School of Commerce

A Performance Linked Management Accounting Typology Within Contingency And Institutional Frameworks In The Malaysian Manufacturing Industry

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ABSTRACT

Management accounting systems' (MAS) information attributes coupled with management accounting practices/techniques (MAPT) form complex configurations that differ across manufacturing firms. The extent to which management adopts and relies on these management accounting configurations is expected to have outcome effects on the performance of their firm. The adoption and reliance upon these configurations are also expected to be influenced by the context in which manufacturing managers operate. In particular, the contingency factors faced by a firm and the institutional norms prevalent on a firm will have an impact on the way management chooses to configure its combination of features of MAS and MAPT. The empirical literature on these complex configurations is not well established.

This study aims to establish a discernable typology of manufacturing firms that adopt and rely on combined features of management accounting systems and practices/techniques in Malaysia. In particular, a systems approach employing cluster analysis is used to determine the existence of a management accounting typology of firms. Using this empirically derived cluster solution, the further aims of this study are to identify which typological group is better performing, based on a weighted average measure of performance of member firms in each MAS/MAPT-type group. The final aim is to model and test a set of predictors of the better and weaker performing MAS/MAPT-type groups of firms. These predictors are drawn from the background characteristics of respondents and their firms, key contingency theory variables and isomorphic institutional theory variables.

Data is collected from a sample of management accountants employed in manufacturing firms in order to obtain measures relating to relevant constructs and their underlying dimensions and variables. The constructs are manufacturing management methods, management accounting systems' presentation of information, management accounting practices/techniques in use, organizational performance, contingency factors (involving strategic manufacturing priorities, organizational interdependence, decentralization of structure and perceived environmental uncertainty), and institutional influences (involving mimetic, coercive and normative dimensions). The survey instrument for this study was based heavily on a selection of multi-item measures that have been tested and validated in prior empirical research literature. This instrument was pre-tested through interviews with five management accounting experts. It was then mailed to the membership list of the Chartered Institute of Management Accountants (CIMA) in Malaysia. There were 127 useable responses received.

The results first reveal that there are two distinct clusters of manufacturing firms, distinguished by the extent to which management accountants in those firms consider MAS' information attributes as more useful and claim more benefit from practising MAPT. Using a weighted average performance index, it is further found that firms in the cluster of high management accounting users perform significantly better. The inference is that better performing manufacturing firms fall into the group whose management uses a wide range of MAS information attributes and MAPT for their planning, control and performance evaluation functions compared to those who tend to not use these methods.

The two clusters of manufacturing firms are also tested for significant associations and relationships with the background information (predominantly demographic factors), manufacturing management methods, the institutional influences and the contingency factors measured through the survey. Both bivariate analyses and multivariate logistic regression are applied. Under bivariate analyses, variables found to be significant determinants of the cluster solution are: respondents' previous length of service and education at certificate level, manufacturing strategies (all three types), all mimetic and normative institutional influences, one coercive influence, and autonomy of management relating to staffing. Logistic regression analysis results in the following variables having a significant effect on the cluster solution: respondents' previous length of service, top management's attention on the functionality of management control systems, the dependence of top management on advice from the management accountant, and the manufacturing strategy of giving priority to customer service and delivery.

In order to test whether MAS' information attributes and MAPT can predict the weighted average performance index, two multiple linear regression modellings are developed. The first model tests all seventy MAS' information attributes and MAPT indicators and discovers that only four of them are significant predictors to the weighted average performance index. The four predictors are owners' (shareholders') value analysis, performance evaluation: non-financial measures, performance evaluation: ongoing suppliers' evaluation and cost-volume-profit analysis. The second model utilizes ten factor analysed dimensions of the MAS' information attributes and MAPT. Out of the ten principal components treated as independent variables in the multiple regression modelling, only one significant predictor to the weighted average performance index emerges. The single predictor is the 'performance benchmarking' factor. Except for cost-volume-profit analysis, all the significant predictors in the first model can be found within the performance benchmarking factor.

The findings from this study provide a better understanding of the many variables that are related to the firms that place greater emphasis on the use and perceived benefits of use, of management accounting systems, practices and techniques. These firms, in turn, are established as the better performing manufacturing firms. This study also manages to isolate a number of management accounting practices/techniques instrumental to predicting a firm's performance. The implications for practice are that an emphasis on the use of management accounting generally is integral to success in the manufacturing industry, although some MAPT stand out as key predictors of this success.

DECLARATION

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Chapter Outline

This thesis begins in section 1.2, with a statement of the purpose of the study. From this overarching purpose, a set of more refined research objectives will be uncovered in chapter three. Section 1.3 will introduce the mainstream research propositions and their underlying theoretical premises. From these broad research propositions, a more specific set of research problem, research questions and research hypotheses will be generated. However, these will only be discussed in chapter three. The significance of the study in contributing to the existing body of knowledge will be explained in section 1.4. Section 1.5 elaborates on the research strategies and approaches employed in this study. Even though the main research strategy will be quantitative using mailed survey questionnaires, some degree of qualitative research strategy will also be undertaken by way of five qualitative interviews of selected professionals. Notwithstanding that the main research approach will be a deductive approach, some elements of an inductive approach will be co-opted in the overall scheme of things. In section 1.6, the scope of the research, seen along the lines of sample selection, underlying theories and variable range, is demarcated. Since this study is centred in the fields of management accounting and manufacturing management, a preamble about developments in these fields is provided for in section 1.7. Sub-section 1.7.1 will highlight the major developments in manufacturing management that affect management accounting. Following this, in sub-section 1.7.2, the impacts on management accounting caused by the development in manufacturing management will be shown. Section 1.8 provides an overview of all the remaining chapters of the thesis. Finally, section 1.9 summarizes the salient points made in this introductory chapter.

1.2 Purpose Of The Research

The purpose or overarching aim of this research is to contribute to the limited body of knowledge concerning the ways in which management accounting systems' information attributes and management accounting practices/techniques combine to enhance performance, under various contingency orientations and institutional influences. Hypotheses will be used to isolate relevant variables and research instruments will be developed to measure these variables. The instruments will only be finalized once acceptable levels of construct validity and internal reliability are assured. It should be noted that from this broad sense of purpose, a set of seven specific research objectives will be outlined in chapter three.

Specifically, manufacturing firms will be identified as to which typological clusters they belong based on the information attributes of management accounting systems they find useful and the benefit derived from management accounting practices/techniques that they adopt. Once clusters of manufacturing firms have been established, it is possible to rank the relative performance of the clusters of firms and to verify if the differences between the relative performance are significant. Then, the study can further isolate specific management accounting systems' information attributes and/or management accounting practices/techniques that are responsible in explaining the relative performance of manufacturing firms. As the functions and operations of manufacturing firms cannot happen in a vacuum, it is feasible to select a number of well-known contingency indicators and institutional isomorphic influences to check for any relationships with the management accounting typological clusters of manufacturing firms.

In order to ensure validity and reliability of the research instruments used to capture the data, it is important to do an extensive literature review. The literature review will also serve as a means of identifying and proving the existence of research gaps. The crux of the discussion on literature review will follow in chapter two. It should also be clarified that a stakeholder view of the firm is taken and assumed throughout the thesis. The stakeholder view of the firm emphasizes that the long-term survival and success of the enterprise ultimately depends upon its mutual interactions with its network of stakeholders. Favourable stakeholder relationships generate long-term competitive advantages for the firm the society at large.

1.3 The Research Propositions

The research propositions are based on a number of pertinent premises that have theoretical backing. The mainstream propositions and their underlying theoretical premises are explained below.

- That management accounting systems' information attributes and management accounting practices/techniques can be used to configure a discernable and meaningful typology of manufacturing firms. The typology of firms can then be ranked according to their respective performance. This is supported by the systems approach to contingency theory. Advocates of this approach (Miller, 1981; Van de Ven and Drazin, 1985) assert that the understanding of context-structure performance relationships can only advance by addressing simultaneously the many contingencies, structural alternatives, and performance criteria that must be considered holistically to understand organization design. Unlike the selection and interaction approaches to contingency theory "fit", the systems approach consists of several novel alternative methods characterizing the 'patterns' of interdependencies present in organizations. The systems approach emphasizes the need to adopt multivariate analysis to examine 'patterns' of consistency among dimensions of organizational context, structure, and performance (Miller, 1981). The systems approach incorporates the concept of equifinality by interpreting fit as feasible sets of equally effective alternative designs, with each design internally consistent in its structural pattern and with each set matched to a configuration of contingencies facing the organization.

- That a number of selected contextual factors can be associated or related to the management accounting typology of manufacturing firms. This selection approach will provide extra correlational and/or explanatory power on the typology of firms. Again, this premise is grounded in contingency theory. According to Drazin and Van de Ven (1985), the three forms of "fit" (selection, interaction and systems approach) are not mutually exclusive and can provide both unique and complementary information on the fit in a researcher's data. The selection approach is considered useful for determining important context-structure relationships.

- That a number of selected institutional isomorphic influences can also be associated or related to the management accounting typology of manufacturing firms. Again, these selected mimetic, coercive and normative isomorphic institutional influences will further embellish the understanding of how management accounting typology of manufacturing firms can be correlated or explained by institutional influences in order to survive and achieve legitimacy. This perspective has its roots in institutional theory itself. According to Richardson (1987), accounting scholarship is undergoing a reconceptualization, in part due to the empirical failure of inter alia, contingency theory to provide rationales for developing accounting techniques and systems. As a result, accounting scholars are being asked to refocus their efforts toward the better understanding of how accounting influences, and is influenced by a multiplicity of agents, agencies, institutions and processes (Miller, 1994). The institutional framework has also provided useful insights into the practice of accounting in organizations. The extant accounting literature contains institutional theory based studies addressing various accounting practices, including management accounting change (see for examples, Burns, 2000; Collier, 2001; Scapens, 1994). These studies provide evidence suggesting the importance of social culture and environment on the practice of accounting; the use of accounting practices as rationalizations in order to maintain appearances of legitimacy; and the possibility of decoupling these rationalizing accounting practices from the actual technical and administrative processes.

From the above mainstream research propositions based on established theoretical foundations, will arise a broad research problem that in turn will give rise to five narrower research questions. From these narrower research questions, it is possible to develop eleven refined research hypotheses to be tested empirically once adequate data have been collected. The detailed discussion of these research problem, questions and hypotheses will be reserved for chapter three.

1.4 Significance Of The Study

This research is motivated by the gap in the management accounting research literature on the functioning of management accounting systems' information and management accounting practices/techniques as an integrated system. In particular, evidence of how these elements are adopted in a juxtaposed manner in manufacturing firms has been limited. No such evidence is available in Asian countries. Moreover, there has been no study of how these juxtaposed management accounting systems' information and management accounting practices/techniques might be affected by contextual and isomorphic variables of the organization, considered from the two perspectives of contingency theory and institutional theory.

This study can make a contribution by extending the application of contingency and institutional theory within a systems-oriented model. Contingency theory has been comprehensively used in behavioural research related to budgeting, costing and performance evaluation. However, the systems-oriented view of contingency theory has received less attention. This study will extend the systems perspective of contingency theory in a way that embraces a newly developed typology of management accounting systems' information and management accounting practices/techniques. Institutional theory, on the other hand, has had minimal attention in management accounting research. This is surprising, given that a principal branch of institutional theory is concerned with isomorphism, i.e. explanations of why organizations adapt to change. As outlined in section 1.2.1, manufacturing firms have undergone rapid change. This study will extend the application of institutional theory to the setting of ongoing change in the juxtaposition of management accounting systems' information and management accounting practices/techniques.

This study also seeks to contribute to management accounting practices by establishing a typology that can be used as a frame of reference for manufacturing managers and management accountants. As the typology groups are ranked with organizational performance, it is possible to detect configurations that contribute to better organizational performance. This can be useful as a guide for firms intending to employ a combination of management accounting practices/techniques and management accounting systems' information attributes, leading to the goal of better organizational performance. Additionally, this study can identify key management accounting system and practice/technique indicators that directly contribute to better organizational performance.

1.5 The Research Strategies And Approaches

The study adopts a positivist methodology based on a quantitative research strategy. Quantitative research, as opposed to the qualitative research, is a research strategy that emphasizes quantification in the collection and analysis of data. This entails a deductive approach to the relationship between theory and research, in which the accent is placed on the testing of theories. Quantitative research incorporates the practices and norms of a scientific model and embodies a view of social reality as an external, objective reality.

In contrast, qualitative research is a research strategy that usually emphasizes words rather than quantification in the collection and analysis of data. Qualitative research predominantly emphasizes an inductive approach to the relationship between theory and research, in which the emphasis is placed on the generation of theories. Notwithstanding that principle, in practice however, qualitative research can be non inductive and the positivist methodology can be applied to encompass both qualitative and quantitative research strategies. This research strategy also rejects the practices and norms of the scientific model and of positivism in particular, in preference for an emphasis on the ways in which individuals interpret their social world and embody a view of social reality as a constantly shifting emergent property of individuals' creation.

The quantitative research strategy entails a deductive approach towards research. A deductive approach represents the commonest view of the nature of the relationship between theory and social research. The sequence that forms the process of a deductive approach to research can be depicted in the following diagram:

Figure 1.5 (1) Process Of A Deductive Approach To Research

1. Theoretical context

   ↓

2. Hypothesis generation

   ↓

3. Data collection and analysis

   ↓

4. Findings

   ↓

5. Hypotheses confirmed or rejected

   ↓

6. Revision of theories (if applicable)

With regard to this study, explanation on each step of the deductive process is as follows:

Step One: The theoretical context

As regards this study, the core theoretical foundation is based on the contingency and institutional theories. These theories have been discussed to a certain extent in section 1.3. In particular, the theoretical context relating to accounting has been explained. To summarise, the choice of contingency and institutional theories as the foundation of this study is broadly explained below:

- *The choice of contingency theory*

  As Dubin (1976) states, every theory is a contingency theory, because for a proposition or 'law of interaction' to hold, assumptions must be made about starting premises, boundaries, and system states. Boundary conditions specify the ranges over which a relationship is expected to hold, and system states specify the temporal period and other conditions under which the relationships hypothesized by a theory are expected to occur. Central to a structural contingency theory is the proposition that the structure and process of an organization must fit its context, if it is to survive or be effective. In Dubin's terms, the law of interaction in a contingency theory is that organizational performance depends on the fit between organization context and structure and process – given that normal assumptions hold about the premises, boundaries, and system states derived from the theory.

- *The choice of institutional theory*

  As Dillard *et al* (2004, p.508) point out:

  > Institutional theory is a way of thinking about formal organization structures and the nature of the historically grounded social processes through which these structures develop. A predominant factor underlying the growth of institutional theory in the organization theory literature is its wide range of applicability.

Initially, the sociologically based institutional theorists assumed that institutional ideas were only applicable to institutionalised organizations. Now, however, it has been shown that institutional theory can be used to analyse all types of organizations because all organizations are institutionalised organizations, albeit to varying degrees (Scott, 1995). That is, all organizations are subject to regulative processes and operate under local and general governance structures. All organizations are socially constituted and are the subject of institutional processes that define what forms they can assume and how they may operate legitimately (Scott, 1995). Therefore, an institution is an established order comprising rule-bound and standardized social practices. Institutionalisation is the process whereby the practices expected in various social settings are developed and learned. Institutional theory is primarily concerned with an organization's interaction with the institutional environment, the effects of social expectations on the organization, and the incorporation of these expectations as reflected in organizational practices and characteristics (Martinez, 1999).

Dillard *et al* (2004, p.508) further comment:

> Organizational activities are motivated from the imperative of legitimacy-seeking behaviour, which in turn is influenced by socially constructed norms. For organizations to survive, they must interact with their environment in ways perceived as acceptable to their various constituents in that environment. This presumes some collective understanding of what constitutes appropriate behaviour.

Step Two: Hypothesis generation

Before a set of rational hypotheses can be developed based on the underlying theoretical foundation mentioned in step one above, it is important first to broadly lay out the research problem. Once that is done, it is then sensible to pose a number of research questions to tackle the broad research problem. The research questions can subsequently be translated into definite quantifiable research objectives. In the quest to find answers to all the research objectives, a highly refined set of believe structure in the form of hypotheses will be developed. These hypotheses need to be tested statistically after data are collected and made available. The research problem, research questions and research objectives will be discussed in chapter three. From the broad research problem, five research questions and subsequently seven research objectives are identified and outlined. In chapter three, the conceptual model will be depicted with all the research constructs identified. Then, the research hypotheses will be generated from the earlier research objectives and the statistical testings that need to be carried out once data are available will be outlined. There are eleven research hypotheses identified even though there are seven research objectives. One of the research objectives will be answered qualitatively by analysing five qualitative interview sessions. The remaining research objectives will thus be met by quantitative methodology employing hypothesis testings. As such, even though the general theme of this research is quantitative in nature, some elements of qualitative data analyses, predominantly by analysing transcript of qualitative interviews, will be undertaken to shed some more light on the quantitative findings.

Step Three: Data collection and analysis

Procedures and issues relating to data collection will be discussed in depth in chapter four. Chapter four is on research design and variable measurement. Detailed analyses of data and interpretations of the findings will be presented in chapter five. Chapter five is on data analysis and discussion.

Step Four: Findings

Some findings will be reported in chapter four where they are considered imperative in the context of explaining the research design and variable measurement. However, the bulk of the detailed research findings will be presented and discussed in chapter five.

Step Five: Hypotheses confirmed or rejected

These will only be possible once full research findings have been reported and interpreted. Therefore, confirmation or rejection of hypotheses will be done in chapter six by recapitulating the core findings in chapter five. This step will wind up the whole argument in the concluding chapter six.

Step Six: Revision of theories (if applicable)

Affirming or revising of extant theoretical foundation, whichever is applicable will be reserved to the last chapter; which is chapter six on conclusion.

Within an overall deductive approach as discussed above, some parts of this research will adopt cognitive and inductive approaches. A cognitive approach can be where expert opinions are required. In this study, expert opinions will be solicited in a number of ways. Firstly, literature search will be undertaken to identify the germane research constructs and dimensions used in the research instruments. Only suitable and proven research constructs and dimensions will be adopted. Many of these constructs and dimensions have been tested for validity and reliability by previous researchers. By drawing on the expertise of these previous researchers, an approach more akin to cognitive is being used. Moreover, opinions from the supervisor of this research project, who himself is a subject specialist, will be solicited as the research progresses. There will also be five structured qualitative interview sessions with five suitable professionals in Malaysia as part of the pre-testing exercise of the survey questionnaire. The interviews will be fully recorded on tapes and transcribed into texts for further analysis. The output from these interview sessions may help in the interpretation of the quantitative research findings. These fit more into the definition of a cognitive rather than a deductive approach. An inductive approach within the overarching deductive approach will also be taken on board. With an inductive stance, theory is the outcome of research. In other words, the process of induction involves drawing generalizable inferences out of observations. Just as deduction may entail an element of induction, the inductive process is likely to entail a modicum of deduction. Not all inductive studies converge into grounded theories. The nature of many supposedly inductive studies generates interesting and illuminating studies but the theoretical significance is not entirely clear. These studies provide insightful empirical generalizations, but little theory. Also, in much the same way that the deductive approach is associated with a quantitative research strategy, an inductive approach of linking data and theory is typically associated with a qualitative research strategy. In this doctoral study, some elements of inductive approach are clearly visible in the exploratory nature of the research. The cluster analysis of management accounting systems' presentation of information and management accounting practices/techniques is exploratory and thus inductive. Similarly, the factor analyses of some research constructs and dimensions are also inductive due to their exploratory nature. The qualitative interviews could also be construed as a typical qualitative strategy and hence inductive approach. However, as the inductive approach falls within the ambit of an overall deductive approach, no theory will be developed.

1.6 Scope Of The Research

This study is delimited in scope in terms of its sample selection, its choices of underpinning theories and its range of variables.

In relation to sample selection, members of the Chartered Institute of Management Accountants (CIMA), Malaysia Division working in the manufacturing sector are chosen as the subjects in this study. This choice is driven by the understanding that members of CIMA are among the widely recognised and respected professionals in the management accounting field, on which this study is based on. The manufacturing industry in Malaysia is chosen as the corporate area for empirical investigation since research in contingency theory in the Malaysian manufacturing environment is scarce and the Malaysian manufacturing sector is increasingly facing fierce external competition from countries with a much lower production cost. Further, Malaysia is chosen, as the manufacturing sector is the largest contributor to export earnings and the largest employer of the total workforce.

The main literature from which this study draws is the contingency literature because this study uses the selection as well as the systems approaches to "fit" as promulgated by the contingency theory. Variables making up management accounting systems' information attributes and management accounting practices/techniques will be subjected to the systems approach to fit in order to discern patterns or configurations. These configurations will in turn be linked to organizational performance. Under the selection approach, a number of other contingent variables will be drawn to investigate the fit with the configurational design. The contingency theory is concerned with contingency aspects of organizational processes and controls. This paradigm has been widely used in management accounting research.

The institutional theory will also be drawn into the research as the understanding of how isomorphic influences may affect organizational quest for legitimacy in order to survive can provide some insight into the configurations of manufacturing firms employing management accounting systems and practices/techniques. Since the analyses are at the organizational level rather than at the personal level, such theories as agency, expectancy, procedural justice and transaction cost are not included because they tend to focus on processes and outcomes for the individual.

This study employs predominantly the research strategy of a field survey with a modicum of qualitative interviews. Many prior studies in management accounting that take contingency approach have been conducted using the field survey method (Chenhall and Morris, 1986; Gordon and Narayanan, 1984; Gul, 1991; Gul and Chia, 1994; Mia and Chenhall, 1994).

The variables to be measured, which form the research constructs in the research instruments, are derived from the literature. They will be discussed in the literature review chapter (chapter two) and the methodology chapter (chapter four). Similarly, the measurement scales have been previously developed and tested as established variables in the management accounting research literature. As a summary, the questionnaire items related to the manufacturing management methods are the main classification used by Woodward (1965). Management accounting systems' presentation of information characteristics are derived from the work of Moores and Yuen (2001), which were based on those developed by Khandwalla (1972) and Chenhall and Morris (1986). The management accounting practices/techniques are derived from a survey by Joshi (2001) who expanded the list used by Chenhall and Langfield-Smith (1998). The latter derived their management accounting practices from prior surveys of, for example, Joye & Blayney (1990), Innes & Mitchell (1995) and additional items recommended in other management accounting literature. The questionnaire items related to management accounting techniques were originally derived from relevant items used in the manufacturing futures survey developed by De Meyer *et al.* (1989) which had been tested extensively (Miller *et al.*, 1992). The contingency factors in management accounting were gathered from prior surveys of many researchers, such as Emmanuel *et al.* (1990), Mitchell *et al.* (2000) and Reid & Smith (2000). In particular, the instruments used by Chenhall and Morris (1986), Inkson *et al.*(1970), Duncan (1972), Pugh *et al* (1969) and Avella *et al.*(1998) are modified to suit the context of this doctoral study. As for the institutional influences or factors, an adapted version of questionnaire items developed by Zainal Abidin (2000) based on the work of, *inter alia,* DiMaggio and Powell (1983) is adopted. Organizational performance is evaluated using an instrument adopted by Chenhall and Langfield-Smith (1998), which was developed by Govindarajan and Fisher (1990) based on suggestions by Gupta and Govindarajan (1984a).

1.7 Background To The Developments In Management Accounting

During the period of change in manufacturing management techniques, both academics and practitioners have started to question prevailing traditional management accounting thinking. Changes in competition and production environment, changes in the cost structures of firms, and the rapid development in information and communication technologies have imposed pressures for change in management accounting practices. Recent empirical studies (Joshi, 2001) provide evidence that if management accounting is to maintain its relevance in today's increasing level of globalization, it needs to meet the changing needs of managers. In the past there were some criticisms that management accountants were not able to adapt new management accounting practices to changing technology and methods of production in manufacturing organizations (Johnson & Kaplan, 1987). It is argued that Japanese companies have been successful, to a large extent, in adopting these practices and they have been dominating in global competitiveness because they transformed themselves for competition by using automation, cost discipline, continuous improvement and collective decision-making (see for example, Kharbanda, 1990; Vuppalapati *et al.,* 1995; Schonberger, 2007).

In recent years various new accounting techniques or new approaches to existing techniques have emerged in response to changes in manufacturing practices or the competitive positions of businesses. These techniques such as activity-based costing, throughput accounting, JIT-accounting and the emphasis on non-financial performance measures have featured in a range of accounting and management journals. There is, however, less clear guidance on when to adopt new techniques, when and whether to adapt old systems and which parts of the information systems to emphasize, in particular, environmental and internal circumstances.

There is a need to study management accounting practices, and the generation and use of performance measures, in the context of manufacturing strategies. It is also necessary to assess each accounting technique or measure to determine under what environmental and internal conditions it is appropriate. The existing theory of manufacturing strategy suggests that best practice manufacturing systems and procedures can be determined by the consideration of other functional strategies. The development of a coherent management accounting and manufacturing strategy demonstrates the importance of the integration of accounting with other related areas. Insights from manufacturing strategies show how the emphasis on management accounting practices may change as a result of a change in competitive, marketing and manufacturing strategy. As such, best practice management accounting techniques and measures are dictated by the company's manufacturing and marketing environment. As the pace of change within organizations increases, there will be an increasing need to swiftly adapt accounting systems to cope with external and internal changes and hence a framework to assist with the development of appropriate management accounting practices will become more important. All these factors point to the changing role of management accounting in this new manufacturing environment and the increasing complexities of management accounting practices/techniques and management accounting information used in manufacturing management decision making.

1.8 Overview Of Subsequent Chapters

This thesis consists of six chapters. Subsequent chapters in this thesis have been organized in the following way:

1.8.1 Overview Of Chapter Two

Chapter two provides a review of the germane literature on management accounting systems' information characteristics, management accounting practices/techniques, manufacturing management methods, organizational performance, contingency factors in management accounting, the isomorphic view of institutional theory and institutional influences. Finally, chapter two provides a summary of focal literature and identifies the research gaps. This doctoral study intends to fill the research gaps identified.

1.8.2 Overview Of Chapter Three

Chapter three presents the development of the conceptual framework that will ultimately lead to the construction of the research hypotheses. The chapter commences by looking at the basic theoretical foundation that underlies the whole research concept. The relevance of using the contingency and institutional theories, which form the basic framework supporting the entire research, will be delved into. A number of contingency factors and institutional influences are incorporated as part of the research constructs. The systems approach to fit employing statistical cluster analysis will be the crux in this study. The conceptual discussion on this cluster analysis will be covered. In this research, only the isomorphic mimetic, coercive and normative influences of the institutional theory will be studied. These isomorphic influences may be able to predict a typological clustering of firms based on their management accounting characteristics. The use of both the contingency and institutional theories in consonance with each other will also be justified. Chapter three proceeds to outline the research problem and the ensuing research questions and research objectives, within the contingency and institutional framework. Then, a number of hypotheses will be generated in order to answer the research questions and subsequently satisfy the research objectives.

1.8.3 Overview Of Chapter Four

Chapter four details how the research is designed and how the variables in the research will be measured. Among other things, this chapter will look at sampling, research instruments used, dealing with data and the statistical techniques employed together with some assumption testings. Detailed explanation and discussion on the key methods used will provide a clearer picture on the research methodology.

1.8.4 Overview Of Chapter Five

Chapter five reports the outcomes of data analyses and discusses the findings. First, the main outcome of the five interview sessions will be reported. Second, results from the factor analyses and reliability tests on all the management accounting systems' presentation of information dimensions and management accounting practice/technique construct will be shown. Third, the computation of the weighted average performance index will be shown. Fourth, cluster analysis of all the variables constituting management accounting systems' presentation of information and management accounting practices/techniques is discussed. Fifth, the clusters of firms will be tested for significant associations with the background information (such as gender and age of respondents) and the manufacturing management methods. Each institutional and contingency variable (indicator) is also subjected to test for significant association with the clusters of firms. Sixth, the results from the tests of association will be further analysed in a multinomial logistic regression modelling with the clusters of firms as the dependent variable. Seventh, analysis will be carried out to determine whether variables (indicators) forming the management accounting systems' presentation of information and management accounting practices/techniques can predict or explain the weighted average performance index. This will be undertaken through the use of a multiple linear regression modelling. Eighth, in order to fulfil a more stringent sampling requirement espoused by some authors, the multiple linear regression exercise will be repeated using a slightly different model. This time, the factor analysed dimensions of management accounting systems' presentation of information and management accounting practices/techniques will be treated as the independent variables instead of the indicators.

1.8.5 Overview Of Chapter Six

Chapter six concludes this thesis by recapitulating the findings for the purpose of consummating the research hypotheses, meeting the research objectives and answering the research questions, posed in chapter three. On top of that, the various limitations of the study will be brought into the scene with a view of highlighting some of the pitfalls in over-relying solely on the empirical evidence produced by this study. The limitations are divided into limitations embodied in the selected theories, limitations embodied in the design and administration of the survey, limitations of the data analyses and limitations of scope in interpreting the results. These limitations will impose some caveats on the findings and temper the interpretations with a fair amount of qualifications. The whole contributions of this study in adding to the existing body of knowledge can then be seen in a better light. To bring the study's findings into alignment with the underlying theoretical perspectives and practical considerations, a separate section will be reserved to implicate such connections. As both the contingency and institutional theories form the bedrock of this study, inevitably tying up the core research findings with theoretical contexts is the ultimate goal of this study. As such, the relevance of the key findings in relation to the germane aspects of the theoretical foundations will be examined. Some practical implications will also be discussed. To conclude, this chapter will furnish some focal guide to future research based on the goings of this study. Although the intention is not to furnish an exhaustive list of potential spin off research, this section will thrash out some clear paths that are practical and plausible as possible follow-ups to this study.

1.9 Summary

This study is driven by the major developments in manufacturing management that inevitably have major consequences on management accounting. As such, this chapter tracks the various innovations and improvements in manufacturing management and then looks at how management accounting has been transformed accordingly. The chapter first outlines the purpose of the study. Although more detailed research objectives will only be unveiled in chapter three, the overriding aim or purpose of the research is spelt out in this chapter. Next, the chapter explains the mainstream research propositions and their underlying theoretical premises. From these mainstream research propositions, a set of research problem, research questions and research hypotheses will be developed in chapter three. The significance of this study in plugging the research gaps is also discussed. The research gaps will be further explained in chapter two on literature review. To a large extent, this research adopts a quantitative research strategy using a survey method. However, some element of qualitative research strategy will also be employed by way of five qualitative interviews with five qualified professionals. Moreover, a deductive research approach will be the mainstay coupled with some degree of inductiveness. As such, the process of a deductive approach to research, vis-a-vis this study is elaborated. The scope of the research in terms of its sample selection, its choices of underpinning theories and its range of variables is also delineated. Finally, the overview of subsequent chapters is outlined so as to explain the organization of the thesis.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

The first aim of this thesis is to come up with a management accounting typology of firms based on the firms' management accounting systems' information characteristics and management accounting practices/techniques. Studies on the constituent parts of the typology make up will form the bases of literature focus in developing the appropriate research instruments under the headings management accounting systems and management accounting practices/techniques.

The next aim of this research is to see if the typological clusters generated in the first aim are significantly different in terms of their organizational performance. To do this, an instrument to measure organizational performance will have to be developed through literature search. As such, relevant studies on organizational performance will be reviewed.

As the focal theoretical foundations of this thesis will be contingency and institutional theories, the main literature review will focus on identifying the germane contingency factors as well as institutional factors that can affect or influence the typological clusters identified above.

The review of the literature is undertaken in several sections in this chapter. First, management accounting systems' information characteristics are outlined in section 2.2. This reviews scope of information, timeliness of information, aggregation of information and integration of information. Second, management accounting practices/techniques are reviewed in section 2.3. This looks at the important works on management accounting practices/techniques and ends up with a list of forty-five items. Third, manufacturing management methods are reviewed under section 2.4. In particular, it focuses on unit and small batch production method, large batch and mass production method and continuous process production method. Fourth, organizational performance is reviewed in section 2.5. The section explores the main issues in organizational performance, methods of measuring them, the debate as to the appropriateness of the measurement methods, and the objective as well as the subjective research instruments used in the literature to measure organizational performance. Fifth, contingency factors in management accounting are reviewed in section 2.6. This section will take a look at the many contingency factors used in the literature, including strategic manufacturing priorities, organizational interdependence, decentralization and perceived environmental uncertainty. Sixth, the isomorphic view of institutional theory is reviewed in section 2.7. This is a precursor to section 2.8 that will review institutional influences that can affect organizations. In order to put the theoretical foundation back into perspectives, section 2.9 discusses the inherent limitations of contingency theory. With the same view as above, section 2.10 reviews the limitations of institutional theory. Finally, section 2.11 provides a summary of focal literature and identifies the research gaps. This doctoral study intends to fill the research gaps mentioned in section 2.11.

2.2 Management Accounting Systems' Information Characteristics

The importance of management accounting systems (MAS) in the business context has been acknowledged by many writers. According to Schiller (1990), as management accounting systems or, in a broader context, management control systems, represent a major capital investment, top management would want to know the discounted cash flow cost-benefits and other capabilities of such large investments, before deciding on whether to employ the systems or not. The main problem is to pre-determine the utility of such systems as a pre-requisite to forecasting cash flows (Schiller, 1990). Some researchers (Kaplan, 1993; Johnson and Kaplan, 1987) say that the benefits arising from the use (or non-use) of MAS reports do not usually get determined in practice. This difficulty poses a challenge to the design of MAS as a whole.

"Conventionally, the design of MAS prior to the 1970's has been confined to financial information internal to the organization. However, the increased role of MAS to assist managers in attention directing and problem-solving tasks has resulted in the evolution of MAS to incorporate external and non-financial data focusing on marketing concerns, product innovation, strategic planning and predictive information related to these decision areas " (Mia & Chenhall, 1994, p.1). A number of studies have looked into the perceived usefulness of MAS to managers (Larcker, 1981; Gordon & Narayanan, 1984; Chenhall & Morris, 1986). These studies have examined MAS according to certain characteristics of information, in particular breadth of scope, timeliness, levels of aggregation and its integrative nature.

