 - 5	
	Scores on both decision items were summed to give the value of the scale.	Integer	
CENTRALISATION OF OPERATING DECISIONS	The scores on the remaining decision items were summed to give the value of the scale.	Integer	

CATEGORY: ORGANISATION CONTEXT

Variable Name	Basis of Scale	Allocated Value	Notes
SIZE	Number of employees in 1975.	Natural number Log. of the number	After Pugh et al (1969a). Log transformation was used to allow for positive skew (see Kimberley (1976)).
AGE	Age of the company in years at 1975.	Natural number	After Pugh et al (1969a).
ORIGIN	Impersonality of origin:		A subscale of dependence measure developed by Pugh et al (1969a) and subsequently used as a subscale of the abbreviated measure of dependence by Inkson et al (1970a).
	Personal foundation	0	
	Foundation by an existing organisation.	1	
STATUS	Status of the organisational unit:		
	Principal unit	0	See ORIGIN
	Subsidiary unit (with legal identity)	1	
	Head branch (with H.Q. on the same location)	2	
	Branch	3	
RELSIZE	Size relative to the size of the parent organisation measured as the total number of employees in the organisation expressed as a percentage of the total employees in the ultimate owning group and categorised as:		

	Over 90% of owning group	0	See ORIGIN
	30 - 90% of owning group	1	
	5 - 29% of owning group	2	
	Under 5% of owning group	3	
DEPENDENCE	Scores on the three subscales of ORIGIN, STATUS and RELSIZE summed to give the scale value.	An integer ranging from 0 - 9 inclusive	The abbreviated version of the dependence measure (see Pugh et al (1969a)) developed by Inkson et al (1970a) in addition to the 3 subscales used here included a measure reflecting the public accountability of the owning group. This was excluded from the dependence measure since it reflects the dependence of the owning group and not of the focal organisation. This measure, however, is an exact replication of that used by McMillan et al (1973) and Hickson et al (1974). The full dependence measure (Pugh et al, 1969a), and the abbreviated version only reflect the dependence of the organisation on the parent organisation and not on other organisations. For dependence on other organisations, see company specific environmental measures.
NSITE	Number of operating sites in 1975.	Natural number	After Pugh et al (1969a).
A-MODE	Automaticity mode or the degree of automation of the bulk of the equipment:		The measure is ordinal reflecting in an increasing direction the degree of automation of the equipment used in the workflow. Based on the classification of automation by Amber and Amber (1962), the scale was used as a subscale of
	Hand tools and manual machines	0	
	Powered machines and tools	1	

	Single cycle automated and self feeding machines	2	workflow integration by Pugh et al (1969a) and as an abbreviated measure of operations technology by Inkson et al (1970a).
	Automated repeat cycle machines	3	
	Self measuring and adjusting feedback machines	4	
	Computer controlled cognitive machines	5	
A-RANGE	Automaticity range or the degree of automation of the most automatic piece of equipment used in the work-flow. This was scored on the same scale as AMODE.	An integer ranging from 0 - 5 inclusive	Also a subscale of workflow integration (see above) and used as an abbreviated measure of operations technology by Inkson et al (1970a).
NTECH	Design and development technology is characterised by:		The measure is ordinal based on Perrow's (1967) classification of technology and reflects in an increasing direction the complexity of design and development technology. The allocation of scores is purely subjective and based on the information obtained in the interviews on the type of products and the lead time for development by the company.
	Occurrence of few exceptional situations which are analysable	1	
	Occurrence of many exceptional situations which are analysable	2	
	Occurrence of few exceptional situations which are unanalysable	3	
	Occurrence of many exceptional situations which are unanalysable	4	
CHARTER	Manufacturing	1	
	Manufacturing and service	2	
PARENT SIZE	Total number of employees in the ultimate owning group.	Log of the number	As for SIZE, Log transformation was used in the analysis.

CATEGORY: ORGANISATIONAL STYLE

Variable Name	Basis of Scale	Allocated Value	Notes
PARTICIPATIVE/ NON-PARTICIPATIVE	The extent to which the following decisions are taken by the board, committees of the board or other important meetings of company personnel: Capital budgeting Entry into new fields of business activity Acquisition of other companies	1 - 5 ranging from never to always	The measures are based on Khandwalla's (1974a) operational measures of organisational style (based on the identification of various management systems by theorists: Burns and Stalker (1961); Likert (1961); McGregor (1960); Lindblom (1959); and Mintzberg (1973). In each case Khandwalla's seven point scales representing at the extremities characteristics of two opposing styles were broken into two five point Likert-type scales to avoid the limiting effect inherent in his scales. In total 44 separate scales were developed. The grouping of the scales representing different organisational styles is based on the results of principal component analysis (oblique rotation, oblimin technique, $\delta = 0$). Scales allocated to each group were chosen on the basis of highest loadings which were at least significant beyond the 0.05 level on the corresponding factors of the structure matrix. Scores on scales forming a group were summed (reverse scored if having a negative loading) to give the organisational style scale values. In this way 15 scales were obtained which were again subjected to principal component analysis.

and six dimensions of organisational style were identified. There was a certain degree of overlap between the analytical grouping thus formed and the intuitive grouping of scales by Khandwalla (1974a). Organisational style scales used in the statistical analysis are those due to the first stage factoring results.

MECHANISTIC	The extent of top management emphasis on:		
	1. Following the formally laid down procedures	1 - 5 ranging from a very little to a great deal	
	2. Getting things done even if it means ignoring formal procedures		Reverse scored
	3. Use of quantitative methods in decision making		
	4. Highly structured channels of communication		
	5. Formal authority in decision making		
TECHNOLOGICAL LEADERSHIP	The extent of top management emphasis on:		
	1. Technological leadership and innovation	1 - 5 as above	
	2. Reliance on technically trained personnel in decision taking		

RISK TAKING	The extent of top management emphasis on:	
	1. Bearing high risks to obtain high rates of return on investment	1 - 5 as above
	2. Undermining major competitors	
AGGRESSIVELY ADAPTIVE	1. The extent of top management emphasis on adapting freely to changing circumstances without too much concern for past experience	1 - 5 as above
	2. In attempting organisational change, the extent to which top management implicitly or explicitly threaten members of the organisation with consequences of resisting management orders	1 - 5 ranging from never to always
	3. In attempting to resolve conflict between different groups in the organisation, the extent of use of arbitration procedures.	
PARTICIPATIVE/ NON-PARTICIPATIVE (B)	The extent to which the following decisions are made by the Board, committes of the Board or other important meetings of the company personnel:	
	1. R&D of new products and services	1 - 5 ranging from never to always
	2. Product mix, distributive channels, advertising and promotion	
	3. Entry into new markets	

TRADITIONAL	The extent of top management reliance on:	
	1. Experience and common sense in decision making	1 - 5 ranging from a very little to a great deal
	2. Learning by apprenticeship and by hard knocks	
CONSERVATIVE (DECISION MAKING AND CHANGE)	The extent of top management emphasis on:	
	1. Holding fast in the face of change to management practices found successful in the past	1 - 5 ranging from a very little to a great deal
	2. Supporting situational expertise in decision making, even if it means ignoring formal authority (reverse scored)	
	3. Requiring throughout the company the same approaches to dealing with subordinates	
	4. Requiring throughout the company the same approaches to planning on-going and new activities and use of management services	
	5. The extent to which decisions taken by the board may be described as cautious, one step at a time adjustment to the problem	1 - 5 ranging from never to always

TRAINING ORIENTATION	1. The extent of top management reliance on formal management training programmes	1 - 5 ranging from a very little to a great deal
	2. In attempting organisational change the extent to which top management emphasises provision of training for those involved in the new methods and procedures required by change	1 - 5 ranging from never to always
	3. In attempting to resolve conflict and for improving co-ordination, the extent to which top management emphasises provision of human relations training for managers to make them understand better their colleagues and subordinates and help them communicate more efficiently	

INFORMAL/ AUTOCRATIC	The extent of reliance on:	
	1. Written communications within a consciously designed information system for control of operations (including computer based systems). (reverse scored)	1 - 5 ranging from a very little to a great deal
	2. Spontaneous, informal communications for control of operations	
	3. The extent of use of authority by top management in conflict resolution	1 - 5 ranging from never to always

CONSERVATIVE (GROWTH)	The extent of top management emphasis on:	
	1. Marketing true and tried products and avoidance of heavy R&D costs	1 - 5 ranging from a very little to a great deal
	2. Growth through external financing (reverse scored)	
	3. Growth through internally generated funds	
RISK AVERTING	The extent of top management emphasis on:	
	1. Avoiding high risks at a cost of achieving only a moderate return on investment	1 - 5 as above
	2. The immediate future (a bird in the hand emphasis)	
PLANNING ORIENTATION	1. The extent of top management emphasis on long-term planning of goals and strategy	1 - 5 ranging from a very little to a great deal
	2. The extent of use of outside experts to investigate problems and propose changes	1 - 5 ranging from never to always
HUMAN RELATIONS ORIENTATION	1. In attempting organisational change, the extent to which top management involves fully those likely to be affected in every stage of the change programme	1 - 5 as above
	2. Explain concepts underlying change to those affected by it	

CATEGORY: PRODUCT MARKET STRATEGY

Variable Name	Basis of Scale	Allocated Value	Notes
STRAT	Single product (95% at least of sales in main product line)	1	The scale is ordinal reflecting in an increasing direction the extent of product market diversification. The basic classification system is drawn from Wrigley (1970) and was used by Channon (1973), Dyas (1972), Pavan (1972) and Thanheiser (1972).
	Dominant product (70% at least of sales in main product line)	2	
	Related product (no product-line accounts for 70% of sales but product lines related by markets, technology or vertical integration)	3	
	Unrelated product (no product line accounts for 70% of sales and product lines unrelated	4	
NSTRAT	Single product (as for STRAT)	1	This new scale is developed along the lines of that of Rumelt (1974)
	Dominant product (as for STRAT but other products related in both market and technology to the main product line)	2	Similar to Rumelt's dominant constrained
	Dominant product (as for STRAT but other product lines related in either technology or market to the main product line)	3	Similar to Rumelt's dominant linked
	Dominant product (as for STRAT but other product lines unrelated to the main product line	4	Similar to Rumelt's dominant unrelated

Related product (as for STRAT but product lines related in both market and technology	5	Similar to Rumelt's related constrained
Related product (as for STRAT but product lines related in either market or technology)	6	Similar to Rumelt's related linked
Unrelated product (as for STRAT)	7	Rumelt's (1974) exact classification was not possible due to his definition of "discrete business" (p. 12) due to company sizes in the CUBS sample.