Breadth of scope of information in the MAS has been identified by several researchers as a characteristic of MAS which is significant in assisting managerial decision making (Gorry & Scott Morton, 1971; Hayes, 1977; Larcker, 1981; Gordon & Narayanan,1984; Chenhall & Morris,1986). Narrowly focused MAS information is derived from conventional financial accounts, tends to be concerned with events within the organization, and produces data that are financial and historic. Alternatively, broadscope MAS information includes external, non-financial and future oriented information.

Timeliness, levels of aggregation and the integrative nature of MAS information characteristics are well established in research instruments used by a number of researchers. These instruments that were used to capture MAS information characteristics were first developed by Khandwalla (1972) and Chenhall and Morris (1986). Based on these instruments, Moores and Yuen (2001) produced a refined instrument for capturing the information 'form' dimensions of MAS. It covers fourteen questions and measures the extent to which information would be generated by a MAS in terms of aggregation, integration, scope and timeliness of information presented. Moores and Yuen (2001) called the instrument management accounting systems' presentation of information.

2.3 Management Accounting Practices/Techniques

Identification of management accounting practices/techniques is important in this research as their relationships with management accounting systems' information characteristics will be used to cluster analyse firms. Several writers have commented that traditional management accounting approaches do not provide the information that managers require to establish strategic priorities and implement recently-developed management techniques (Johnson & Kaplan, 1987; Shank and Govindarajan, 1993). " Hence, management accounting practices have emerged that focus on developing more accurate product costs, provide a broader focus for evaluating the effectiveness of manufacturing processes, and relate activities and processes to strategic outcomes " (Chenhall and Langfield-Smith , 1998, p.245) .

Several writers have classified management techniques into various categories. For example, according to Hayes *et al*. (1988), De Meyer *et al* (1989) and Miller *et al*. (1992), management techniques can be classified into the broad categories of improving existing processes, quality systems, manufacturing systems innovations, integrating systems, team-based structures and human resource management policies.

As Shank (1989) observes, various management techniques and management accounting practices have the prospect of benefiting companies emphasising alternative manufacturing strategies. However, he argues that different managerial mind sets underlying different strategies influence preferences for specific management accounting practices. Milgrom and Roberts (1990b) further add that particular techniques/practices are likely to be more important, depending on the degree to which particular strategies are emphasized. They also observe that combinations of strategies and management accounting practices/techniques improve organizational performance. These findings would provide further opportunities for other researchers to explore the taxonomy of the combinations in order to find the contingency fit with a host of contingency factors.

The items constituting management techniques can be derived from the manufacturing futures survey developed by De Meyer *et al.* (1989) which has been tested extensively (Miller *et al.*, 1992). Management accounting practices are derived from prior surveys of management accounting practices (see, for example, Joye & Blayney, 1990; Innes & Mitchell, 1995) and additional items recommended in recent management accounting literature. Based on previous studies, Chenhall and Langfield-Smith (1998) included approximately forty two management accounting practices and techniques in their survey instrument. More recently, Joshi (2001) expanded the list to forty five management accounting practices/techniques after pilot testing his research instrument. The present researcher intends to use the forty five items as the initial constructs under management accounting practices/techniques in his research instruments.

2.4 Manufacturing Management

Manufacturing management methods are very often shaped by new technology. Manufacturing technology is operationalized on the basis of the well-established classification of Woodward (1965), and the nine types of advanced manufacturing technologies representing the three components of Computer Integrated Manufacturing (CIM) (Vonderembse &White, 1991). Woodward (1965) highlights the three broad manufacturing categories of unit and small batch production, large batch and mass production, and continuous process production. Numerous studies show that the adoption of advanced manufacturing technologies significantly alters the production environment by increasing flexibility and complexity (Jelinek &Goldhar,1984;.Adler,1988;Zammuto & O 'Connor,1992;Parthasarthy &Sethi,1993).

A study by Heijltjes and Van Witteloostuijn (2003) reveals another two developments. First, the use of advanced manufacturing technologies has a greater impact on the production environment of companies employing large batch and mass production than on those employing continuous process production. Second, the results raise questions regarding the homogeneity of Woodward 's technology groups (Woodward, 1965), since the basis for decisions between the adopters and non-adopters of advanced manufacturing technologies within Woodward 's categories differ. A refined classification of production systems has thus been developed, incorporating the implications of using advanced manufacturing technologies in terms of the level of flexibility and integration (Heijltjes, 2000). Heijltjes and Van Witteloostuijn (2003) argues that the level of flexibility and integration in a company is lowest if only one component- the design, the production or the planning and control function- of CIM has been automated, and highest if all three components of CIM have been automated in an integrated manner. This is consistent with the arguments in Hayes & Jaikumar (1988), where it is pointed out that a piecemeal approach to building a CIM network will not reap the potential benefits of flexibility and integration.

In the case of large batch and mass production four sub-categories are distinguished, with the level of integration and flexibility increasing in an ascending order (Heijltjes and Van Witteloostuijn, 2003). They are:

1. Modified large batch and mass production firms only employ Computer Numerical Control (CNC) machines in production and/or Material Requirement Planning (MRP) in their planning function. This sub-category captures the technically least integrated and least flexible firms.

2. Automated large batch and mass production companies integrate automation in their production function, using CNC machines and/or robots and/or Continuous Process Software (CPS), with the automation of the design of their production process using Computer Aided Process Planning (CAPP), and automation of their planning function by way of MRP.

3. Flexible large batch and mass production firms automate their production process in an integrated way using Computer Aided Manufacturing (CAM) as well as CNC machines and CPS, their design function with Computer Aided Design (CAD),CAPP and/or Computer Aided Engineering (CAE), and their planning function with MRP.

4. Innovative large batch and mass production companies are the most advanced: they integrate the three components of CIM and flexibility and automate their production function using at least Flexible Manufacturing Systems (FMS) in addition to CAM and/or CNC machines and/or Robotics and/or CPS. These companies also integrate their design function with at least CAD, as well as CAPP. Finally these companies integrate their planning function with MRP.

In the case of continuous process production, Heijltjes and Van Witteloostuijn (2003) distinguishes four sub-categories, viz.:

1. Automated planning in continuous process production companies only automate their planning process with MRP. There is no advanced automation of the production or of the design function.

2. Automated design in continuous process production firms only automate their design function with CAD,CAE and/or CAPP, but have no automation in their production or planning functions.

3. Automated continuous process production companies restrict automation to their production function by implementing CPS, without automating either their planning or their design.

4. Flexible continuous process production companies use CAM in production as well as CPS. They also automate their planning function with MRP and their design function with CAD and/or CAE.

The first three sub-categories in the case of continuous process production represent the automation of a single function of CIM (Vonderembse &White, 1991). These three sub-categories represent a relatively low level of integration and flexibility. A company can progress from the automation of a single function to multi-function integration. The fact that there is less variety in the automation profiles in continuous process production is not surprising. Since advanced manufacturing technologies offer opportunities for process integration and parts variety, the impact on continuous process production – where process integration has already been achieved to a large extent and parts variety is thus not really permitted - will be limited.

Heijltjes and Van Witteloostuijn (2003) classification bears some resemblance to the traditional division between fixed and flexible automation (Buffa &Sarin, 1987). In fixed automation, the product is designed first and the automated system is subsequently used to produce as efficiently as possible. The two sub-categories of modified large batch and mass production and automated continuous process production come closest to fixed automation, since firms in both groups have automated only parts of the production process. Flexible automation, on the other hand, is aimed at machine integration, where each automated part of the production process is programmed to perform several integrated functions. Design is thus linked to production as well as to planning and control. Companies in the sub-categories of innovative large batch and mass production and - albeit to a lesser extent-flexible continuous process production - provide examples of flexible automation. The other sub-categories of automated large batch and mass production and flexible large batch and mass production exist because a firm 's technology hardly ever falls into either of the two extreme category sets, but is better described through visualizing a continuum from fixed to flexible automation (Parthasarthy & Sethi, 1992). In applying this typology, assumptions regarding the manufacturing objectives are imposed: companies in the first two large batch and mass production sub-categories and the third continuous process production sub-category emphasize the development of their production processes, whereas firms in the innovative large batch and mass production and in the flexible continuous process production groups are able to concentrate on the development of their production processes as well as on the development of products.

2.5 Organizational Performance

Explaining, and often predicting, organizational performance is a primary research objective in the field of strategic management. Indeed, the quest to understand and control performance is an important way to distinguish strategic management from other organizational sciences (Hrebiniak, Joyce & Snow, 1989; Meyer, 1991; Summer *et al.*, 1990). The performance implications of the major decisions that are made in anticipation

of, or in response to, environmental conditions are of particular interest to strategy researchers. Inquiry related to the link between strategic decision making and performance traditionally has been divided into process and content research (e.g., Summer *et al.*, 1990). *Process* research looks at the activities leading to and supporting strategic decisions (Huff & Reger, 1987); in other words, process research has examined "how" strategy is formed. *Content* research focuses on the subject of a strategic decision (i.e., "what" is decided) and thus is concerned with the competitive strategy of corporations or their business units (Fahey & Christensen, 1986). Both process and content researchers have sought to establish a relationship between strategic decisions and performance, but the nature and relative intensity of the link remains unclear. Several authors assert that the distinction between process and content is, to a large extent, artificial (e.g., Blair & Boal, 1991; Huff & Reger, 1987); thus, making such a distinction may impede progress toward understanding the relationship between strategy and performance. Although useful for labeling research efforts, a process/content distinction obscures the possibility that process influences content, content influences process, or that a synergistic influence exists.
Rich, albeit preliminary, evidence that the overall coherence between process and content is a critical influence on organizational performance is offered by Pettigrew and Whipp (1991, 1993). In addition, their inquiry suggested that the role of the context (both internal and external to the organization) in which process and content exist must be considered. Pettigrew and Whipp's efforts can perhaps best be described as theory building because they sought to explore the nature of strategy as "holistically as possible" (1993). The historical development of the field of strategic management has been such that the concept of strategy has generally been viewed in terms of two constructs - process and content. Research focused on either process or content offers numerous studies that address the implications of specific strategic variables for performance.

Taken together, the process and content streams of research provide only limited understanding of the nature of the effects of each on performance. However, the growing recognition of the interplay between process and content (e.g., Huff & Reger, 1987; Pettigrew & Whipp, 1991, 1993) suggests that understanding the performance implications of the alignment of process and content is an important concern. The empirical studies that address this concern have generally taken a configurational perspective, where organizations are viewed in terms of sets or groups that are alike within and different between groups along important dimensions (Miller & Mintzberg, 1983). In contrast, most organizational inquiry focuses on linear (or bivariate) relationships. The differences between the two perspectives direct how organizational performance is analyzed. Specifically, while studies based on a linear approach provide evidence regarding "simple causation," the degree to which an independent variable impacts a dependent variable (Miller & Mintzberg, 1983), configurational studies focus on whether or not performance varies across different confluences of process and/or content variables (i.e., groups).

The results regarding the performance implications of process/content fit are ambiguous. Segev's (1987) study of the match between Miles and Snow's (1978) strategic types and Mintzberg's (1973) modes of strategy-making offers weak evidence that fitting process and content increases performance. Also, Miller (1989) found that the match between process and content is related to performance for firms following a differentiation strategy (Porter, 1980), but not for firms employing a cost leadership or focus strategy. This led Miller to suggest that fit is sometimes, but not always, needed. At a broader level, the strategic group literature is a body of configurational inquiry that often examines the performance implications of the alignment of a variety of process and/or content factors. Strategic group (or configuration) membership is expected to be related to performance (Porter, 1979); yet evidence for the absence of a relationship (e.g., Cool & Schendel, 1987; Hayes, Spence & Marks, 1983) and ambiguous results (e.g., Caves & Pugel, 1980; Oster, 1982) abound. The ambiguous results of previous studies may be driven by insufficient accounting for the internal and external contexts that impact, and are impacted by, process and content (Pettigrew & Whipp, 1991, 1993). For example, both Miller (1989) and Segev (1987) use a firm's generic strategy as the key internal context variable influencing the impact of process/content interactions on performance. However, to a large extent, a generic strategy can be defined as a particular confluence of strategy process and content (e.g., Miles & Snow, 1978). Thus, the assertion that generic strategy moderates the impact of process/content fit on performance may be logically untenable in light of the operational definition usually used for generic strategy.

Many years ago, the publication of 'Relevance Lost' (Johnson and Kaplan, 1987) irrevocably changed the performance measurement agenda. Among other criticisms of management accounting, Johnson and Kaplan recognized that traditional financial performance measures are not only too late and too aggregated, but also poor proxies for aspects that matter to customers, such as quality and delivery speed. Subsequently, various multidimensional performance measurement models have been developed, such as the 'balanced scorecard' (Kaplan and Norton, 1992), the 'performance pyramid' (Lynch and Cross, 1991) and the 'results and determinants framework' (RDF: Fitzgerald *et al.*, 1991), and adopted by companies wishing to stay ahead of the competition. Since the early 1990s, some research has focused on how models can best be implemented (Brignall, 1993a; Kaplan and Norton, 1993; Kaplan, 1994b; Fitzgerald and Moon, 1996) and developed into tools for strategic performance management (Brignall and Ballantine, 1996b; Kaplan and Norton, 1996, 1997).

A number of performance measurement frameworks, typically pivoting around the three e's—economy, efficiency and effectiveness—have also been devised for public sector organizations (e.g. Mayston, 1985; Midwinter, 1994). Unlike the previously reviewed performance measurement frameworks, the model advanced by Van Peursem *et al.* (1995) explicitly links various types of performance measures to the main stages of the process of converting inputs into outputs and the subsequent outcomes of public-service provision. However, it has little to say about how the actual emphasis on various performance dimensions is linked to different stakeholder interests. This aspect needs to be investigated more thoroughly. The successful implementation of multidimensional performance measurements in public-sector services like health care, which are characterized by multiple stakeholders with complex, heterogeneous, intangible services delivered in circumstances of high uncertainty about means–ends relationships, is especially difficult (see Kanter and Summers, 1987, for similar points about performance measurement in non-profit organizations). This task has been further complicated by the fact that in recent years many public services have come under pressure to become more efficient and effective, so as to reduce their demands on taxpayers, while maintaining the volume and quality of services supplied to the public. To achieve this, they have been subjected to the introduction of various 'private sector' management techniques and the frequent adoption of neo-market systems in which the purchasers and providers of public services have been split and are required to contract with each other, necessitating greatly improved service product costing systems. Ironically, this might encourage an over-emphasis on public-sector financial performance at a time when many private-sector organizations have been moving towards more 'balanced' modes of performance measurement and evaluation. It has been argued that this danger might be countered by the adoption of a suitable model of multidimensional performance measurements (Bates and Brignall, 1993), whose successful implementation would require the recognition of the interests of key stakeholders and the differing information needed to manage their interrelationships. The presence in public services of numerous stakeholders and multiple dimensions of performance implies a situation of considerable complexity in which large numbers of interactions and trade-offs across the dimensions must be managed in order to satisfy the interests of differing stakeholders.

An important normative argument in recent performance measurement research in the private sector is that measures reflecting the interests of different stakeholders should 'balance' each other and be 'integrated' (Ittner and Larcker, 1998). Both balance and integration have several possible meanings in a performance measurement context. For example, balance could simply mean that there are measures representing the interests of different stakeholders, or a balance of financial and non-financial measures, or internal and external measures, and so on. However, the mere presence of a balanced set of measures does not necessarily ensure a balanced approach to realizing the underlying interests of all the stakeholders whose interests they purport to represent. Similarly, integration could mean that there are sets of performance indicators that cascade neatly down (or aggregate up) the organizational hierarchy, with each level perhaps having responsibility for different aspects of performance (cf. Lynch and Cross, 1991; Kaplan and Norton, 1996). Integration could instead (or also) mean that the performance measurement system enables the analysis of interactions between different performance dimensions, i.e. changes in certain measures (e.g. quality) explain changes in certain other measures (e.g. financial) (Nanni *et al.*, 1992; Kaplan and Norton, 1996). This latter meaning is similar to the 'business model' view, originally outlined by Eccles (1991), in which an integrated set of measures developed from a 'theory of the business' as a system explicitly links the multidimensional measures in a causal chain of performance drivers and outcomes, (Kaplan and Norton, 1996; Ittner and Larcker, 1998) similar to a pilot's use of the instruments and dials in an aircraft's cockpit to help fly the aircraft (Kaplan and Norton, 1996; Lebas, 1996a).

While balance and integration have several possible meanings, they are clearly separate but linked conceptual constructs. From an instrumental perspective, the link between them would seem to be that some degree of integration is necessary to secure a balanced approach to realizing the differing interests of the various stakeholders. However, there may be considerable problems associated with achieving balance and integration in performance measurement system design and use, not least because the rational instrumentalism informing most performance measurement frameworks advanced in the private as well as the public sectors offers few insights into issues of power and institutional processes, which might prevent balance and integration. For instance, Ballantine *et al.* (1998) used the results and determinants framework to conduct 'gap analyses' to reveal inadequacies in health-care performance measurement system in terms of missing information across the six dimensions that might be crucial to meeting the interests of various stakeholders, but were not able to show why these gaps occurred.

There is a stream of studies on accounting within the contingency context relating to performance. These studies address a simple and well defined question, namely the appropriateness or otherwise of only a simple characterization of accounting. The name which these studies develop for this characterization is 'reliance on accounting performance measures', and they go on to formulate hypotheses as to when it might be appropriate, and when it might not. Through this careful problem formulation, these studies effectively avoid having to deal with more complex formulations of accounting as a tool for organizational control. As such, the results seem valid for the given problem formulation. Hopwood (1972) was the first writer in the accounting literature to examine the issue of how accounting was used in a non-technical sense. Coming out of a survey of what criteria were used in the evaluation of the performance of sub-unit managers, a major finding of this study was that an exclusive emphasis on meeting budget targets produced job-related tension, but also encouraged various forms of dysfunctional activity such as padding of budgets. This style of management (termed budget constrained) was contrasted sharply with an alternative approach (termed profit conscious) in which cost control is considered important, but not meeting budget targets. " The Profit Conscious style appears to be one aspect of a problem solving style of management, as distinct from a style which attempts to impose a false measure of cognitive simplicity onto a complex and highly interdependent series of activities "(Hopwood, 1972, p.175).

This pointed the way to a vision of accounting as a source of information which could be integrated with other organizational concerns in order to combat complexity. Such a view was consistent with the results of Khandwalla (1972) who found in his study that increased competitive pressure resulted in increasing sophistication and use of accounting systems.

Otley (1978) investigated the issues raised by the Hopwood (1972) study further. However in his study the results were reversed, showing that a heavy reliance on meeting the budget as a criteria of performance evaluation produced positive results in the shape of no dysfunctional activity and relatively higher budget accuracy. The issues raised by the seeming contradiction between these two studies then formed the basis of a series of later studies, including Brownell (1985); Brownell and Hirst (1986); Govindarajan (1984);

Hirst (1981), (1983), which all broadly addressed the question of under what circumstances rigid adherence to budget targets was beneficial.

Hirst (1981), building on arguments presented by Hopwood (1972) and Hayes (1977), argued that the reason for these contradictory findings was to do with the nature of the organizations under study in each case. The organization in the Hopwood study was comprised of interdependent cost centres, whereas the organization in the Otley (1978) study was comprised of independent profit centres. The complex nature of the organization in the first case resulted in incompleteness in accounting representations. Taking the tensions between these two studies as a starting point, Hirst went on to develop a series of hypotheses about the relationship between a style of accounting he terms 'reliance on accounting performance measures' (RAPM) and uncertainty. RAPM was directly related to the budget constrained style of Hopwood (1972). This concept is adopted and tested in a number of subsequent studies, the results of which are summarized by Brownell (1987a).

The central aim of the group of studies building on Hirst (1981) was to explore the issue of the incompleteness of accounting information under the conditions of uncertainty which had been described by Hopwood (1972) and Otley (1978). The research is premised largely on the quite reasonable assumption that in complex settings, the abstraction of physical processes into numerical form will result in an incomplete picture of these underlying processes, the level of incompleteness being determined by the complexity of the processes. From this, it follows that if accounting information is incomplete under conditions of uncertainty, the complete reliance on it for performance evaluation under such circumstances is inappropriate. When the situation is as tightly defined as that, then the results presented are unsurprising. However, the model of accounting being tested was only one of four possible ones developed by Hopwood (1972), thus the results do seem to be quite limited in scope.

Despite this, many subsequent studies have gone on to explore the implications of a budget constrained style of accounting, ignoring other possible styles. For instance, a series of studies directly addressed the issue of how to alleviate dysfunctional budget-related behaviour through participation in the budgetary process (Brownell, 1982, 1983; Brownell & Hirst, 1986; Brownell & Merchant, 1990). The dysfunctional behaviours themselves are elaborated by Birnberg *et al.* (1983). In a related study Merchant (1985b) examined the role of budgetary slack in the face of uncertainty. The issues at stake in all these studies clearly overlap to quite a large extent. Brownell and Hirst (1986) when discussing the issue of participation, for example, hypothesize that it might allow managers to gain access to resources which might be used to buffer against uncertainty. Running through all of them is a concern with a quite specific approach to 'reliance on accounting performance measures'.

The studies discussed above all addressed questions based on contingent notions of the relationship between accounting and uncertainty. They were premised on a highly specific notion of accounting as a tool for organizational control, but within this limited scope produced consistent performance results. Developing alongside this stream of studies however was another (Bruns & Waterhouse (1975); Gordon & Miller (1976); Waterhouse & Tiessen (1978), for example), which sought to address the contingent nature of accounting in a broader context. Significantly these studies concerned themselves with more detailed conceptions of how accounting systems might be affected by a variety of contingent variables. This second stream of studies does not materially depart from an image of accounting as a control technology described in the 'reliance on accounting performance measures' of the first set of studies.

Given the assumption that research should identify organizational performance as the criterion variable, a critical issue is what constitutes organizational performance? Distinguishing official and operative goals would seem an essential aspect of management control system research that includes consideration of goals, mainly as it flags that the issue of organizational goals is far from unproblematic (Perrow, 1970). Investigating these goals requires a dynamic approach that examines the goal formulation process (Chenhall, 2003). Chenhall (2003) further asserted that linkages between management control systems and organizational goals are quite explicit, as a primary function of management control systems is to measure progress towards achieving desired organizational ends. He proposed the accommodation of multiple stakeholders; measurement of efficiency, effectiveness and equity; capturing of financial and non-financial outcomes; provision of vertical links between strategy and operations and horizontal links across the value chain; and finally the provision of information on how the organization relates to its external environment and its ability to adapt.

Researchers have offered a variety of measures of organizational performance. Organizational performance can be measured through objective data or subjective means. Some concern has been expressed in the literature regarding the use of self-rating or subjective measures, in contrast to the use of 'objective' measures, such as those drawn from quantitative reports and superiors' ratings, to evaluate organizational performance. While the employment of self-ratings may be perceived to present difficulties in assessing performance, often from the perspective that they introduce bias, the nature, effect and the threat to the validity of conclusions reached arising from the use of self-ratings have never been clearly enunciated. Venkatraman & Ramanujam (1987) argued that neither objective nor perceptual measures are superior intrinsically to the other in terms of consistently providing valid and reliable measures of performance. Their study provided modest support for the proposition that managers' self-ratings of performance tend to be less biased than researchers have tended to give them credit for. Similar results have been found in other studies. For example, Heneman (1974) found that self-ratings of performance were less lenient than supervisory ratings. Parker *et al.* (1959) and Kirchner (1965) found that there was moderate agreement between supervisory and self-ratings. Subjective measures too have been shown to capture a broad concept like business performance (Khandwalla, 1977). According to Bishop (1974), an organization emphasizing goal setting as a pervading management practice where employees are given precise objective criteria of performance that are to be met, fairly close agreement might be expected between a unit's standing on various objective criteria and judgements of individuals about their relative performance.

There are a number of different instruments developed to measure subjective organizational performance. For example, an instrument developed by Khandwalla (1977) was based on the manager's assessment of the company's performance relative to its competitors. Four items were used to measure long term profitability, availability of financial resources, sales growth, and image and client loyalty. Each was measured using a five point scale, ranging from very weak to very strong. Khandwalla found that these measures correlated fairly strongly with objective performance measures and they have since been validated in a number of business contexts by Miller (1987) and Raymond *et al.* (1995). Another instrument to measure production performance is used by Merchant (1981, 1984) and Brownell & Merchant (1990). This fully anchored single item Likert scale measure requires respondents to rate the overall performance of their departments.

Yet another instrument, which will be used in this doctoral research was used by Chenhall and Langfield-Smith (1998), and drawn from an instrument developed by Govindarajan and Fisher (1990) based on a suggestion by Gupta and Govindarajan (1984b). Specifically, ten performance dimensions were used, viz. return on investment, profit (or income), cash flow from operations, cost control, development of new products, sales volume (or revenues or turnover), market share, market development, personnel development, and political-public affairs. On each dimension, respondents were asked to rate their companies' performance relative to industry standards on a seven-point Likert scale ranging from "unsatisfactory" (score one) to "outstanding performance" (score seven). Next, respondents would be solicited to rate each dimension on a five-point Likert scale ranging from "not important" (score one) to "extremely important" (score five) to indicate the level of importance the companies attached to each performance dimension. Using the data on dimensional importance as weights and muitiplying them with the corresponding performance, a single weighted-average performance index was arrived at for each company.

2.6 Contingency Factors Affecting Management Accounting System Design

One body of research on the application of contingency theory to management accounting relates to the design of management accounting systems (MAS). This empirical research has had the limited aim of explaining how particular circumstances (that is, contingencies) shape the design of management accounting systems (MAS). In the past, contingency theory had the broader aims of explaining the form of the organization itself. However, Gordon and Miller (1976), manage to link the narrower contingency theory application of today, with the broader application of the past. They contend that MAS, being the most important aspect of an organization, are indeed a coherent depiction of the organization itself. Using a flowchart, they illustrate how the MAS can be influenced by contingencies and vice-versa. This provides opportunities for future researchers to find the relationships between contingency factors and the taxonomy of firms employing a combination of management accounting systems and management accounting practices/techniques.

One way to look at the development of contingency theory is to cross-tabulate the contributions of authors to the subject. This is the approach adopted by Emmanuel *et al.* (1990, ch. two). Another way of viewing it is to view it historically. The earliest work on the subject focused on the influence of environmental factors, such as technology, on organizational form (Burns and Stalker, 1961; Woodward, 1958, 1965). A more specific element of such a contingency variable was the type of production system used in the firm. In the ensuing literature, contingency factors were extended to include corporate strategy (initially by Chandler, 1962), and market environment (initially by Lawrence and Lorch, 1967). The list of contingency factors continues to be extended over the years.

The authoritative survey of the contingency literature by Donaldson (ed.) (1994, p. xvi–xvii) observes that 'the contingency theory of organizations can be rated as a success . . . [which] remains the mainstay of almost all serious textbooks on organizational structure and design'. Donaldson (1994) also observes that the success of contingency theory is partially due to the attempts to expand the scope of contingency factors. For example, Brignall (1997) has used contingency theory in the design of cost systems. Another study by Anderson and Lanen (1999) identifies national culture and competitive strategy as contingency factors impacting the MAS.

As contingency factors affect MAS as well as a combination of MAS, strategy and management accounting practices/techniques, it is important to interpret MAS. A common interpretation in the extant literature is a more narrow interpretation of MAS as the objectification of the organizational form. Using this interpretation, Burns and Waterhouse (1975) found out that budgeting was dictated by the contingency factors of organizational autonomy, management centralization and business uncertainty. These contingency factors were believed to be related to the structure of principal activities within the firm. Hayes in 1977, concluded that three contingent variables which acted as the main determinants of the MAS were sub-unit interdependence (e.g. Research & Development intensity), dynamism of environment (e.g. marketing intensity), and work method specification (e.g. production intensity). He discussed the way in which management accounting practices varied across sub-units within an organization. However, his work did not cover the effects of contingency factors across many organizations.

After the work of Waterhouse and Tiessen (1978), contingency theory began to explain the differences in MAS across many organizations. The researchers discovered that contingent variables had different effects on different parts of the firm being studied. The contingency framework was further extended by Kloot (1997). She argued that in order for the organization to adapt to unforeseen external shocks, the organization should be flexible enough by embracing contingency planning.

Looking at MAS as the objectification of organizational form is not the only approach. Another approach by Gordon and Miller (1976) view the determination of the form of the MAS in normative terms, emphasizing decision-making style, organizational and environmental factors. Further studies related to this, include the work of Otley (1980) and Alum (1997). The scope of contingency theory is further expanded by other literature. Jones in 1985, for example, introduced the influence of the parent company on the subsidiary as the contingent variable in determining the subsidiary's MAS. This is relevant where a takeover has taken place. A further improvement by Chapman (1997) is to treat uncertainty as an intervening variable which arises from the formulation of objectives and actions. The uncertainty influences the way in which the MAS will adapt to external contingencies. This helps to explain some inconsistencies in previous works. Highlighting this aspect, the study by Langfield-Smith (1997) reviews much previous work, indicating how a firm's strategy affects its control system in a contingency framework. Other recent studies include the impact on MAS by contingency factors such as Information Technology (Xiao *et al.*, 1996), international competition (Anderson and Lanen, 1999), and societal differences (Bhimani, 1999). All these studies identify a number of contingency factors that can affect an organization. The factors can be used as variables to be tested against groupings of companies employing a combination of management accounting systems and management accounting practices/techniques.

A number of studies point to the fact that it is possible to relate contingency factors to a taxonomy of firms. For example, studies by Gordon and Miller (1976); Otley (1980) and Alum (1997) show that the effects of contingencies on the MAS adopted within a firm lead to distinct firm types. Gordon and Miller (1976) discover that three types of firms emerge as the result of clustering contingencies. The types of firms are referred to as the adaptive, the 'running blind' and the stagnant. The contingency factors used are the firm's environment, organizational form, and decision making style. The work of Hayes (1977) further concludes that the MAS can also be explained by the contingency factors of sub-unit interdependence, market dynamics and work method specification. Reid and Smith (2000) further support this relationship between contingency clusters and types of firms. Their findings identify the contingency factors of technological uncertainty, production systems, strategy and the market as determining the organizational form of the firm. As such, based on the literature, it is possible to match contingency factors to groups of companies with a view of finding the relationships between them.

The choice of an ideal list of contingency factors is subject to debate. The contingency theory of management accounting, as such, suggests that there is no ideal form for a MAS. Rather, particular circumstances, or contingencies, dictate the best choice of MAS in each particular circumstance. These contingencies are usually classified as the environment, organizational structure, and technology (Emmanuel *et al.,* 1990). More recently, Mitchell *et al.* (2000) see organizational strategy and aims, technology, organizational structure and management style as impinging on MAS development. In turn, these are conditioned by the organization, technological environment, the parent company (if relevant) and market conditions, respectively. However, the major external contingency factors that have been examined at the company level in management accounting and control research are the external environment (Khandwalla, 1977; Merchant, 1990; Chapman, 1997; Hartmann, 2000), and national culture (Hofstede, 1984; Harrison, 1992; O'Connor, 1995). The most widely emphasized research aspects are environmental uncertainty and hostility. As the result of intensive competition, environmental hostility emphasizes the importance of formal control and sophisticated accounting (Khandwalla, 1972; Otley, 1978). Internal contingency factors too have been examined in relation to management accounting. The most common are organizational size (Khandwalla, 1972; Bruns and Waterhouse, 1975; Merchant, 1981), technology (Khandwalla, 1977; Merchant, 1984; Dunk, 1992), and companies' strategies (Miles and Snow, 1978; Gupta and Govindarajan, 1984b; Simons, 1987; Chenhall and Morris, 1995). Chenhall (2003) in reviewing earlier studies on contingency-based research identifies seven main contextual variables, namely, the external environment, generic concepts of technology, contemporary technologies, organizational structure, size, strategy and culture. However, Chenhall (2003) argues that to maintain the relevance of management control systems' contingency-based research, scholars will need to focus their attention on contemporary dimensions of management control systems, context and organizational and social outcomes. This does not mean ignoring previous work as according to Chenhall (2003), much can be gained by reflecting on the work of original organizational theorists and more recent thinking in a number of areas.

2.7 The Isomorphic View Of Institutional Theory

Much of the institutional literature emphasizes the point that organizational structures and processes tend to become isomorphic with the accepted norms for organizations of particular types (DiMaggio and Powell, 1983). Eisenhardt (1988) quoted few studies where an environment legitimates certain ways of organizing. For example, Tolbert and Zucker (1983) found that over time, civil service reform was adopted because it became symbolic of good government rather than because it was efficient. Rowan (1982) obtained similar results in his study of the diffusion of school health, psychology, and curriculum programs in California public schools. In a similar way, Kaplan (1984) described the institutionalisation of accounting practices, arguing that many current internal accounting practices were developed in the 1930s from external reporting requirements for firms manufacturing stable products with a high direct labour content (Eisenhardt, 1989).

In relation to the above concept of isomorphism, Beliveau *et al* (1994) argued that this process of legitimacy seeking ensures that organizations seeking similar ends look and act alike. With regard to structure, for example, Galbraith (1973) shows that firms at similar ends of the chain of distribution face similar resource needs, and adopt similar structures. Though Galbraith based his explanation of this similarity on the technical needs of efficiency, the mimetic processes involved in legitimacy building would predict the same outcome. Similarly, Spender (1989) described how firms develop recipes, or formulae for behaviour. Behavioural routines within industries are similar, while routines across industries are dissimilar. What becomes legitimate in one industry is not legitimate in another industry (Beliveau *et al.*, 1994). They cited three studies that illustrate the phenomena of legitimacy:

- Meyer and Zucker (1990) described permanently failing firms as those that persist because they are legitimate, even though inefficient. Legitimacy grants these firms enduring life.
- Torres (1988) illustrated how funeral homes used regulatory processes to attain their status as legitimate institutions, without much regard to issues of efficiency.
- Forbrum and Shanley (1990) showed how firms use charitable contributions and advertising to maintain the image of legitimacy.

Institutional theory has taken on a variety of guises (DiMaggio, 1988; DiMaggio and Powell, 1991; Scott 1987) but generally the central thrust has been to explain the isomorphism of organizational fields and the establishment of institutional norms. DiMaggio and Powell (1983) discussed isomorphism based on the assumption that organizations become increasingly similar through institutional forces. Their primary focus is on the movement towards, and the maintenance of, institutional norms through coercice, mimetic and normative processes. Institutional theory posits that organizational environments '.....are characterized by the elaboration of rules and requirements to which individual organizations must conform if they are to receive support and legitimacy.....' (Scott and John, 1983).

In 1996, Deephouse's study tested a central proposition of institutional theory, that organizational isomorphism increases organizational legitimacy. The results showed that isomorphism in the strategies of commercial banks is related to legitimacy conferred by bank regulators and the media, even in the presence of organizational age, size, and performance (Deephouse, 1996).

According to Dacin (1997) institutional framework is primarily concerned with an organization's relationship or fit with institutional environment, the effects of social expectations on an organization, and the incorporation of these expectations as reflected in organizational characteristics. She postulated that this fit occurs through the process of ' institutional isomorphism'. She claimed that organizations within the same population facing the same set of environmental constraints would tend to be isomorphic to one another and to their environment because they face similar conditions. New and existing organizations adopt emergent, socially defined elements and legitimated practices in efforts to become increasingly similar to their institutional environments (Dacin, 1997).

Institutional theory has emerged as a reaction to epiphenomenal constructions of collective behaviour, that is, the characterization of collective behaviour as an aggregation of individual actions (DiMaggio & Powell, 1991). In comparison, institutional theory focuses on socially generated rules as an explanation of this. Alternative management accounting research has been influenced mostly by the institutionalism of organizational theory and sociology. In organizational theory and sociology, there has been an explicit movement towards cognitive and cultural explanations of institutions, focusing on the meaning and accomplishment of various rules that structure behaviour in organizations and society. Drawing on the arguments of Meyer and Rowan (1977) and DiMaggio and Powell (1991), management accounting practices, such as budgeting and casemix accounting, are seen as 'rational myths 'that confer social legitimacy upon organizational participants and their actions (Covaleski &Dirsmith, 1983,1988; Covaleski, Dirsmith, & Michelman, 1993). The emergence and prevalence of these forms of management accounting practices is attributed not only to the exigencies of technical imperatives, but to the existence of rationalized norms that ''specify in a rule-like way the appropriate means to pursue them ''(Meyer &Rowan, 1977,p.343). As such, the environments of an organization now proliferate. There is the 'technical 'environment and various 'institutionalized 'environments - legal, professional, regulatory, and so on. Researchers adopting institutional theory argue that the form that management accounting practices assume is influenced by the complexities of these multiple constructions of the environment and the expectations that they convey.

Soin *et al.* (2002) has used institutional theory to interpret the role of management accounting in organizational change within the Clearing Department of a UK-based multinational bank. It focuses on the intra-organizational aspects of change, although consideration was given to the broader institutional dimensions since these form part of the cumulative institutional context in which the intra-organizational processes of change operate (Burns and Scapens, 2000). In this context, despite the fact that a more commercial and competitive environment had emerged in UK banking, and the introduction of marketing concepts had led to a greater awareness of both 'products' and customers, these developments were very recent in terms of organizational culture. As Cressey and Scott (1992) explain, up until the late 1980s, UK Clearing Banks had traits of an almost nineteenth century approach to employee control that had been hidden by the benign nature of the commercial environment. When faced with a severe profits crisis, their first inclination was to rely on scientific management technologies which were inherently operations-centred and cost-cutting in their approach. The new element in the 1990s was an attempt to supplement work measurement with the introduction of more sophisticated management accounting techniques. Against this historical background, Soin *et al.*(2002) have therefore responded to calls for a processual approach to case study research (Burns, 2000) by using an institutional framework (Barley and Tolbert, 1997; Burns and Scapens, 2000). With other techniques of intervention accompanying the introduction of Activity Based Costing, their method of research and the theoretical framework used has enabled them to explore the interplay between management accounting and the other agents of organizational change.

The case has provided evidence along different time-frames beginning with the initial recognition of a need for change together with details of the process of organizing transition through the operation of new work practices and procedures (Burns, 2000). A record of this journey through time was only made possible through the use of longitudinal case study research. Burns and Scapens (2000) have provided three dichotomies derived from Old Institutional Economics (Tool, 1993), allowing the interpretation of the role of management accounting in organizational change. These three dichotomies related to: formal versus informal change; revolutionary versus evolutionary change; and regressive versus progressive change.

In terms of formal versus informal change, Soin *et al.* (2002) observations of formal change confirmed that a bank's preference for older management technologies when, in the early stages of the project, the data gathered by the Activity Based Costing team seemed quite subservient to other agents of change, especially productivity consultants. During the period reviewed by Soin *et al.* (2002), the Activity Based Costing project survived because it was congruent with the mood of cost cutting demanded by senior managers. However, once staff cuts had been made then the more subtle, diagnostic potentialities of the Activity Based Costing model could emerge as it produced more cost information than formerly. At this later stage, there was evidence of informal change as the non-accountants in the bank began to appreciate cost data that was derived from operational knowledge rather than arbitrary allocations imposed by a remote accounting process. As the advocates of Activity Based Costing claimed, there was evidence that the cost data seemed both more accurate and more 'real' (Jones and Dugdale, 2002).

Regarding revolution versus evolution, the change could almost be classed as revolutionary. The radical nature of the change was partly due to previous limited exposure to management accounting and partly due to the perception of completely new links between costs and processes. In this respect, the Activity Based Costing system introduced not only more comprehensive cost data but also a system of calculation that was quite different from earlier modes of bank management. Soin *et al.* (2002) confirmed other research (Adams, 1996; Malmi, 1997; Daniels, 1999; Rosander, 1999) finding that the implementation of ABC suggested the consideration of more drastic organizational re-engineering. Indeed, the change introduced by the Activity Based Costing project could not be reflected in comparisons between 'old' and 'new' cost allocations but rather through an articulation of business processes in a bank that amounted to a new understanding of its products, its competitors and its customers.

With respect to regressive versus progressive change the reluctance to employ the full strategic potential of Activity Based Management provided evidence of regressive change and the associated concept of ceremonial behaviour. In terms of Cooper and Kaplan's (1998) four stages of cost system implementation, Activity Based Costing implementation in a bank never progressed beyond Stage three (Soin, *et al.* 2002). They found that Activity Based Costing data was not totally integrated with other systems and there was no reproduction of the strategic potential of Activity Based Management. Managerial conservatism and a desire to maintain previous levels of managerial discretion, together with a misunderstanding of the value of this additional accounting information, led to behaviour which restricted institutional change (Tool, 1993).

The application of an institutional theory of management accounting and organizational change that emphasizes the centrality of routines has enabled Soin *et al.* (2002) to pinpoint new characteristics of Activity Based Costing implementation. They also identified tensions between the need to establish Activity Based Costing as an organizational routine thereby ensuring its reproduction with the less routine but more revolutionary aspirations of Activity Based Management. Soin *et al.*(2002) findings suggested that the Activity Based Costing team succeeded in institutionalizing a version of Activity Based Costing that revealed new links between costs and products but did not transform the strategic thinking of the bank's senior management.

In general, Soin *et al* (2002) note that the particular version of institutional theory that they drew on enabled them to explore the micro-processes of the organization rather than the influence of the more macro-level structures that are often associated with institutional theory. The explicit focus on the role of agency enabled them to analyse the relationships between the various teams of management change that were at play in the Clearing Department of the bank they studied. Soin *et al.*(2002) also argue that one further advantage of the Burns and Scapens (2000) model of the dichotomies of formal versus informal change, revolutionary versus evolutionary change, and regressive versus progressive change, was its sceptical attitude towards the wilder claims of organizational transformation sometimes made by consultants and others.

2.8 Institutional Influences

DiMaggio and Powell (1983) identified three mechanisms through which institutional isomorphic change occurs:

- *Coercive isomorphism* that stems from political influence and the problem of legitimacy;
- *Mimetic isomorphism* resulting from standard responses to uncertainty; and
- *Normative isomorphism* which is associated with professionalisation.

According to DiMaggio and Powell (1983), coercive isomorphism results from both formal and informal pressures exerted on organizations by other organizations upon which they are dependent and by cultural expectations in the society within which organizations function. For example, they quoted a situation where, in a direct response to government mandate, manufacturers adopt new pollution control technologies to conform to environmental regulations, and nonprofits maintain accounts and hire accountants in order to meet tax law requirements. Likewise, subsidiaries are compelled to adopt accounting practices, performance evaluations, and budgetary plans that are compatible with the policies of the parent companies and monopolistic servicing firms such as telecommunications and transportation, exert common pressures over the organizations that use them (DiMaggio and Powell, 1983). They also claimed that in general, organizations are pressured to become isomorphic, that is, to conform to a set of institutionalised beliefs. In addition, Shanks-Meile and Dobratz (1995) believed that organizations become increasingly homogeneous within their fields because of coercive factors that compel them to behave in similar ways. They argued that isomorphism can be attributed to a common legal environment at local, state and federal levels, which require organizations adopting organizational controls to meet legal obligations. For instance, governments create regulatory agencies that need public and private organizations to hire staff and create structures than ensure conformity with regulations (Shanks-Meile and Dobratz, 1995).

Haverman (1993) defined mimetic isomorphism as one of the processes through which organizations change over time to become more similar to other organizations in their environments. She claimed that when faced with uncertainty, organizations economize on search costs and imitate the actions of other organizations. Her list of evidence of mimetic change comes from a wide array of studies which examine a diverse set of organizational outcomes. They include the evolution of hospital structure (Starr, 1982), the adoption of civil-service reform by municipal governments (Knoke, 1982; Tolbert and Zucker, 1983); the spread of the multidivisional corporate form (Fligstein, 1985); the diffusion of diversification strategies (Fligstein, 1991); form changes by health-maintenance organizations (Wholey and Burns, 1993), and the adoption of matrix management programs by hospitals (Burns and Wholey, 1993).

DiMaggio and Powell (1983) professed that uncertainty is a powerful force that encouraged imitation. They alleged that when organizational technologies are poorly understood, when goals are ambiguous, or when the environment creates symbolic uncertainty, organizations may model themselves on other organizations. Organizations may model themselves after similar organizations in their field that they perceive to be more legitimate or successful. The ubiquity of certain kinds of structural arrangements can more likely be credited to the universality of mimetic processes that to any concrete evidence that the adopted models enhance efficiency (DiMaggio and Powell, 1983).

Galaskiewicz and Wasserman (1989) explored further DiMaggio and Powell's thesis that under conditions of uncertainty organizational decision makers will mimic the behaviour of other organizations in their environment. They added to their discussion by positing that managers are especially likely to mimic the behaviour of organizations to which they have some type of network tie via boundary-spanning personnel. Based on their findings, their results strongly suggest that the so-called institutional processes are critical in explaining organizational behaviour, as suggested by DiMaggio and Powell (1983). Their research suggested that when faced with uncertainty, decision makers will mimic the behaviour of other actors in their environment.

DiMaggio and Powell (1983) believed that normative isomorphic organizational change stems primarily from professionalization as professions are subject to the same coercive and mimetic pressures as are organizations. They observed that while various kinds of professionals within an organization may differ from one another, they exhibit much similarity to their professional counterparts in other organizations. In addition, they considered filtering of personnel as one important mechanism for encouraging normative isomorphism. They professed that to the extent managers and key staff are drawn from the same universities and filtered on a common set of attributes, they will tend to view problems in a similar fashion, see the same policies, procedures, and structures as normatively sanctioned and legitimated, and approach decisions in much the same way (DiMaggio and Powell,1983).

According to Oliver (1991), institutional theory offers several unique insights into organizational environment relations and the ways in which organizations react to institutional processes. An institutional perspective demonstrates how non-choice behaviours can occur and persist, through the exercise of habit, convention, convenience, or social obligation, in the absence of any ostensible indication that these behaviours serve the organization's own interests or contribute to organizational efficiency or control (Tolbert, 1985; Tolbert and Zucker, 1983; Zucker, 1983). Institutional theory also draws attention to the causal impact of state, societal, and cultural pressures on organizational behaviour, and to effects of history, rules and consensual understandings on organizational conformity to environmental constraints (Oliver, 1991).

Ruef and Scott (1998) examined the antecedents and effects of two forms of organizational legitimacy (managerial and technical) using data on 143 hospital organizations over a forty six year period. The result suggested that antecedents of legitimacy vary, depending on the nature of the institutional environment as well as the organizational function that is being legitimated. The mission of an organization, as reflected in its ownership characteristics, is particularly important for attracting managerial legitimacy. In the healthcare sector, in particular, they found that the shift in dominant logic from one of providing collective goods to one of profit maximization had a major influence on the managerial legitimacy of hospitals with different ownership characteristics (Ruef and Scott, 1998).

The concept of how institutional influences affect organizational performance has also been the subject of some research. An important insight from institutional theory is that performance may be viewed as institutionally defined, as institutional factors determine the interests being pursued by organizations (Scott, 1987). More succinctly, Meyer and Zucker (1990) argue that in general, performance will be defined narrowly to the extent that (a) elites dominate an organization, (b) a high degree of professionalization exists, and (c) the organization performs a technical function, outputs of which are measurable. Performance will be construed much more broadly, by contrast, to the extent that (a) the norm of participative democratic governance operates, sometimes in the formal structure or rules of an organization, (b) the interests of multiple constituencies are given recognition, and (c) the organization's function is non-technical and outputs elude measurement.

In addition to these determinants of what is regarded as 'good' performance, it is important to consider the dependence of the organization on different groups of stakeholders. Even if the existence of multiple and conflicting interests increases the need to balance these by establishing some trade-off between them, organizational dependence on a particular constituency reduces the likelihood of balance (Oliver, 1991). The rationale for this is that acquiescence to one dominant stakeholder is vital for long-term survival, but is also likely to limit the organization's ability to meet the objectives of other stakeholders.The growing managerialism has been more or less equated with a reconception of performance in terms of 'efficiency', 'economy' and 'effectiveness' at the expense of non-financial, less easily measurable aspects endorsed by professional service providers (Pollitt, 1986; Broadbent and Guthrie, 1992; Lapsley, 1996; Lindkvist, 1996). Following Meyer and Zucker (1989), this narrowing of the conception of performance may be interpreted as a power struggle in which the emerging managerial elite is attempting to redefine organizational priorities in competition with the old professional elite. Furthermore, many organizations have a history of resolving the often ambiguous and multifaceted nature of their objectives by reaching some negotiated consensus regarding which objectives to pursue (Hofstede, 1981; Bourn and Ezzamel, 1986). This would suggest that, in practice, performance in organizations has long been construed more narrowly than the normative statements in contemporary literature.

2.9 Limitations Of Contingency Theory

Schoonhoven (1981) identifies a number of problems with contingency theory. The problems stem from the lack of clarity in contingency theory. This is substantially due to the ambiguous character of the theoretical statements. Schoonhoven (1981,p.350) argues that:

> contingency theory is not a theory at all, in the conventional sense of theory as a well-developed set of interrelated propositions. It is more an orienting strategy or metatheory, suggesting ways in which a phenomenon ought to be conceptualized or an approach to the phenomenon ought to be explained.

The two explicit assumptions in contingency theory are firstly, that there is no one best way to organize and secondly, any way of organizing is not equally effective under all conditions (Galbraith, 1973). It follows that in order to be most effective, organizational structures should be appropriate to the work performed and/or to the environmental conditions facing the organization. Schoonhoven (1981) asserts that although the overall strategy is reasonably clear, the substance of the theory is not clear. This lack of clarity by contingency theorists also blurs the fact that an empirical interaction is being predicted. Due to the lack of clarity, theoretical statements fail to provide any clues about the specific form of the interaction intended. One consequence of this is that the mathematical function implied by the verbal theory may be represented in practice by a function that has quite different properties. This allows for ambiguous multiple interpretations. As the mathematical function used to express an interaction is not a trivial operational decision and should be grounded in 'theory', this function is reduced to a relatively thoughtless operationalization.

Another problem with contingency theory pointed out by Schoonhoven (1981) is that the operational and computational procedures that researchers tend to use impose assumptions on an already imprecise conceptual framework. In particular, the reliance on the general linear models and correlational procedures has been criticized.

Chapman (1997) contends that contingency theory based research has not yet developed a comprehensive theory of accounting. Covaleski, Dirsmith and Samuel (1996, p.8) criticise contingency theory for presenting:

> a deterministic, a historical view of organizations which provides limited insight as to the mediating processes of organizations.

Langfield-Smith (1997) is of the opinion that there is lack of an overall framework for the analysis of the relationship between contingent factors and accounting despite the clarity and precision of such seminal studies as Burns and Stalker (1961), Woodward (1965) and Lawrence and Lorsch (1967).

Chapman (1997, p.189) comments that earlier studies in the contingency literature adopted the approach of investigating a domain. These studies explore issues that arise from dominant contingencies emerging from such studies. Studies done later are approaching the issues with a set of pre-conceived hypotheses. Although Chapman (1997) appreciates such an approach, he also criticises that these hypotheses are formulated in terms of complex concepts expressed via simple research instruments. Overall, he comments that a comprehensive picture of a contingent view of accounting can be derived from a synthesis of the results of various types of research in this area.

Limitations surrounding the nature and scope of contingency studies apply to this study. Aspects of this theory that have been relied upon in this study are not devoid of criticisms. In the words of Chapman (1997, p.189):

> Contingency studies have come to be seen as large scale, cross-sectional, postal questionnaire based research which examine the interactions of a limited number of variables.

In relation to studies which have related contingency theory and management accounting systems to performance, there have been some major deficiencies according to Otley and Wilkinson (1988). First, these studies have not used an objective measure of performance as the dependent variable. Like prior studies, this study uses the accountants' perceptions of their own performance. These are soft data which are open to subject bias. Subject bias can be problematic when the respondents seek to provide pleasing or favourable results of themselves (i.e. cause leniency error). Second, Otley and Wilkinson (1988) contend that in studies of management accounting systems there is a lack of consideration of other types of control arrangements apart from the management accounting systems. They comment that management accounting system research has failed to recognize that organizations have a choice of using controls as substitutes for one another or as reinforcements to one another.

A general limitation of contingency studies is that they are viewed as large scale, cross-sectional postal questionnaire based research. Contingency theory research, according to Otley (1980), has been quite limited in the sense that only limited insight is provided because reliance is put on only a few variables such as task, environment and technology that, in turn, have been used to provide explanations of organizational structure and design of management accounting systems.

Selto, Renner and Young (1995), however, argue that the extensive interactions of variables and continuous changes in organizations would make application of contingency theory difficult.

The general criticism that Otley (1980, p.90) points out is that:

> All that can be concluded is that there is some degree of association between some hypothesized contingent variables and the existence of certain features of an accounting system. The general case for a contingency theory is thus supported but specific findings are sparse.

Otley (1980) suggests that studies in organizational theory should move further to more complex expressions of the contingency framework. As such, this study attempts to provide more complex expressions of the contingency framework by providing a linkage between a systems approach resulting in typological clusters of organizations, with not just performance but a coterie of contingency factors as well. In addition, this study also brings in the institutional isomorphic framework with a view of incorporating the notion of legitimacy among organizations. As a result, this gives rise to the need to discuss the limitations of the institutional theory as well. The discussion will ensue next.

2.10 Limitations Of Institutional Theory

The old institutionalism, in emphasising organizational adaptation, change and uniqueness rather than inertia, persistence, and conformity (Kraatz and Zajac, 1996, p. 833), avoids the charge of assuming organizations automatically conform with institutional pressures. Isomorphism, therefore, is not only a state, but a process subject to constant development and change. Once organizations have adopted institutions, those institutions must be either maintained, changed (when new institutions are introduced), or eliminated. However, under new institutionalism, the notions of institutional isomorphism, organizational inertia and an organization's imperative to achieve legitimacy, form the basis of much work based on institutional theory, and yet it has been suggested that there has been too little attention devoted to the limits of these assumptions (Kraatz and Zajac, 1996, p. 812).

Carmona *et al.* (1998, p.119) observe that:

> More recent literature in the field has attempted to highlight, and to some extent address, a number of limitations which have been raised against institutional theory. One limitation concerns the presumption that practices aimed at attaining/enhancing external legitimacy are decoupled from internal operating systems

Perrow (1991) has asserted that it makes no sense to rigidly differentiate technical matters from institutional environments, and pressures of efficiency from those of legitimacy, and then advocating using rational organizational theory to investigate organizations oriented to profits, and institutional theory to investigate not-for -profit organizations as is common in new institutionalists' work. In actuality, institutional and economic forces coexist (Powell, 1991), thus it is logical to extend institutional analyses to incorporate both to comprehend organizations in their full complexity.

Institutional isomorphism can be thought of as a not completely straightforward process (Montgomery and Oliver, 1996), since there may be selection processes within organizations that either resist or adopt homogenizing pressures (Oliver, 1988, p. 558; Powell, 1991, p. 195). Within organizations, there may be pockets of acquiescence or resistance, depending on the nature and intensity of institutional pressures, and the culture and organizational structures of the individual organization. The organization should not be thought of as "a unitary functioning agency with a unitary goal", and therefore its response to institutional pressures would be made within the constraints of organizational ambiguities (Ahmed, 1992, p. 159). One of these could be organizational belief systems, where an organization might choose whether or not it would copy the behaviour of other organizations within the religious field (Demerath, 1998, p.168–169), and might choose to resist, for example, "bureaucratic isomorphism" (Nelson, 1993, p. 675). As an extension of this emphasis on institutional isomorphism, institutional theory stresses conformity, not diversity, in spite of the fact that organizations are unique and individual, complex in their ways of learning and adopting new forms of organizing (Roberts and Greenwood, 1997, p. 368). Interlocked with the failure of much institutional theory to acknowledge a variety of possible organizational responses to institutional pressures, and its seeming lack of interest in individual organizations, is its failure also to consider the dynamics of decision making. It has focused primarily on the capacity of institutional elements to constrain, rather than the links between actions and institutions (Barley and Tolbert, 1997). Bordt's (1997) study on the institutionalisation of alternative ideas and structures, highlights the role of human agency and interest in the formation of institutions:

> ... an institution does not materialize out of the blue; nor is the process of institutionalization inevitable. It is the result of the work of individuals or a group of actors with particular interests; the process is political and often highly contested. Therefore, if alternative organizational forms are able to surface and eventually become institutionalized themselves, it should be viewed as a result of the actions of interested parties (Bordt, 1997, p.136).

Perceptions of institutional constraints are important factors that determine to what extent organizational change will occur:

> ... any theory of organizational change must also take into account the fact that the leaders of organizations watch one another and adopt what they perceive as successful strategies for growth and organizational structure. The picture one obtains is that organizational change will occur in a murky environment guided by what key powerful actors perceive and their abilities to implement change (Fligstein, 1985, p.389).

Institutional theory, it is claimed, has emphasised change within a population of organizations, to the neglect of emphasis on the intraorganizational transformation process itself (Bacharach *et al*, 1996, p.501). It is likely that when organisational actors at the institutional level adopt a new logic of action, it will be inconsistent with the logics held by actors at the core level of the organization. The result is dissonance, with the possibility of increasing dissonance as the various hierarchical levels of the organisation are brought into alignment (Bacharach *et al*, 1996, p.502). Obviously, an understanding of the network structures within organizational populations is essential to an understanding of how various institutionally acceptable practices spread across an organizational field (Davis and Greve, 1997, p.34), but individual organizations might operate under different institutional logics, that may cause them to resist pressures for change (Townley, 1997, p.264). The result would be that while the environment may require conformity to institutional norms, organizations could choose the extent to which they would conform to those norms.

If studies were conducted at a micro level, a variability of organizational strategic responses to similar institutional environments could be observed (Zucker, 1991, p. 105), in contrast with the macro viewpoint. A study of the more mundane and micro classes of organizational behaviors could therefore reveal the concrete ways in which institutional systems are embedded in organizational systems (Meyerson, 1994, p. 650). This leads to whether to regard institutionalisation as a "why" or a "how". The "why" viewpoint looks at the macro view, with the entire cultural or social system seen as an entity in which organizations operate, but the "how" would concentrate on the development, over time, of regulative, normative or mimetic systems (Scott, 1995, p.64). If, as Zucker (1977, p.728) suggests, institutionalization is both a process and a property variable, then both provide valuable and complementary insights into the creation, change, maintenance and diffusion of institutions. Perceptions of institutional influences cause problems to be identified, alternatives to be proposed, and responses to be determined, in something like a garbage can process embedded in a large institutional environment (Mezias and Scarselletta ,1994, p.655). It is not likely to be a smooth and untroubled process, which means that studies of individual organizations will provide valuable insights into the different dynamics in play at a micro level of an organization. If institutionalisation is to be studied as a process, then the behaviours whereby individuals and organizations deliberately modify and even eliminate institutions, in a combination of choice and action, will be most relevant (Barley and Tolbert, 1997, p.94).

The assumption of institutional isomorphism has also been criticized for its overly passive conception of individual action (Roberts and Greenwood, 1997, p. 368, referring to Powell, 1991), for its downplaying of organizational innovation and adaptation (Davis and

Powell, 1992, p.342) and its passive view of human agency (Davis and Powell, 1992, p.363). By assuming that organizations are passive players, researchers sometimes disregard the ability of individual organizational members to respond proactively, creatively, and strategically to institutional influences (Ang and Cummings, 1997, p. 235). Other factors that might work against a passive response to institutional pressures could be resource dependencies (Oliver, 1991), functional complexity, technical uncertainty, organizational size (Ang and Cummings, 1997), the desire for organizational effectiveness, autonomy over decision making, flexibility, or satisfying conflicting internal demands (Townley, 1997, p.262).

If change does occur, opinions vary as to how the process happens. It has been suggested that strong forces within organizations resist change in cultural beliefs (Zucker, 1977). Once a practice has been institutionalised, the notion of 'cultural persistence' leads to its maintenance, through being embedded in networks, and resistance towards pressure to change (Zucker, 1988). But perhaps it is the maintenance of institutions that requires explanation, since it requires continuing effort in order to ensure that structures do not erode or dissolve (Scott, 1995, p.79), and if left alone, would lead to organizational entropy. In some situations, institutional constraints aid the maintenance of institutions over a long period of time (Miller, 1994), but whatever the situation, the process by which ideas and procedures become institutionalised over time, i.e. by which 'external legitimating functions become internal reality' (Ansari and Euske, 1987, p.564) is subject to a variety of influences, from forces both external and internal to the organization. It depends on perceptions of institutional pressures, resource dependencies, and the organization's own structures, cultures and routines, including decision-making processes.

Institutional theory has also been criticized for its strong assumption that causality runs only in one direction, i.e. from the institutional environment to organizations. Although this assumption is sustainable in the short run (Kornai, 1986), it probably needs to be relaxed in the long view; some reciprocal influence undoubtedly occurs.

In this study, institutional theory has not used objective measures, particularly when operationalized as the management dominant logic. Like prior studies, this study uses management accountants' perceptions of institutional influences, which are soft data open to subject bias. Subject bias can be problematic when the respondents seek to provide pleasing or favourable results of themselves or their organization (i.e. they cause leniency error). Nevertheless, research by Crampton and Wagner (1994) suggests that self-reported data, while open to subject biases, is not as limited as commonly repeated.

2.11 Summary Of Focal Literature And Its Gaps

The literature review shows that management accounting systems have been regarded as important by many writers since they involve heavy capital expenditure. However, the perceived usefulness of management accounting systems to managers have been studied and have produced mixed results. These studies have examined management accounting systems based on certain characteristics of information, in particular breadth of scope, timeliness, levels of aggregation and its integrative nature. Established research instruments are used in the literature to capture the information characteristics. No research has yet been done to combine management accounting systems' information attributes with other management accounting practices/techniques in use to form a peculiar typology for management accounting in organizations.

There were many studies done on management accounting practices/techniques in the literature. The literature proves that there are no standard definitions of management accounting practices/techniques. The terms have often been used synonymously or mixed up. However, Chenhall and Langfield Smith (1998) have collated earlier works and produced a list of forty two items. They have proven that the instruments to measure the items are valid. The latest work by Joshi (2001) extends the list to forty five items that is the most comprehensive so far in the literature. Although the seminal study by Chenhall and Langfield Smith's in 1998 found clusters of management accounting practices/techniques and corporate strategies taken together, no researcher(s) as yet has tried to combine management accounting practices/techniques with management accounting systems' information attributes to form a discernable typology of firms practising the variables.

Manufacturing management methods are again not subject to a standard definition. Different researchers interpret them in different ways. However, it is regarded in the literature that a well-established classification was formed by Woodward in 1965. This classification is still regarded as applicable today. A number of researchers have used this basic classification and expanded on it to suit today's advanced manufacturing technology. However, no study has incorporated the fundamental of Woodward's classification (1965) to be tested for relationships with manufacturing firms' combined typology of management accounting systems' information attributes and management accounting practices/techniques. That is something novel in which this doctoral study intends to attempt. The results are expected to be clusters of companies that are differentiated by the way they do certain things, how they report information, what kinds of information they used and whether the manufacturing methods they employ can predict their cluster memberships.

The literature suggests that the right organizational performance is often an elusive concept. There are many ways of measuring organizational performance. Similarly, organizational performance can be related to or linked to a host of other things in an organization. Developing research instruments to gauge organizational performance can also be challenging. Some researchers support the idea of using objective measures, others point to the superiority of employing subjective measures. The literature shows that there are well-established subjective instruments in measuring organizational performance developed over the years and used by many researchers. However, no study to date has measured the performance of a typology of firms employing the various management accounting systems' information attributes and management accounting practices/techniques.

The contingency theory has been widely used in management accounting research. Over the decades, many contingency factors that affect organizations have been researched, some more than the others. The literature shows that there is no one definite set of contingency factors affecting organizations. Researchers tend to select a few as parameters or variables and subject them to all sorts of testings and analyses. Although there have been well developed research instruments to measure contingency factors like strategic manufacturing priorities, organizational interdependence, organizational structure and perceived environmental uncertainty, there has been no research yet undertaken to study the impact of these contingency factors on a typology of firms clustered along their management accounting systems' information attributes and management accounting practices/techniques. The choice of just four contingency factors as mentioned above is deemed appropriate for this study due to a number of reasons. Firstly, all the four contingency factors have well developed research instruments fully disclosed in respectable publications. The reference sources will be fully discussed in chapter four under section 4.5. Secondly, as the design of this study is extensive, incorporating a number of other separate variables, limiting the contextual factors to just four will ensure that the survey questionnaire is not too lengthy to an average respondent. Having a longer list, while potentially can capture more data, carries a risk of lower response rate which can severely affect the validity of the analyses.

Another theoretical background often used in social science research is institutional theory. There are many studies that show that in order to legitimise itself, an organization needs to become isomorphic, i.e., to be closely similar to other corresponding organizations. This forms the isomorphic view of institutional theory that has been widely studied in the literature. Central to this notion of isomorphism was the work of DiMaggio and Powell (1983) that identified three mechanisms of institutional isomorphic change, namely, coercive isomorphism, mimetic isomorphism and normative isomorphism. Coercive isomorphism is the organization's inclination to be similar to others due to pressure put to bear on the organization. Mimetic isomorphism is the tendency to be similar among organizations as a result of mimicking each other. Normative isomorphism on the other hand is the act of conforming to certain established ways due to the influence of professionals and key personnel who often associate themselves with professionalism. The literature points to how institutional theory may affect a typical organization. It is only a natural progression that institutional factors should be tested to see if they have any bearing on a typological clusters of firms expected to transpire from this research. To date, there is no such work undertaken to establish this relationship.

Overall, the literature review indicates that there is tremendous opportunity to develop a complex typology of firms based on cluster analysis that can then be ranked by the clusters' performance. The typological clusters can further be statistically tested against well-established contingency factors and institutional influences that can then be used to explain or predict the clusters of firms. This is the big research gap in which this doctoral study intends to plug. It should be noted that, Gerdin and Greve (2004) in reviewing ten studies of forms of contingency fit in management accounting research arrive at the conclusion that very different conceptualizations of fit have been used and that very few researchers fully acknowledge the difficulties of relating different forms to each other. Gerdin and Greve (2004) as such recommend that future research in accounting specify whether a Cartesian or a configuration approach is adopted. In this study, both approaches will be adopted. The typological clustering is an example of the configuration approach while the testing of the typological clusters of firms against contingency factors and institutional influences is clearly a Cartesian approach. Gerdin and Greve (2004) further argue that if both approaches to fit are included in one and the same study, the research task should be to explore and contrast the predictive power of each approach, rather than to search for complementary information. This argument fits very well into the exploratory nature of this doctoral study.

CHAPTER THREE

CONCEPTUAL FRAMEWORK AND HYPOTHESIS GENERATION

3.1 Introduction

The aim of this chapter is to outline the development of the conceptual framework that will ultimately lead to the construction of the research hypotheses. The chapter commences by looking at the basic theoretical foundation that underlies this whole research study. Section 3.2 will further be divided into sub-sections that will delve into the relevance of using the contingency and institutional theories that form the basic framework, which supports the entire research. A number of contingency factors and institutional influences are incorporated as part of the research constructs. The use of contingency theory in accounting research and how accounting fits into the contingency model will be briefly discussed in sub-section 3.2.2. In addition, an approach to doing research within the contingency perspective will be proposed. The systems approach to contingency model "fit" employing statistical cluster analysis will be the crux in this study. The conceptual discussion on this cluster analysis will be covered in sub-section 3.2.1. Sub-section 3.2.3 will look at the use of institutional theory in organizations in general and specifically its context to accounting. In discussing the application of institutional theory, invariably a broad spectrum of issues need to be addressed, such as decision making within an institution, formal institutional structure, power and politics. In this research, only the isomorphic mimetic, coercive and normative influences will be studied. These isomorphic influences may be able to predict a typological clustering of firms based on their management accounting characteristics.

Section 3.3 outlines the research problem and the ensuing research questions and research objectives, within the contingency and institutional framework. Section 3.4 will show the conceptual model developed for this research and some categorizations of the research constructs. Section 3.5 will then be the climax of this chapter where a number of hypotheses will be generated in order to answer the research questions and subsequently satisfy the research objectives. From this point onwards, the whole research process including the data analysis will be guided by the research hypotheses which form the believe structure. In order to test the research hypotheses, the most appropriate statistical techniques are suggested with justifications. These techniques will be used as the core component of the research methodology. To summarize the salient points contained in this chapter, section 3.6 will wrap the whole chapter up. Section 3.6 will also justify the use of both the contingency and institutional theories in consonance with each other.