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CATEGORY: R&D

Variable Name	Basis of Scale	Allocated Value	Notes
RDEXP	Average annual expenditure (current + capital) on R&D as a percentage of sales	Percentage	The measure reflects the intensity of R&D activities in the company.
RELEXP	$\frac{\text{RDEXP}}{\text{(Expenditure on R\&D as percentage of sales for the industry subsection under which the company is classified)}}$	Ratio	The figures for R&D expenditure as percentage of sales was obtained for each subsection of Electrical Engineering Industry represented in the sample. (Trade & Industry, 5 Sept. 1974), (Report on Census of production, Summary Tables PA1002, 1972). The figures relate to 1972.
RDEMP	Numbers employed on R&D activities including scientists, engineers, technicians, administrative and clerical personnel.	Natural number	As for RDEXP the measure reflects the extent of R&D activities in the company. Log transformation was used to allow for positive skew. Instead of using R&D employment as a percentage of total employment, effects of size were controlled for by using partial correlations in the statistical analysis controlling for Log size.
RDATT	Perception of top management as to the importance of R&D activities in the company 1. Necessary for survival — 5 2. Essential for high financial performance — 4		The measure reflects the importance of R&D activities to Company's performance and also may be regarded as a proxy for the perceived level of competition in the market in terms of introducing new products.

	3. Important but not essential for high performance	3	
	4. Desirable but not important	2	
	5. Not worthwhile	1	
RDPOS	Hierarchical position of the R&D department/team:		Again this measure reflects the importance of R&D within the company.
	Division of a multi-divisional company	3	
	Functional department	2	
	Department within a functional department	1	
RDIN	Initiation of idea for development of a new product:		
	Managing director	1	The measure, apart from reflecting the source of initiation of idea, represents involvement of departments in the process.
	Sales	2	
	Marketing	4	
	Technical	8	
	Customers	16	
	Combination of the above categories scored accordingly		

PROGROUP	Number of product groups manufactured by the company	Natural number	It is very difficult to develop a measure representing the extent of product innovation which can be used in a comparative analysis of companies due to wide differences in technology and types of end product developed. This, however, is an attempt to obtain such a measure.
VARIANT	Number of variants within existing product groups	Natural number	
INOPRO	Number of product groups developed by the company within the past 5 years	Natural number	
INOVAR	Number of variants developed by the company within the past 5 years	Natural number	
INO1	$\frac{\text{INOPRO}}{\text{PROGROUP}}$	Ratio	
INO2	$\frac{\text{INOVAR}}{\text{VARIANT}}$	Ratio	
PLEAD	Lead time (from initiation to commercialisation) for development of products which may result in an entirely new product group. Measured in months.	Natural number	The measure reflects the complexity of design and development technology (also see NTECH).
VLEAD	Lead time for development of variants of existing product groups. Measured in months.	Natural number	
RDPER1	Average annual percentage contribution to sales due to new product groups developed in the past 5 years.	Percentage	The measure reflects the performance of product innovation.
RDPER2	Average annual percentage contribution to sales due to new variants developed in the past 2/3 years.	Percentage	

CATEGORY: FORMAL PLANNING

Variable Name	Basis of Scale	Allocated Value	Notes
T PLAN	Respondents were asked if they had any of 20 written plans. The number of affirmative responses was summed to give the scale value	An integer ranging from 0 - 20	A list of 20 written plans was used to develop scales representing the extent of formal planning (Steiner, 1969). The 20 plan items were used in isolation due to their importance as well as in groups suggested by the factor analysis.
PLAN 1	Diversification plan	0/1	These two plan items loaded statistically significantly on a factor which was correlated, $p < 0.05$, with the factor representing plans 7 & 8 (see below). However, they are used separately due to their importance.
PLAN 2	Acquisition and merger plan	0/1	
RDPLAN	Basic research plan (plan 3) R&D new products plan (plan 4) R&D new production technology plan (plan 5) The number of affirmative answers was summed to give the scale value.	0 - 3	A measure reflecting the extent of formal R&D planning. The 3 plan items together with plans 6 & 7 loaded on a single factor ($p < 0.05$).
PLAN 6	Development of financial structure plan	0/1	
PLAN7	Development of administrative structure plan	0/1	
PLAN 8	Market development plan	0/1	

GPLAN	Advertising and promotion plan (plan 9) Material purchase plan (plan 11) Production plan (plan 12) Expansion of production capacity plan (plan 13) Production control plan (plan 14) Inventory control plan (plan 16) Recruitment and replacement plan (plan 17) Management training and development plan (plan 19) Employee benefit plan (plan 20) The number of affirmative answers was summed to give the scale value.	An integer ranging from 0 - 10	The measure reflects the extent of formal operating planning. These plan items clustered on 3 separate factors which were intercorrelated. Plans 10 and 15 relating to quality control and distribution were excluded from the scale due to low item correlation.

CATEGORY: ENVIRONMENT

Analytical structure and content of scales for the environment were derived from the literature:-

Levine & White (1961), Evan (1966), Emery & Trist (1965), Von Bertallanffy (1950), Terrebery (1968), Dill (1958), Burns & Stalker (1961), Thompson (1967), Lawrence & Lorsh (1967), Tosi et al (1973), Duncan (1972), Child (1972b, 1975), Downey et al (1975), Osborn & Hunt (1974), Negandhi & Reimann (1973,1974), Pennings (1975), Negandhi (1975).

Environmental scales were divided into three categories of general, industrial and company specific.

CATEGORY 1: GENERAL ENVIRONMENT

Variable Name	Basis of Scale	Allocated Value	Notes
RATE OF CHANGE	Perception of respondents as to the rate of change of social, political and economic conditions (three separate scales).	1 - 5 ranging from very little to very great	A similar but aggregated measure was used by Khandwalla (1974a).
THREAT	Respondents were asked to what extent the survival of their firm was threatened by each of the social, political and economic conditions (three separate scales).	1 - 5 as above	As above
PREDICTABILITY	Perception of the respondents as to the ease with which their firm could predict changes in the social, political, economic and technological conditions (four separate scales).	1 - 5 ranging from easily to with great difficulty	This measure may be regarded as a proxy for the perceived level of uncertainty in the environment. A similar but aggregated measure was used by Khandwalla (1974a).

CATEGORY 2: INDUSTRY SPECIFIC ENVIRONMENT

Variable Name	Basis of Scale	Allocated Value	Notes
MARKET VARIABILITY	Standard error of estimate of sales data from 1966 - 75 inclusive, obtained by regressing against time divided by the mean sales figure.	Ratio	This ratio is calculated for each of the eight different subsections of the Electrical Engineering Industry represented in the CUBS sample. The measure represents market variability in the company's specific environment. Similar measures were used by Child (1975) and Tosi et al (1973).
TECHNOLOGICAL COMPLEXITY	Total R&D expenditure expressed as percentage of net output for the firm's specific industry subsection.	Percentage	Figures for 1972 calculated for each of the 8 industry subsections. The measure may be regarded as a proxy for the extent of technological complexity and variability in the firm's specific environment. Also used by Child (1975).
GROWTH RATE	Average annual percentage growth in sales over a 10 year period 1966 - 75 inclusive.	Ratio	Calculated for each of the 8 industry subsections.
INTERNATIONAL COMPETITION	Average of the ratio of total sales by foreign competitors to total sales over a 10 year period 1966 - 75 inclusive.		Calculated for each of the 8 industry subsections, subject to availability of data.

CATEGORY 3: COMPANY SPECIFIC ENVIRONMENT

Variable Name	Basis of Scale	Allocated Value	Notes
NUMBER OF TRADE UNIONS	Number of Trade Unions represented in the firm.	Natural number	The measure may reflect the extent of heterogeneity of the task environment.
NUMBER OF SUPPLIERS	Number of suppliers used by the firm categorised as follows:		
	Under 5	1	As above
	6 - 25	2	
	26 - 50	3	
	51 - 100	4	
	101 - over	5	
NUMBER OF CUSTOMER CATEGORIES	Number of the following outlets used: (a) Government (b) Other industry (c) Wholesalers (d) Retailers (e) General public	An integer in the range of 1 - 5 inclusive	As above
CONSTRAINT	Respondents were asked the extent to which the following organisations constrained the activities of their companies:		
	(a) Trade Unions (b) Financial Institutions (c) Major buyers (d) Suppliers of raw materials and parts (e) Local government (f) Central government (g) EEC and other international bodies	1 - 5 ranging from none to a great deal	
	(seven separate scales)		

COMPETITION	Perception of respondents as to the extent of competition:		The measure reflects the extent of perceived competition in the market.
	(a) for obtaining raw materials, parts and equipment	1 - 5 ranging from a very little to a great deal	
	(b) for obtaining technical manpower		
	(c) in promotion, marketing and distribution		
	(d) in service, product, quality and variety		
	(e) in price		
DEPENDENCE ON SUPPLIERS	Percentage of raw materials and parts supplied by largest 10 suppliers.	Percentage	This scale measures dependence on existing supplies to the company.
DEPENDENCE ON CUSTOMERS:			
(a) PERCENTAGE SALES TO FIVE LARGEST CUSTOMERS	$\frac{\text{Sales to 5 largest customers}}{\text{Total company sales}} \times 100$	Percentage	Sales figure for 1975. This and the following measure reflect dependence on major customers.
(b) DEPENDENCE ON 10 LARGEST CUSTOMERS	Not dependent at all	1	
	Not particularly dependent	2	
	Dependent	3	
	Fairly dependent	4	
	Very dependent	5	

DISTRIBUTION SYSTEMS:

(a) PERCENTAGE SALES TO GOVERNMENT	Company sales to government X 100 / Total company sales	Percentage	Sales figure for 1975
(b) PERCENTAGE SALES TO OTHER INDUSTRIES	Company sales to other industries X 100 / Total company sales	Percentage	Sales figure for 1975
(c) PERCENTAGE SALES TO WHOLESALERS	Company sales to wholesalers X 100 / Total company sales	Percentage	Sales figure for 1975
(d) PERCENTAGE SALES TO RETAILERS	Company sales to retailers X 100 / Total company sales	Percentage	Sales figures for 1975
(e) PERCENTAGE SALES TO GENERAL PUBLIC	Company sales to general public X 100 / Total company sales	Percentage	Sales figure for 1975
MARKET SHARE	Company's sales to its most important market X 100 / Total sales to (size of) this market	Percentage	This percentage is calculated for the company's three most important markets.
STATE OF MARKET	Perception of the respondents as to the company's standing in each of its 3 most important markets:		

(a)	Shrinking	1
(b)	Stagnant	2
(c)	Shows little expansion	3
(d)	Expanding and slow emergence of new markets	4
(e)	Expanding fast and emergence of new markets	5

FINANCIAL PERFORMANCE

Data to be collected and scales to be developed (see Grinyer and Norburn, 1975).