3.2 Theoretical Foundation

As regards this study, the core theoretical foundation is based on the contingency and institutional theories. These have been discussed in chapter two on literature review. In particular, the theoretical context relating to accounting has been duly explained. To summarise, the main points relating to this study are outlined below. The systems approach to fit will be elaborated under section 3.2.1. Section 3.2.1 will highlight the theoretical perspective of cluster analysing firms and matching them to performance. In section 3.2.2, the use of contingency perspective peculiar to this research will be delved into. Specifically, the use of contingency factors as potential predictors to clusters of firms is shown to have theoretical backing. Institutional considerations will be dealt with under section 3.2.3. Section 3.2.3 will explain that there is theoretical justification to co-opt some institutional factors as possible predictors to clusters of firms.

3.2.1 Cluster Analysing Of Firms And Matching Them To Performance

In this study, the dimensional and construct variables chosen for clustering are management accounting systems' presentation of information and management accounting practices/techniques. This model is plausible as Schoonhoven (1981) observes that since information required and information yielded are abstractions in the information processing model, they cannot be directly measured. Van de Ven and Drazin (1985) postulate that these two key constructs viz., information required and information yielded, are the latent constructs embodying the many manifest features of organization context and structure. Therefore, organization (subunit) context and structure as surrogates for information required and information yielded can be used. Galbraith (1973) questioned the viability of a single ideal structural design for a given context. Even facing similar contingencies, organizations have at their disposal not just a single answer, but a feasible set of solutions to choose from, i.e different, but equally effective structure patterns. Miller (1981) argues that dynamic interaction among variables of environment, organizational structure and strategy generates organizational configurations or adaptive patterns that are holistic in nature (Miller, 1981). Such holistic patterns of interdependencies are characterized by the systems approach. In short, structural contingency (organizational context–structure–performance relationship) can be used to illustrate the systems approach to fit.

3.2.2 Contingency Factors As Possible Predictors To Clusters Of Firms

In this study, variables which represent a number of well established contingency factors of strategic manufacturing priorities, organizational interdependence, organizational structure and perceived environmental uncertainty will be tested against the cluster of firms to determine if any of the variables is a significant predictor to the cluster solution. This attempt to find a relationship is supported by the contingency theory. In terms of the three characteristics of research often employed in contingency style studies, namely reliance on accounting performance measures, centralization of control and accounting, and strategy and accounting, the line of argument which supports different responses to similar external stimuli, presents a simple and general framework for developing understandings of the contingent nature of accounting. Galbraith (1973) attests to the fact that any contingency study is at the expense of specific accuracy in any individual situation.

Despite this apparent problem for contingency-type studies, Galbraith's framework (Galbraith, 1973) might still be used as the starting point of an attempt to develop a set of expectations, which take this limitation into account. This task is by no means an easy one, and some commentators have suggested that it might be a virtually impossible one (Dent, 1990). However one step in this direction has already been taken. A more subtle appreciation of the relationship between accounting and uncertainty explicitly suggests that accounting might perform a variety of different roles depending on the level of uncertainty (Hopwood, 1980). Four possible roles for accounting are presented, viz., answer machines, learning machines, ammunition machines and rationalization machines. The organizations that form the basis of most contingency studies are business organizations. As such, their objectives for action are at largely unambiguous, in that they are trying to stay in business and make profits. In doing, or trying to do so however, they are faced with a limitless range of options. The rationale of the four roles, mentioned above, is firmly rooted in the information processing requirements. Where certainty exists as to the consequences of actions, then activity can be pre-planned as suggested by Galbraith (1973). Thus communication requirements during the actual process are reduced, as the most appropriate course of action has already been ascertained. However, where such advance planning is no longer possible, further information must be gathered during the completion of whatever tasks are undertaken, requiring a higher level of communication. This is what is meant by accounting taking the role of a learning machine. The objectives of the organization can also be reasonably assumed to be expressed in financial terms. Then accounting might be expected to be involved in helping to evaluate how such goals might be achieved.

3.2.3 Institutional Factors As Possible Predictors To Clusters Of Firms

This study will investigate whether variables that measure mimetic, coercive and normative isomorphism have an impact on the clusters of firms, i.e. whether these variables can predict the cluster solution. This is in consonance with the institutional theory as processes of isomorphism, the ways in which organizations come to have the same general form is widely discussed by DiMaggio and Powell (1991). Organizations come to emulate each other because they are in similar environments.

DiMaggio and Powell (1991) distinguish between competitive and institutional types of isomorphism, and within the latter category, between coercive, mimetic and normative isomorphism. Competitive isomorphism concerns efficiency. When there is one best, cheapest or most efficient way to do things, then the forces of competition will eventually impose upon organizations that one best way. DiMaggio and Powell (1991) devote more attention to institutional isomorphism, and in so doing help spell out some of the ways that rationalized procedures spread.

Coercive isomorphism concerns the ways in which organizations may be subject to external pressure from organizations upon which they are dependent, or from more general cultural expectations. Government regulations, for example, can coerce organizations into adopting new procedures; a large manufacturing firm can force its suppliers to standardize their delivery operations. Uncertainty is the moving force behind mimetic isomorphism. In situations where they are not sure what to do, organizations frequently look to a reference group, to kindred organizations, and emulate what they do in the same situation. There is reassurance if not actual safety in numbers, and in the absence of a compelling reason to strike out on their own, organizations do what others are doing. Organizational fads and fashions seem likely to spread through mimetic isomorphism. Professions play the major role in the third category, normative isomorphism. Organizational personnel who are also members of a profession are recognized as possessing specialized training and knowledge, and frequently can define the terms and conditions of their labour. The experience of a specialized education, and the involvement in professional networks, influences how professional personnel undertake their activities within the organization. DiMaggio and Powell's analysis of isomorphism thus points to two actors, the state and professions, as being particularly important for how rationalized procedures spread among organizations.

Institutional studies have emphasized a major insight of March and Simon (1958) that information sets the premises of decisions, and the premises of decisions determine the outcome of decisions. How people behave in organizations depends less on the objective world and more on how they perceive that objective world. These subjective perceptions are not, however, individual and idiosyncratic. They are institutionally based, collective understandings based on shared cognitive categories. Accounts are consequential when they shape how information is created, processed, and presented both within and between organizations. Accounts share their importance with other information technologies that are utilized by organizations (Yates,1989,1991), but also with the more general cultural categories discussed by the new institutionalists (DiMaggio and Powell, 1991). The new institutionalism is scarcely a completed intellectual project. If DiMaggio and Powell's work (1991) shows anything, it is that the new institutionalism is still under construction. Even as it moves in new directions, the new institutionalism clearly has much to offer those interested in accounting. Mainstream accountancy will not appreciate the new institutionalism's willingness to unravel rationalized myths, or to take exception to rationality itself. But those who believe that accounts are more than just a passive mirror, that they are part of a set of rationalized practices that help to construct organizational reality, will find kindred spirits among the new institutionalists. Along with the new institutionalism, accountants recognize the importance of the state and the accounting profession. The core issues of power, legitimacy, and rationality run through both literatures. The affinity goes both ways, for, if the new institutionalism has something to offer, the reverse is also true. Accounts are the quintessential rationalized myth, and it is surprising that the new institutionalists have not devoted more time to studying them.

3.3 The Research Problem, Questions And Objectives

In the sub-sections that follow, the research problem, questions and objectives will be outlined.

3.3.1 The Research Problem

In the present day scenario, the role of management accounting is seemingly diverse and changing, especially in relation to manufacturing industry. This suggests the need for improved understanding of inter-relationships in manufacturing firms between management accounting systems' information attributes and management accounting practices/techniques. The establishment of a typology i.e. a scheme that can classify these interrelationships into a set of alternative types can contribute to an understanding of the current positioning of the management accounting discipline in modern manufacturing management. Empirical research into a classification scheme which can identify alternative groupings of types of management accounting practices/techniques and management accounting systems' information attributes would also need to provide evidence about which typological groups or classifications result in improved organizational performance.

Management accounting in manufacturing companies needs to serve the planning, control and performance evaluation purposes of manufacturing management. By establishing a set of typologies of firms that has identifiable classifications and a performance rating of these classifications, a frame of reference can be provided to help management in its strategic modelling considerations.

However, the strategic choice by management of a desirable management accounting grouping within a typology cannot be made in a vacuum. Manufacturing companies face different contexts, i.e. contingency factors, and develop out of different institutional influences. Therefore, a management accounting typology needs to be related to these contingency and institutional influences in order to have more complete problem solving application as an aid in strategic modelling by manufacturing companies. To this end, the particular management accounting typology to which a manufacturing company belongs, or should consider moving into, can be determined empirically. Contingency and institutional factors can be tested for their significance as predictors or discriminators of the members of particular management accounting typology.

In this study, contingency theory is drawn upon to identify three key internal contingencies and one external contingency facing manufacturing companies. The three internal contingencies considered are the strategic manufacturing priorities, organizational interdependence and the extent of decentralization of organizational structure. The key external contingency is perceived environmental uncertainty. These contingency factors are expected to be predictors of the membership of respondent manufacturing companies to a particular typology class.

Likewise, institutional theory is drawn upon to identify the key isomorphic factors of mimetic, coercive and normative influences that can shape organizational processes and systems. Again, these institutional influences are expected to be predictors of the membership of the management accounting typology. By drawing on both contingency and institutional theory, this research study can consider the problem emerging in management accounting as to the relative explanatory power of each of these theoretical perspectives.

3.3.2 The Research Questions

Essentially, the central problem in this kind of empirical research is to set up a model to be tested. The quest for this model shall start with a literature review in order to identify dimensions of management accounting systems' (MAS) information characteristics, management accounting practices/techniques, and manufacturing methods that can be formulated into measurable dimensions. The literature review will also identify contingency factors and institutional influences relevant to the management of manufacturing firms. The researcher will seek to develop variables that are comprehensive and up-to-date. The items used to measure the variables will be thoroughly searched in the literature. The literature review related to the variables adopted in this study has been discussed in chapter two. Some data reduction techniques will be employed to establish factors that are reconciled with those dimensions already tested in previous research studies. By building from previously tested dimensions, the credibility of the dimensions used in this study will be strengthened, and the incremental contribution to the existing body of knowledge can be better identified.

This study aims to address five central research questions. They are:

Research question one. What is the nature and extent of diversity and stability of management accounting systems' information attributes and management accounting practices/techniques used in various sectors of the manufacturing industry in Malaysia?

Research question two. What particular types of management accounting systems' information attributes and management accounting practices/techniques cluster together to form a discernable management accounting typology of firms for application in manufacturing management?

Research question three. Can the member firms in the typology of clusters formed be differentiated on the basis of their organizational performance?

Research question four. Can a firm's membership of a particular typology cluster be explained by any of the firm's background information, manufacturing management methods, internal and external contingency or institutional isomorphic factors?

Research question five. Can organizational performance be explained directly by any of the management accounting systems' information attributes or management accounting practices/techniques?

From these broad research questions, specific research objectives can be proposed that bring the research to a more applied focus.

3.3.3 The Research Objectives

Based on the research questions developed, the following are the research objectives:

Research objective one. To describe the nature, extent of diversity and stability of management accounting systems' information attributes and management accounting practices/techniques used in various sectors of the manufacturing industry in Malaysia.

Research objective two. To establish a discernable typology of firms that presents distinct clusters of combined variables of management accounting systems' information attributes and management accounting practices/techniques.

Research objective three. To determine an organizational performance ranking of the typology clusters.

Research objective four. To explain or predict the membership of each typology cluster in relation to the organization's manufacturing management method and other background information.

Research objective five. To explain or predict the membership of each typology cluster in relation to contingency factors faced by the organization.

Research objective six. To explain or predict the membership of each typology cluster in relation to institutional influences on the organization.

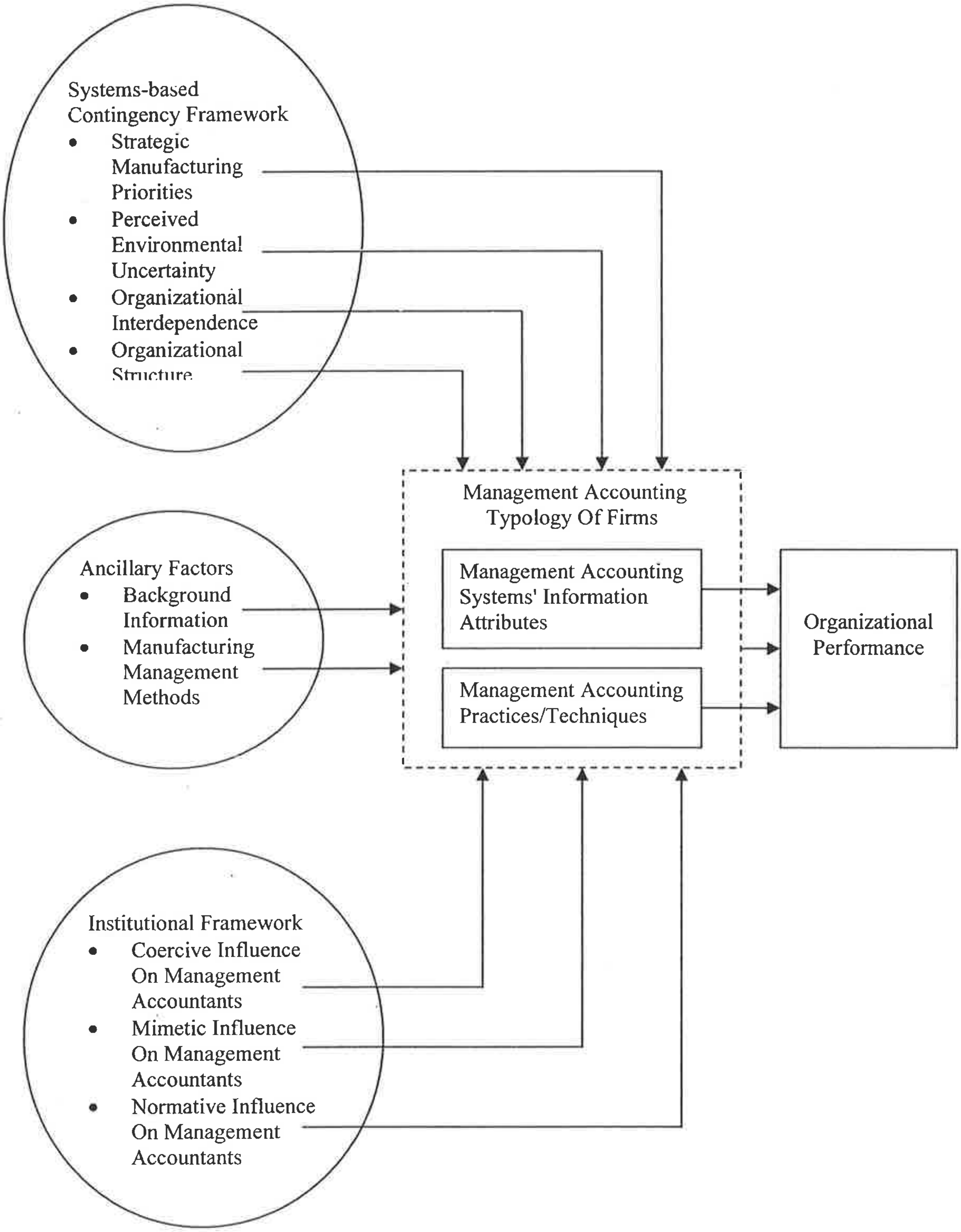
Research objective seven. To explain or predict the organizational performance based on the variables or dimensions used in the typology clustering.

3.4 The Conceptual Model And Main Components Of The Constructs

The conceptual model will be depicted under sub-section 3.4.1. It portrays in diagrammatical form (figure 3.4.1(1)) the main constructs of the research and how they inter-relate to each other. Further statistical tests will augment the search for any relationships in order to address all the research objectives. Under sub-section 3.4.2, the main components of the research constructs will be listed and categorised.

3.4.1 The Conceptual Model

Figure 3.4.1 (1) Conceptual Model Of Management Accounting Typology Within Contingency And Institutional Frameworks



The conceptual model comprises of five blocks. The central block is the block with the dotted perimeter. The block is labelled as management accounting typology of firms. As this is a resultant variable as a product of cluster analysis of two main constructs of variables, the two clustering constructs of variables are enclosed within the dotted perimeter in two separate sub-blocks. The two sub-blocks are called management accounting systems' (MAS) information attributes (or presentation of information) and management accounting practices/techniques. Organizational performance is measured by a weighted average performance index that will be computed separately. As the typology of firms (comprising of clusters of firms) is linked to organizational performance, an arrow line starting from the outer dotted perimeter and pointing to the organizational performance block is indicated.

The other three blocks are those of contingency factors, institutional influences and other ancillary factors. They are shown as blocks with elliptical boundaries. Four main contingency dimensions will be tested for relationship with the typology of firms. The four contingency dimensions are strategic manufacturing priorities, organizational interdependence, organizational structure and perceived environmental uncertainty. Apart from that, three institutional influences will also be tested for relationship with the typological clusters of firms. The three institutional influences are mimetic, coercive and normative influences. Ancillary factors comprise of the background information of the respondents and manufacturing management methods. In a number of other researches, background information is regarded as demographic control. However, in this study, background information is brought into the model as variables to be tested against the typology of firms.

The need to discern relationships between the contingency, institutional and ancillary variables with the typology of firm is explained by the arrow lines emanating from each respective variable to the typological block (i.e. block with the dotted perimeter). Finally, it is possible to test if the management accounting systems' (MAS) information attributes and management accounting practices/techniques can predict organizational performance. This explains the two arrow lines from the MAS information attributes and management accounting practice/technique sub-blocks heading towards the organizational performance block. Further explanation will be clarified in chapter four.

3.4.2 Main Components Of The Research Constructs

Data on these constructs and their underlying scales or dimensions will be captured in the survey questionnaire. These constructs and their underlying scales will also be pre-tested with five interviewees comprising of selected qualified professionals. Under sub-sections 4.4 and 4.5 in chapter four, the development of the survey questionnaire and the measurements of all the research constructs and dimensions within the questionnaire will be discussed and justified. A specimen of the survey questionnaire is enclosed in appendix four. However, the main components of the research constructs used will be listed and categorised as follows. This listing will follow the order adopted in the survey questionnaire and will help explain the main contents and context of the conceptual model (see figure 3.4.1(1)).

Section A: Background Information On Respondents And Their Firms:

Gender

Age

Educational background

Length of service

Management level

Remuneration

Decision-making function

Functional responsibility

Area of operation

Status of firm

Section B: Manufacturing Management Methods:

Unit and Small Batch Production

Large Batch and Mass Production

Continuous Process Production

Section C: Management Accounting Systems – Presentation Of Information (Information Characteristics):

Scope: internal; external; financial; non-financial; historic and future.

Timeliness: speed of reporting; automatic reporting; frequency of reporting; time-lag in receiving information.

Aggregation: analytical or decision models (e.g., marginal analysis, discounted cash flows, inventory models), aggregated by time period and aggregated by functional area.

Integration: precise targets for activities and their interrelationship within sub-unit, and reporting on intra-sub-unit interactions

Section D: Management Accounting Practices/Techniques:

Budgeting Techniques:

Budgeting to plan day-to-day operations

Budgeting for planning cash flows

Budgeting for coordinating activities across business units

Budgeting for controlling costs

Budgeting for planning financial position

Capital budgeting tools

Budgeting for compensating managers

Activity based budgeting

Zero base budgeting

Performance Evaluation Techniques:

Performance evaluation: rate of return on project or product

Performance evaluation: budget variance analysis

Performance evaluation: divisional profit

Performance evaluation: ongoing suppliers evaluations

Performance evaluation: controlling profit

Product profitability analysis

Performance evaluation: customer satisfaction surveys

Performance evaluation: cash flow return on project/product

Performance evaluation: team performance

Benchmarking for operational processes

Performance evaluation: non-financial measures

Performance evaluation: residual income

Performance evaluation: balanced scorecard

Benchmarking with the wider organization

Performance evaluation: qualitative measures

Benchmarking with outside organizations

Benchmarking of product characteristics

Benchmarking of management processes

Performance evaluation: employees attitudes

Owners' (Shareholders') value analysis

Costing Techniques:

Cost-volume-profit analysis

Product costing: variable costing

Product costing: absorption costing

Target costing

Activity based costing

Standard costing

Back flush costing

Strategic Planning Techniques:

Formal strategic planning

Long range forecasting

Strategic plans developed separate from budgets

Product life cycle analysis

Strategic plans developed with budgets

Benchmarking of strategic priorities

Quality Control Techniques

Operational research techniques

Value chain analysis

Activity based management

Section E: Organizational Performance:

Part one: Firm's performance relative to corporate standards

Part two: Relative importance of each performance measure

Section F: Institutional Factors:

Mimetic influence on management accountants

Coercive influence on management accountants

Normative influence on management accountants

Section G: Contingency Factors (Contextual Variables):

Strategic Manufacturing Priorities

Organizational Interdependence

Organizational Structure: centralized or decentralized

Perceived Environmental Uncertainty

3.5 Hypothesis Development And Testings

Setting up and testing hypotheses is an essential part of statistical inference. In order to formulate such a test, usually some theory is put forward either because it is believed to be true or because it is to be used as a basis for argument. In this study, the contingency and institutional theories will be drawn upon as bases for arguments. The germane parts of these two theories have been discussed in section 3.2. In each research objective considered (except for research objective one), the issue of interest is formulated into two competing claims/hypotheses; the null hypothesis, denoted as H_O, and the alternative hypothesis, denoted as H_1. These two competing claims/hypotheses are not however treated on an equal basis. In fact, special consideration is given to the null hypothesis. There are two common situations in this regard. Firstly, the empirical test is carried out in an attempt to disprove or reject a particular hypothesis, i.e. the null hypothesis. So priority is given to the null hypothesis such that it cannot be rejected unless the evidence against it is sufficiently strong. Secondly, if one of the two hypotheses is simpler, it is given priority so that a more complicated theory is not adopted unless there is sufficient evidence against the simpler one.

Therefore, the null hypothesis relates to the statement being tested, whereas the alternative hypothesis relates to the statement to be accepted if/when the null hypothesis is rejected. The final conclusion once the test has been carried out is always given in terms of the null hypothesis. The outcome of a hypothesis test is either 'reject H_O in favour of H_1 ' or ' do not reject H_O '. As such, it is not strictly correct to conclude that 'reject H_1 ', or even 'accept H_1 '. If it is concluded that ' do not reject H_O ', this does not necessarily mean that the null hypothesis is true, it only suggests that there is no sufficient evidence against H_O in favour of H_1 . Rejecting the null hypothesis then, suggests that the alternative hypothesis may be true. The alternative hypothesis, H_1 , on the other hand, is a statement of what a statistical hypothesis test is set up to establish. The final conclusion upon the completion of the test, again, is always given in terms of the null hypothesis, i.e. either 'reject H_O in favour of H_1 ' or ' do not reject H_O ' . Rejecting H_1 or accepting H_1 is not a proper conclusion. Again, if the conclusion is ' do not reject H_O ', this does not necessarily mean that the null hypothesis is true, it only suggests that there is insufficient evidence against H_O in favour of H_1 . Thus, rejecting the null hypothesis suggests that the alternative hypothesis may be true.

3.5.1 The Research Hypotheses And Hypothesis Testings

Based on the seven research objectives mentioned in sub-section 3.3.3, it is possible to develop research hypotheses to be tested using appropriate statistical techniques. They are as follows:

Research hypothesis one. To test for significant difference in the organizational performance (weighted average performance index) scores for the typological cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant difference in the mean organizational performance (weighted average performance index) scores for the typological management accounting cluster solution.

H_1 : There is a significant difference in the mean organizational performance (weighted average performance index) scores for the typological management accounting cluster solution.

Hypothesis testing one. This test is to check if each management accounting cluster can be distinguished from other clusters in terms of performance of organizational members in each cluster. If each cluster is found to be significantly different from other clusters in its weighted average performance index, then it is safe to conclude that each cluster can indeed be ranked according to underlying organizational performance. Then criterion validity of the cluster solution can be substantiated. As the weighted average performance index will be the test variable and the cluster membership is treated as the grouping variable, the independent samples t-test will be chosen in case of a two cluster solution. For a solution above two clusters, one way ANOVA will be used instead of the independent samples t-test. Further discussion will be given in chapter four.

Research hypothesis two. To test for significant differences in all the variable items (management accounting systems' information attributes and management accounting practices/techniques) that are used as the basis for clustering of firms, for the typological cluster solution (clusters of firms). In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant difference in the mean score of each of the management accounting systems' information attributes and management accounting practices / techniques for the cluster solution.

H_1 : There is a significant difference in the mean score of each of the management accounting systems' information attributes and management accounting practices / techniques for the cluster solution.

Hypothesis testing two. This test is to check if there is any significant difference between each variable that forms each cluster with the same variable that forms other clusters. As each variable item that makes up management accounting systems' information attributes and management accounting practices/techniques will be treated as a test variable and the cluster membership as the grouping variable, the choice of statistical test will depend on whether the cluster analysis yields a two cluster solution or more than two cluster solution. For a two cluster solution, an independent samples t-test or z-test is appropriate. The most important difference between a z-test and a t-test is that a z-test usually assumes that the key population parameters, i.e. the population mean and the population standard deviation are known. Since the population mean and the population standard deviation are not known in this study, a t-test seems to be more appropriate. However, if the sample size is sufficiently large, i.e. over 120, then the results of the t-test and the z- test are close. In this study, as the sample size is 127 (i.e. over 120) the z-test can be used. It should be noted that if more than two clusters are identified, the analysis of variance (ANOVA) will instead be employed. The justification of either test will be further elaborated in chapter four.

Research hypothesis three. To test the relationships between all the categorical variables (that make up the background information and the manufacturing management methods) and the typological cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between the cluster members for each of the variables of background information and manufacturing management methods.

H_1 : There is a significant relationship between the cluster members for each of the variables of background information and manufacturing management methods.

Hypothesis testing three. This test is to check if there is any significant relationship between each of the categorical variables (from sections A and B of the survey questionnaire) and the cluster solution. As categorical variables entail a level of measurement that is not interval or ratio (non-scale), a bivariate non-parametric test is warranted. In particular, the chi-square test for independence or relatedness will be used. In SPSS (the statistical software used in this study), this test is known as chi-square cross-tabulation. Significant relationship can also be explained in a multivariate modelling. A multinomial logistic regression is considered the best method of determining this relationship given the data consideration. The clusters of firms will be the dependent variable and the categorical variables will be treated as among the independent variables within the model. Detailed discussion will be reserved in chapter four.

Research hypothesis four. To test for significant relationships between strategic manufacturing priorities of firms and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each strategic manufacturing priority of firms and the management accounting cluster solution.

H_1 : There is a significant relationship between each strategic manufacturing priority of firms and the management accounting cluster solution.

Research hypothesis five. To test for significant relationships between organizational interdependence and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each attribute of organizational interdependence and the management accounting cluster solution.

H_1 : There is a significant relationship between each attribute of organizational interdependence and the management accounting cluster solution.

Research hypothesis six. To test for significant relationships between organizational structure and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each attribute of organizational structure and the management accounting cluster solution.

H_1 : There is a significant relationship between each attribute of organizational structure and the management accounting cluster solution.

Research hypothesis seven. To test for significant relationships between perceived environmental uncertainty and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each attribute of perceived environmental uncertainty and the management accounting cluster solution.

H_1 : There is a significant relationship between each attribute of perceived environmental uncertainty and the management accounting cluster solution.

Research hypothesis eight. To test for significant relationships between mimetic isomorphic influences and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each mimetic isomorphic influence and the management accounting cluster solution.

H_1 : There is a significant relationship between each mimetic isomorphic influence and the management accounting cluster solution.

Research hypothesis nine. To test for significant relationships between coercive isomorphic influences and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each coercive isomorphic influence and the management accounting cluster solution.

H_1 : There is a significant relationship between each coercive isomorphic influence and the management accounting cluster solution.

Research hypothesis ten. To test for significant relationships between normative isomorphic influences and the management accounting cluster solution. In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between each normative isomorphic influence and the management accounting cluster solution.

H_1 : There is a significant relationship between each normative isomorphic influence and the management accounting cluster solution.

Hypothesis testings four to ten. This test is again to check whether there is any bivariate significant difference in the mean score of each variable that makes up the contingency and institutional factor constructs/dimensions, for the cluster groupings. Again, as each one of the test variables is considered an interval scale against cluster membership as the grouping variable, an independent samples t-test will be adopted for a two cluster solution. Otherwise (more than two clusters), ANOVA will be employed instead. Another approach to ascertain relationship is to conduct a suitable multivariate test. This multivariate test is to identify if any of the independent variables is a predictor to the dependent variable (management accounting cluster solution). Here, the multinomial logistic regression analysis is the most appropriate test. Multinomial logistic regression is a form of regression that is used when the dependent variable is at the nominal level of measurement (normally categorical as well) and the independent variables are of any type (i.e. can be both nominal, ordinal or scale). In this case, the dependent variable (cluster solution) is nominal (also categorical) and the independent variables (institutional and contingency variables) are deemed interval scales. As such, multinomial logistic regression or multinomial logit is chosen. For further discussion, see chapter four.

Research hypothesis eleven. To test for linear relationship between each of the independent variables (management accounting systems' information attributes and management accounting practices/techniques, used as the basis for clustering of firms) and the dependent variable (organizational performance represented by the weighted average performance index). In particular, the null hypothesis (H_O) and the alternative hypothesis (H_1) are as follows:

H_O : There is *no* significant relationship between management accounting systems' information attributes or management accounting practices/techniques and the weighted average performance index.

H_1 : There is a significant relationship between management accounting systems' information attributes or management accounting practices/techniques and the weighted average performance index.

Hypothesis testing eleven. This test is to identify if any of the independent variables is a predictor to the dependent variable. The independent variables are all variables that make up management accounting systems' information attributes and management accounting practices/techniques. These variables are all considered interval. The dependent variable this time is the weighted average performance index. It is also at the interval level of measurement. The choice of statistical test this time is the multiple linear regression. Multiple linear regression is used to account for (predict) the variance in an interval dependent, based on linear combinations of interval, dichotomous, or dummy independent variables. Further elaboration on the matter will follow in chapter four.

Research objective one however, does not require hypothesis testing. It can be satisfactorily deduced from the analysis of the transcripts of the qualitative interviews. The remaining research objectives can be satisfactorily met by the above research hypotheses. These are the main or core hypotheses. As statistics often entail many sub-hypotheses within the main (core) hypotheses, these sub-hypotheses will be reported as adjunct to the core hypotheses. For example, in the independent samples t-test, used widely in the data analysis stage, apart from the main objective of determining any significant association between the interval scales, sub-hypothesis to test for homogeneity of variance is also essential as part of the assumptions underlying the t-test.

3.5.2 The Significance Levels And P-Values

The question of whether to reject or not to reject a null hypothesis can be subjected to two types of errors. In a hypothesis test, a type I error occurs when the null hypothesis is rejected when it is in fact true. That is, H_O is wrongly rejected. A type I error is often considered to be more serious, and therefore more important to avoid, than a type II error. The hypothesis test procedure is therefore adjusted so that there is a guaranteed low probability of rejecting the null hypothesis wrongly. This probability of a type I error can never be zero and can be precisely computed as p (type I error) = significance level = α. If the null hypothesis is not rejected, it may still be false (a type II error) as the sample may not be big enough to identify the falseness of the null hypothesis, especially if the truth is very close to the null hypothesis. For any given set of data, type I and type II errors are inversely related, i.e. the smaller the risk of one, the higher the risk of the other. In a hypothesis test, a type II error occurs when the null hypothesis H_O, is not rejected when it is in fact false. A type II error is frequently due to sample sizes being too small. The probability of a type II error is generally unknown, but is symbolised by β and written as p (type II error) = β.

Having acknowledged the existence of the two errors in hypothesis testing, the procedure of rejecting or not to reject the null hypothesis involves comparing the test statistic and the critical statistic within the rejection region. A test statistic is a quantity calculated from the sample of data. Its value is used to decide whether or not the null hypothesis should be rejected in the hypothesis test. The choice of a test statistic will depend on the assumed probability model and the hypotheses under question. The critical statistic for a hypothesis test is a threshold to which the value of the test statistic in a sample is compared to determine whether or not the null hypothesis is rejected. The critical value for any hypothesis test depends on the significance level at which the test is carried out, and whether the test is one-sided or two sided. The rejection region (or critical region), is a set of values of the test statistic for which the null hypothesis is rejected in a hypothesis test. That is, the sample space for the test statistic is partitioned into two regions, whereby one region (the rejection region) will lead to the rejection of the null hypothesis. Conversely, the other region will not bring about a rejection of null hypothesis. Therefore, if the observed value of the test statistic is a member of the rejection region, the conclusion is 'reject H_O'. On the contrary, if the test statistic is not a member of the rejection region, then the conclusion is 'do not reject H_O'.

In order to minimise the risk of making type I error, it is important to choose an acceptable significance level. The significance level of a statistical hypothesis test is a fixed probability of wrongly rejecting the null hypothesis if it is in fact true. The significance level is therefore the probability of a type I error and is set in relation to the consequences of such an error. That is, the significance level should be as small as possible in order to protect the null hypothesis and to prevent, as far as possible, the likelihood of inadvertently making false claims. The significance level is usually denoted as α. In this study, the significance level generally accepted as appropriate and thus chosen is 0.05 or 5%. However, there is one instance when an alpha value (α) of 0.001 will be chosen. This will be applicable in the test to identify multivariate outliers as recommended by the literature. Detailed reporting and explanations of all the significance levels used will be reserved in chapters four and five.