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

QUESTIONNAIRE

GRADUATE BUSINESS CENTRE

THE CITY UNIVERSITY

Company Code number:

PART I

1. When was your organisation founded?
2. Was your organisation founded by an existing organisation? YES/NO
3. Is your organisation:
   (i) Principal unit (holding or parent co.)?
   (ii) Subsidiary (with legal identity)?
   (iii) Head branch (with H.Q. on the same location)?
   (iv) Branch of a parent co.?
4. Is your organisation (if a principal unit) OR
   Is the ultimate owning group:
   (i) a part of local or central government?
   (ii) has voting shares with stock quoted on the stock market?
   (iii) has unquoted stock?
5. If not a principal unit, what is the total number of employees in your ultimate owning group?
6. Do you have an organisation chart? YES/NO
7. Is the organisation chart given to;
   (i) Chief executive only? YES/NO
   (ii) Chief executive plus one other executive? YES/NO
   (iii) Chief executive plus most department heads? YES/NO
8. Could you please supply us with your organisation chart? YES/NO

IF ANSWER IS YES GO TO NO. 12

9. How many people report directly to the chief executive?
10. What is the number of direct workers per first line supervisor?

11. What is the number of levels between the chief executive and the direct workers?

12. What is the number of direct workers with no supervisory responsibility?

13. Is the overall formal structure of your organisation;

(i) Owner manager

(ii) Functional

(iii) Holding company

1. Semi autonomous subsidiaries added to the functional organisation of the parent company.

2. Deliberate holding company structure.

(iv) Multi divisional

1. By product.

2. By geography.

3. Combination of both.

(v) Multi divisional plus an international division?

(vi) World wide product division structure?

(vii) World partitioning geographic structure?

(viii) Others please specify.

PART II

1. Could you please tick the boxes provided if there is at least one person in your organisation performing each of the following functions, whilst performing no other function.

Public relations ☐, Advertising ☐, or both ☐

Sales and services ☐, Customr complaints ☐, or both ☐

Market research ☐

Transportation ☐

Employment ☐

Education and training ☐

Welfare ☐, Medical ☐, Safety ☐, Social ☐, or a combinatio

of these ☐

Buying ☐, Material control ☐, Stock control ☐, or a

combination of these ☐

Maintenance ☐, Works engineering ☐, or both ☐

Accounting ☐ , Costing ☐ , Wages preparation ☐ , or a combination of these ☐

Planning and processing of the work flow ☐ ,

Inspection and testing of equipment ☐ , quality of material and output ☐ , or both ☐

Work study ☐ , Industrial engineering ☐ , operational research ☐ , rate fixing ☐ , or a combination of these ☐ .

Devising new products ☐ , Devising new processes and equipment ☐ , or both ☐ .

Registry, filing, statistics, and O&M ☐ .

Legal, insurance, licensing, etc. ☐ .

2. Do you have the following documents?

(i)	Written union contracts	YES/NO
(ii)	Written policies	YES/NO
(iii)	Written research programme reports	YES/NO
(iv)	Written operating instructions	YES/NO
(v)	Manual of procedures	YES/NO
(vi)	Work flow, production schedule or programme	YES/NO

3. Do you have written job descriptions?

(i)	for direct workers	YES/NO
(ii)	for line superordinate	YES/NO
(iii)	for staff	YES/NO
(iv)	for chief executive	YES/NO

4. Do you have any information booklets?

   (i) If yes, how many?

5. Is the information booklet given to:

   few employees many employees all employees

6. Do you have at least one person in the organisation with relevant professional qualification in each of the following functions?

   (i) Research and development YES/NO

   (ii) Marketing YES/NO

   (iii) Finance YES/NO

   (iv) Personnel YES/NO

   (v) Welfare YES/NO

   (vi) Work flow planning and maintenance YES/NO

   (vii) Stock control and quality control YES/NO

7. What is total number of employees with ;

   (i) H.N.Cs and first degrees.

   (ii) Masters and higher degrees

8. Who is the last person whose assent must be obtained before legitimate action is taken on the following decisions, even if others have to subsequently confirm the decisions.

   (i) Supervisory establishment

   (ii) Appointment of supervisory staff from outside the establishment

   (iii) Promotion of supervisory staff

   (iv) Salaries of supervisory staff

   (v) To spend unallocated or unbudgeted money on capital items

(vi) To spend unallocated or unbudgeted money on revenue items

(vii) What type or what brand the new equipment is to be

(viii) To determine a new product or service

(ix) To determine marketing territories covered

(x) The extent and type of market to be aimed for

(xi) What shall be costed

(xii) What shall be inspected

(xiii) What operations shall be work studied

(xiv) Dismiss a supervisor

(xv) Training methods to be used

(xvi) Buying procedures

(xvii) Which suppliers of material are to be used

(xviii) What and how many welfare facilities are to be provided

(xix) To determine the sales price of products

(xx) To alter responsibility, areas of work of specialist departments

(xxi) To alter responsibility, areas of work of line departments

(xxii) To create a new department(functional specilist or line

(xxiii) To create a new job(a new job title)

PART III

1. How many manufacturing sites do you have?

2. Are the most frequently used equipment in the work flow of your organisation

   (i) Hand tools and manual machines?

   (ii) Powered machines and tools?

   (iii) Single cycle automated and self feeding machines?

   (iv) Automated repeat cycle machines?

   (v) Self measuring and adjusting feedback machines?

   (vi) Computer cotrolled automatic cognitive machines?

3. Which of the categories listed above fits the most automatic equipment used in your work flow?

4. What is the ratio of capital/labour in your organisation?

5. What is the total number of;

   (i) Product groups manufactured by your company?

   (ii) Variants of products within all product groups?

6. Are these products produced by basically similar manufacturing technology?
   YES/NO

7. Are these products marketed through similar distributive channels?
   YES/NO

8. What percentage of your total turnover is accounted for by your most important product line?

9. How many

(i) Product groups

(ii) Variants of products within existing product groups

have been developed by your organisation within the past five years?

10. How many new procedures or techniques of production have been employed by your organisation within the past five years?

11. What approximate percentage of your sales is spent on research and/or development within the past one/five years? (current plus capital)

12. What is the total number of employees engaged in research and/or development activities in your organisation? (scientists, engineers, technicians, draftsmen, administrative and clerical personnel)

13. What is the position of the research and/or development team/Dept.

14. Who initiates the idea for development of a new product?

15. What is the lead time (from approval of idea to the sales of the product) for;

(i) Products which may result in the production of an entirely new product group?

(ii) Variants of products within existing product groups?

16. What measures,if any, do you use to assess the efficiency or performance of the research and/or development activities?

17. What approximate percentage contribution to sales is made annually by

(i) New product groups developed within the past five years?

(ii) New variants of products within existing product groups developed within the past 2-3 years?

18. What is the rate of return on investment in research and/or development activities?

19. Do you think that research and/or development activities in your organisation is;

(i) Necessary for survival

(ii) Essential for high financial performance

(iii) Important but not essential for high performance

(iv) Desirable but not important

(v) Not wothwhile

PART IV

1. How many different trade unions do your employees belong to?

2. How many different suppliers of raw materials and parts do you have?

(i) Under five suppliers

(ii

(ii) 5 - 25 suppliers

(iii) 25 - 50 suppliers

(iv) 50 - 100 suppliers

(v) Over 100 suppliers

3. What approximate percentage of your raw materials and parts is supplied by your ten largest suppliers?

4. Do you sell your products to any of the following?

(i) Government (directly to)

(ii) Other industries

(iii) Wholesalers

(iv) Retailers

(v) General public

5. What approximate percentage of your total sales goes to each of the above?

6. What approximate percentage of your total sales is to your five largest customers?

7. How dependent do you think your company is on its ten largest customers?

Very dependent Fairly dependent Dependent

Not particularly dependent Not dependent at all

8. To what extent do the following organisations constrain the activities of your organisation?

(i) Trade Unions — VERY LITTLE/LITTLE:MODERATE:GREAT/VERY GREAT

(ii) Financial Institutions

(iii) Major buyers

(iv) Suppliers or raw materials and parts

(v) Local Government

(vi) Central government

(vii) E.E.C. and other international bodies.

9. What is the extent of competition?

(i) For raw materials, parts, and equipment? — VERY LITTLE/LITTLE:MODERATE:GREAT/VERY GREAT

(ii) For technical manpower?

(iii) In promotion, marketing and distribution?

(iv) In service, produced quality and variety?

(v) In price?

10. How do you regard the rate of change of the following conditions in your environment?

(i) Social — VERY SLOW:SLOW:MODERATE:FAST:VERY FAST

(ii) Political

(iii) Economic

11. To what extent do the following conditions of the environment threaten the survival of your organisation?

(i) Social — VERY LITTLE:LITTLE:MODERATE:GREAT:VERY GREAT

(ii) Political

(iii) Economic

12. How easily can you predict the changes in the following conditions of your environment?

(i) Social VERY EASILY:EASILY:WITH DIFFICULTY:WITH GREAT DIFFICULTY

(ii) Political

(iii) Economic

(iv) Technological

13. What are your three most important markets?

14. For each of your three most important markets could you please indicate if the market is :

(i) S hrinking

(ii) Stagnent

(iii) Shows little expansion

(iv) Expanding and slow emergence of new ones

(v) Expanding fast and emergence of new ones

15. What percentage of market share do you hold in each of these?

PART V (separate answer sheet is provided for this part)

(I) What emphasis does top management in your company place on each of the following?

1. Technological leadership and innovation in your industry or industries.

2. Marketing true and tried products and avoidance of heavy research and development costs.

3. Bearing high risks to obtain high rates of return on investments.

4. Avoiding high risks at the cost of achieving only a moderate rate of return.

5. Growth through external financing.

6. Growth through internally generated funds.

7. Undermining major competitors.

8. Co-operative coexistence with major competitors within the limits of the law.

9. Following the formally laid down procedures.

10. Getting things done if it means disregarding formal procedures.

11. Holding fast in the face of change to management approaches found successful by your company in the past.

12. Adopting freely to changing circumstances without too much concern for past experience.

13. Formal authority in decision making.

14. Supporting situational expertise in the decision making even if this means ignoring formal authority.

15. Requiring throughout the company:(a): same approaches to dealing with subordinates, (b) to planning ongoing and new activities and to use of management services.

16. Long term (over five years) planning of goal and strategy.

17. Immediate future (a bird in the hand emphasis).

18. Use of quantitative analysis (e.g. forecasting, discount and cash flow analysis, operational research) in making major decisions involving capital investment.

19. Restriction of flow of important information as opposed to important information flowing freely throughout the organisation

20. Highly structured channels of communication as opposed to undesigned, widely ranging ones.

(II) Throughout the organisation what is the extent of:

1. Reliance on specialised, technically trained personnel in decision making.

2. Reliance on experience and common sense in the decision making.

3. Reliance on formal management training programme.

4. Reliance on learning by apprenticeship and learning by hard knocks.

5. Reliance on written communication within a consciously designed information system for control of opertaions (including computer based systems).

6. Reliance on spontaneous (informal) communications for control of operations.

(III)

1. Roughly how frequently could major decisions made by the board by properly described as cautious, one step at a time adjustment to the problems?

2. Roughly how often could major decisions made by the board be properly described as an active search for big new opportunities, large decisions despite the uncertainty of the outcome?

3. Are the following decisions made by the board, committees of the board or other important meetings of the company personnel?

(i) Level of operations of products or services

(ii) Product mix, distributive channels, advertising and promotion activities.

(iii) R&D of new products and services

(iv) Capital budgeting

(v) Entry into new markets

(vi) Entry into new fields of business activity

(vii) Acquisition of other companies

4. In attempting organisational change do top management:

(i) Involve fully those likely to be affected at each phase of the change process, in the articulation of the problem, gathering of the information, formulating the action alternatives and implementation of the schedule course of action, by means of participative, concensus seeking, democratic decision taking?

(ii) Implicitly or explicitly threaten members of the organisation with consequences of resisting management orders?

(iii) Explain concepts underlying change to those affected by it?

(iv) Procure services of outside experts to investigate the problems and propose changes?

(v) Train those involved in new methods and procedures required by change?

5. In attempting to resolve conflict between different groups in the organisation, or for improving coordination do management;

(i) Provide human training for managers to make them understand better their colleagues and subordinates and help them communicate more efficiently?

(ii) Use arbitration procedures?

(iii) Use authority to resolve conflict?

		VERY LITTLE	LITTLE	SOME	QUITE A LOT	A GREAT DEAL
QUESTION	1.					
"	2.					
"	3.					
"	4.					
"	5.					
"	6.					
"	7.					
"	8.					
"	9.					
"	10.					
"	11.					
"	12.					
"	13.					
"	14.					
"	15.(a)					
"	15.(b)					
"	16.					
"	17.					
"	18.					
"	19.					
"	20.					
	(II)					
"	1.					
"	2.					
"	3.					
"	4.					
"	5.					
"	6.					

(III)

		NEVER	RARELY	SOME TIMES	MOST TIMES	ALWAYS
QUESTION	1.					
"	2.					
"	3(i)					
"	(ii)					
"	(iii)					
"	(iv)					
"	(v)					
"	(vi)					
"	(vii)					
"	4(i)					
"	(ii)					
"	(iii)					
"	(iv)					
"	(v)					
"	5(i)					
"	(ii)					
"	(iii)					

PART VI

	SUPERIORS	COLLEAGUES	SUBORDINATES	SUPPLIERS	CUSTOMERS	COMPETITORS	OTHERS
1. Could you please give an estimate of the number of persons (of the following categories (I - VII) with whom you are in contact per week							
(i) In the form of reports, written data, forms and memos							
(ii) In scheduled meetings							
(iii) By telephone							
(iv) By face to face discussion							
2. How many reports, written data, forms and memos do you: RECEIVE FROM							
the following persons on average per day? SEND OUT TO							
3. How many telephone calls do you ; RECEIVE FROM							
the following persons per day on average? MAKE TO							
4. How many scheduled meetings do you have with the following on average per month?							
5. How many face to face discussions do you have with the following on an average day?							

6. What importance do you attach to the information communicated via each of the above channels (i - iv) ? on this scale: (100 - 80 - 60 - 40 - 20)

7. What are your reseans for giving these weights?

PART VII

1. Do you have any of the following written plans?

Diversification plan	YES/NO
Acquisition and merger plan	YES/NO
Basic research plan	YES/NO
R & D (new products) plan	YES/NO
R & D (new production technology) plan	YES/NO
Development of financial structure plan	YES/NO
Development of administrative structure plan	YES/NO
Market development plan	YES/NO
Advertsiing and promotion plan	YES/NO
Distribution plan	YES/NO
Material purchase plan	YES/NO
Production plan (existing products)	YES/NO
Expansion of production capacity plan	YES/NO
Production control plan	YES/NO
Quality control plan	YES/NO
Inventory control plan	YES/NO
Recruitment and replacement plan	YES/NO
Management training and development plan	YES/NO
Wages and salary administration plan	YES/NO
Employee benefit plan	YES/NO

Other plans, please specify.

2. Do you have any of the following budgets?

Profit budget	YES/NO
Sales budget	YES/NO
Production budget	YES/NO

Expenditure budget (all direct costs)	YES/NO
Overhead budget (all indirect costs)	YES/NO
Capital expenditure budget	YES/NO
Working capital budget	YES/NO
Funds budget	YES/NO
Cash flow budget	YES/NO

Others, please specify.

3. Do the top management use the following as means of financial control?

(i)	Trading results control sheets	YES/NO
(ii)	Reports on sources and uses of funds	YES/NO
(iii)	Cash flow reports	YES/NO
(iv)	Other please specify	

4. Do middle management in your company use the following controls?

(i)	Sales results by area analysis	YES/NO
(ii)	Sales results by product analysis	YES/NO
(iii)	Manufacturing control reports	YES/NO
(iv)	Administrative control reports	YES/NO
(v)	Others please specify.	

5. Do the lower middle management group use written documents for controlling the actual expenditures against budgets in each section of the departments?

6. How frequently are these documents used?

7. Do you have any incentive schemes for the following and in each case could you please specify the type of scheme used and its effectiveness?

(i)	Direct workers	YES/NO
(ii)	Supervisors	YES/NO
(iii)	Lower middle management	YES/NO
(iv)	Middle management	YES/NO
(v)	Directors of subsidiaries or divisions (if appropriate)	YES/NO
(vi)	Directors of the main company board	YES/NO

8. Could you please provide us with brief details of your personal education and career to date?

M.Y.A. / JUNE, 1975.

APPENDIX B

SCALING MODELS

In this Appendix, aspects of measurement theory in relation to construction of multi-item measures are discussed using the measure of functional specialisation as an illustration. The underlying reasons for using multi-item measures are briefly discussed in Section B.1. Trace lines, Guttman scale, probability scaling models, item value analysis, reliability measurement and finally, multi-dimensional scaling based on factor analysis are presented in Sections B.1 through to B.8.

B.1 Construction of a Scale from a Collection of Items

Multi-item measures are frequently used by psychologists to measure attributes. The following are some of the reasons for using more than one item in measurement of attributes:

(1) Items have considerable specificity, i.e. each item tends to have low correlations with the attribute to be measured and tends to relate to other attributes.

(2) Single items, especially dichotomous items tend to classify the respondents into two categories only and a fine distinction cannot be made between respondents.

(3) Existence of measurement error due to misrecording of information, and ambiguity of questions is reduced with multi-item scales.

The variable "functional specialisation" is used as an example in demonstrating construction of a scale from a collection of items.

This attribute is measured by a collection of 31 items. Respondents in the companies were asked to indicate whether the company had at least one full time employee, not in the line management, performing each of a list of specialist jobs. Each of the jobs was scored as a dichotomous item, having values of 1/0, depending on whether the respondent reported the specialist to exist or not respectively. Thus a total of 31 scores on the binary measures was obtained, each representing a distinct specialisation which was regarded as applicable to all work organisations. The measure of "functional specialisation" is a more detailed breakdown of the specialisation measure used by Pugh et al (1968) to measure the same characteristic. The 31 items used to measure functional specialisation in the CUBS Study are listed on top of Table B.3.2.

B.2 Trace Lines

According to Nunnally (1970), nearly all models of scaling people can be depicted by different types of curves relating an attribute to the probability of responding in one way rather than another to items. For dichotomous items, there are two types of responses α and β. The curves are called trace lines and the probability of response α is the probability of a positive response. In this case a positive response would be endorsing the existence of a specialisation.

The abscissa of the trace line concerns the true scores(1)

(Note (1) - True scores are completely reliable measures of the attribute and the approximations to true scores obtained from any collection of items are called fallible scores.)

on the attribute. However, an approximation to the true scores may be obtained from some combination of the available items, so that an approximate test can be made for the actual trace lines of a particular item.

Trace lines were constructed for each of the 31 specialisation items. The attribute specialisation was assumed to be measured as the sum of all positive responses to items varying in range from 0 - 31 as an approximation to the true scores and the probability of response $\propto$ was obtained from the cross-tabulation of each specialisation item with the total scores.