As this study will employ the use of a statistical software called the SPSS which stands for Statistical Package for Social Science version 12.0.1, it is not necessary to compare the test statistic and the critical statistic in the context of the rejection region[1]. SPSS will generate a p-value instead. The p-value or probability value of a statistical hypothesis test is the probability of getting a value of the test statistic as extreme as or more extreme than that observed by chance alone, if the null hypothesis is true. The p-value is therefore the probability of wrongly rejecting the null hypothesis if it is in fact true. It is equal to the significance level of the test for which the null hypothesis will just be rejected. The p-value is compared with the actual significance level of a statistical test and, if it is equal or smaller, the result is significant. That is, when the null hypothesis is rejected at the 5% significance level, this will be reported as ' $p \leq 0.05$ ' or the significance value is less than 0.05. Small p-values suggest that the null hypothesis is unlikely to be true. The smaller it is, the more convincing is the rejection of the null hypothesis. The p-value indicates the strength of evidence in rejecting the null hypothesis, rather than simply concluding 'reject H_O' or 'do not reject H_O'.

3.6 Summary

This chapter starts by discussing the relevance of the two main theories underlying this research. They are the contingency as well as the institutional theories. The literature suggests that both theories can be used in conjunction with each other as they both complement one another. It has been argued that the use of a contingent approach to information systems design (Brignall, 1997) may help these developments meet the differing needs of multiple stakeholders (Kanter and Summers, 1987; Doyle, 1994; Brignall and Ballantine, 1996a; Atkinson *et al.*, 1997), such as shareholders, customers and employees (Heskett *et al.*, 1994). However, as argued by some writers, contingency theory has been criticized for its simplistic treatment of power, choice and the existence of multiple stakeholders, each of which has many overlapping but different objectives. Furthermore, most contingency research on management accounting has focused on systems design and only rarely discusses implementation issues (Ginzberg, 1980). It is therefore believed that an institutional approach has advantages to complement contingency theory as it more closely examines problems of implementation grounded in power relationships and conflicting stakeholder interests (Covaleski *et al.*, 1996), which are particularly relevant to this study. Contingency studies also need to be seen in the light of the many approaches to studying it. In particular, the concept of 'fit' will be pursued in later chapters. This chapter provides an approach to conducting a contingency and

[1] This study will also use Microsoft Excel productivity software in conjunction with the SPSS for certain statistical testings.

institutional research within the context of a systems approach to management accounting and linked to the all-pervasive performance indicator.

The next logical step from theories to approaches is the development of research problem, questions and objectives. This chapter covers such a step under section 3.3. Next, the conceptual model is constructed and research constructs categorized under section 3.4. Section 3.5 sees the generation of the research hypotheses that will form the core of the process that will eventually lead to the answering of the research questions and fulfilling the research objectives. Section 3.5 also outlines the statistical techniques necessary to test the hypotheses and some justifications on their adoption. Generally this research employs a quantitative strategy with a modicum of qualitativeness and thus embarks on a predominantly deductive approach. As such, the research design and variable measurements will take into account the need to capture both quantitative and some qualitative data. These matters will be explained and discussed in subsequent chapters.

CHAPTER FOUR

RESEARCH DESIGN AND VARIABLE MEASUREMENTS

4.1 Introduction

The aim of this chapter is to explain how the research is designed and how the variables in the research will be measured. Among other things, this chapter will look at sampling, research instruments used, dealing with data and the statistical techniques employed together with some assumption testings. Detailed explanation and discussion on the key methods used will provide a clearer picture on the research methodology.

This chapter is divided into fifteen sections. Section 4.2 will describe the characteristics of the sampling design, including the sampling frame and a number of related matters regarding sampling. Section 4.3 outlines the whole survey process in general, giving an overall view of how the survey had transpired and what to look for.

Section 4.4 explains how the research instruments used in the survey were developed. Pre-testing the survey questionnaire by way of interviewing five selected professionals with the aid of a qualitative interview sheet will be highlighted. The structure and main components of the survey questionnaire will be depicted. Administration of the survey questionnaires is also discussed.

Section 4.5 looks at how research constructs and dimensions are measured. It will elaborate on the main sources of the research instruments used by previous researchers with high degrees of validity and reliability. Where appropriate, the research instruments will be modified to suit the context and scenario of this undertaking. Section 4.5 will also elaborate on how the research constructs are measured using the scaling techniques used widely in survey styled research.

Once data had been collected and collated, issues relating to data screening, cleaning, recoding and transformation will be dealt with. This will be discussed in section 4.6. The issues include missing values, outliers, influential scores and testing for normality. Following section 4.6, section 4.7 will see the research constructs and dimensions used in this research subjected to factor analyses and reliability tests. Summary findings will be reported.

Section 4.8 is a full discussion on cluster analysis, the primary statistical method used in this research. It ties in very well with the systems approach used in various contingency studies. The reason for having this section is to give a thorough explanation of what constitutes a cluster analysis. Even though only some aspects of the wide spectrum of cluster analysis will be chosen in this research, it is considered circumspect to show the whole mechanics of cluster analysis before any meaningful justifications of the methods/techniques adopted are put forward. Results of the cluster analysis will also be briefly exposed after being criterion validated. Variables that made up the clusters will also be tested for cluster differences.

Section 4.9 with all its sub-sections is a detailed coverage on non-response bias in general. It will be a comprehensive discussion on the various ways of accommodating for non-response bias in a typical mail survey. Although only one way of measuring the non-response bias will be adopted in this doctoral study, it is deemed essential that a full discussion is given on the subject matter.

As the demographic factors were considered not to cause any bias, attempt will be made to test for significant associations between the cluster solution and background information (demographic factors) together with manufacturing management methods. The choice of the statistical technique employed will be defended. Results will be briefly stated. All these will be discussed under section 4.10.

Similarly, the cluster solution will also be tested for significant differences in the mean scores of the institutional and contingency factor variables. As the institutional and contingency factor variables were deemed continuous rather than categorical, another suitable test for significance will be proposed. Section 4.11 will justify the test. Brief results will also be reported.

In section 4.12, the multinomial logistic regression will be employed to predict the cluster membership based on values from the background information, manufacturing management methods, institutional and contingency factor variables. The use of the multinomial logistic regression procedure will be extensively covered and justified. Thorough assumption testings will however not be dealt with as these testings will be discussed extensively in chapter five. Some results will be reported to tie in with the discussion.

To ensure criterion validity of the cluster solution, the clusters will be tested for significant differences in organizational performance. The performance measure will be derived using a well-established formula. As mentioned earlier, this will be discussed in section 4.8 on cluster analysis. Section 4.13 however will attempt to show how performance could be predicted based on values from the variables that make up the clusters of firms. These variables are from the constructs of management accounting systems' presentation of information and management accounting practices/techniques. To predict the performance, a multiple linear regression procedure will be prescribed together with all the justifications, including justification on specifying the stepwise model. However, assumption testings on the multiple linear regression procedure will only be meticulously carried out and reported in chapter five. These assumption testings are considered too extensive to be reported in chapter four. How to interpret the results will also be explained in chapter five. To make sense of the explanation, it is deemed appropriate to release some findings even though discussion on data analysis will continue to be revisited in the next chapter (chapter five) with a different emphasis given.

Section 4.14 will repeat the multiple linear regression procedure to predict performance, but this time the independent variables will be the constructs' dimensions rather than the constructs' variables. Constructs here refer to the management accounting systems' presentation of information and management accounting practice/technique constructs. A brief result of the data analysis will be reported. However, interpreting the results will only be given extensive coverage in the light of the major assumption testings in chapter five.

Section 4.15 will conclude the chapter by providing a summary of the main essence of the chapter. This section also provides a brief prelude to the data analysis and conclusion chapters (i.e. chapters five and six) that follow suit.

4.2 Sample Selection

The sampling frame used in this research is all members of the Chartered Institute of Management Accountants (CIMA), Malaysia Division. However, only those working in manufacturing or with experience working in manufacturing concerns are solicited to respond. This had been made feasible principally through the support of Universiti Teknologi Mara (UiTM) in Malaysia, under a collaboration outfit called CIMA-UiTM Asian Management Accounting Research Centre (AMARC). Under this arrangement, researchers working for UiTM or its associates are allowed limited access to CIMA membership database that would otherwise be held as confidential. However, the full mailing list of CIMA members in Malaysia was not made available. The professional body's main contribution was to apply mailing labels on prepared envelopes, each containing a set of questionnaire, a cover letter, a postage paid self addressed reply envelope and an inducement in the form of a table calendar. By insisting on preparing and pasting the name and address labels on the envelopes using the professional body's resources, confidentiality of membership information was assured. The envelopes were subsequently bulk mailed by CIMA's personnel.

As CIMA Malaysia Division did not give a breakdown of members working in the various sectors, it was impossible to determine how many and who worked in the manufacturing sector per se. To overcome this problem, questionnaire sets were sent to all registered members. They numbered 2,432 members. Nevertheless, the cover letter specifically solicited response from only those involved or having experience in the manufacturing sector. In the event, after about three months of waiting, 130 responses were received, out of which only 127 were considered usable. It is therefore not known what the actual response rate is, as the real figure of those working in manufacturing was not disclosed by the professional accountancy body. The 127 responses were good enough to be processed for data analysis. Whether the respondents' firms were 'strategic business units' (divisions of larger corporations) or independent companies would have been known from the filled out questionnaires.

In order to improve the content validity of the research instruments, qualitative interviews and pre-testing of the questionnaire were conducted on a group of five professionals with requisite experiences in the Malaysian manufacturing environment. All the qualitative interview sessions were recorded on tapes, with consent from the interviewees. The recordings were later transcribed to facilitate analysis.

The sample selected is a non-probability sampling design (quota sampling), being drawn from selected manufacturing industry segments. The researcher is fully aware that this design possesses the basic shortcomings of high variable error and lacks the characteristics to estimate this error. Nonetheless, in view of the relatively poor response, the researcher is of the opinion that this sampling design is adequate to satisfactorily answer the research questions outlined earlier. It should be noted that a non-probability sampling design has been used extensively in social science researches. Nevertheless, the findings of this study may not be generalisable to the whole population of manufacturing companies. In as much as companies in selected manufacturing segments as well as large companies adopt a greater range of management accounting systems and practices/techniques, it is likely that the sample will represent more sophisticated management accounting than the total population of manufacturers. Getting a very high response rate is inherently and intrinsically difficult in mail survey type research. This study has further vindicated such a contention. However, using appropriate statistical analyses, it is quite possible to generate useful findings from which some generalizations can be extracted. With replications in future researches, contributions to new knowledge can be consolidated.

4.3 Survey Development

The intention of this research is to contribute to the limited body of knowledge concerning the ways in which contingency factors and institutional influences predict management accounting typology groups which in turn affect performance. Research questions and objectives were posed from which research instruments were developed after going through the literature. The instruments were only finalized once acceptable levels of content validity and internal reliability were established. This in part, would be after the due process of qualitative interviews and pre-testing of the instruments. Hypotheses were then used to isolate relevant variables and to measure these variables. Consequently, this study adopted the survey approach rather than case studies or content analysis as the survey approach is considered to be the more suitable way of collecting data in a standardized form on a wide range of organizational practices and management behaviours.

Specifically, the study examines how combinations of management accounting systems' information attributes and management accounting practices/techniques form discernable clusters of companies. Attempts are then made to explain the findings by way of some contextual (contingency) factors and institutional influences found in the literature. The management accounting systems' (MAS) information attributes present information by appropriate levels of aggregation and integration and breadth of scope. Another attribute analysed in prior studies is timeliness of information (Chenhall & Morris, 1986; Gul, 1991; Mia & Goyal, 1991). Management accounting practices/ techniques included in the study are a list of forty five items adopted from Joshi (2001) which were modelled after the survey of Chenhall and Langfield-Smith (1998) and Miller et al. (1992).

As some scale constructs with multiple indicator variables used in this research will be factor analysed, it is possible to confirm established constructs from the literature as well as explore new constructs that had not yet being verified. The internal consistencies of these constructs will also be subjected to scrutiny. As the data on management accounting practices/techniques captured will be factor analysed, a reduced set of management accounting practices/techniques will emerge. Taken together with the MAS' information characteristics, the data then can be regressed against organizational performance to elicit management accounting features that contributed more towards performance. All variables making up MAS' information characteristics and management accounting practices/techniques will be cluster analysed to identify the relevant cluster groupings. As the clusters would only be descriptive in nature, a number of contingency variables will be identified beforehand to enable statistical analyses such as multinomial logit to be carried out to further shed light on various explanatory relationships based on the widely used contingency theory. Contingency factors such as organizational structure will be built into the research instrument. Similarly, a number of institutional influences identified in the literature will be tested against the cluster groupings. Other background categorical variables will also be subjected to similar tests. The findings then could be used as a predictive tool in management accounting.

The findings of this thesis intend to relate the relationships based on the above variables to corporate performance, as Chenhall and Langfield-Smith (1998) did, using an instrument first developed by Govindarajan (1988). After clustering the variables as a typology of the main categories of the MAS' information attributes and management accounting practices/techniques, the resultant clusters will be ranked and compared by corporate performance. It would thus be possible to know which cluster performed better and what variable characteristics were possessed by this cluster. Furthermore, in order to understand which variables contributed to performance, a multiple regression analysis will be run against performance.

4.4 Research Instruments

The interview sheet and mail questionnaire used in this study are presented in appendices one and four respectively. The development of the research instruments started from the interview sheet listing a number of open-ended questions. Questions one to three are merely to check on the suitability of the interviewees apart from getting consent to be interviewed. As identifications of the suitable candidates and arrangements for interviews had always been secured beforehand, questions one to three were generally treated as superfluous and often waived. However, these questions did function as a decorum in a very formal situation. Questions four to six are regarding management accounting systems' presentation of information. These questions seek feedback on the nature, diversity and stability over time of management accounting systems' presentation of information (MAS information attributes). The aim is not to gauge the interviewees' understanding of the corresponding literature, but rather to get a broad idea of how MAS presentation of information is being put into practice. Questions seven to twelve are concerned with management accounting practices/techniques. Again, feedback on the broad nature, diversity and stability of implementation of these practices/techniques were sought. Questions thirteen to seventeen are concerned with institutional factors (influences). This time, the emphasis is on the organization's similarities with other organizations as stipulated in the institutional theory. To encourage clear responses, the use of plain English was favoured to minimise confusing jargons often found in the literature. Questions eighteen to twenty two are regarding contingency factors. Feedback on each of the four contingency factors employed in the study was solicited, in so far as these factors affected management accounting. Lastly, questions twenty three and twenty four are open ended questions on the interviewees' personal off-the-cuff opinions on the survey questionnaire proper.

The interview sheet in general, would guide the interviews with five senior officers having extensive experiences in management accounting within the Malaysian manufacturing industry. These semi-structured interviews were only carried out once willingness to participate was agreed upon by the individuals identified. The interviews were audiotaped to enable text analysis. Some points were jotted down on paper. The main aim of the interviews was to develop a deeper understanding of current practices and issues relating to the constructs to be used in the mail questionnaire. Inter alia, the nature, stability and diversity of the management accounting systems' presentation of information and management accounting practices/techniques employed was analysed. This analysis will help answer the first research question which is to find out the extent of diversity and stability of adoption of management accounting systems' information attributes and management accounting practices/techniques.

At the end of the open-ended questions, each interview session requested the interviewee to scrutinize a draft questionnaire comprising all variables in the empirical schema. The interviewees were solicited to vet the draft questionnaire to comment on whether any items needed to be scrapped, reworded, combined or new items added in. The qualitative interviews were transcribed and interrogated manually. This is particularly useful in analyzing open ended questions and/or interviews and/or documents. This feedback can enable the researcher to eliminate ambiguous and redundant wordings in the questionnaire. This is the preliminary stage of the field research. Depending on the recommendations of these senior officers and moderated by an overall assessment of the feedback from both the qualitative interviews as well as the pre-testing, a more relevant and understandable modified questionnaire would be produced. In the event, only minor editing changes and additions were needed to the original survey questionnaire. For examples, question 6 on monthly remuneration level was added and shareholders' value analysis was replaced by owners' value analysis. The whole qualitative interview and draft questionnaire feedback sessions were designed to lend credibility to content validity before administration of the survey questionnaire proper was undertaken. The textual data from the qualitative interviews / pre-assessment of the questionnaire can also serve as valuable input in interpreting quantitative findings.

The questions contained in the initial draft questionnaire were based on multi-item measures of variables that had been tested in previous empirical studies, including Avella *et al.*(1998) ; Moores and Yuen (2001); Joshi (2001); and Reid & Smith (2000). These particular studies had developed their variable measures based on even earlier studies, sometimes enhancing and modifying these earlier instruments. This has been discussed in the literature review section.

Where necessary, the survey instrument was re-drafted following the interviews. This lead to the production of the final questionnaire. Given the potential for poor responses that could arise from lengthy and complex surveys, considerable attention would be given to refining the readability of the survey. The final survey questionnaire took the shape of a seven section research instrument. Section A captures the background information of the respondents. It consists of ten questions on gender, age, educational background, length of service, management position, remuneration, decision-making function, area of responsibility, area of operation and status of the firm. Section B comprising just one question is about manufacturing management methods. Section C is a research construct on management accounting systems-presentation of information. It is further divided into four dimensions: scope of information comprising six questions, timeliness of information with four questions, aggregation of information consisting of twelve questions and finally, integration of information with three questions. Factor analysis and a reliability test on each dimension will be used to test the construct validity and reliability of these multi-item dimensions. Section D is a construct on management accounting practices/techniques. As the literature does not suggest any valid and reliable dimensions, the forty five questions that make up this construct will be subjected to factor analysis to explore possibilities for data reduction. Section E on organizational performance is divided into two parts. Part one is a ten question part requiring the respondents to rate their firms' performance relative to corporate standards. Part two also consists of the same ten performance measures (another ten questions), but this time it requires respondents to rate the relative importance of each measure. The weighted average of part one and part two will form the weighted performance index for each respondent firm. Section F is a nine question section on institutional factors or influences. These questions are designed to measure three separate dimensions of mimetic, coercive and normative influences, with three questions for each dimension respectively. However, the three dimensions are not explicitly labelled, as the literature was weak on affirming the scales. It is therefore imperative to conduct both confirmatory as well as exploratory factor analyses on the nine questions (variables). The corresponding reliability tests would also need to be carried out. Section G is concerned with a construct on contingency factors. It is composed of four dimensions, namely, strategic manufacturing priorities (three questions), organizational interdependence (three questions), organizational structure: decentralization (twenty three questions) and perceived environmental uncertainty (three questions). All these dimensions will also be subjected to factor analyses and reliability tests.

The instrument was administered in a way that preserved the confidentiality of respondents. This is made clear in the cover letter accompanying the survey instrument. The covering letter is given in appendix three. However, to improve response rate, an inducement is offered. A standard token gift in the form of a table calendar was enclosed in all questionnaires sent out . The mailed survey package included an introductory letter explaining the purpose of the research, a copy of the survey questionnaire, a gift token and a postage-paid addressed envelope for returning the survey questionnaire. In order to make it easier for the respondents to appreciate the essence of the questionnaire, each questionnaire booklet was titled differently from the thesis title. The questionnaire title is Management Accounting Practices in the Malaysian Manufacturing Industry. A couple of months after posting the survey package, reasonable time was deemed to be allowed and the data collection exercise was then halted.

4.5 Measurements Of Research Constructs And Dimensions

Data was collected to measure variables specified in the research questions and the ensuing research objectives and hypotheses. Apart from the background information on each respondent or respondent firm, the data included manufacturing management methods, management accounting systems' presentation of information (information attributes), management accounting practices/techniques, organizational performance, institutional factors (influences) and contingency factors.

Two types of scaling techniques were used in the questionnaire's design. They are the itemized rating scale and the summated rating (or Likert) scale. Section A on background information and section B on manufacturing management methods of the survey questionnaire would use itemized rating scale. Other sections of the survey questionnaire require attitude scales in the form of Likert scales.

Three manufacturing management methods established from the classification of Woodward (1965) were used. These three classifications were also used as a foundation in the study by Heijltjes and Van Witteloostuijn (2003). The three methods are unit and small batch production method, large batch and mass production method, and continuous process production method. A respondent was required to tick only one that he or she deemed to be the main manufacturing method employed by his/her firm.

Respondents were next asked to indicate whether they found that particular management accounting systems' (MAS) presentation of information characteristics, had been useful or not to them in carrying out their overall tasks over the past three years in the firm. In particular, the summated rating (or Likert) scale was employed. The scale ranges from 'not useful at all' (score one) to 'useful to a great extent' (score seven). This set of questions to capture the four information characteristics of MAS was developed by Chenhall and Morris (1986) from discussions with numerous managers, professional management accountants, and academics. After considerable testing on an initial forty items covering all information dimensions, the questions were reduced by Chenhall and Morris (1986) to twenty four items. These were tested and proven to be valid and reliable.

Moores and Yuen (2001) adopted the same instrument to measure information attributes of MAS as part of their study.

Likert scales were then used to assess the level of benefits firms had obtained from a range of management accounting practices/techniques. For each management accounting practice/technique, respondents were asked to show whether they adopted the practice/technique or not. They were required to circle zero in cases where they did not adopt the practice or technique. Where there was an adoption of a particular practice/technique, each respondent was requested to indicate the degree of benefit derived from such an adoption. The Likert scale was anchored at 'no benefit' (score one) to 'high benefit' (score seven).

Organizational performance can be measured either objectively or subjectively. Objective performance measures are of limited use as far as this research is concerned. Firstly, it is not possible to use the same measures to gauge the performance of every manufacturing company. This is due to the fact that different strategies pursue different goals and priorities. Even by putting different weights to different performance measures, carries the difficulty of not being able to be objective in arriving at such weights. Secondly, no objective data can measure the critical success factors of certain strategies. Notwithstanding the fact that objective performance measures cannot be used in this research, it is acknowledged that in the area of performance management, the difference between subjective and objective measures of performance creates additional difficulties (Boyne *et al.,* 2005). It is reassuring however, that in an organization emphasizing goal setting as a pervading management practice where employees are given precise objective criteria of performance that are to be met, fairly close agreement might be expected between a unit's standing on various objective criteria and judgements of individuals about their relative performance (Bishop, 1974). As a result of the above, a subjective approach using the respondents' perceptions was adopted. An instrument used by Chenhall and Langfield-Smith (1998), which was developed by Govindarajan and Fisher (1990) based on a suggestion by Gupta and Govindarajan (1984a) is an example of such approach and has been employed in this research. Specifically, ten performance dimensions are used, viz. return on investment, profit (or income), cash flow from operations, cost control, development of new products, sales volume (or revenues or turnover), market share, market development, personnel development, and political-public affairs. On each dimension, respondents were asked to rate their firms' performance relative to industry or corporate standards on a seven-point Likert scale ranging from 'significantly below average' (score one) to 'significantly above average' (score seven). Respondents who were ambivalent could opt for 'not sure' (score zero). Next, respondents were solicited to rate each dimension on a five-point Likert scale ranging from 'not important' (score one) to 'extremely important' (score five) to indicate the level of importance the firms attached to each performance dimension when determining the incentive bonus of a manager. Using the data on dimensional importance as weights and multiplying them with the corresponding relative performance, it was possible to arrive at a single weighted-average performance index for each firm. This was treated as the overall performance of each firm and will be used to rank the clusters of firms or organizations in the typology. Attempts were also made to ascertain whether each variable that made up the typology clusters had predictive power on the weighted-average performance index. As the variables that constituted the clusters will be factor analysed, the emerging principal component factors would also be regressed against the weighted-average performance index to determine whether any of the factors was a predictor to organizational performance.

The impact of each item that forms the research construct of the contingency factors on each typology cluster was measured, again, by a Likert scale starting from 'strongly disagree' (score one) to 'strongly agree' (score seven). In particular, respondents were solicited to indicate their perceptions of each question asked. If the question was deemed to be not relevant, the respondents had the option to circle score zero. The four contingency factors used were strategic manufacturing priorities, organizational interdependence, organizational structure (vis-à-vis decentralization) and perceived environmental uncertainty. The research instrument on strategic manufacturing priorities drawn from scales developed by Avella *et al*. (1998) which were rigorously tested and proven to be valid and reliable. Organizational interdependence was measured using a modified version of the 'interdependence of workflow' instrument developed by Pugh *et al.* (1969). A fairly similar instrument with a minor modification was also used by Chenhall and Morris (1986). Organizational structure relating to decentralization was measured by the abbreviated Aston measures of 'Concentration of Authority' (Inkson *et al.* 1970). These measures used a series of standard decisions and identified whether managers/management accountants had decision autonomy. Perceived environmental uncertainty was measured using a modified instrument first developed by Duncan (1972) and revised by Sathe (1974). The instrument measured perceived uncertainty by focusing on lack of information on environmental factors, inability to assign probabilities with confidence as to how the environment would affect success or failure, and not knowing the outcome of a decision in terms of how much the organization would lose if the decision was incorrect.

Finally, in the questionnaire, the impact of each institutional influence on each typology cluster was measured using a modified instrument developed by Zainal Abidin ((2000). Respondents were asked on a Likert scale to indicate whether they 'strongly disagree' (score one) up to 'strongly agree' (score seven) for each item of question. In case the items were not relevant to their organization, the respondents could indicate this by circling score zero.

The variables to be measured, which formed the research constructs in the research instruments, were derived from the literature. They have been discussed to some extent in the literature review chapter. Similarly, the measurement scales had been previously developed and tested as established variables in the management accounting research literature. As a summary, the questionnaire items related to the manufacturing management methods were the main classification used by Woodward (1965). Management accounting systems' presentation of information characteristics were derived from the work of Moores and Yuen (2001), which was based on those developed by Khandwalla (1972) and Chenhall and Morris (1986). The management accounting practices/techniques were derived from a survey by Joshi (2001) who expanded the list used by Chenhall and Langfield-Smith (1998). The latter derived their management accounting practices from prior surveys of, for example, Joye & Blayney (1990), Innes & Mitchell (1995) and additional items recommended in other management accounting literature. The questionnaire items related to management accounting techniques were originally derived from relevant items used in the manufacturing futures survey developed by De Meyer *et al.* (1989) which had been tested extensively (Miller *et al.*, 1992). The contingency factors in management accounting were gathered from prior surveys of many researchers, such as Emmanuel *et al.* (1990), Mitchell *et al.* (2000) and Reid & Smith (2000). In particular, the instruments used by Chenhall and Morris (1986), Inkson *et al.*(1970), Duncan (1972) and Pugh *et al* (1969) were modified to suit the context of this doctoral study. As for the institutional influences or factors, an adapted version of questionnaire items developed by Zainal Abidin (2000) based on the work of, *inter alia,* DiMaggio and Powell (1983) was adopted. Organizational performance was evaluated using an instrument adopted by Chenhall and Langfield-Smith (1998), which was developed by Govindarajan and Fisher (1990) based on suggestions by Gupta and Govindarajan (1984a).

Table 4.5 (1) below summarizes the reference sources of the variables used in the survey questionnaire:

Table 4.5 (1) Summary Of The Variable Sources Used In The Research Instruments

Variables	Reference Sources	Modification of variables (if any)
Background Information.	No particular sources. These are generally demographic information.	Only question 6 was added to the original questionnaire after the outcome of the qualitative interviews.
Manufacturing management methods.	Woodward (1965). Also used by Heijltjes and Van Witteloostuijn (2003).	No modification made to the three methods after the qualitative interviews.
Management accounting systems' presentation of information characteristics.	Chenhall and Morris (1986). Also used by Moores and Yuen (2001).	No modification made after the qualitative interviews.
Management accounting practices/techniques.	Joshi (2001) who expanded the original list by Chenhall and Langfield-Smith (1998).	After the qualitative interviews, no modification made except for minor editing such as shareholders' value analysis was replaced by owners' value analysis.
Organizational performance.	Govindarajan and Fisher (1990) based on a suggestion by Gupta and Govindarajan (1984a). Also used by Chenhall and Langfield-Smith (1998).	No modification made after the qualitative interviews.
Institutional factors	Zainal Abidin (2000) based on the work of, *inter alia,* DiMaggio and Powell (1983).	Modifications were made after consultation with the supervisor primarily to suit the present research context. As the variables come from Zainal Abidin's PhD thesis with the same supervisor, the supervisor was well versed on the matter. However, after the qualitative interviews, no further change was necessary.

Contingency Factors : Strategic Manufacturing Priorities.	Avella *et al.* (1998).	No modification made after the qualitative interviews.
Contingency Factors : Organizational Interdependence	Pugh *et al.* (1969). A fairly similar instrument with a minor modification was also used by Chenhall and Morris (1986).	A simplified version as used by Chenhall and Morris (1986) was adopted. No modification was made after the qualitative interviews.
Contingency Factors : Organizational Structure: Decentralization	Inkson *et al.* (1970)	No modification made after qualitative interviews.
Contingency Factors : Perceived Environmental Uncertainty	Duncan (1972). Revised by Sathe (1974).	No modification made after qualitative interviews.

4.6 Data Screening, Cleaning, Recoding And Transformation

Prior to proceeding to the crux of the statistical analyses required to test the various research hypotheses outlined in chapter three, it is vital to address a number of issues regarding the accuracy and appropriateness of the data set. One such issue is error in data entry. To ensure there were no incorrectly entered data, the data entry procedure was conducted twice. Numerous descriptive statistics were produced to check for any discrepancy. Once errors were found, they were immediately rectified. Apart from that, there were a number of other pertinent matters that needed to be dealt with. These will be discussed below.

At the close of the data collection exercise, 130 responses or cases were received. After data entry errors were identified and corrected, the data were screened for missing values. The Statistical Package for Social Science or SPSS software version 12.0.1 as used in this study offered a number of ways to screen the data. The number of missing values was checked using frequency distribution. The 'count' function was also instigated to count missing values for each case. SPSS produced a column in the data view tab to indicate the number of missing values. Three cases with very high missing values were eliminated. The cases deleted were cases with serial numbers ten, seventy nine, and 112. As a result, there were 127 cases left out of the initial 130 cases. These 127 usable cases or good responses were used for subsequent data analyses.

Categorical or discrete data on educational background (Q3), functional area of responsibility (Q8) and main area of operation (Q9) were recoded to change 'not selected' (9) from missing value to 'no' (0), a value. Therefore these categorical variables would not have any missing value. Another 'count' showed a further reduction in missing values in the end column of the data view of the SPSS. It was noticed that there were still missing values around. A check of the frequency of missing values for continuous variables indicated that 42.5% of cases had no missing value and 48.0% had just one missing value. This meant that 90.5% of cases had either no or just one missing value. To take a couple of steps further 95.2% of cases just had three or less missing values. To further reduce missing values in the 'continuous' data parts of the questionnaire (as this was a social science research, any Likert scale of five points and above was regarded as continuous), the missing values were replaced with the mean. Another count confirmed the absence of missing values. However, missing values in some categorical (discrete or non-continuous) variables could not be replaced by means. The variables were gender (Q1), age (Q2) – here age was designed as categorical data, length of service (Q4), current management level (Q5), monthly remuneration (Q6), decision-making function (Q7), status of firm (Q10) and manufacturing management methods (Q11).

All Likert scales in this study were treated as continuous (as opposed to discrete or categorical) interval level variables even though in principle these variables were ordinal in nature. Likert scales are very commonly used with interval procedures, provided the scale item has at least five and preferably seven categories. However, most researchers would not use a three-point Likert scale with a technique requiring interval data. The fewer the number of points, the more likely the departure from the assumption of normal distribution, required for many tests. It should however be noted that the assumption of normality may not matter after all in many tests, such as t-tests, even though the assumption of normality is generally required. In a lot of research (particularly in the social sciences), scores on the dependent variable are not nicely normally distributed. Fortunately, most of the techniques are reasonably robust or tolerant of violations of this assumption. With large enough sample sizes (e.g. 30+), the violation of this assumption should not cause any major problems (Gravetter & Wallnau , 2000; Stevens, 1996). Jaccard and Wan (1996) for example summarized that for many statistical tests, rather severe departures from intervalness did not seem to affect Type I and Type II errors dramatically. A Type I error is when the researcher thinks there is a relationship, but there really is not. For example, the researcher may reject the null hypothesis because $p \leq 0.05$, leading to the conclusion there is a relationship, even though in reality there is no relationship. A Type II error on the other hand, is when the researcher thinks there is no relationship, but there really is. The researcher may make the mistake of accepting the null hypothesis because $p > 0.05$, leading to the conclusion there is no relationship.

Histograms overlaid with normal curves were computed for every continuous variable (non-demographic). The results revealed that the distributions for all the continuous variables were fairly normally distributed. There was no evidence that the responses on the Likert scales were skewed to the upper end.

4.7 Unidimensionalities Of Research Constructs And Dimensions

The intention of this research is to utilise every single variable as far as possible. Grouping the variables together into factors of constructs or dimensions is considered incidental and secondary to the overall research scheme. Nonetheless, there were three requirements where such groupings or data reduction exercises were inevitable as they were fundamental to the research process outlined earlier. Cluster analysis of cases based on the variables management accounting systems' presentation of information and management accounting practices/techniques was one such grouping. Another grouping was the computation of a weighted average performance index for each case based on the twenty performance indicator variables. The third grouping was the factor analyses of management accounting systems' presentation of information and management accounting practices/techniques to derive factorised independent variables which met the sample requirement of a multiple regression analysis with the weighted average performance index as the independent variable. Therefore, no factor analyses on other constructs or dimensions will be carried out as they are superfluous to the requirement of the research proper.

In order to measure a construct or dimension with multiple indicator variables, it is imperative to demonstrate that the variable items measure the same thing. This is known as testing for unidimensionality. Factor analysis and reliability measures are attempts to test for unidimensionality of scales.

4.7.1 Method Used To Factor Analyse Management Accounting Systems' Presentation Of Information Dimensions And Management Accounting Practice/Technique Constructs

While care would be taken to include relevant questionnaire items, it is necessary to examine the extent to which these items would be measuring the constructs of concern to the study. As a first step, items are factor analyzed. Factor analysis is included in the Statistical Package for Social Science or SPSS software version 12.0.1 used in this research, as a data reduction technique.