Trace lines are hypothetical curves and, depending on the assumptions made about their shape, various models of scaling may be employed. In this case approximations to the actual trace lines were obtained only for illustration of their relationship with the scaling models used. Figure B.2.1 shows an approximately monotone deterministic(2) trace line. It can be seen that the probability of having public relations specialisation for companies with total scores of less than 16 is zero and for companies with total scores greater than 20, the probability is one. Figure B.2.2, the trace line for having a medical specialist, is of linear ascending type. In this case, the probability of having the specialisation is zero for companies with total scores of less than 15 and increases linearly with increasing specialisation

(Note (2) - Monotonic trace line means that higher levels of the attribute always correspond to higher probabilities of responding in one way rather than another. The term deterministic means that the probability is either one or zero.)

Figure B.2.1 Trace Line for Public Relations Specialisation

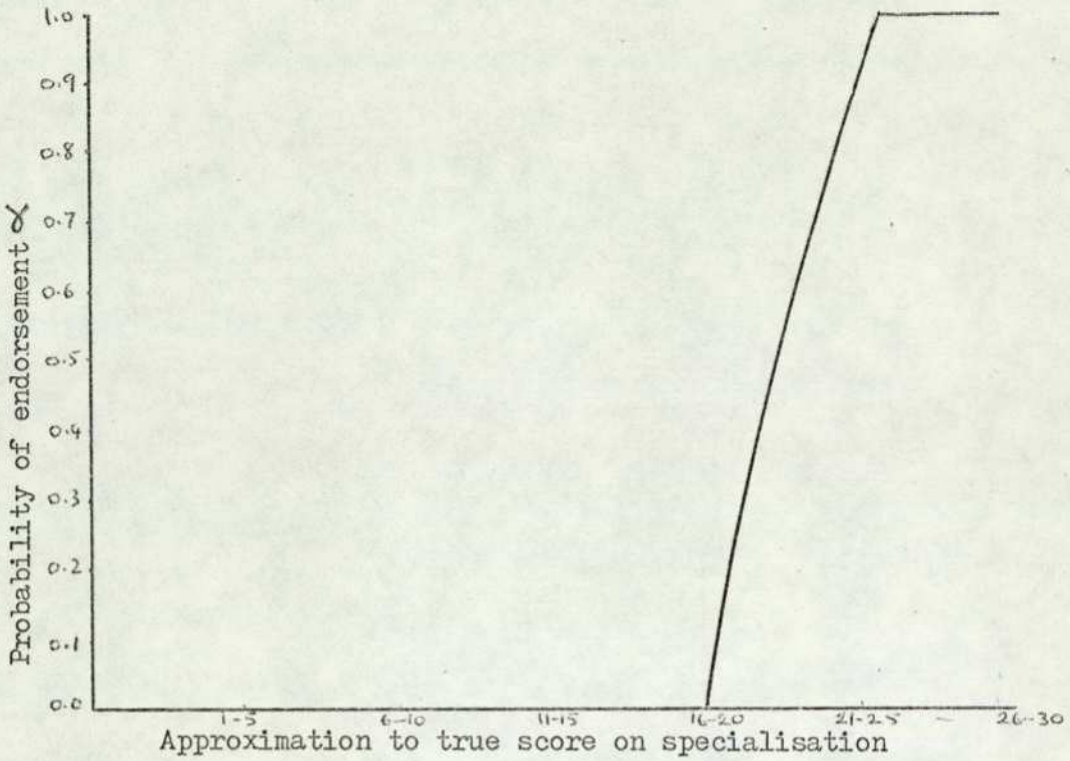
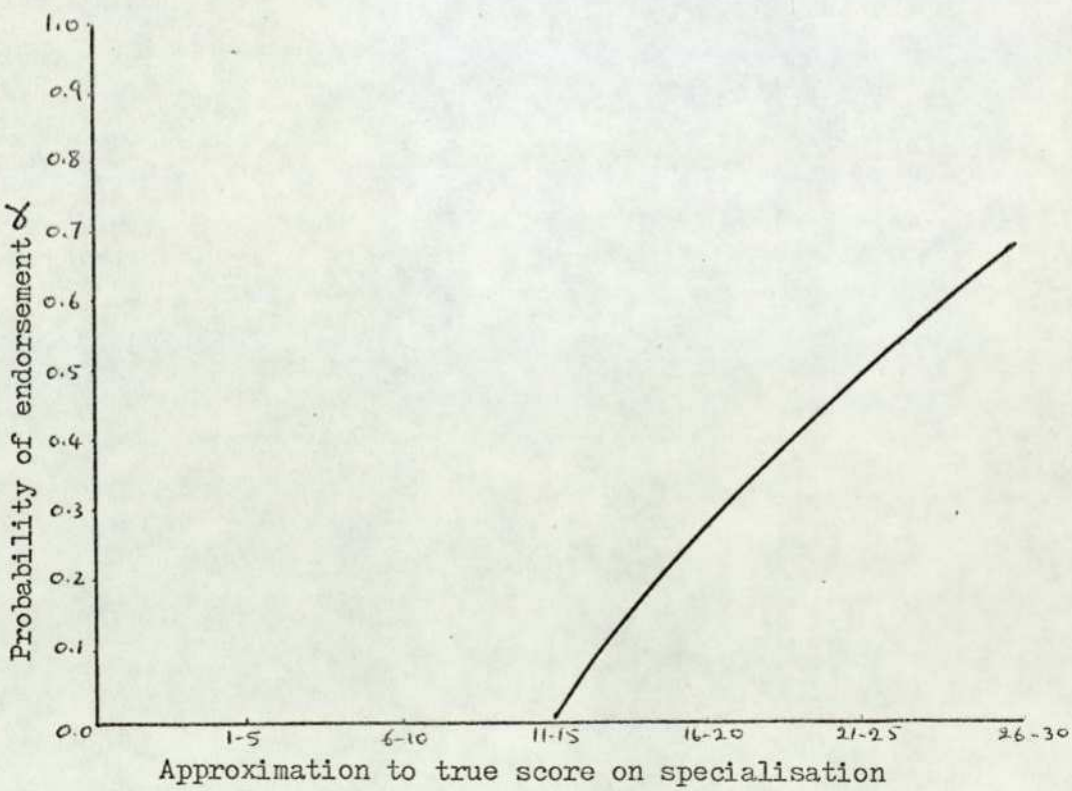


Figure B.2.2 Trace Line for Medical Specialisation



total score. Figure B.2.3 shows an ascending monotonic and Figure B.2.4 a non-monotonic[3] trace line.

B.3 Guttman Scale

If the trace lines for each item are such that the probability of response α is zero up to a certain level of the attribute and immediately above that level of the attribute the probability takes a value of one, as shown in Figure B.3.1, then any person who responds positively to item one will also respond positively to items 2, 3 and 4, and any person who responds negatively to item one, but positively to item 2, will respond positively to items 3 and 4.

(Note (3) - The slope of the curve changes sign along the attribute.)

Figure B.2.3 Trace Line for Transportation Specialisation

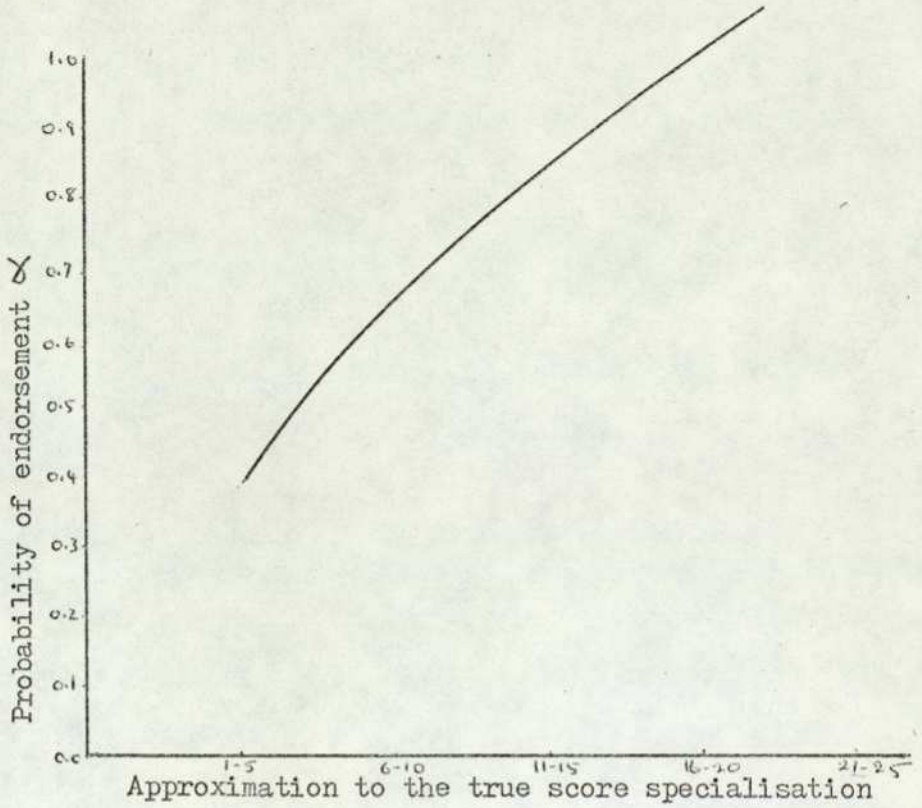


Figure B.2.4 Trace Line for Work Study Specialisation

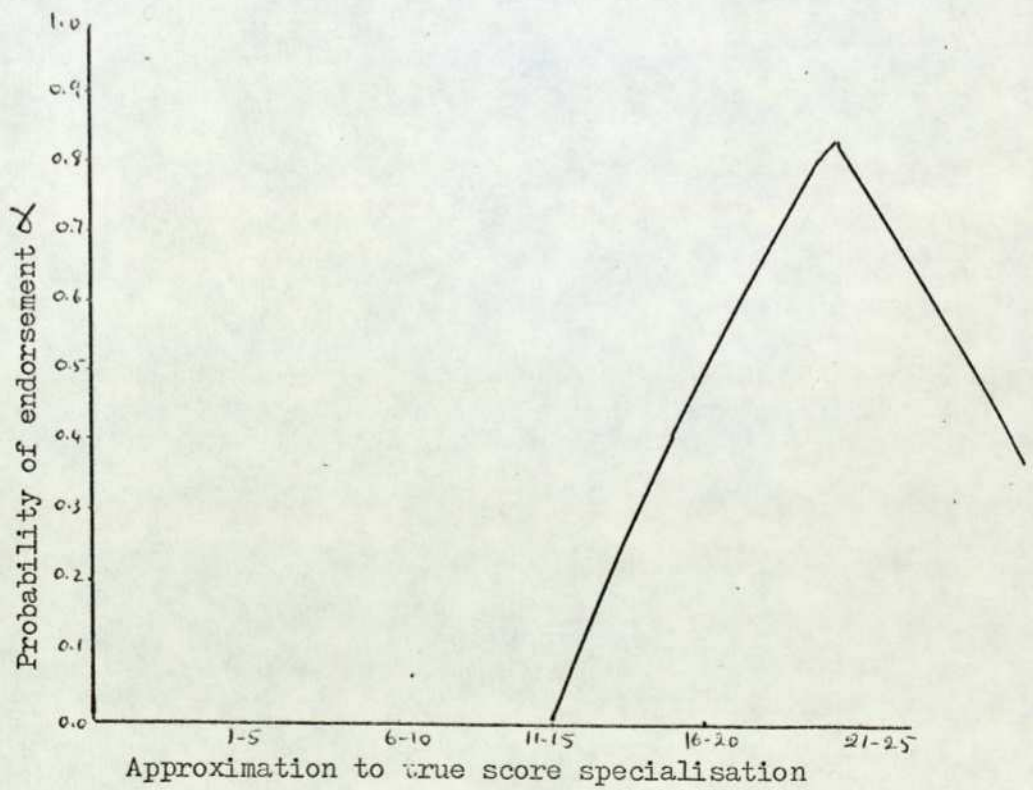
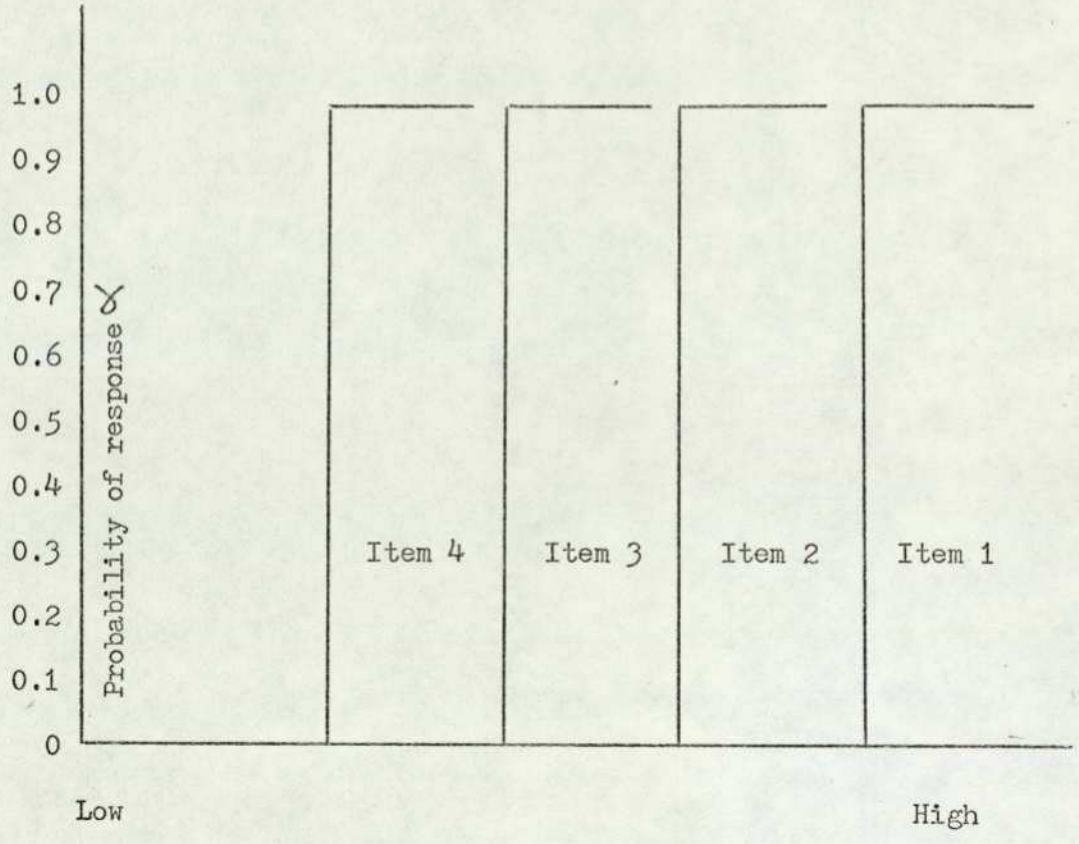


Figure B.3.1 Deterministic Trace Line



If persons are represented along the rows and items along the columns of a matrix, then by re-ordering rows and columns a perfect triangular pattern will be obtained. Any set of items producing an approximately perfect triangular pattern is called a Guttman scale. If the pattern is perfectly triangular, then the knowledge of the number of positive responses enables one to to reproduce the whole response pattern of the respondent. However, in reality, this rarely happens and the pattern is not perfectly triangular. One index which measures the degree of fit between the observed pattern of data is called the coefficient of reproducibility and is calculated as $1 - \frac{\text{Total no. of errors}}{\text{Total no. of responses}}$. An error is a departure from the perfect pattern and the total number of errors is merely the count of the number of responses which should be positive but are negative and vice versa - and hence does not take into account the position of the errors with respect to the perfect pattern. Also, as argued by Levy and Pugh, 1969.

> "The Guttman model is stated at an ordinal level of measurement, yet the coefficient devised to measure the degree of fit merely counts the discrepancies and thus fails to consider the ordinal degree of misfit of each discrepancy. In other words no clear statement of an error theory is either given or required for its calculation."

Although the trace lines for specialisation items indicate that a perfect pattern cannot be obtained, an attempt was made to observe the extent of departure from the perfect pattern. In this case companies were used in place of respondents and the endorsement of a specialisation in place of a positive response.

Items of specialisation were arranged in descending order of the number of endorsements from their frequency distributions. Using the "sort cases" facility of the S.P.S.S.(1) the companies were sorted in descending order of specialisation total scores and the "write cases" facility was used to obtain the matrix shown in Figure B.3.2. Here the rows of the matrix represent individual companies and the columns, the individual specialisations. The X's represent endorsement of a specialisation by the companies. The pattern produced is approximately triangular, with some departures from the perfect Guttman scale pattern, both below and above the main diagonal as expected, since none of the trace lines are similar to the ones shown in Figure B.2.3. However, the pattern illustrates the distribution of particular specialisations with respect to specialisation total scores and, since it is approximately triangular, the knowledge of the total specialisation score enables one to determine approximately, the existence of various specialisations. The Guttman model is deterministic, due to the assumptions underlying the shape of the trace lines.

(Note (1) - Statistical Package for Social Sciences)

Fig. B.3.2 Guttman scale for functional specialisation

B.4 Probability Models

There are a number of probability models depending on the type of curve assumed for the trace lines. One such model is called the linear or summative model which makes three major assumptions. First, it is assumed that each item has a monotonic trace line, but not necessarily of the same type. Second, it is assumed that the sum of all the trace lines is linear, i.e. that the departures from linearity are averaged out as items are combined. Third, it is assumed that the items as a whole tend to measure the same attribute, i.e. they only have one factor in common. The model leads to a summation of item scores to obtain the total scores as the measure of the attribute. In adding scores, it is assumed that each item adds something to the others, i.e. it increases the capability of making finer distinctions between subjects when ordered according to their total item scores.

B.5 Item Analysis

If all the items are measuring the same attribute, then there will be high correlations between them and, since the average correlation of items with one oanother is related to the correlation of items with total scores, these items will be highly correlated with total scores. The inclusion of an item in total scores depends on the degree to which it discriminates between subjects. The slope of the trace line is an indication of the discriminatory power of the item. The higher the slope, the higher the discrimination between subjects or equivalently, the higher the correlation between an item and the total scores, the higher the discriminatory

power of the item. For example, there is an item-total correlation of 1.0 for items having deterministic trace lines. The items which have higher correlations with total scores have more variance relating to the common factor among the items. Calculating the correlation between individual items and total scores and choosing the items for inclusion in the total score on the basis of their item-total correlations is called Item Value Analysis.

The choice of the correlation coefficient to be used depends on the type of data. For multi-point items, regular product moment correlation coefficient may be used. In the case of dichotomous items, either the point-biserial correlation coefficient, which is only different in appearance to the product moment coefficient, generally used when correlating a dichotomous variable with a continuous variable, or the biserial correlation coefficient, which is an estimate of the product moment coefficient that would have been obtained if the dichotomous variable were continuous, may be used. However, the latter has been criticised on the grounds that it assumes bivariate normal distribution and the former on the grounds that it penalises the items which have positive response proportions far removed from a 50 - 50 split relative to the value obtained from other coefficients. (See also Nunnally, 1967, 1970.)

Levy and Pugh (1969) suggest the use of a coefficient which they call General Biserial Correlation Coefficient developed by Brogden (1949), which has all the properties of the biserial coefficient but frees it from the bivariate normality assumption.

The formula is: $r = \frac{m_1 - m_0}{M_1 - M_0}$

where:

m_1 = Mean score of those who endorsed the item.

m_0 = Mean score of those who did not endorse the item.

M_1 = Mean of the topmost scores equal in number to respondents who endorsed the item.

M_0 = Mean of the bottom-most scores equal in number to respondents who did not endorse the item.

The numerator of the ratio is the mean difference for respondents who did and did not endorse the item and the denominator is the mean difference for the same number of respondents if the item were a perfect discriminator. The logic of the above analysis used in psychological test construction may be extended to analyse the multi-item measures used in organisational studies. Item-total correlations may be calculated for each item sequentially and, if too low(1), the item may be eliminated, the total score corrected, and the coefficient calculated for the next item.