The term 'factor analysis' encompasses a variety of different, although related techniques. One of the main distinctions is between what is termed principal components analysis and factor analysis. These two sets of techniques are similar in many ways and are often used interchangeably by researchers. Both attempt to produce a smaller number of linear combinations of the original variables in a way that captures or accounts for most of the variability in the pattern of correlations. Although both approaches often produce similar results, books on the topic often differ in terms of which approach they recommend. In this study, the principal components analysis is the adopted approach. Stevens (1996) admits a preference for principal components analysis and gives a number of reasons for this. He suggests that it is psychometrically sound and simpler mathematically, and it avoids some of the potential problems with factor indeterminancy associated with factor analysis (Stevens, 1996). Tabachnick and Fidell (2001) conclude that if the researcher wants an empirical summary of the data set, principal components analysis is the better choice. The procedure for factor analysis (or principal components analysis adopted in this study) involves a number of steps: assessment of the data, factor extraction and factor rotation. The three steps involved are elaborated below.

Step one: Assessment of the suitability of the data for factor analysis (testing for assumptions)

This step is to assess the suitability of the data for factor analysis. Sample size and the strength of the relationship among the variables (or items) are considered. While there is little agreement among authors concerning how large a sample should be, the recommendation generally is: the larger, the better. In small samples the correlation coefficients among the variables are less reliable, tending to vary from sample to sample. Factors obtained from small data sets do not generalise as well as those derived from larger samples. Tabachnick and Fidell (2001) review this issue and suggest that 'it is comforting to have at least 300 cases (respondents) for factor analysis' (p.588). However, they do concede that a smaller sample size (e.g. 150 cases or respondents) should be sufficient if solutions have several high loading marker variables (above 0.8). Stevens (1996) suggests that the sample size requirements advocated by researchers have been reducing over the years as more research has been done on the topic. Some authors suggest that it is not the overall sample size that is of concern but rather the ratio of subjects to items. Nunnally (1978) recommends a ten to one ratio: that is, ten cases for each item to be factor analysed. Others suggest that five cases for each item is adequate in most cases (Tabachnick & Fidell, 2001). In this study, the 'five cases for each item' recommendation would be adhered to.

The four research dimensions that formed the management accounting systems' presentation of information construct met the required ratio of cases to variables of 5:1. The four dimensions were scope of information, timeliness of information, aggregation of information and integration of information. However, the forty five items that made up the management accounting practices/techniques did not fulfil the sample size/proportion requirement as forty five multiplied by five yielded 225 cases, which was well in excess of the usable 127 cases collected. In other words, factor analysis could not be undertaken on all forty five management accounting practice/technique variables (items) simultaneously in a sample size of just 127 cases because this would violate the required ratio of cases to variables of 5:1. As such, interim variable divisions would be made by way of drawing the experience of a content expert, my supervisor, Professor Dennis Taylor. Content or face validity is usually established by content experts. The tentative divisions were budgeting techniques (comprising of nine variables), performance evaluation techniques (twenty variables), costing techniques (seven variables), strategic planning techniques (six variables) and quality control techniques (three variables). After full factor analyses, budgeting techniques, costing techniques, strategic planning techniques and quality control techniques were retained as single factors. However, from performance evaluation techniques emerged two separate factors which were subsequently labelled as performance benchmarking (comprising fourteen variables) and performance evaluation (constituting six variables). The labels were carefully chosen based on the highest loading variables on each of the component (factor), which were used to help identify the nature of the underlying latent variable represented by each component or factor. To assist in discussing the results of this study, titles for each factor are chosen so as to reflect the substance of the variables. The use of appropriate wording is drawn from the literature as well as the input gathered from the qualitative interviews.

Another issue to be addressed concerns the strength of the inter-correlations among the items or variables. Tabachnick and Fidell (2001) recommend an inspection of the correlation matrix for evidence of coefficients greater than 0.3. If few correlations above this level are found, then factor analysis may not be appropriate. The research constructs and dimensions factor analysed in this study showed enough evidence of correlation coefficients above 0.3 indicating suitability for factor analysis. Two statistical measures are also generated by SPSS to help assess the factorability of the data: Bartlett's test of sphericity (Bartlett, 1954), and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1970, 1974). The Bartlett's test of sphericity should be significant ($p \leq 0.05$) for the factor analysis to be considered appropriate. The KMO index ranges from zero to one, with 0.6 suggested as the minimum value for a good factor analysis (Tabachnick & Fidell, 2001). The research constructs and dimensions that needed to be factor analysed in this study passed the Bartlett's tests and the KMO thresholds.

Full discussion on data analyses and findings on this matter would be reserved to chapter five of this thesis. However, it should be noted that, as each individual variable within institutional and contingency factors would be tested against the typology clusters independently, there was no necessity to produce factors for subsequent testing. Data reduction on these institutional constructs and contingency dimensions was deemed not necessary as the sampling requirements were adequately met.

Factor analysis can be sensitive to outliers. The issue of outliers had already been resolved in section 4.6.2 above. Also, since factor analysis is based on correlation, it is assumed that the relationship between the variables is linear. It is certainly not practical to check scatterplots of all variables with all other variables. Tabachnick and Fidell (2001) suggest a spot check of some combination of variables. A spot check of some scatterplots of some variable combinations revealed no clear evidence of a curvilinear relationship. Thus, factor analysis could proceed.

Step two: Factor extraction

Factor extraction involves determining the smallest number of factors that can be used to best represent the interrelations among the set of variables. There are a variety of approaches that can be used to identify or extract the number of underlying factors or components. In this study, the principal components approach would be adopted. There are a number of techniques that can be used to assist in the decision concerning the number of factors to retain. The techniques are Kaiser's criterion, scree test and parallel analysis. Kaiser's criterion is also known as the eigenvalue rule. Using this rule, only factors with an eigenvalue of 1.0 or more are retained for further investigation. The eigenvalue of a factor represents the amount of the total variance explained by that factor. Kaiser's criterion has been criticised, however, as resulting in the retention of too many factors in some situations. Another technique that can be used is Catell's scree test (Catell, 1966). This involves plotting each of the eigenvalues of the factors and inspecting the plot to find a point at which the shape of the curve changes direction and becomes horizontal. SPSS would generate this plot and call it scree plot. Catell recommends retaining all factors above the elbow, or break in the plot, as these factors contribute the most to the explanation of the variance in the data set. Horn's parallel analysis (Horn, 1965) is the technique widely advocated in many social science journals. The technique is fast gaining popularity in the social science literature (e.g. Choi, Fuqua, & Griffin, 2001; Stober, 1998). Parallel analysis involves comparing the size of the eigenvalues with those obtained from a randomly generated data set of the same size. Only those eigenvalues that exceed the corresponding values from the random data set are retained. This technique to identifying the correct number of components to retain has been shown to be the most accurate, with both Kaiser's criterion and Catell's scree test tending to overestimate the number of components (Hubbard & Allen, 1987; Zwick & Velicer, 1986). In this research, Horn's parallel analysis will be employed. Detailed findings will be elaborated in chapter five.

Step three: Factor rotation and interpretation

Once the number of factors have been determined, the next step is to try to interpret them. To assist in this process, the factors are 'rotated'. This does not change the underlying solution but rather, it presents the pattern of loadings in a manner that is easier to interpret. There are two main approaches to rotation, resulting in either orthogonal (uncorrelated) or oblique (correlated) factor solutions. According to Tabachnick and Fidell (2001), orthogonal rotation results in solutions that are easier to interpret and to report; however, they do require the researcher to assume that the underlying constructs or dimensions are independent (not correlated). Oblique approaches allow for the factors to be correlated, but they are more difficult to interpret, describe and report (Tabachnick & Fidell, 2001, p.618). In practice, the two approaches (orthogonal and oblique) often result in very similar solutions, particularly when the pattern of correlations among the items or variables is clear (Tabachnick & Fidell, 2001). Within the two broad categories of rotational approaches, there are a number of different rotational techniques provided by SPSS (orthogonal: varimax, quartimax, equamax; oblique: direct oblimin, promax). The most commonly used orthogonal technique is the varimax method, which attempts to minimise the number of variables that have high loadings on each factor. The most commonly used oblique technique is direct oblimin. It should be noted that rotation is only possible if the factor analysis yields more than one factor or component. There is no need to rotate if only one component or factor is extracted. In this research, the approach taken was that if the parallel analysis identified more than one factor, then varimax rotation would be done first and the result noted. Then the procedure would be repeated with direct oblimin rotation.

The component correlation matrix table generated by SPSS under direct oblimin rotation will be examined in this study. If the components (factors) are strongly correlated among themselves (i.e. above 0.3), the result from the direct oblimin rotation will be reported instead of the corresponding varimax rotation. However, it was discovered that both varimax and direct oblimin rotation used in this survey yielded the same solutions. They will be extensively covered in chapter five.

4.7.2 Method Used For Reliability Analyses Of Management Accounting Systems' Presentation Of Information Dimensions And Management Accounting Practice/Technique Constructs

The reliability of a scale indicates how free it is from random error. Two frequently used indicators of a scale's reliability are test-retest reliability (also referred to as 'temporal stability') and internal consistency. The test-retest reliability of a scale is assessed by administering it to the same people on two different occasions, and calculating the correlation between the two scores obtained. High test-retest correlations indicate a more reliable scale. As far as this study is concerned, it was not possible to run a test-retest reliability since the quantitative data were gathered from questionnaire responses. However, some input on temporal stability could be deduced from the five qualitative interviews. From the qualitative interviews, there was no incontrovertible evidence to suggest that the variables and scales used in the study were grossly unstable.

The second aspect of reliability that can be assessed is internal consistency. This is the degree to which the items that make up the scale are all measuring the same underlying attribute. Internal consistency can be measured in a number of ways. The most commonly used statistic is Cronbach's coefficient alpha (Cronbach, 1951). This statistic provides an indication of the average correlation among all of the items (variables) that make up the construct or dimension. Values range from zero to one, with higher values indicating greater reliability. While different levels of reliability are required, depending on the nature and purpose of the scale measures, Nunnally (1978) recommends a minimum level of 0.7. Cronbach's alpha is based on the average correlation of items within a test if items are standardised. If the items are not standardised, it is based on the average covariance among the items.

In this study, only the non-standardised results will be reported as items usually possess comparable variances and as such, there is little difference between both the standardised and the non-standardised alphas. Examination of the two sets of alphas in this study, confirmed that there is indeed hardly any difference between the two. Reporting just one set of alphas would suffice the need to test for reliability. Cronbach's alpha values are dependent on the number of variable items in the construct or dimension. When there are a small number of variable items in the construct/dimension (fewer than ten), Cronbach's alpha values can be quite small. In this situation it may be better to report the mean inter-item correlation for the items. Optimal mean inter-item correlation values range from 0.2 to 0.4 (as recommended by Briggs & Cheek, 1986). The reliability of a scale construct or dimension depends on the sample that it is used with. If the scale construct or dimension contains items that are negatively worded, these need to be reversed by way of recoding before checking for reliability. Sometimes a scale construct or dimension may contain a number of sub-constructs/dimensions or sub-dimensions. If necessary, the reliability of each of these dimensions or sub-dimensions will need to be calculated.

Reliability analysis has similar underlying assumptions as correlational analysis. Data had to come from related pairs as Cronbach's alpha could be written as a function of the number of test items (or variables) and the average inter-correlation among the items. Cronbach's alpha measures how well a set of items (or variables) measures a single unidimensional latent construct. When data have a multidimensional structure, Cronbach's alpha will usually be low. Technically speaking, Cronbach's alpha is not a statistical test - it is a coefficient of reliability (or internal consistency). All the data subjected to reliability tests in this study were interval level scales in the form of Likert scales with at least five points. This fulfilled the requirement of a scale level of measurement. The assumption of normality was disregarded based on the central limit theorem mentioned in section 4.6.3. Examinations of the various scatterplots did not reveal any violation of linearity and homoscedasticity. As such, full reliability analyses of all the dimensions that made up management accounting systems' presentation of information and management accounting practices/techniques could proceed.

It was found that all the dimensions or factors relating to management accounting systems' presentation of information and management accounting practices/techniques registered a high level of reliability (Cronbach's alphas of above 0.7). Findings will be reported in full in chapter five on data analysis and discussion.

4.8 Method Used For Cluster Analysis Of Management Accounting Systems' Presentation Of Information And Management Accounting Practices/Techniques

As the use of cluster analysis will be employed to determine the typology of firms (cases) based on the variables management accounting systems' presentation of information and management accounting practices/techniques, it is pertinent to discuss the critical issues in the use of cluster analysis. This section and its sub-sections describe the key issues involved when using cluster analysis. It is important to note that there is considerable variation in how unified methodological experts are regarding these issues. Specifically, experts tend to agree on what the important issues are, but often disagree about how to address them. As described below, there are some limited areas of agreement regarding appropriate remedies for clustering issues. There is a larger body of issues, however, for which no consensus has emerged. Here, the disagreements will be highlighted and ways to deal with the issue will be discussed. Thus, this section will be inter-alia the collection and synthesis of the wisdom offered by methodological experts. The strengths, weaknesses, and trade-offs involved with each issue as it relates to this research will be identified. The mechanics of cluster analysis are offered by a number of literature such as Aldenderfer and Blashfield (1984), Everitt (1980), Hair *et al.* (1992), Lorr (1983), Punj and Stewart (1983).

4.8.1 Clustering Variables

Choosing the variables along which to group observations is the most fundamental step in the application of cluster analysis, and thus, the most important. This process involves three critical issues: (1) how to select variables; (2) whether or not to standardize variables; and (3) how to address multicollinearity among variables.

1. *Selection of variables*

   There are three basic approaches to identifying appropriate clustering variables: inductive; deductive; and cognitive (Ketchen *et al.*,1993). The inductive approach focuses on exploratory classification of observations. In other words, neither the clustering variables nor the number and nature of the resultant groups are tightly linked to deductive theory. Instead, the inductive approach seems to follow McKelvey's (1975, 1978) suggestion to consider as many variables as possible because one cannot know in advance which variables differentiate among observations. Thus, the use of many clustering variables is expected to maximize the likelihood of discovering meaningful differences. One example of an inductive study is Hambrick (1983), where the author used ten environmental variables to develop a taxonomy of mature industries with no a priori expectations about the likely nature of the resultant types.

   When following a deductive approach, the number and suitability of clustering variables, as well as the expected number and nature of groups in a cluster solution, are strongly tied to theory (Ketchen *et al.* 1993). Methodological research suggests that using deductive theory to guide variable choice is often wise. Cluster analysis derives the most internally consistent groups across all variables, thus irrelevant variables can cause a deterioration of a solution's validity (Punj and Stewart, 1983). An implication is that, when possible, studies should focus on variables with solid theoretical foundations. One example of a deductive study is Lawless and Finch (1989), where theory-based predictions of the relative performance of different configurations are tested within each type of environment identified by Hrebiniak and Joyce (1985).

   The cognitive approach can be viewed as conceptually related to the inductive approach because both avoid making theory-based predictions. While inductive configurations are defined along dimensions that researchers view as important, the cognitive approach relies on the perceptions of expert informants such as industry executives (e.g., Mascarenhas and Aaker, 1989a, 1989b; Reger and Huff, 1993) to define clustering variables. This latter approach has its roots in research on interpretation in organizations, which posits that it is the meaning that top managers attach to phenomena, not objective characteristics, which directs subsequent organizational action (Dutton, Fahey, and Narayanan, 1983) and performance (Thomas, Clark, and Gioia, 1993). One implication is that configurations based on the perceptions of top managers may be crucial to understanding any given setting (Porac and Thomas, 1990).

In this study, the inductive or perhaps the cognitive approach to selecting variables will be adopted. However, this study is also inextricably linked to contingency and institutional theories. When attempting to explain or predict relationships, a theoretical foundation is advisable, if not required (Bacharach, 1989). Hence, it is preferable that studies designed to discern the nature and extent of links between key constructs (e.g., organizational configurations and performance) should rely on a deductive approach (Ketchen *et al.*,1993). However, this research is partly exploratory, with a focus on both theory building as well as theory testing. While the approach to selecting variables is exploratory, the contingency and institutional factors chosen to explain or predict the relationships with the cluster solution are based on established contingency (contextual) and institutional theories.

In this study, variables are chosen in a way that fosters rich description of a sample's characteristics (as in Meyer *et al.,* 1993). Both the inductive and cognitive approaches fit this requirement in so far as the cluster analysis is concerned. The selection of the variables management accounting systems' presentation of information and management accounting practices/techniques to be cluster analysed could be regarded as inductive based on their arbitrary choice by the researcher. Conversely, one could argue that as the research instruments that measure the two constructs are based on established prior research, they are derived from expert informants, and thus cognitive.

2. *Standardization of variables*

Since cluster analysis groups elements (e.g. firms) such that the distance between groups along all clustering variables is maximized, variables with large ranges (i.e. where elements are separated by large distances) are given more weight in defining a cluster solution than those with small ranges (Hair *et al.*, 1992). As a result, a subset of variables can dominate the definition of clusters. The remedy to this is standardization, which transforms the distribution of elements along variables so that each has a mean of zero and a standard deviation of one. This process allows variables to contribute equally to the definition of clusters but may also eliminate meaningful differences among elements (Edelbrock, 1979). This is a dilemma of using cluster analysis, i.e. for any remedy, there is almost always an associated cost. Given this trade-off, the question of whether to standardize clustering variables is an equivocal issue. Some experts (Hair *et al.,* 1992; Harrigan, 1985) recommend standardization, perceiving a need to eliminate the potential effects of scale differences among variables. Others offer evidence that standardization has no significant effects (Edelbrock, 1979; Milligan, 1980). Aldenderfer and Blashfield (1984) advise that because standardization may have adverse effects, it should be addressed on a case-by-case basis. However, they do not offer specific guidance about how to approach a particular case. Since results may differ solely based on standardization, the clusters may be inconsistent across the two solutions. If this is the case, the validity of each solution should be assessed, where the solution exhibiting the highest validity may then be adopted (Ketchen & Shook, 1996).

As this study employed the two step cluster analysis available in SPSS version 12.0.1, both analyses of using and not using standardization are options provided in the package. The 'option' button under the two step cluster analysis offers 'to be standardized' as using standardization and alternatively 'assumed standardized' as not using standardization. Both options were selected separately and the results noted. It was found that the two sets of cluster solutions did not differ at all irrespective of whether the variables were standardized or not. Both options generated the same two cluster solution, comprising of thirty nine cases (cluster one) and eighty eight cases (cluster two). As such, standardization of variables is not an issue in this study. Full results will be reported in chapter five.

3. *Multicollinearity among variables*

High correlation among clustering variables can be problematic because it may overweight one or more underlying constructs. Thus, researchers may want to correct multicollinearity, especially if it is desirable that constructs be equally weighted. Hair *et al.,* (1992) suggest using Mahalanobis distance measure, which both standardizes variables and adjusts for high correlations. As noted earlier, standardization however, is controversial. Multicollinearity can also be addressed through subjecting variables to factor analysis (specifically, principal components analysis with orthogonal rotation as used in this study) and using the resultant uncorrelated factor scores for each observation as the basis for clustering (Punj and Stewart, 1983). However, this technique is controversial because researchers often drop all factors with low eigenvalues (a statistic representing the amount of variance explained by a factor). The excluded factors may represent unique, important information (Dillon, Mulani, and Frederick, 1989), meaning that a less-than-optimal set of clusters may result. Thus, as with standardization, any remedy for multicollinearity has a cost.

In this study, principal components factor analyses would not be interpreted in the light of resolving the issue of multicollinearity among the variables that formed management accounting systems' presentation of information and management accounting practices/techniques. This was due to the fact that all the variables involved would be chosen as clustering variables; not just the factor analysed dimensions of the management accounting systems' presentation of information and management accounting practice/technique constructs. The SPSS version 12.0.1 too does not provide the option for measuring Mahalanobis distance within the two step cluster analysis. However, as the variables concerned also needed to be subjected to a multiple regression analysis with weighted performance index as the dependent variable, it was possible to check for multicollinearity among the variables using the variance inflation factor (VIF). VIF is simply the reciprocal of tolerance. Therefore, when VIF is high, there is high multicollinearity and instability of the beta coefficients. VIF and tolerance are found in the SPSS output section on collinearity statistics. Standard error is doubled when VIF is four and tolerance is 0.25, corresponding to $R_j = 0.87$ in multiple regression. Therefore VIF of more or equal to four is an arbitrary but common cut-off criterion for deciding when a given independent variable displays too much multicollinearity. Values above four suggest a multicollinearity problem. Some researchers use the more lenient cut-off of five, i.e. to them, multicollinearity is a problem only if VIF is more or equal to five. In this study, all the VIF values concerned were found to be less than four. In fact, they were all below two, indicating that there was no problem with multicollinearity.

4.8.2 Clustering Algorithms

In cluster analysis, the rules or procedures followed to sort observations are known as clustering algorithms. The selection of appropriate clustering algorithms is critical to the effective use of cluster analysis (Punj and Stewart, 1983). There are two basic types of algorithms, which are hierarchical and non-hierarchical.

Hierarchical algorithms progress through a series of steps that build a tree-like structure by either adding individual elements to (i.e. agglomerative) or deleting them from (i.e. divisive) clusters. The five most popular agglomerative algorithms are single linkage, complete linkage, average linkage, centroid method, and Ward's method (Hair *et al.,* 1992). The differences among them lie in the mathematical procedures used to calculate the distance between clusters. Each has different systematic tendencies (or biases) in the way it groups observations. For example, the centroid method has a bias toward producing irregularly shaped clusters. Further, it can only be used with interval or ratio data (Hair *et al.,* 1992). Ward's method tends to produce clusters with roughly the same number of observations (SAS Institute, 1990) and the solutions it provides tend to be heavily distorted by outliers or observations with extreme values (Milligan, 1980). Given such tendencies, there should be a match between the algorithm selected and the underlying structure of focal data (i.e., sample size, distribution of observations, and what types of variables are included – nominal, ordinal, ratio, or interval). Thus, for example, the centroid method should only be used when firstly, data are measured with interval or ratio scales and secondly, clusters are expected to be very dissimilar from each other. Likewise, Ward's method is best suited for studies where firstly, the number of observations in each cluster is expected to be approximately equal and secondly, there are no outliers.

The use of divisive methods in the social sciences has been limited to the field of archaeology (e.g. Whallon, 1972). There are two types of divisive techniques, namely, monothetic and polythetic (Everitt, 1980). The monothetic techniques are used with binary (i.e. dichotomous) variables. A sample is divided into groups based on each observation's possession of an attribute or it's lack of. Groups are then broken into smaller groups based on the presence or absence of individual attributes. Since this procedure groups observations through successive rather than simultaneous application of variables, it would not be useful for configurational research. Polythetic divisive methods, in essence, are the logical opposite or mirror image of agglomerative methods. Agglomerative methods initially view each observation as a separate cluster and then compile them into successively smaller numbers of groups, eventually putting all observations into one group. It is the task of the researcher to decide at what point the number of groups is appropriate. Polythetic divisive methods follow the opposite approach. These methods put all observations in one group initially, then observations are divided into smaller groups until eventually each observation becomes a separate cluster. Again, the researcher must decide what level of division is appropriate. Although the methods start at opposite ends of the clustering process, the number of groups identified should be the same regardless of which one is used. Thus, the distinction between the two methods is of little practical consequence. A divisive method procedure using matrix algebra is described in Everitt (1980).

All hierarchical algorithms suffer from several problems. First, researchers often do not know the underlying structure of a sample in advance, making it difficult to select the correct algorithm. Second, these algorithms make only one pass through a data set, thus poor cluster assignments cannot be modified. Finally, solutions are often unstable when cases are dropped, especially when a sample is small (Jardine and Sibson, 1971). Due to these problems, confidence in the validity of a solution obtained using only hierarchical methods is limited.

Non-hierarchical algorithms (also referred to as *k*-means or iterative methods) partition a data set into a pre-specified number of clusters. Specific non-hierarchical methods vary slightly, but function in essentially the same manner (Hair *et al.,* 1992). After initial cluster centroids (the centre points of clusters along input variables) are selected, each observation is assigned to the group with the nearest centroid. As each new observation is allocated, the cluster centroids are recomputed. Multiple passes are made through a data set to allow observations to change cluster membership based on their distance from the recomputed centroids. To arrive at an optimal solution, passes through a data set continue until no observations change clusters (Anderberg, 1973).

Non-hierarchical methods have two potential advantages over hierarchical methods. First, by allowing observations to switch cluster membership, non-hierarchical methods are less impacted by outlier elements. Although outliers can initially distort clusters, this is often corrected in subsequent passes as the observations switch cluster membership (Aldenderfer and Blashfield, 1984; Hair *et al.,* 1992). Second, by making the multiple passes through the data, the final solution optimizes within-cluster homogeneity and between-cluster heterogeneity. Obtaining this improvement, however, requires that the number of clusters be specified *a priori* (Milligan, 1980). In many fields, this is problematic because cluster analyses are often exploratory. A solution advocated by many experts is to use a two-stage procedure where a hierarchical algorithm is used to define the number of clusters and cluster centroids; these results then serve as the starting points for subsequent non-hierarchical clustering (Hair *et al.,* 1992; Milligan, 1980; Punj and Stewart, 1983). Research has shown that this procedure increases validity of solutions (Milligan, 1980; Punj and Stewart, 1983).

In this study, the use of hierarchical and non-hierarchical methods in tandem will not be adopted. Instead, a relatively novel algorithm called the SPSS two step cluster analysis will be chosen. This applies only to SPSS 11.5 and later releases and provides for an auto-clustering procedure. The SPSS two step cluster analysis suits this study, as it allows clusters to be determined automatically and thus fits into the exploratory nature of this research. The method also provides for an outlier-handling option, which automatically resolves the problem of outliers in the clustering algorithms. The two step cluster analysis does not allow for missing values. Cases with missing values are deleted on a listwise basis. In this study, all missing values in the variables concerned were replaced by means. As such, no cases were deleted.

The two step cluster analysis has also a number of other inherent advantages. It is a scalable cluster analysis algorithm designed to handle very large data sets. Unlike traditional clustering, the two step cluster analysis can handle both continuous and categorical variables or attributes. Cases represent objects to be clustered, and the variables represent attributes upon which the clustering is based. With traditional clustering, working with mixed typed variables requires arbitrarily choosing the weight, though improper weight may bias the treatment of different variable types.

The two step cluster analysis data considerations have underlying assumptions that are easily met. The likelihood distance measure assumes that variables in the cluster model are independent. Further, each continuous variable is assumed to have a normal (Gaussian) distribution, and each categorical variable is assumed to have a multinomial distribution. Empirical internal testing indicates that the procedure is fairly robust to violations of both the assumption of independence and the distributional assumptions. The two step cluster analysis also requires only one data pass. As the name suggests, the procedure has two steps. They are explained below:

Step one: Pre-clustering of cases into many small sub-clusters

The pre-cluster step uses a sequential clustering approach. It scans the data records one by one and decides if the current record should be merged with the previously formed clusters or starts a new cluster based on the distance criterion. The procedure is implemented by constructing a modified cluster feature (CF) tree. The CF-tree consists of levels of nodes, and each node contains a number of entries. A leaf entry (an entry in the leaf node) represents a final sub-cluster. The non-leaf nodes and their entries are used to guide a new record quickly into a correct leaf node. Each entry is characterized by its CF that consists of the entry's number of records, mean and variance of each continuous variable, and counts for each category of each categorical variable. For each successive record, starting from the root node, it is recursively guided by the closest entry in the node to find the closest child node, and descends along the CF-tree. Upon reaching a leaf node, it finds the closest leaf entry in the leaf node. If the record is within a threshold distance of the closest leaf entry, it is absorbed into the leaf entry and the CF of that leaf entry is updated. Otherwise it starts its own leaf entry in the leaf node. If there is no space in the leaf node to create a new leaf entry, the leaf node is split into two. The entries in the original leaf node are divided into two groups using the farthest pair as seeds, and redistributing the remaining entries based on the closeness criterion. If the CF-tree grows beyond allowed maximum size, the CF-tree is rebuilt based on the existing CF-tree by increasing the threshold distance criterion. The rebuilt CF-tree is smaller and hence has space for new input records. This process continues until a complete data pass is finished. All records falling in the same entry can be collectively represented by the entry's CF. When a new record is added to an entry, the new CF can be computed from this new record and the old CF, without knowing the individual records in the entry. These properties of CF make it possible to maintain only the entry CFs, rather than the sets of individual records. Hence the CF tree is much smaller and more able to be stored in main memory. Note that the CF tree may depend on the input order of the cases or records. To minimize the order effect, cases are randomly ordered.

An optional outlier-handling step is implemented in the algorithm in the process of building the CF-tree. Outliers are considered as data records that do not fit well into any cluster. Data records in a leaf entry are considered as outliers if the number of records in the entry is less than a certain fraction (25% by default) of the size of the largest leaf entry in the CF-tree. Before rebuilding the CF-tree, the procedure checks for potential outliers and sets them aside. After rebuilding the CF-tree, the procedure checks to see if these outliers can fit in without increasing the tree size. At the end of CF-tree building, small entries that cannot fit in are outliers. In this study, outlier treatment with 'noise handling' was selected. There were no outliers as all cases fell into two distinct clusters after step two.

Step two: Clustering the sub-clusters (from step one) into the final number of clusters

The cluster step takes sub-clusters (non-outlier sub-clusters if outlier handling is used) resulting from the pre-cluster step as input and then groups them into the desired number of clusters (in case where the number of clusters is pre-determined). Since the number of sub-clusters is much less than the number of original records, the traditional clustering methods can be used effectively. SPSS uses the agglomerative hierarchical clustering method. A primary reason is that it works well with the auto-cluster method, which is provided as an option. In this study, the number of clusters was determined automatically as the exploratory nature of this survey necessitated such a choice.

In general, the larger the number of sub-clusters produced by the pre-cluster step (step one), the more accurate the final result is. However, too many sub-clusters will slow down the clustering during the second step. The maximum number of sub-clusters should be carefully chosen so that it is large enough to produce accurate results and small enough not to slow down the second step clustering. In this study, the maximum number of sub-clusters was set at fifteen. This was the default setting offered by SPSS. Default settings for the CF tree tuning criteria were also selected.

4.8.3 Determining The Number Of Clusters

A variety of techniques are available to determine the number of clusters in a data set. When using hierarchical methods, the most basic procedure is to visually inspect a dendogram, a graph of the order that observations (or cases) join clusters and the similarity of observations joined. Dendograms resemble decision trees with short limbs representing the joining of observations. A researcher looks for natural clusters of the data that are indicated by relatively dense branches. This method's reliance on interpretation requires that it be used cautiously (Aldenderfer and Blashfield, 1984). The agglomeration coefficient (i.e., a numerical value at which various cases merge to form a cluster) is the basis for two related techniques. The first method involves graphing the coefficient on a y-axis and the number of clusters on an x-axis. A marked flattening of the graph suggests that the clusters being combined are very dissimilar, thus the appropriate number of clusters is found at the elbow of the graph. Interpreting a graph, however, may be difficult.

For example, the elbow may not be pronounced, indicating that there may not be any natural groups in the data (Hambrick and Schecter, 1983). Alternatively, the graph may have more than one elbow, indicating that more than one natural set of clusters fit the data (Aldenderfer and Blashfield, 1984). The second procedure involves examining the incremental changes in the coefficient. A large increase implies that dissimilar clusters have been merged; thus, the number of clusters prior to the merger is the most appropriate. A major limitation with this approach is that there may be no large jumps in the coefficients, indicating that there may not be any natural groups in the data. In some cases, there may be several large jumps; this would be evidence for more than one natural set of clusters. The cubic clustering criterion (CCC) is a measure of within-cluster homogeneity relative to between-cluster heterogeneity. The appropriate number of clusters is indicated by the peaking of the CCC. However, Milligan and Cooper (1985) found that this test may suggest too many clusters. Finally, *a priori* theory can serve as a non-statistical tool for determining the number of clusters (Hair *et al.,* 1992). Although a priori theory is, by definition, not central to exploratory research, it does provide a benchmark for assessing the results of theory-testing inquiry. For example, comparison of emergent clusters with a theory-based typology can provide evidence regarding the typology's descriptive validity (e.g., Ketchen *et al.,*1993). In summary, using a single method to determine the number of clusters is questionable because each method has limitations (Everitt, 1980). Ketchen and Shook (1996) advocated the use of multiple techniques that can overcome each others' shortcomings.

However, recent innovation introduces new clustering criteria that do not suffer from suggesting too many clusters, a shortcoming described by Milligan and Cooper (1985). The SPSS two step cluster analysis offers two clustering criteria, namely the Schwarz's Bayesian Criterion (BIC) and Akaike's Information Criterion (AIC). To determine the number of clusters automatically, SPSS developed a two-step procedure that works well with the hierarchical clustering method. A characteristic of the hierarchical clustering method is that it produces a sequence of partitions in one run. This is in contrast to *k*-means algorithm which needs to run multiple times (one for each specified number of clusters) in order to generate the sequence. Using the SPSS two step cluster analysis, the first step starts by having the BIC or AIC for each number of clusters within a specified range calculated and used to find the initial estimate for the number of clusters. In the second step, the initial estimate is refined by finding the largest increase in distance between the two closest clusters in each hierarchical clustering stage. In this study, the clustering criterion chosen was BIC under the two step cluster analysis.

A distance measure is also needed in both pre-cluster (step one) and cluster (step two) steps. Two distance measures are available. The log-likelihood distance measure can handle both continuous and categorical variables. It is a probability based distance. The distance between two clusters is related to the decrease in log-likelihood as they are combined into one cluster. In calculating log-likelihood, normal distributions for continuous variables and multinomial distributions for categorical variables are assumed. It is also assumed that the variables are independent of each other, and so are the cases. However, SPSS states that empirical internal testing indicates that the procedure is fairly robust to violations of both the assumption of independence and the distributional assumptions. Euclidean distance measure, on the other hand, can only be applied if all variables are continuous. The Euclidean distance between two points is clearly defined. The distance between two clusters is defined by the Euclidean distance between the two cluster centres. A cluster centre is defined as the vector of cluster means of each variable. In this study, the log-likelihood distance was selected. No testing for underlying assumptions was made. As this study also opted for outlier treatment, the outliers or noises were assumed to follow a uniform distribution. The software calculated both the log-likelihood resulting from assigning a record or case to a noise cluster and that resulting from assigning it to the closest non-noise cluster. The record or case was then assigned to the cluster which lead to the larger log-likelihood. This was equivalent to assigning a record or case to its closest non-noise cluster if the distance between them was smaller than a critical value. Otherwise, the record or case would have been designated as an outlier.

By default SPSS version 12.0.1 determines the number of clusters using the change in BIC (the Schwarz Bayesian Criterion: when BIC change is small, it stops and selects as many clusters as thus far created). It is also possible to have this done based on changes in AIC or the Akaike Information Criterion. Alternatively, researcherrs can request SPSS the number of clusters required. The researchers can also ask for a range of solutions, such as three to five clusters. The autoclustering statistics table in SPSS output gives, for example, BIC and BIC change for all solutions. In this study, the default alternative was selected as the automatic selection of clusters was deemed appropriate due to the exploratory nature of the study. All the 127 cases formed two distinct clusters without the presence of any outlier or noise. Cluster one had a membership of thirty nine cases and cluster two consisted of the remaining eighty eight cases. These two clusters were identified at the point where the BIC change was the most negative. The cluster distribution table produced by SPSS also confirmed the observation. Detailed findings will be reported in chapter five.

4.8.4 Validating Clusters

The goals of validation are to ensure that a cluster solution has external validity (i.e., is representative of the general population of interest – Cook and Campbell, 1979) and criterion-related validity (i.e., is useful for the prediction of important outcomes – Kerlinger, 1986). Extreme care in validation is warranted because, despite the rigour used in previous steps, without validation one is not assured of having arrived at a meaningful and useful set of clusters (Punj and Stewart, 1983). Reliability (i.e. consistency) is a necessary but not sufficient condition of validity (Kerlinger, 1986). Therefore, the reliability of a cluster solution must be established before validity is tested.

There are two primary ways to evaluate reliability. First, researchers may perform a cluster analysis multiple times, changing algorithms and methods for addressing multicollinearity. The degree of consistency in solutions indicates reliability (Hair *et al.*, 1992). Second, researchers may split a sample and analyse the two halves independently (Hambrick, 1983). A modified version of this latter procedure is to obtain cluster centroids from half of a sample and use them to define clusters in the other half. In either case, consistency across sample halves indicates reliability (Hair *et al.*, 1992). However, there is no standard for assessing a satisfactory level of consistency, leaving this determination largely to the researcher's judgement. Also, in some studies, sample sizes may be too small for meaningful clusters to be derived from sample halves. For example, splitting their sample of eighteen companies probably would not have been helpful to Reger and Huff's (1993) efforts to establish the reliability of the three strategic groups they found. In this study, there was sufficient sample size to be split into two halves. The first sample half comprised of cases one to sixty three, while the second sample half constituted the remaining cases (i.e. cases sixty four to 127). A separate two step cluster analysis was conducted on each sample half. It was found that the first sample half did not generate more than one cluster. The second sample half generated two clusters. This finding substantiated the fact that the cluster solution could not have exceeded two clusters, and thus reliability of the two cluster solution was assured.

If reliability has been demonstrated, attention can turn to external validity. This may be done by cluster analysing both the sample of interest and a second, similar sample and then assessing the similarity of the results (Hair *et al.,* 1992; Hambrick, 1983). In many studies, however, a hold-out sample is not available. In other instances, the use of a second sample may not even be appropriate. For example, strategic groups are often viewed as industry specific (Thomas and Venkatraman, 1988), and thereby cannot be generalized to another setting. Thus, validation using multiple samples should be used only if consistent with the assumptions underlying a study. Criterion-related validity can be assessed through significance tests (often multivariate analysis of variance) with external variables (Aldenderfer and Blashfield, 1984; Anderberg, 1973). Such variables should be theoretically related to the clusters, but not used in defining clusters. For example, given the field's emphasis on defining the strategy – performance relationship (Summer *et al.,* 1990), the external variables in strategy research are often performance measures (e.g., Miller, 1988; Robinson and Pearce, 1988). Significance tests with external variables offer a powerful tool to establish validity of a cluster solution because the technique uses a test statistic (often an F-statistic), thereby avoiding having the researcher provide the meaning of results. External variables are expensive to obtain in many fields (Bailey, 1994), but, in some research, the availability of archival data often solves this problem. Ketchen and Shook (1996) strongly advocate the use of this technique whenever possible. They suggest that reliability and validity will be questionable whenever a research design uses clustering techniques in isolation. Ketchen and Shook (1996) also propose that only when cluster analysis is augmented with additional techniques – especially ones that are less subject to researchers' biases – can confidence in the results obtained be strong.

In this study, a significance test with an external variable to establish criterion-related validity will be employed. The external variable used is the weighted average performance index. To derive this index, firstly, the summation of the product of a firm's relative performance and the corresponding performance importance was calculated. This numerator would then be divided by a denominator in the form of a summation of the performance importance. The result was the individual firm's weighted average performance index. A firm's relative performance measures were given in part one of section E of the questionnaire (Q61 to Q70). The corresponding importance of performance measures were in part two of section E (Q71 to Q80). Using SPSS 'transform' and 'compute variable' menu and sub-menu, it was possible to generate a synthesized variable of the weighted average performance index[2].

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[2] A separate analysis on MS Excel spreadsheet revealed that there was a high degree of positive correlation between the firm's relative performance and it's corresponding performance importance, where r = 0.8916. Therefore, the higher the relative performance, the higher the importance attached to it by respondents.

To establish criterion-related validity of the cluster solution, independent samples t-test, with the weighted performance index as the test variable and the cluster membership as the grouping variable, will be undertaken. The independent samples t- test was selected instead of analysis of variance or ANOVA (for F-statistic) as what needed to be ascertained was whether there is any significant performance difference between the two cluster means. Had there been more than two clusters, then an analysis of variance would have been more appropriate.

The independence samples t-test underlying assumptions needed to be met prior to analysis. These assumptions needed to be evaluated because the accuracy of test interpretation depends on whether assumptions are violated. The first two assumptions of requiring scale level of measurement and random sampling were met by virtue of the research design. The third assumption requiring normal distribution was violated. However, the t-statistic has repeatedly and convincingly been shown to be practically immune to violations of the normality assumption (Rasch & Guiard, 2004). The fourth assumption was independence of groups. As the two cluster memberships comprised of distinct and separate individual cases, assumption four was satisfied. The last assumption was on the homogeneity of variance. To test for homogeneity of variance, SPSS uses the Levene test for equality of variances. If this test is significant ($p \leq 0.05$), then reject the null hypothesis, i.e. do not reject the alternative hypothesis that the variances are unequal. It follows that the unequal variance estimates are consulted. If the test is not significant ($p > 0.05$), then do not reject the null hypothesis that there are no significant differences between the variances of the groups (clusters). If this is the case, the equal variance estimates are consulted.

In this study, equal variances were assumed, as the Levene's test had a probability of 0.381 (i.e. greater than 0.05). The corresponding two tail significant value of the t-test for equality of means was 0.001 (i.e. less than 0.05). Hence, there was a significant difference between the weighted average performance indices of the two clusters. Cluster two had a higher mean performance of 4.9302 compared with cluster one, with just 4.2850. In other words, cluster two performed better than cluster one. The two clusters then, were distinguished by virtue of an outside performance variable. Thus, criterion validity was established.

4.8.5 Method Used To Test Cluster Differences

In sub-section 4.8.3, it was determined that there were two clusters of firms (cases) using SPSS two step cluster analysis. The relevant tables on the findings will be shown in chapter five. These two clusters were identified at the point where the BIC (Bayesian Information Criterion) change was negative. Cluster one had a membership of thirty nine cases and cluster two consisted of the remaining eighty eight cases. In sub-section 4.8.4, the existence of the two clusters was validated. This was proven when an independent samples t-test between the two clusters (the grouping variable) and the weighted performance index (test variable) showed a significant difference ($p \leq 0.05$) amongst the two clusters in terms of their performance. Clearly, cluster two performed better than cluster one, with a mean performance index of 4.9302 and 4.2850 respectively. Moreover, the two clusters were distinguished by virtue of an external performance variable, which validated their existence in the first place.

As the two clusters of firms could also be distinguished by their internal variables, it was also important to test the differences between the component variables that made up cluster one against the corresponding variables that made up cluster two. In other words, this test is to check if there is any significant difference between each variable that formed each cluster with the same variable that formed the other cluster. There were seventy internal variables used to distinguish the two clusters of firms. Twenty five of the variables formed the construct, management accounting systems' presentation of information while another forty five were variables on the construct, management accounting practices/techniques. All of these variables were treated as continuous variables by virtue of being Likert scales of at least five categories. Even if a stricter interpretation of categorical (discrete) scales is assumed, SPSS two step cluster analysis will not pose any problem. The log-likelihood distance measure can handle both continuous and categorical variables. It is a probability-based distance. The distance between two clusters is related to the decrease in log-likelihood as they are combined into one cluster. In calculating log-likelihood, normal distributions for continuous variables and multinomial distributions for categorical variables are assumed. It is also assumed that the variables are independent of each other, and so are the cases. However, SPSS states that empirical internal testing indicates that the procedure is fairly robust to violations of both the assumption of independence and the distributional assumptions.

As the two cluster solution was considered to be final and legitimate, attempt was made to see if there was any significant difference between each of the seventy variables that made up cluster one against the corresponding one that made up cluster two. Given that each variable that made up management accounting systems' information attributes and management accounting practices/techniques would be treated as the test variable and the cluster membership as the grouping variable, the choice of statistical test would depend on whether the cluster analysis resulted in a two cluster solution or more than two cluster solution. Again, as a two cluster solution was accepted in this case, an independent samples t-test or z-test was appropriate. The most important difference between a z-test and a t-test is that a z-test usually assumes that the key population parameters, i.e. the population mean and the population standard deviation are known. Since the population mean and the population standard deviation were not known in this study, a t-test seemed to be more appropriate. However, if the sample size is sufficiently large, i.e. over 120, then the results of the t-test and the z- test are close. In this study, as the sample size was 127 (i.e. over 120), the z-test could be used[3]. SPSS version 12.0.1 cannot run the z-test directly from the cluster analysis output data. As such, the relevant information generated by SPSS was exported to MS Excel spreadsheet and a z-test was undertaken. The underlying assumptions needed to be tested first. These assumptions were all fulfilled. They will be explained in chapter five.

It was found that the p values were all below 0.05 for each pair of variables tested indicating that there were significant differences between the mean scores of cluster one against cluster two. All the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables indicated higher mean readings for cluster two. Detailed results of the z-test and further discussion will be reported in chapter five.

4.9 Issues On Demographic Controls And Testing For Bias

In section 4.8 and its various sub-sections, a two cluster solution was determined and validated from the cluster analysis of management accounting systems' presentation of information and management accounting practices/techniques. As the cluster analysis could only be done on respondents as opposed to non-respondents who were also part of the population of those working in the Malaysian manufacturing sector, the likelihood of a non-response bias was real. Had these non-respondents answered the questionnaires, the

[3] It should be noted that if more than two clusters were identified, then the analysis of variance (ANOVA) would be employed instead of the z-test.

results could have been different. Respondents' demographic backgrounds too have sometimes been cited as possible source of bias. In the following sub-section 4.9.1 the issue of demographic controls is espoused. Discussion on testing for non-response bias will ensue in sub-sections 4.9.2 and 4.9.3.

4.9.1 Demographic Controls

The possibility exists that respondents' demographic backgrounds may introduce bias. Respondents could come from accounting and non-accounting backgrounds. Some writers suggest that an examination of the mean responses, between these groups, for the various variables can be subjected to a t-test to determine if there is any significant difference. Other demographics of the respondents (e.g., experience, seniority, age and gender) and the respondents' organizations (e.g., size, industry sector, ownership concentration) can also be analysed in terms of their confounding effects on hypothesised relationships. However, in this study, differences in responses purely and simply on demographic or background factors are not considered as causing bias. These variables were in fact treated as factors on their own right to be tested against the clusters of firms in order to discern any meaningful relationships.

4.9.2 Non-Response Bias In Mail Surveys

The mail survey has been criticized for non-response bias. If respondents who respond differ substantially from those who do not, the results do not directly allow one to say how the entire sample would have responded which is certainly an important step before the sample is generalized to the population.

The most commonly recommended protection against non-response bias has been the reduction of non-response itself. Non-response can be kept under 30% in most situations if appropriate procedures are followed (Kanuk *et al.*, 1975). Another approach to the non-response problem is to sample non-respondents (Hansen *et al*, 1946). For example, Reid (1942) chose a 9% sub-sample from his non-respondents and obtained responses from 95% of them. Still another approach to the non-response problem is to estimate the effects of non-response (Daniel and Wayne, 1975). Many researchers have concluded that it is not possible to obtain valid estimates (Ellis *et al*, 1970; Hochstim and Athanasopoulous, 1970; Lansing and Morgan, 1971; Ognibene, 1971). Filion (1976) reanalysed data from Ellis *et*

.al (1970) and concluded that, in fact, extrapolation did help. Furthermore, Erdos and Morgan (1970) favour estimation where judgement warrants.

4.9.3 Estimating Non-Response Bias

The literature on non-response bias (e.g., Kish, 1965) describes three methods of estimation: comparisons with known values for the population, subjective estimates, and extrapolation. Each one of the methods will be briefly discussed below.

1. *Comparison with known values for the population.*

   Results from a given survey can be compared with known values for the population (e.g., age, income). However, as the known values come from a different source instrument, differences may occur as a result of response bias (Wiseman, 1972) rather than non-response bias. Furthermore, even if the tested items are free from non-response bias, it is often difficult to conclude that the other items are also free from bias (Ellis *et. al*, 1970). Regardless, the use of known values still can be helpful.

2. *Subjective Estimates.*

   Several researchers (e.g. Brown, 1969) have suggested that subjective estimates of non-response bias would be useful. It is not clear how these subjective estimates of bias should be obtained, although several approaches have been proposed. One approach is to determine socio-economic differences between respondents and non-respondents (Vincent, 1964). For example, respondents generally are better educated than non-respondents (Wallace, 1954), and there may be differences in personality between respondents and non-respondents (Vincent, 1964). The 'interest hypothesis' is another widely recommended basis for subjective estimates (Donald, 1960). It involves the assumption that people who are more interested in the subject of a questionnaire respond more readily (e.g., Larson and Catton, 1959), and that non-response bias occurs on items in which the subject's answer is related to his interest in the questionnaire (Blair, 1964). Finally, Rosenthal (1965) concludes from a review of the literature that people are more likely to respond to a questionnaire if they would make a favourable impression upon anyone who reads the responses. Despite the uncertainty about the use of subjective estimates, they are used in practice. Furthermore, they have been shown to have some validity in Schwirian and Blaine (1966), where the direction of bias was correctly predicted for each of seventeen items.

3. *Extrapolation Methods.*

Extrapolation methods are based on the assumption that subjects who respond less readily are more like non-respondents (Pace, 1939). 'Less readily' has been defined as answering later, or as requiring more prodding to answer. The most common type of extrapolation is carried over successive waves of a questionnaire. 'Wave' refers to the response generated by a stimulus, e.g. a follow-up postcard. Persons who respond in later waves are assumed to have responded because of the increased stimulus and are expected to be similar to non-respondents. Time trends provide another basis for extrapolation (Ferber, 1948). Persons responding later are assumed to be more similar to non-respondents. The method of time trends has an advantage over the use of waves in that the possibility of a bias introduced by the stimulus itself can be eliminated. On the negative side, it is difficult to measure the time from the respondent's awareness of the questionnaire until completion. The method of concurrent waves involves sending the same questionnaire simultaneously to randomly selected sub-samples. Wide variations are used in the inducements to ensure a wide range in rate of return among these sub-samples. This procedure allows for an extrapolation across the various sub-samples to estimate the response for a 100% rate of return. The advantage of this procedure is that the extrapolation can be done at an early cut-off date because only one wave is required from each of the samples.

In this study, the percentage of non-response is not known. The questionnaires were distributed to 2,432 members of the Chartered Institute of Management Accountants (CIMA), Malaysia Division. CIMA, Malaysia Division had agreed to label address and mail the survey sets, each comprising of a questionnaire, a cover letter, a postage paid self addressed return envelope and an inducement. No information as to how many of the respondents worked in the manufacturing sector was made available due to the confidentiality requirement insisted by the professional accountancy body. From the 2,432 questionnaires administered, 130 responded, out of which only 127 responses were considered usable. Three were deleted after data entry upon discovering that they had far too many missing values. All the 130 responses were collected over a period of twelve weeks. The data collection exercise was called off after a period of sixteen weeks from the time of mailing. During keying-in of the data into the SPSS software, each questionnaire was given a serial identity, labelled as serial and a 'wave' number. Here, a wave is defined as those questionnaires that were received within a period of two weeks. It was possible to segregate the questionnaires into the above definition of waves as the questionnaires were periodically collected from the post office mailbox every two weeks. Hence, those questionnaires collected in the first two weeks from the time of mailing would fall into wave one, and those collected in the last two weeks would be categorized as belonging to wave. This means there were six waves over a period of twelve weeks. After the twelve week collection period, no more questionnaire arrived and the whole collection exercise was called off once the sixteen week period had elapsed.

The first wave saw the largest number of responses, with a frequency of fifty eight and accounting for 45.7% of the 127 usable responses. The second, third, fourth, fifth and sixth waves registered frequencies of twenty one, sixteen, twenty, five and seven respectively. To test for non-response bias, a variant of the extrapolation methods discussed above would be adopted. It was assumed that later waves behaved more like non-response compared to earlier waves. If there was any significant difference between the waves with the two cluster solution, then a non-response bias might have existed and could have compromised the legitimacy of the findings. If this was the case, it might be necessary to estimate the direction and the magnitude of the non-response bias. The test entailed finding out if there was any significant association between the six waves and the two clusters. As the data scales were not interval or ratio, a non-parametric test was appropriate. One of the most popular ways to test for statistical significance in the social sciences is by using the chi square test of independence, which measures variables at the nominal and ordinal level, or categorical data (Walsh, 1990). The chi square compares the frequency of expected values, if chance alone were operating, with the observed values (Rowntree, 1991). It will not tell how strong a relationship is or in what direction it is; nevertheless, it helps researchers screen out those contingency tables that are significantly weak (O'Sullivan, 1995).

In this study, to test for non-response bias, this chi square test for relatedness or independence is used. The waves and the clusters would be treated as the rows and columns respectively. A chi square test requires three assumptions to be met. All the assumptions were satisfied. These assumption testings will be discussed in chapter five. The Pearson's p-value in this case was 0.196. Since the p-value was more than 0.05, there was no significant association between the waves of responses and the cluster membership. In other words, later waves were not significantly different from earlier waves. The relevant tables and discussion will be shown in chapter five.

The two cluster solution was chosen to be tested against the six waves for significant difference as the two cluster solution is the lynchpin in the conceptual model. The result from this test is considered sufficient in identifying possibility of a non-response bias. However, further tests of significant differences between the waves and the continuous recoded institutional, contingency and weighted performance index variables were also undertaken to provide more evidence on the occurrence, if any, of non-response bias. These further tests necessitate the use of one-way analysis of variance (ANOVA) with post-hoc comparisons. The post-hoc sub-test chosen was Tukey's honestly significant difference (HSD), as this sub-test is said to be more lenient in identifying any significant differences between the waves. All the three assumption testings and the results of the one-way ANOVA will be discussed in chapter five. At this juncture, it was sufficient to report that non-response bias was not significantly detected from these further tests.

4.10 Method Used To Test For Significant Associations Between Cluster Solution And Ancillary Factors (Background Information And Manufacturing Management Methods)

The conceptual model in sub-section 3.4.1 in chapter three, groups background information and manufacturing management methods as ancillary factors to be tested against the two clusters for any significant association. Again, as the ancillary factors and the clusters were two sets of categorical (discrete) variables, the chi square test for independence or relatedness would be used to determine whether the two sets of variables were related. The ancillary factors would be the rows while the two clusters would form the columns of the crosstabulation. The chi square test compares the frequency of cases found in the various categories of one variable across the different categories of another variable. Percentages can also be solicited from the SPSS software. As with other statistical tests, the assumptions underlying the chi square test needed to be addressed first before the test findings could be considered valid. These assumption testings and the discussion that follows will be elaborated in chapter five. At this juncture, it would suffice to indicate that all the assumptions were met, albeit with some recoding.

In this study, the total sample size was 127 cases and as such, the minimum expected count for validity would be one. Crosstabulations and chi square tests were performed on each variable that constituted background information and manufacturing management methods as the rows against the cluster number as the columns. There were ten questions that made up background information as contained in section A of the questionnaire. These questions were on gender, age, educational background, length of service, management level, remuneration, decision-making function, functional responsibility, area of operation and status of firm. Some of the questions stood as single variables while other questions were broken down into many separate variables to facilitate data input into the SPSS. This gave rise to twenty seven variables for section A. The variable manufacturing management methods was a separate categorical (discrete) nominal variable as in section B of the questionnaire. For this variable, respondents were required to select one of three choices of unit and small batch production, large batch and mass production, and finally, continuous process production.

Combining sections A and B, altogether there were twenty eight variables that constituted ancillary factors (background information and manufacturing management methods). After running the crosstabulations and the subsequent chi square tests, virtually all the relevant p-values were more than 0.05 except for two variables, namely education-certificates and previous length of service. This meant that except for education-certificates and previous length of service, there were no significant associations between the variables and the clusters. The minimum expected count for the education-certificates versus cluster number was 2.15. This was above the required minimum of one. Hence, the chi square test was valid. The p-value was 0.028 (lower than 0.05) indicating that there was a significant association between education-certificates and the cluster solution. Tabulations on the analyses and the resulting discussion will be reserved in chapter five.

The p-value for the previous length of service variable was also less than 0.05, indicating a significant association. However, the minimum expected count was only 0.32 which was less than one. As such, the result was not valid. After 'collapsing' (a way of recoding) some variable values, the chi-square test was performed again on the recoded previous length of service against clusters. The resultant p-value of 0.021 (lower than 0.05) showed that there was a significant association between the recoded previous length of service with the clusters, with a valid minimum expected count of 8.96. Tabulated analyses and findings will be produced in chapter five.

4.11 Method Used To Test For Significant Differences In The Mean Scores Of The Institutional And Contingency Factor Variables For The Cluster Solution

In section 4.10, the two clusters were tested for significant associations with all the background information (section A of questionnaire) and manufacturing management methods (section B of questionnaire). The non-parametric chi square test for independence or relatedness was chosen for the purpose, as the clusters and each variable that constitutes background information and manufacturing management methods were all categorical or discrete variables. In this section, attempt will be made to see if there was any significant difference between the two clusters and each of the interval variables that made up the institutional and contingency factors as contained in sections F and G of the questionnaire. Despite the Likert scales being ordinal in nature, they were taken to be interval as all of them had seven points. This would enable the parametric independent samples t-test to be selected for significant testing. The t-test is appropriate for a single interval dependent and a dichotomous independent to test the difference of means. The t-test is used when sample sizes are small, typically less than thirty, but with larger samples the normal curve z test can be used. The normal curve z tests assume that the sample size n is large enough to form a normal curve. There is no accepted cut-off, but typically if $n < 30$, then t-tests should be used in place of z-tests. The t-tests are computed identically to z tests for larger samples, but a table of the t distribution is consulted with the corresponding degree of freedom. The two tests are in effect equivalent. Computation of t differs for independent vs. dependent samples, but inference is the same. The independent samples t-test is used to compare the means of a criterion variable for two independent samples or groups. Here, the interval criterion dependent variable was each of the institutional and contingency variables, and the dichotomous independent groups were the two clusters[4]. When $p \leq 0.05$ a researcher concludes that the two groups are significantly different in their means.

The assumptions underlying the independent samples t-test were evaluated first because the accuracy of test interpretation depends on whether any of the assumptions is violated. These assumption testings will be reported in chapter five. In summary, all the underlying assumptions were adequately complied with. To find out whether there was a significant difference between the two groups (clusters), the two-tailed significant value (p value) of the t-test for the equality of means was examined. If the p value was equal to or less than 0.05, then there was a significant difference in the mean scores of the dependent variable

[4] With polytomous independent variables, researchers would have used analysis of variance (ANOVA).

for each of the two groups (clusters). Otherwise, there was no significant difference between the two clusters.

Examination of the results revealed that, for all the nine variables that made up institutional factors (section F of the questionnaire), seven variables were found to have statistically significant differences in their mean scores for clusters one and two. The seven variables were identified as the recoded versions of institutional mimetic 1 (Q81), institutional mimetic 2 (Q82), institutional mimetic 3 (Q83), institutional coercive 3 (Q86), institutional normative 1 (Q87), institutional normative 2 (Q88) and institutional normative 3 (Q89). As for the three recoded variables (i.e. where the missing values had been replaced by means) that made up the strategic manufacturing priority dimension of the contingency factor construct, all three of them were found to show significant differences in mean scores for the two clusters. As for the three recoded variables (the original missing values replaced by means) that formed the organizational interdependence dimension, none was found to be significantly different between the two clusters. There were twenty three recoded variables that constituted organizational structure: decentralization dimension of the contingency factor construct. After subjecting them to the t-tests for equality of means with the two clusters, only two variables were observed to exhibit significant differences in mean scores for the two clusters. The two variables concerned were the recoded decentralization 2 and decentralization 3. The last dimension that constituted the contingency factor construct was perceived environmental uncertainty. There were three recoded variables under this dimension. After the t-tests were carried out, it was found that none of the three recoded variables revealed any significant difference in mean scores for the two clusters. All the p values were more than 0.05 for the t-test for equality of means sub-test, where equal variances were assumed. Tabulations, explanation and discussion on the findings will be further elaborated in chapter five.

4.12 Method Used To Predict The Cluster Membership Based On Values From The Ancillary, Institutional And Contingency Factor Variables

In section 4.10, the twenty eight variables under ancillary factors (background information and manufacturing management methods) were tested for significant associations with the cluster solution using the chi square test for independence or relatedness. Only two variables, namely education-certificates and previous length of service were found to have significant associations with the clusters. In section 4.11, the independent samples t-tests were conducted to determine whether there was any significant difference in the mean score of each of the institutional and contingency factor variable for the cluster solution. Out of the nine institutional factor variables tested, seven were found to have significant differences in their mean scores for clusters one and two. Also, all variables that constituted strategic manufacturing priority under the contingency factor construct exhibited significant differences in mean scores for the two clusters. However, none of the organizational interdependence variables of the contingency factor construct was found to be significantly different in means for the two clusters. From the twenty three variables forming the organizational structure: decentralization dimension of the contingency factor construct, only two were significantly different in terms of their means for the two clusters. Not a single recoded variable (the original missing value replaced by means) of the perceived environmental uncertainty dimension of the contingency factor construct was observed to have significant difference in means for the two clusters. Therefore, altogether, there were 7+3+2 =12 significant recoded variables that had statistically different means for the two clusters. Out of the twelve significant recoded variables, seven were institutional variables and the remaining five were contingency variables. The contingency variables could be broken down into three strategic manufacturing priority variables and two organizational structure: decentralization variables. In this section, using all the significant variables tested above, further tests will be carried out to ascertain if any or some or all of the variables could predict the cluster membership based on the variables' values.

4.12.1 Techniques Available For Predicting (Explaining) And Model Testing

The requirement is to predict an outcome, such as group membership, from a set of variables. Besides predicting, model testing was also required; not just assessing the strength of association or relationship. A number of statistical techniques are available to do all those requirements. One is known as logistic regression. Logistic regression allows the prediction of a discrete outcome, such as group membership, from a set of variables that may be continuous, discrete, dichotomous, or a mix of any of these. The dependent or response variable can be dichotomous or more than two.

Discriminant analysis is also used to predict group membership with only two groups, even though it is still applicable for more than two groups. However, discriminant analysis can only be used with continuous independent variables (i.e. the predictors are at the scale level of measurement). Thus, in instances where the independent variables are categorical, or a mix of continuous and categorical, logistic regression is preferred.

Logistic regression has many variants. Binary (or binomial or Bernoulli) logistic regression procedure is a useful tool for predicting the value of a categorical response (dependent) variable with two possible outcomes (two groups). If there are more than two possible outcomes and they do not have an inherent ordering, the multinomial (or polytomous) logistic regression is used. Nevertheless, multinomial logistic regression can also be used as an alternative when there are only two outcomes or groups or classes. When there are multiple classes of the dependent variable (i.e. more than two possible outcomes) and they can be ranked (i.e. are ordered), then ordinal logistic regression is preferred to multinomial logistic regression. Another technique called logit regression has numerically identical results to logistic regression. Some computer programs offer both logit as well as logistic regression family of procedures, often with different output options. However, in case where the dependent variable is scale and some or all predictors are categorical, the generalized linear model (GLM) univariate procedure is appropriate. If both the dependent variable and independent variables (predictors) are at the scale level of measurement, then ordinary least square (OLS) linear regression is used.

4.12.2 The Choice Of Multinomial Logistic Regression Procedure

In this study, the dependent or response variable is the cluster solution. The proposed independent variables or predictors are the significant background information identified in section 4.10 and all the significant institutional and contingency variables ascertained in section 4.11. Both the significant background information variables (education-certificates and the recoded previous length of service) were categorical independent variables. All the respective institutional and contingency variables were deemed continuous. As there were only two categorical outcomes of the dependent variable (i.e. two separate clusters of firms), either one of three statistical techniques could be employed to test the models. The three available techniques were binary (binomial) logistic regression, multinomial logistic regression and logit regression.

For the purpose of this research, the multinomial logistic regression was chosen. Multinomial logistic regression is useful for situations in which the aim is to classify subjects based on values of a set of predictor variables. This type of regression is similar to binary logistic regression, but is more general because the dependent variable is not restricted to two categories. Multinomial logistic regression allows models to be tested to predict or explain categorical outcomes with two or more categories. The predictor (independent) variables can be either categorical or continuous, or a mix of both in the one model. In other words, multinomial logistic regression can be used to predict a categorical dependent variable on the basis of both categorical and continuous independent variables. The technique also serves other purposes. It can be used to determine the percent of variance in the dependent variable explained by the independents, to rank the relative importance of independents, to assess interaction effects and to understand the impact of covariate control variables. Covariates are continuous interval independents.

Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). In this way, logistic regression estimates the probability of a certain event occurring[5]. The success of the logistic regression can be assessed by looking at the classification table, showing correct and incorrect classifications of the dichotomous, ordinal, or polytomous dependent. Also, goodness-of-fit tests such as model chi-square are available as indicators of model appropriateness as is the Wald statistic to test the significance of individual independent variables.

4.12.3 The Need For Assumption Testings In The Multinomial Logistic Regression

Logistic regression enables the researcher to overcome many of the restrictive assumptions of OLS (ordinary least squares) regression. However, other assumptions still apply. With regard to this research, the main assumptions will be dealt with and reported in chapter five. For the purposes of this research, all the assumptions were duly met.

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[5] Note that logistic regression calculates changes in the log odds of the dependent, not changes in the dependent itself as OLS (linear) regression does.

4.12.4 Justification On Specifying A Stepwise Model For The Multinomial Logistic Regression Procedure

Stepwise logistic regression screens the available list of independent variables to select only those that it deems important in describing the dependent variable. While crosstabulation and independent samples t-test are one-at-a-time analyses, multinomial logistic regression is a simultaneous evaluation procedure. In practice, predictors do not work one at a time. They have a composite impact. The logistic regression evaluates among the competing predictors which predictors are the strong ones. This procedure helps to eradicate confounding and moderation effects in the model. As mentioned previously, the independent or predictor variables in logistic regression can take any form. That is, logistic regression makes no assumption about the distribution of the independent variables. They do not have to be normally distributed, linearly related or of equal variance within each group. The relationship between the predictor (independent) and response (dependent) variables is not a linear function in logistic regression, instead, the logistic regression function is used, which is the logit transformation of the dependent variable. The goal of logistic regression is to correctly predict the category of outcome for individual cases using the most parsimonious model. To accomplish this goal, a model is created that includes all predictor variables that are useful in predicting the response variable. Several different options are available during model creation. Variables can be entered into the model in the order specified by the researcher or logistic regression can test the fit of the model after each coefficient is added or deleted, called stepwise regression.

Stepwise regression, supported by SPSS, is used in the exploratory phase of research or for purposes of pure prediction. It is not recommended for theory testing (Menard 1995). Theory testing is the testing of a-priori theories or hypotheses of the relationships between variables. In the theory testing stage the researcher should base selection of the variables on theory, not on a computer algorithm. Menard (1995, p.54) writes, 'there appears to be general agreement that the use of computer-controlled stepwise procedures to select variables is inappropriate for theory testing because it capitalizes on random variations in the data and produces results that tend to be idiosyncratic and difficult to replicate in any sample other than the sample in which they were originally obtained'. Those who use this procedure often focus on step chi square output in SPSS, which represents the change in model chi square at each step. Exploratory testing on the other hand makes no a-priori assumptions regarding the relationships between the variables, thus the goal is to discover relationships. As this study was exploratory in nature, the stepwise logistic regression procedure employed was appropriate. The procedure was also defensible because there was no previous research on the subject matter on which to base hypothesis. Moreover, causality was not of interest.

4.12.5 Justification On Selecting The Forward Entry As The Stepwise Method

Generally, backward stepwise regression appears to be the preferred method of exploratory analyses, where the analysis begins with a full or saturated model and variables are eliminated from the model in an iterative process. The fit of the model is tested after the elimination of each variable to ensure that the model still adequately fits the data. When no more variables can be eliminated from the model, the analysis has been completed. Backward is also preferable due to suppressor effects in the forward method leading to a higher risk of type II error (declare that there is no significant effect when it really is there). A type II error results in the acceptance of the null hypothesis when in fact the alternative is true. However, in this study, based on the recommendation by Nau (2005), the forward entry method was adopted instead, since there was a very large set of potential independent variables to start with and only a few emerged as predictors in the final analysis.

4.12.6 Presenting The Results Of The Multinomial Logistic Regression

There are two main uses of logistic regression. The first is the prediction of group membership. Since logistic regression calculates the probability or success over the probability of failure, the results of the analysis are in the form of an odds ratio. Logistic regression also provides knowledge of the relationships and strengths among the variables.