In the case of specialisation, since most of the trace lines are of ascending monotonic type, the linear model discussed may offer a good representation of the data. Therefore, total specialisation may be represented by a simple summation of individual item scores and the selection of any individual specialism for inclusion in the total score may be made on the basis of its item-total correlation. To this end, Brogden coefficients were

(Note (1) - Coefficients below 0.5 may be considered as too low.)

calculated for each specialisation and the values are shown in Table B.5.1. Point-biserial coefficients were also calculated for each item. The values obtained were lower than Brogden coefficients in each case. However, they were all significant at 0.01 level with O.R specialism being an exception. This had a significance level of 0.014. The rank order of items in terms of the coefficients was only slightly different, which seems to confirm the statement made by Nunnally (1970: 216), that the correlation between different sets of ranks is generally high. However, the Brogden coefficient is used for selecting items in multi-item measures throughout the CUBS Study, where the items are dichotomous. The coefficients for specialisms dealing with customers' complaints, market research, operational research and rate fixing were the lowest coefficients obtained. Looking at the trace lines for these specialisations, it can be seen that they are non-monotonic. They do not discriminate between the companies as well as other specialisations do. Hence, by eliminating these from the total scores, larger coefficients will be obtained. If the Guttman pattern is reproduced with these specialisations eliminated, there will be fewer departures from the perfect pattern. It must be mentioned that the point-biserial coefficient obtained for these specialisations was also lowest among the item-total correlations.

Table B.5.1 Item Total Correlations. Brogden Coefficients and Point-Biserial Coefficients.

	Brogden	Point-Biserial
Public relations	.9396	.6636
Advertising	.6238	.4225
Sales and services	.8752	.5707
Customer complaints	.5794	.4671
Market research	.5514	.4359
Transportation	.6117	.4658
Employment	.9406	.7081
Education and training	.8298	.6561
Welfare	.8688	.4802
Medical	.7948	.5382
Safety	.7183	.5073
Social	.7310	.4335
Buying	.8627	.5626
Material control	.8050	.6465
Stock control	.7940	.6407
Maintenance	.7654	.6417
Works Eng.	.6882	.5661
Accounting	.8717	.6813
Costing	.7806	.6269
Wages	.8189	.6718
Production scheduling	.8382	.4859
Inspection/Equipment	.6018	.4833
Quality control	.8995	.7310
Work study	.7026	.5073
Industrial Eng.	.8931	.6822
O.R.	.5570	.3303
Rate fixing	.5939	.4102
Product design	.8005	.6696
Process design	.8467	.6971
Registry	.6425	.4686
Legal	.7218	.5174

B.6 Reliability Measurement

The purpose of any measurement is to estimate the measurement that would be obtained if all the items in the domain were employed. The score that any subject would obtain over the whole domain is called the true score. To the extent that any sample of items correlated highly with true scores, the sample would be highly reliable (Nunnally, 1970: App. D). From the parallel test model which is a special case of domain sampling model (Nunnally, 1970: App. D; Nunnally, 1967: Ch. 6) a coefficient is obtained which is called the reliability coefficient. This is the correlation obtained between a test and an alternative form of the test. This coefficient is symbolised as r_{11} and is an estimate of the squared correlation of either test with the hypothetical true scores. If the correlations of either test with true scores are r_{1t} and r_{2t} then $r_{11} = r_{1t}^2 = r_{2t}^2$ and since the square of the correlation equals the percentage of variance that one test explains in another, r_{11} equals the percentage of true scores variance explainable by either test. For example, if the reliability coefficient is 0.80, it can be said that the test is 80 per cent reliable and that 20 per cent of the variance in the test consists of measurement error.

Extending the logic of the coefficient above which is used in psychological test construction to the data on specialisation and by using the Kuder Richardson formula 20 as an estimate of r_{11}, the reliability for the specialisation measure was

calculated and it was 89 per cent.

$$r_{11} = \frac{k}{k - 1} \left(1 - \frac{\Sigma pq}{\sigma_x^2}\right)$$

where:

k = number of items in the measure or test
σ_x^2 = variance of the total scores
p = percentage of the subjects who pass an item (score 1)
q = $1 - p$

The above formula applies to tests with dichotomous items. For the case of tests with multi-point items, the formula takes the form:

$$r_{11} = \frac{k}{k - 1} \left(1 - \frac{\Sigma \sigma_i^2}{\sigma_x^2}\right)$$

where σ_i^2 equals the variance of each multi-point item. In the above form the coefficient is called the coefficient alpha. The reliability coefficient was calculated using the above two formulae where appropriate throughout the study.

B.7 Multi-Dimensional Scaling

In discussing the scalogram analysis (Guttman scale) and item analysis technique so far, a unidimensional view of the measure has been assumed. Referring to the approximately triangular pattern obtained for specialisation items in Figure B.3.2 and knowledge about other characteristics of companies under investigation, it may be inferred that the departures from the perfect pattern may in some cases be due to the multi-dimensional nature of the data. For example, the companies which endorsed the existence of an advertising specialism were mostly consumer goods manufacturers. The discrepancies which occurred below the diagonal were for companies in the above category and the two companies which were above the diagonal and did not endorse the specialism were manufacturers of electronic capital goods. In the case of rate fixing specialisation, the discrepancies below the diagonal occurred in companies predominantly engaged in the production of standard equipment and discrepancies above the diagonal occurred in companies producing technically sophisticated equipment. The companies which had the legal specialists and were also below the diagonal were all independent private companies, the ones which did not have legal specialists and were above the diagonal were all subsidiaries of large corporations. From the three examples of departures from the perfect triangular pattern, it may be deduced that the specialisation scale composed of all the 31 items may not be unidimensional and that the type of markets served, the nature and complexity of the end product and the status of the company may influence development of particular specialisations. The above statement points to a need to employ multi-dimensional scaling models to investigate the data to a greater extent.

A number of multi-dimensional scaling models exist which may be employed (Coombs,1960) for this purpose. Levy and Pugh (1969) point out the difficulties involved in using a model based on scalogram analysis.

B.8 Factor Analysis

Factor analysis is a method of data reduction through which a number of variables may be reduced to a smaller number of factors explaining most of the variance in the original data. Each factor if formed as a linear combination of the variables. By adopting factor analysis for investigating possible multi-dimensionality of a multi-item measure or for identifying the underlying dimensions of a collection of measures, it is important to note the implications of the assumptions underlying the technique used in interpretation of the results.

There are numerous methods of factor analysis (see Rummel, 1970; and Harman, 1976). Principal component analysis provides an exact transformation of the data and assumes that all the variance of a variable is explained by other variables included in the model, whilst principal factor analysis allows for the existence of specific variance. This is the proportion of the variance of a variable not explained by other variables in the model. The unrotated factor solution results in a first factor which accounts for the greatest amount of the variation in the data with each successive factor explaining smaller proportions of the variance. The first unrotated factor generally has high loadings for a large proportion of the variables included in the model and the remaining factors are of bi-polar nature. In order to obtain a 'simple structure', i.e. a solution whereby groups of variables have high loadings on single factors and loadings of close to zero on other factors, a number of factors may be retained for rotation. The simple structure illustrates most

clearly the clustering of groups of variables which are more significantly intercorrelated.

Various methods of rotation may be used. Varimax, Equimax and Quartimax result in orthogonal factors, i.e. factors which are uncorrelated, whilst oblique rotation allows the factors to be correlated. According to Rummel (1970: 392), of the orthogonal rotation techniques, the varimax technique generally results in solutions which are most likely to satisfy the 'simple structure' criterion. Oblique rotation, relaxing the orthogonality condition which imposes an analytical constraint on the formation of clusters, would be expected to provide clearer clustering of the variables. Also, if factors are uncorrelated, the obliquely rotated factors will also be uncorrelated.

The criterion for retention of factors for rotation is a rule of thumb criterion. Normally factors with eigenvalues of equal to or greater than one are retained. In this way, factors which at least explain an amount of variance equal to the total variance of one variable are retained for rotation.

Finally, a criterion must be used for selecting variables representing a factor in the final solution. Variables may be selected on the basis of the significance of their loadings on the factors using the formulae[1]: $\underline{P} = p\sqrt{\frac{n}{n+1-r}}$

where:

(Note (1) - Child (1976: 97)

$\underline{P}$ = standard error of a loading

p = standard error of a correlation

n = number of variables in the factor model

r = position of the factor

Factor analysis is used as an exploratory tool for testing possible multi-dimensionality of multi-item measures and for identifying underlying dimensions of certain groups of organisational characteristics. To this end, both principal component and principal factor analysis were used. In almost all cases varimax and oblique rotations were used to arrive at a final grouping of variables. However, in some cases, equimax and quartimax rotatims were also used to test for stability of clusters. Factors with eigenvalues of greater than one were retained for rotation and significance of loadings was used as a criterion for selection of variables representing a factor.

Data on specialisation was factor analysed using the principal component analysis model. The first unrotated factor accounted for 32.6% of the total variance (Table B.8.1). As may be seen, the loading for O.R. specialisation is only significant at the 0.05 level, the loadings for advertising, customer complaint, market research, social, rate fixing, and registery and O&M are significant at the 0.01 level and the loadings for the remaining 24 specialisation items are significant at or beyond the 0.001 level. The loadings for advertising and social specialisation are, however, most significant on the first factor and only five of the 31 specialisation items load more significantly on other factors (Table B.8.1). Different rotated solutions did not suggest that

Table B.8.1 Principal Component Analysis of Specialisation Items.

Factor 1. Unrotated.

	FACTOR 1		Factors on which the variable loaded more significantly
Public relations	.65681	***	
Advertising	.40869	**	
Sales and services	.58081	***	
Customer complaint	.44946	**	.49901 on F6
Market research	.40243	**	.45233 on F2
Transportation	.47048	***	
Employment	.70760	***	
Education and training	.64813	***	
Welfare	.47160	***	
Medical	.53721	***	
Safety	.49829	***	
Social	.42062	**	
Buying	.57418	***	
Material control	.66744	***	
Stock control	.65966	***	
Maintenance	.64385	***	
Works Eng.	.58454	***	
Accounting	.69389	***	
Costing	.63533	***	
Wages	.68318	***	
Production scheduling	.50006	***	
Inspection equipment	.48828	***	
Quality control	.74580	***	
Work study	.49502	***	
Industrial Eng.	.67194	***	
O.R.	.30138	*	.42338 on F9
Rate fixing	.39471	**	.51344 on F3
Product design	.67221	***	
Process design	.70754	***	
Registry and O&M	.45157	**	.55896 on F3
Legal	.51132	***	
% of variance	32.6		

Notes

* Significant at the 0.05 level

** Significant at the 0.01 level

*** Significant at the 0.001 level

the measure may be multi-dimensional. In view of this and the significance of the loadings on the first unrotated factor, this first factor was called the specialisation factor and it was thus assumed that the measure may be unidimensional. The assumption that the measure is unidimensional is further reinforced by comparing the loadings on the first unrotated factor of Table B.8.1 with the size of the point biserial correlation obtained between each specialisation item and a scale of specialisation constructed by simple summation of individual items, Table B.5.1. The size of the loadings and the size of the correlation coefficients for each specialisation item are remarkably close. In this case, therefore, the linear or summative model discussed in Section B.4 may best fit the data and the attribute specialisation is measured by summation of individual item scores.

Factor analysis of data could have, however, resulted in a number of distinct clusters or groups of variables with different underlying characteristics in which case a number of scales, each representing these different attributes would have to be constructed, and company scores calculated. This may be done in a number of different ways:

(1) Factor scores may be used to represent the company's score on each attribute.

(2) Standardised scores for items forming each cluster may be multiplied by their respective factor score coefficients to represent company's score on that attribute.

and

(3) Row item scores of items forming a cluster may be summed to represent the company's score on that attribute.

As mentioned earlier, since factor analysis is only used as an exploratory tool and the level of measurement of the variables in most cases does not satisfy all the assumptions underlying factor analysis techniques, and for the sake of simplicity, the third option is used throughout the CUBS Study in construction of scales developed through the use of factor analysis.

APPENDIX C

Company Characteristics

Descriptive statistics and frequency distributions for structural, contextual and stylistic variables are given in Tables 3 - 18. The figures and percentages for each variable only relate to the number of companies for which information was available. For completeness, Tables 2.2.1 and 2.2.2 are also reproduced as Tables 1 and 2.

Table 1 Frequency distribution of companies in the population and the sample by subsection of industry

Standard industrial classification minimum list heading	Industry subsection	Number of companies in the population	Number of companies in the sample	Number of companies in each subsection of industry as %'age of total for the population	Number of companies in each subsection of industry as %'age of total for the sample
361	Electrical machinery	91	6	18.1	13.3
362	Insulated wires and cables	21	0.0	4.2	0.0
363	Telegraph and telephone apparatus and equipment	26	1	5.2	2.2
364	Radio and electronic components	97	10	19.3	22.2
365	Broadcast receiving and sound producing equipment	36	4	7.2	8.9
366	Electronic computers	17	1	3.4	2.2
367	Radio, radar and electronic capital goods	72	11	14.3	24.4
368	Electric appliances, primarily for domestic use	39	4	7.8	8.9
369	Miscellaneous electrical goods	103	8	20.5	17.8
	TOTAL	502	45	100.0	100.0

Table 2 Sample of 45 companies stratified by size and industrial classification

Company size categories (number of employees)			Number of companies in the sample in each standard industrial classification								
Range	Mean	Standard deviation	Components	Capital goods	Miscell-aneous	Machines	Broad-casting	Domestic	Computer	Telephone & telegraph	TOTAL
35-89	60.4	16.7	3	2	1		1				7
100-200	134.2	32.0	1	1	2	2					6
250-350	295.6	43.3	3	1	1	2	1	1			9
400-600	505.3	81.3	1	2	3	1	1		1		9
655-1600	1082.5	326.0	1	3	1	1		1		1	8
2300-3500	2766.6	524.9	1	1				1			3
4500-17000	9166.6	5572.7		1			1	1			3
		TOTAL	10	11	8	6	4	4	1	1	45

Table 3 Descriptive Statistics for Structural Variables

	Mean	Standard Deviation	Range
1. Chief executive's span of control	6.0	2.8	3-14
2. Subordinate ratio	16.2	7.6	4-40
3. Vertical span of control	5.2	1.0	3-8
4. Administrative/production (A/P) ratio	1.8	3.2	0.1-19
5. Number of indirect employees	656.7	1798.4	10-10560
6. Logarithm of number of indirect employees	2.2	0.7	1-4
7. Qualifications	4.6	2.3	0-8
8. First degree holders	70.5	223.8	0-1193
9. Logarithm of first degree holders	1.03	0.73	0-3.08
10. Higher degree holders	48.3	205.8	0-1200
11. Logarithm of higher degree holders	0.40	0.74	0-3.08
12. Formalisation	11.7	4.8	3-20
13. Functional specialisation (ASPEC)	10.3	3.7	2-16
14. Functional specialisation (ESPEC)	14.2	7.7	1-31
15. Autonomy	22.2	1.6	16-23
16. Centralisation (AC)	63.5	9.1	41-84
17. Centralisation of marketing decisions	14.0	2.3	8-19
18. Centralisation of financial decisions	7.6	1.4	4-10
19. Centralisation of operating decisions	38.6	7.0	17-51

Table 4 Frequency Distribution of Chief Executive's Span of Control

Number of persons reporting to the chief executive	Number of companies	% of sample
3-4	13	29.5
5	11	25.0
6-7	12	27.3
8-14	8	18.2

Median = 5.3

Mode = 5

Table 5 Frequency Distribution of Vertical Span of Control

Number of levels	Number of companies	% of sample
3	1	2.2
4	9	20.0
5	21	46.7
6	11	24.4
7	2	4.4
8	1	2.2

Median = 5.1

Mode = 5

Table 6 Frequency Distribution of Subordinate Ratio

Number of employees per first line supervisor	Number of companies	% of sample
4-10	8	21.6
11-15	12	32.4
16-25	14	37.8
26+	3	8.1

Median = 15

Mode = 20

Table 7 Frequency Distribution of Type of Structure (SHAPE)

Category	Number of companies	% of sample
Owner manager	4	8.9
Functional	27	60.0
Functional plus sales/ service divisions	3	6.7
Holding company	5	11.1
Semi-multidivisional	4	8.9
Multidivisional	1	2.2
World wide product/ world partitioned geographical	1	2.2

Modal category: Functional structure

Table 8 Descriptive Statistics for Contextual Variables

	Mean	Standard Deviation	Range
1. Size (number of employees)	1175.5	2698.4	35-17000
2. Size (logarithm of number of employees)	2.61	0.59	1.54-4.23
3. Age	37.8	21.4	2-86
4. Impersonality of origin	0.4	0.5	0-1
5. Status	0.7	0.6	0-3
6. Relative size	1.7	1.3	0-3
7. Dependence	2.8	2.1	0-7
8. Number of operating sites	3.6	4.0	1-23
9. Automaticity mode	1.3	1.2	0-5
10. Automaticity range	3.1	1.4	0-5
11. Design and development technology	2.1	1.0	1-4
12. Parent company size (number of employees)	30537.9	55990.3	50-202000
13. Parent company size (logarithm of number of employees)	3.55	1.11	1.70-5.30

Table 9 Frequency Distribution of Impersonality of Origin

Category	Number of companies	% of sample
Personal foundation	27	60.0
Foundation by an existing organisation	18	40.0

Modal category: personal foundation

Table 10 Frequency Distribution of Status

Category	Number of companies	% of sample
Principal unit	14	31.1
Subsidiary	30	66.7
Head branch	-	0.0
Branch	1	2.2

Modal category: subsidiary

Table 11 Frequency Distribution of Relative Size

Category	Number of companies	% of sample
Over 90% of owning group	15	33.3
30% - 90% of owning group	2	4.4
5% - 29% of owning group	9	20.0
Under 5% of owning group	19	42.2

Modal category: under 5% of owning group

Table 12 Frequency Distribution of Number of Operating Sites

Number of operating sites	Number of companies	% of sample
1	14	31.1
2	10	22.2
3	9	20.0
4	1	2.2
5	2	4.4
6-8	5	11.1
10 and over	4	8.8

Mode = 1

Table 13 Frequency Distributions of Automaticity Mode and Range

Category	Automaticity mode no. of companies	Automaticity mode % of sample	Automaticity range no. of companies	Automaticity range % of sample
Hand tools and manual machines	8	18.6	1	2.3
Powered machines and tools	24	55.8	4	9.3
Single cycle automated and self-feeding machines	4	9.3	8	18.6
Automated repeat cycle machines	5	11.6	17	39.5
Self-measuring and adjusting feedback machines	-	0.0	2	4.7
Computer controlled cognitive machines	2	4.7	11	25.6

Modal categories:

Automaticity mode, powered machines and tools.

Automaticity range, automated repeat cycle machines.

Table 14 Frequency Distribution of Design and Development Technology

Category	Number of companies	% of sample
Few exceptions/ analysable problems	15	34.1
Many exceptions/ analysable problems	16	36.4
Few exceptions/ unanalysable problems	7	15.9
Many exceptions/ unanalysable problems	6	13.6

Modal category: Design and development technology characterised by occurrence of many exceptional situations which are analysable.

Table 15 Frequency Distribution of Charter

Category	Number of companies	% of sample
Manufacturing	40	88.8
Manufacturing and service	5	11.2

Table 16 Descriptive Statistics for Organisational Style Dimensions

Style	Mean	Standard Deviation	Range
1. Technological leadership	8.0	1.7	2-10
2. Planning orientation	5.9	1.7	2-9
3. Risk taking	4.5	2.0	1-9
4. Risk averting	7.0	2.2	2-10
5. Training orientation	5.6	1.9	2-9
6. Conservative (change)	8.0	2.3	4-13
7. Conservative (growth)	10.8	3.2	3-15
8. Participative (A)	13.3	3.1	3-15
9. Participative (B)	12.6	2.4	6-15
10. Mechanistic	16.0	4.2	6-23
11. Aggressively adaptive	7.6	3.0	3-15
12. Human relations orientation	8.1	1.3	5-10
13. Autocratic	8.7	2.3	5-15
14. Traditional	8.0	1.3	4-10

Table 17 Frequency Distribution of Strategy based on Wrigley's (1970) Classification

Category	Number of companies	% of sample
Single product	24	58.5
Dominant product	6	14.6
Related product	11	26.8
Unrelated product	-	0.0

Modal category: single product

Table 18 Frequency Distribution of Strategy based on Rumelt's (1974) Classification

Category	Number of companies	% of sample
Single product	24	58.5
Dominant related by market and technology	4	9.8
Dominant related by market or technology	1	2.4
Dominant unrelated	1	2.4
Related by market and technology	7	17.1
Related by market or technology	4	9.8
Unrelated	-	0.0

Modal category: single product