Once the model has been built and predictions produced, it is necessary to determine how effective that model is at predicting the dependent variable. This is referred to as goodness-of-fit. To analyze goodness-of-fit for the logistic regression model, close parallels to the F ratio and R^2 tests used in linear regression were developed. In logistic regression the G_M statistic is analogous to the F test in linear regression (Menard 1995, Hosmer and Lemeshow 1989)[6]. The log-likelihood ratio statistic was used for selecting parameters in the logistic regression model. The SPSS statistical package presents not the

[6] Hosmer and Lemeshow denote G_M as G.

log-likelihood itself but the log-likelihood multiplied by –2. Output from SPSS denotes log-likelihood multiplied by -2 as '-2 Log Likelihood'. By multiplying the log-likelihood by -2 it approximates a χ^2 (chi-square) distribution (Menard 1995). Larger values of -2 log likelihood indicate worse prediction of the dependent variable. Before independent variables were entered into the logistic regression model, the –2 log likelihood for the model with only the intercept constant (α) was given. This intercept-only -2 log likelihood is designated D_0 (Denoted as L_0 by Hosmer and Lemeshow) to indicate that none (zero) of the independent variables were included in the equation. In SPSS, this value is located at the beginning of the output and is labeled 'Initial Log Likelihood Function -2 Log Likelihood'. D_0 is analogous to the total sum of squares (SST) in linear regression analysis (Menard 1995). At each additional step in the logistic regression procedure a new -2 log likelihood value was determined. This -2 log likelihood statistic was produced using only those independent variables included at that step and the intercept. This statistic is referred to as D_M^n (n denoting the step number in the logistic regression procedure) or the deviation χ^2 for the full model. D_M^n is analogous to the error sum of squares (SSE) in linear regression analysis and indicates how poorly the model fits with the independent variables in the equation (Menard 1995). Taking the difference between D_0 and D_M, that is (D_0 - D_M), gives the model G_M. In SPSS G_M is labeled as 'model chi square' and appears in the model fitting information table of the multinomial logistic regression. G_M is not only analogous to the multivariate F test, but also to the regression sum of squares (SSR) (i.e. SSR = SST - SSE) (Menard 1995). G_M provides a test of the null hypothesis that $\beta_1 = \beta_2 = \ldots.. = \beta_k = 0$ for the logistic regression model. If G_M is statistically significant, then the null hypothesis can be rejected, and it can be concluded that the independent variables contribute to better predictions.

The forward entry selection of the stepwise logistic regression starts with a model that only includes the intercept, if specified. At each step, the term whose addition causes the largest statistically significant change in –2 log likelihood is added to the model. Therefore, the final model should only include important predictors. In the initial run, only the recoded previous length of service appeared in the likelihood ratio test table, indicating that the variable was the only categorical variable (factor) among all the ancillary factors, that was a significant predictor to the cluster solution (dependent variable). Even the education.certificates that was earlier identified as having significant association with the clusters by the chi square test for independence, proved to be a non-predictor. By manually dropping off those variables that were not significant predictors and gradually bringing in new continuous variables (covariates) to be tested, Peduzzi *et al.* (1996)

recommendation of minimum ten observations per parameter was complied with. Thus, the sample size was adequate and as such, overfitting was not a concern.

In the final analysis, the likelihood ratio test table revealed that there were four significant predictors from among the ancillary, institutional and contingency independent variables. The predictors to the cluster solution (dependent variable) were the recoded previous length of service, instit_6 (recoded institutional coercive 3), instit_9 (recoded institutional normative 3) and mfg.st_3 (recoded manufacturing strategy 3). Tabulated analysis and discussion on the findings will be further followed up in chapter five.

4.13 Method Used To Predict Performance Based On Values From The Management Accounting Systems' Presentation Of Information And Management Accounting Practice/Technique Variables

In this section, attempt will be made to bridge the gap left by sub-sections 4.8.4 and 4.8.5. Section 4.8.4 confirmed that cluster two performed better than cluster one based on their mean performance indices. In section 4.8.5, all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables (altogether seventy variables) indicated higher mean readings for cluster two (the better performing firms). This implied that those firms which regarded management accounting systems' information attributes as more useful and claimed more benefit from practicing management accounting practices/techniques were the relatively better performing firms. The gap was to ascertain if any of the seventy variables could predict or explain performance, irrespective of the cluster solution. Based on the data consideration, this was best done by way of a multiple linear regression.

4.13.1 The Choice Of Multiple Linear Regression Procedure

Multiple linear regression is an extension of bivariate correlation. The result of the regression is an equation that represents the best prediction of a dependent variable from several independent variables. Regression analysis is used when independent variables are correlated with one another and with the dependent variable. Independent variables can be either continuous or categorical (discrete). However, in the latter case these variables must be coded as dummy variables. In contrast, the dependent variable must be measured on a continuous scale. In this section, as the dependent variable and all the independent variables were continuous, the multiple linear regression would be chosen. The dependent variable was the weighted average performance index. The independent variables were the twenty five variables that made up the recoded management accounting systems' presentation of information construct and the forty five variables that constituted the management accounting practice/technique construct. Altogether, there were seventy independents tested in the initial model. Multiple regression is used to account for (predict) the variance in an interval (i.e. continuous) dependent, based on linear combinations of interval, dichotomous, or dummy independent variables. In this study, there was no categorical independent variable. As such, there was no dummy variable involved. Multiple regression can establish that a set of independent variables explains a proportion of the variance in a dependent variable at a significant level (significance test of R^2), and can establish the relative predictive importance of the independent variables (comparing beta weights).

4.13.2 Justification On Specifying A Stepwise Model For The Multiple Linear Regression Procedure

There are three major multiple linear regression models, namely, standard or simultaneous multiple regression, hierarchical multiple regression and stepwise multiple regression. These models differ in two ways: first, in the treatment of overlapping variability due to correlation of the independent variables, and second, in terms of the order of entry of the independent variables into the equation. In the standard or simultaneous model, all independent variables enter the regression equation at once because the aim is to examine the relationship between the whole set of predictors (independent variables) and the dependent variable. In hierarchical multiple regression, the researcher determines the order of entry of the independent variables based on theoretical knowledge. In stepwise multiple regression, the number of independent variables entered and the order of entry are determined by statistical criteria generated by the stepwise procedure. Method of entry can be forward, backward or a combination of both. Forward selection involves the entry of predictors (independent variables) one at a time. The order of entry and whether the predictor is eventually accepted are decided on the basis of whether the F test exceeds a certain critical value (FIN) and whether a critical alpha level (PIN) is met. Backward selection starts with all the variables in the equation and gradually deletes poor performers on the basis of whether the partial F value is less than a critical value (FOUT). The default criterion (POUT) must also be met. Stepwise selection is a combination of the forward and backward procedures. It allows for the later removal of variables that were previously entered.

Stepwise regression is used in the exploratory phase of research or for purposes of pure prediction,, not theory testing. In the theory testing stage the researcher should base selection of the variables and their order on theory, not on a computer algorithm. Menard (1995) writes, 'there appears to be general agreement that the use of computer-controlled stepwise procedures to select variables is inappropriate for theory testing because it capitalizes on random variations in the data and produces results that tend to be idiosyncratic and difficult to replicate in any sample other than the sample in which they were originally obtained'. Likewise, the nominal 0.05 significance level used at each step in stepwise regression is subject to inflation, such that the real significance level by the last step may be much worse, even below 0.50, dramatically increasing the chances of Type I errors, i.e. thinking there is a relationship when there really is not (Draper, Guttman, & Lapczak, 1979). For this reason, Fox (1991) strongly recommends any stepwise model be subjected to cross validation. Since this study was exploratory in nature, the use of stepwise multiple regression was justified. The SPSS 12.0.1 tutorial states that ' if, however, you have many predictors and no idea where to start, running a stepwise analysis and adjusting the selected model provides better prediction than no model at all '. Also, in this study, there were no categorical (discrete) independent variables. As such, there was no need to create dummy variables. Treatment for dummy variables was therefore not applicable in this research.

4.13.3 The Need For Assumption Testings In The Multiple Linear Regression Procedure

A number of important assumptions underpinned the use of multiple linear regression. Details of the assumption testings will be reported in chapter five. In this study, all the important assumptions were adequately met and no transformation of variables was required.

4.13.4 Brief Results Of The Multiple Linear Regression Procedure For The Seventy Variables (Items)

Multiple linear regression (MLR) is a method used to model the linear relationship between a dependent variable and one or more independent variables. The dependent variable is sometimes also called the predictand, and the independent variables the predictors. MLR is based on least squares: the model is fit such that the sum-of-squares of differences of observed and predicted values is minimized. In the process of fitting, or estimating, the model, statistics are computed that summarize the accuracy of the regression model.

Because stepwise regression was requested, SPSS first tested a model with the most correlated independent (first selected independent). Then it tested a model with the first selected independent plus the variable with the highest partial correlation with the dependent controlling for the first selected independent. This might become the second selected independent if it significantly increased R^2. The process went on and on until all independents were tested one by one, each time controlling for the others. If a dependent variable significantly added to an increase of R^2, the independent would be included into the model.

SPSS produces a number of outputs that facilitate interpretations. In the variables entered/removed table, four significant predictors came out from the analysis of the final model. The four predictors were the recoded MAPT39, MAPT21, MAPT9 and MAPT17 (named and labelled as MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1 respectively). It was thus evident that out of the seventy variables tested as independent variables (i.e. all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables), only four emerged as significant predictors using the stepwise multiple regression procedure. All the four predictors were among the recoded management accounting practice/technique variables, and no predictor was identified from the management accounting systems' presentation of information variables. Details of the findings and subsequent discussion will be reserved in chapter five.

4.14 Method Used To Predict Performance Based On Values From The Management Accounting Systems' Presentation Of Information And Management Accounting Practice/Technique Dimensions

Insofar as multiple regression is concerned, larger samples are better than smaller samples (all other things being equal) because larger samples tend to minimize the probability of errors, maximize the accuracy of population estimates, and increase the generalizability of the results. However, published sample size guidelines tend to take a number of different opinions. This is problematic because statistical procedures that create optimised linear combinations of variables such as multiple regression tend to overfit the data. This means that these procedures optimise the fit of the model with the given data; yet no sample is perfectly reflective of the population. Thus, this overfitting can result in erroneous conclusions if models fit to one data set are applied to others. In multiple regression this manifests itself as inflated R^2 (shrinkage) and misestimated variable regression coefficients (Cohen & Cohen, 1983). The ultimate concern is error. At the end of the analysis, if one has too small a sample size, errors of inference can easily occur. Also, adding variables to the equation while hoping that each addition significantly increases R^2 will pose a temptation to add too many variables just to increase R^2 by trivial amounts. Such overfitting trains the model to fit noise in the data rather than true underlying relationships. Subsequent application of the model to other data may well see substantial drops in R^2.

As noted, there are many different opinions as to the minimum sample size one should use in prediction research. The general process for creating a prediction equation involves gathering relevant data from a large, representative sample from the population. What constitutes large is open to debate, and while guidelines for general applications of regression are as small as $50 + 8m$, where m = number of predictors (Tabachnick & Fidell, 2001), guidelines for prediction equations are more stringent due to the need to generalize beyond a given sample. While some authors have suggested that fifteen subjects per predictor as sufficient (Park & Dudycha, 1974; Pedhazur, 1997), others have suggested minimum total sample (e.g., 400, see Pedhazur, 1997), a minimum of forty subjects (cases) per predictor (Cohen and Cohen, 1983; Tabachnick & Fidell, 2001). Of course, as the goal is a stable regression equation that is representative of the population regression equation, more is better. In multiple regression texts some authors (e.g., Pedhazur, 1997) suggest subject (case) to independent variable ratios of 15:1 or 30:1 when generalization is critical. There are also researchers that recommend an ideal case to independent variable ratio of 20:1, that is twenty cases (subjects) for every independent variable in the model. The lowest ratio allowed in the literature is 5:1 (i.e. just five cases for every independent variable in the model). In this study, as the predictors emerging from the final model of the stepwise method were four predictors, it seemed that a ratio 30:1 could be complied with. This meant that thirty cases multiplied by the four predictors would yield a figure of 120, which was just below the usable sample size of 127. The ratio of 30:1 in this study might not satisfy the most stringent requirement for a stepwise multiple regression. Nonetheless, the ratio was supported by some authors such as Pedhazur (1997). According to Tabachnick and Fidell (2001), a rule of thumb for testing b coefficients is to have the sample size, $N \geq 104 + m$, where m = number of predictors. For stepwise regression, $N \geq 40m$ is a rule of thumb since stepwise methods can train to noise too easily and not generalize in a smaller dataset. A rule of thumb for testing R^2 is $N \geq 50 + 8m$. Where $m \geq N$, regression gives a meaningless solution with $R^2 = 1.0$. In general, a larger N is needed when the dependent variable is skewed. If Tabachnick and Fidell (2001) guidelines were to be used, it would seem that for stepwise multiple regression employed in this study, the minimum sample size required would have been 160, as 40 x 4 predictors =160. Thus, the usable sample size of 127 in this study would have fallen short of requirement.

One way to follow these stricter guidelines on sample size is to use constructs or dimensions rather than individual variables as the independent variables. As explained in section 4.7 above, factor analyses and reliability tests on the recoded management accounting systems' presentation of information dimensions and management accounting practice/technique construct had identified latent dimensions. Using constructs or dimensions as the independent variables has a number of other advantages. It meets the requirement of the reliability assumption in multiple regression better, as problems with measurement errors can be ameliorated. One of the best things that can be done to deal with measurement errors, especially systematic errors, is to use multiple measures of the same construct or dimension. Independent variables consisting of constructs or dimensions may also be more valid. In terms of convergent validity, which is a type of construct validity, the indicators for a given construct should be at least moderately correlated among themselves. Poor convergent validity among the indicators (variables) for a factor may mean the model needs to have more factors. Cronbach's alpha is commonly used to establish convergent validity (also referred to as reliability or internal consistency). A second, broader meaning of convergent validity has to do with the convergence of related scales and instruments. Convergent validity in this sense exists when the researcher's proposed scale or measure of a given construct correlates with measures of the same construct using instruments proposed by other researchers. In this study (see section 4.7 on unidimensionalities of research constructs and dimensions), factor analyses and reliability tests were conducted on the research constructs and dimensions. The convergent validity on each construct or dimension was thus assured. Discriminant validity, also a type of construct validity, refers to the principles that the indicators for different constructs should not be so highly correlated as to lead one to conclude that they measure the same thing. Factor analysis is commonly used to establish discriminant validity. In this study, the issue of discriminant validity was not addressed by way of looking at the bivariate correlations as the computations would be far too enormous to relate to this research. Instead, collinearity statistics in the multiple regression procedure would be used. Before discussing multicollinearity, it should be acknowledged that without any correlation between predictors, multiple regression analysis would merely be a more convenient method of processing a series of bivariate regressions. Relationships between variables then actually give meaning to multiple regression, and indeed all multivariate statistical techniques. If the correlation between two predictors (or a linear combination of predictors) is inordinately high, however, then conditions can arise that are deemed problematic. A distinction is thus routinely made between correlated predictors and multicollinearity.

Although no universally acceptable definition of multicollinearuty has been established, correlations of 0.70 and above are frequently mentioned as benchmarks. Highly correlated predictors can cause problems in a regression or regression-like model (e.g., logit). These problems are principally ones of reliability and interpretability of the model coefficient estimates. A common solution, therefore, has been to delete one or more of the offending collinear model variables, or to use factor or principal components analysis to reduce the amount of redundant variation present in the data. Multicollinearity, however, is not always harmful, and deleting a variable or variables under such circumstances can be the real problem. The collinearity statistics in this study revealed the absence of perfect multicollinearity (i.e. all variance inflation factors or VIF were below four, in fact all were below two), indicating that variables (indicators) for different constructs/dimensions were not highly correlated. Thus, discriminant validity was assured. Deleting some variables or using factors (principal components) as the independent variables was therefore unnecessary. Nonetheless, it would still be useful to test reliable factors (principal components) as alternative independent variables in the multiple regression modelling.

Due to the arguments elaborated above, in this section, an alternative stepwise multiple regression procedure would be conducted to supplement the above stepwise multiple regression. This time the independent variables would be reliable dimensions of the management accounting systems' presentation of information and management accounting practices/techniques. The dependent variable would still be the weighted average performance index.

Based on the results of factor analyses and reliability tests discussed in section 4.7, the four dimensions that made up management accounting systems' (MAS) presentation of information were confirmed. The four dimensions were the recoded MAS scope of information (comprising of six variables or indicators), MAS timeliness of information (consisting of four indicator variables), MAS aggregation of information (with twelve indicator variables) and MAS integration of information (with three indicator variables). Factor analyses and the subsequent reliability tests on the management accounting practice/technique construct unravelled six latent dimensions. The dimensions were labelled as budgeting techniques (comprising of the recoded MAPT1, MAPT5, MAPT6, MAPT7, MAPT8, MAPT10, MAPT36, MAPT42 and MAPT45), performance benchmarking (composed of the recoded MAPT34, MAPT15, MAPT32, MAPT16, MAPT39, MAPT33, MAPT27, MAPT9, MAPT38, MAPT21, MAPT13, MAPT25, MAPT26, and MAPT29), performance evaluation (consisting of the recoded MAPT4, MAPT2, MAPT12, MAPT3, MAPT14 and MAPT11), costing techniques (recoded MAPT23, MAPT43, MAPT40, MAPT44, MAPT17, MAPT31 and MAPT22), strategic planning techniques (recoded MAPT18, MAPT20, MAPT30, MAPT37, MAPT19 and MAPT24) and quality control techniques (recoded MAPT28, MAPT35 and MAPT41). Therefore, there were ten independent factors tested in the model (i.e. four dimensions from the recoded management accounting systems' presentation of information construct and six dimensions from management accounting practice/technique construct).

4.14.1 Brief Results Of The Multiple Linear Regression Procedure For The Ten Dimensions (Factors)

The results of the stepwise multiple regression procedure showed that the only significant predictor to the weighted average performance index was the performance benchmarking factor (comprising of the recoded MAPT34, MAPT15, MAPT32, MAPT16, MAPT39, MAPT33, MAPT27, MAPT9, MAPT38, MAPT21, MAPT13, MAPT25, MAPT26, and MAPT29). Except for MAPT17, all the significant predictors in the stepwise multiple regression of variables (as opposed to dimensions as predictors) could be found within the performance benchmarking dimension. The former significant predictors within the performance benchmarking dimension were the recoded MAPT39, MAPT21 and MAPT9. Details of findings and discussion will be reserved in chapter five.

4.15 Summary

This chapter covers two aspects of research methodology, viz. research design and variable measurement. The sampling design describes the sampling frame, the sampling method and sample selected. Five respondents were used to pre-test the questionnaire with the aid of a qualitative interview sheet as mentioned in chapter three. The questionnaires were administered to 2,432 members of the Chartered Institute of Management Accountants (CIMA), Malaysia Division. However, only those working in manufacturing or had experience working in manufacturing concerns were solicited to respond. A quota sampling method would be used as often the case in a typical social science research. This chapter also describes how the research was conducted. The survey method was chosen. Details on the development of the research instruments (qualitative interview sheet and questionnaire) are outlined. An overall view of how the survey (including interviews) had transpired and what to look for would be clearly mentioned. Sources of the component parts of the research instruments with appropriate adaptations to match the study are clearly highlighted and supported. The measurements of constructs and dimensions used in the research instruments are appropriately laid out. These include scaling techniques, such as the Likert scales, where rating scores are explained. Issues relating to data screening, cleaning, recoding and transformation are discussed. Factor analyses and reliability tests on the constructs and dimensions used in the research are explained with summary results briefly reported.

The statistical tests used in this survey are discussed step by step. Justifications of the statistical techniques used are given ample emphasis. Generally, assumption testings are not deliberated in this chapter. These assumption testings will instead be pursued in chapter five.

As the use of cluster analysis would be employed to determine the typology of firms (cases) based on the variables management accounting systems' presentation of information and management accounting practices/techniques, the critical issues in the use of cluster analysis are discussed. The choice and mechanism of the SPSS two step cluster analysis are explained. Results of the cluster analysis are cursorily revealed and then criterion validated with performance. Cluster analysis is the main tool used in the systems approach to contingency studies. In subsequent chapters, where findings are analysed and interpreted, it would be useful to come back to the discussion on cluster analysis. The management accounting systems' presentation of information and management accounting practice/technique variables that formed the clusters were tested for differences using the z test and summary findings reported.

Issues relating to demographic controls and testing for non-response bias are also taken on board. Demographic factors are regarded as not causing any bias. Non-response is approximated by later 'waves' in the survey responses. The chi square test for independence would be the chosen method to test if there was any significant difference between earlier and later waves. Results are briefly reported.

The cluster solution would be tested for significant associations with the background information (demographic control) and manufacturing management methods. The selection of the chi square test for independence or relatedness is explained. Summary findings are tied to the discussion.

Testing for significant differences in the mean scores of the institutional and contingency factor variables for the cluster solution was done using the independent samples t-test. The choice of the independent samples t-test is defended.

In order to predict the cluster membership based on the values from the background information, manufacturing management methods, institutional and contingency factor variables, the use of the multinomial logistic regression was employed. The stepwise model was selected with forward entry as the stepwise method. This chapter allocates a lot of attention in justifying the use of the forward entry stepwise multinomial logistic regression procedure. Abridged results are briefly described. Assumption testings will be followed on in chapter five.

As management accounting systems' presentation of information and management accounting practice/technique variables were used to cluster analyse the respondent firms, this chapter explains how the variables can be used to predict performance. It has been explained before that the clusters were criterion validated with performance, but not the elements that made up the clusters. To predict performance based on the constituent variables in each cluster, the multiple linear regression procedure was selected. In particular, the stepwise model for the multiple linear regression was specified. Detailed arguments to justify the use of the stepwise model and the multiple linear regression procedure are put forward. Testings for underlying assumptions are not pursued, as the testings will be covered in depth in chapter five. Results of the multiple regression exercise are briefly mentioned. Detailed interpretations of the results will be discussed in chapter five.

To supplement the above multiple linear regression of constructs' variables to predict performance, an alternative multiple linear regression of the constructs' dimensions, also to predict performance was executed. The reasons for this auxiliary multiple linear regression procedure are elaborately delved into. Even though a brief result of this alternative regression exercise is revealed, the main discussion will be reserved in chapter five.

All in all, this chapter four on research design and variable measurements does not just endeavour to lay out the finer details of the research methodology but also reports some essential findings in order to make sense of the relevant discussion. Detailed assumption testings considered pertinent but not discussed in this chapter will be duly explained in chapter five.

The following chapter five on data analysis and discussion too will invariably need to expand on and give another focus on the main statistical methods used to round up the discussion. Chapter five will reiterate much of the findings reported in this chapter four with emphasis on tabulations and analyses of data. Some discussion in this chapter four will be revisited in chapter five to facilitate interpretations. Nonetheless, chapter five will concentrate more on discussing the outputs from the data analyses rather than justifying the various methodological issues. In chapter six the main findings will be recapitulated and matched with the hypotheses generated in chapter three with a view of answering all the research objectives.

CHAPTER FIVE

DATA ANALYSIS AND DISCUSSION

5.1 Introduction

The aim of this chapter is to report the outcomes of data analyses and to discuss the findings. While the adoptions of the various statistical techniques were explained in chapter four with summary results disclosed, chapter five will concentrate on furnishing detailed findings including results from the main assumption testings. This will entail appropriate tabulations and graphical presentations coupled with the ensuing discussion. Some logical interpretations will also be elucidated.

This chapter is divided into thirteen sections. Section 5.2 will report on the main outcome of the five interview sessions. Only a brief summary of the overall interview sessions will be highlighted. The excerpt summary of full interview sessions is made available in appendix two. In appendix one, a specimen copy of the interview sheet listing all the interview questions is furnished. Section 5.3 will provide a guide on all the variable names and labels used in the study. Where appropriate, this will enable a systematic tracking of each variable to the corresponding question in the questionnaire proper. A specimen copy of the survey questionnaire is enclosed in appendix four.

In section 5.4, results from the factor analyses and reliability tests on all the management accounting systems' presentation of information dimensions and management accounting practice/technique construct will be shown. No other dimensions or constructs will be subjected to factor analyses and reliability tests, as such dimensions/constructs are not required for subsequent data analyses. Instead, variables or indicators within these other dimensions/constructs will be utilized in further analyses.

Section 5.5 will briefly show the computation of the weighted average performance index from the relevant data surveyed. The weighted average performance index is a measure used to gauge performance of firms and/or indicators (i.e. either variables or factors). The weighted average performance index will also be tested for normality to ascertain its suitability as a dependent variable in further multiple regression exercises.

Cluster analysis of all the variables constituting management accounting systems' presentation of information and management accounting practices/techniques is discussed in section 5.6. Clustering issues of whether to standardize or not to standardize variables, multicollinearity among clustering variables, reliability and validity of the cluster solution, and testing cluster differences will be explained and resolved. The result suggests the existence of two clusters of firms based on the clustering variables mentioned. Section 5.7 will dispel the existence of non-response bias with the appropriate statistics.

The clusters of firms will be tested for significant associations with the background information (such as gender and age of respondents) and the manufacturing management methods. This will be covered in section 5.8. Each institutional and contingency variable (indicator) is also subjected to a test for significant association with the clusters of firms. This will be explained and discussed in section 5.9. The results from sections 5.8 and 5.9 will be further analysed in a multinomial logistic regression model with the clusters of firms as the dependent variable. The findings and the respective discussion will be elaborated in section 5.10.

Section 5.11 will determine whether variables (indicators) forming the management accounting systems' presentation of information and management accounting practices/techniques can predict or explain the weighted average performance index. This will be undertaken through the use of a multiple linear regression model. The findings, including results from the main assumption testings will be fully reported and interpreted. The results show that no transformation of data is required. A number of predictors are also identified.

In order to fulfil a more stringent sampling requirement espoused by some authors, the multiple linear regression exercise as per section 5.11 will be repeated using a slightly different model. This time, the factor analysed dimensions of management accounting systems' presentation of information and management accounting practices/techniques will be treated as the independent variables instead of the indicators. These factor analysed dimensions will have already been identified in section 5.4. The full discussion on the findings of this alternative modelling will be reserved in section 5.12. From the findings, appropriate interpretation will be made and related to the corresponding interpretation in section 5.11.

Section 5.13 will conclude the chapter by providing a summary of the core findings. This section also provides a brief prelude to the conclusion chapter (i.e. chapter six) where the main findings of this study will be recapitulated and reiterated with a view of wrapping up the research questions, objectives and hypotheses introduced in chapter three.

5.2 Analysis of Interviews

The development of the research instruments started from an interview sheet listing a number of open-ended questions. The instruments were only be finalized once acceptable levels of content validity and internal reliability were established. This validity and reliability checking involved, in part, a due process of interviews and pre-testing of the survey questionnaire. A copy of the interview and pre-testing of survey questionnaire sheet is presented in appendix one of this thesis. The summary or excerpt of the interview sessions with five management accounting professionals in five different organizations/firms in Malaysia appears in appendix two. Only the essence of their comments and arguments are outlined. The full transcripts of the five interviews have not been produced, but are available on request. The following sub-section will highlight the core findings from the interview sessions.

5.2.1 Findings From The Interviews

Based on the analysis of the transcripts of interviews from the five interviewees, it was found that the originally drafted survey questionnaire was acceptable to all interviewees in its entirety. This feedback formed the pre-testing of the questionnaire instrument. The pre-testing justified the retention of the original survey questionnaire without any modification. The whole interview and pre-testing of survey questionnaire sessions were designed to assure face validity before full administration of the survey questionnaire proper was undertaken. As such, the interviews confirmed the face validity of the survey questionnaire. The interviews/pre-testing of questionnaire will also serve as valuable input in interpreting findings and deducing conclusions therefrom. This will be drawn together in chapter six on the conclusion of the research.

However, there is one aspect of the interview sessions that deserves attention in this sub-section. It is the specific requirement to meet research objective one. Although all the research objectives, questions and hypotheses will eventually be addressed in chapter six, the reporting of issues relating to research objective one will be introduced in this sub-section as this will not be covered by the analyses of responses from the survey questionnaire. It should be noted that research objective one as outlined in chapter three does not need hypothesis testing. It can be satisfactorily deduced from the analysis of the transcripts of the interviews. Research objective one requires respondents to describe the nature, extent of diversity and stability of management accounting systems' information attributes and management accounting practices/techniques used in various sectors of the manufacturing industry in Malaysia. As for management accounting systems' (MAS') information attributes, the answer could be derived from questions 4, 5 and 6 of the interview sheet (see appendix one). The summarized feedback can be seen in appendix two. Nonetheless a highly condensed answer will be furnished below.

On the nature of management accounting systems' (MAS') information (see question 4 of the interview sheet), overall the interviewees agreed that MAS' information varied from firm to firm depending on the circumstances and the management hierarchy level in which it was used. The interviewees claimed that the information generated was useful for management purposes even though the contexts of use might vary between organizations. Similarly, the diversity of the presentation of MAS' information (see question 5 of the interview sheet) could vary considerably between one organization to another organization. On the stability of presentation of MAS' information (question 6), generally the interviewees concurred that it was each firm's prerogative to change the way in which MAS' information was being presented over time. Management would therefore independently decide on the need and nature of such a change.

The issues of the nature, diversity and stability of management accounting practices/techniques (MAPT) could be inferred by examining the feedback to questions 7 to 12 of the interview sheets (see appendices one and two). A concise description is reported as follows.

Regarding the types of management accounting practices/techniques (MAPT) used in manufacturing firms (see question 7), the interviewees confirmed that there were many different types of such practices/techniques in use. In relation to the diversity of management accounting practices/techniques (MAPT) used in a manufacturing concern (question 8), the interviewees generally replied that the extent of use of management accounting practices/techniques (MAPT) was diverse in nature. On the stability of the use of management accounting practices/techniques (MAPT) over time (question 9), the general view was that the application of management accounting practices/techniques

(MAPT) was fairly stable. This was further testified by the answers to question 10, where the interviewees affirmed that a number of management accounting practices/techniques (e,g. budgeting) would remain the same over many years. However, interviewees moderated the general view by explaining that some management accounting practices/techniques would be regularly developing or modified over time according to changing needs. This was evidenced from the replies to question 11. To accentuate that the use of management accounting practices/techniques was fairly stable, the feedback from question 12 confirmed that the interviewees were unsure or unaware of any management accounting practice/technique being brought in, but then being quickly discontinued or dropped.

5.3 A Guide To The Constructs, Dimensions and Variables Used In This Research

This section should be read in conjunction with the full copy of the survey questionnaire as attached in appendix four of this thesis. In general, all the section headings in the questionnaire (i.e. section headings A,B,C,D,E,F, and G) are regarded as 'constructs' and sub-headings within the section heads are referred to as 'dimensions'. Individual questions or their breakdowns are treated as 'variables'. In instances where a construct or a dimension or a factor (out of factor analysis) or any other output is treated as a 'variable' for data analysis purposes using the SPSS version 12.0.1, then each one of these variables would be named and labelled separately. Similarly, all recoded variables, such as those where the missing values were replaced by means would be given modified names and/or labels.

The table below summarizes only the important and germane 'variables' used in the data analysis stage. The table does not show the detailed wordings of each question asked. A full appreciation of all the questions asked would require cross referencing to the survey questionnaire proper as in appendix four. Questions 1 to 10.2 are those in section A of the questionnaire. They cover the background information of the respondent/firm. Question 11 is exclusively for section B on manufacturing management methods. Questions 12.1 to 15.3 refer to section C on management accounting systems' presentation of information. Section D on management accounting practices/techniques contains all questions beginning from question 16 to question 60. Section E (organizational performance) comprises of all those questions from questions 61 to 80. Institutional factors are contained in section F. They are represented by questions 81 to 89. The last section is section G, which is on contingency factors. They range from question 90 to question 121.

Note that where possible, treatment of missing values was by replacing them with means. Variables with missing values replaced with means are generally labelled as 'recoded' variables. Since these variables were used in data analysis in lieu of the 'original' variables, only the recoded variables are listed in table 5.3 (1) as being relevant to data analysis. SPSS automatically created a new variable name for recoded variable by adapting the original name and affixing an underscore to it. Such names are retained for data analysis as evident below.

Table 5.3 (1) Variable Labels And Names Used In This Study

Question	Variable Label	Variable Name
-	a usable case number	serial
-	a fortnightly period when questionnaires were returned	wave
Q1.	respondent's gender	gender
Q2.	age of respondent	age
Q3.1	respondent's educational background – certificate(s)?	education.certificate
Q3.2	respondent's educational background – diploma?	education.diploma
Q3.3	respondent's educational background – bachelors degree?	education.bachelors
Q3.4	respondent's educational background – masters degree?	education.masters

Q3.5	respondent's educational background – doctoral degree?	education.doctoral
Q3.6	respondent's educational background – professional qualification(s)?	education.professional
Q3.7	respondent's educational background – others?	education.others
Q4.1	respondent's length of service in present firm	presentlengthofservice
Q4.2	respondent's length of service in previous firm(s)	previouslengthofservice
Q5.	respondent's current management level	managementlevel
Q6.	respondent's monthly remuneration level	remuneration
Q7.	respondent's decision-making function	decisionmaking
Q8.1	respondent's functional responsibility – accounting/finance?	responsibility.acctg
Q8.2	respondent's functional responsibility – general management?	responsibility.gen.mgt.
Q8.3	respondent's functional responsibility – sales/marketing?	responsibility.sales
Q8.4	respondent's functional responsibility – strategic management?	responsibility.strategic
Q8.5	respondent's functional responsibility – production/manufacturing?	responsibility.production
Q8.6	respondent's functional responsibility – other?	responsibility.other

Q9.1	firm's operation – manufacturing/production?	Operation.mfg
Q9.2	firm's operation – retail trading?	Operation.retail
Q9.3	firm's operation – wholesale trading?	Operation.wholesale
Q9.4	firm's operation – services?	Operation.services
Q9.5	firm's operation – other?	Operation.other
Q10.1	firm's status – associate or subsidiary?	Associateorsubsidiary
Q10.2	firm's status – decentralised or not?	decentralisedornot
Q11	manufacturing management methods	manufacturingmethod
Q12.1	recoded management accounting systems' presentation of information (MAS) : scope of information 1	MASSco_1
Q12.2	recoded MAS : scope of information 2	MASSco_2
Q12.3	recoded MAS : scope of information 3	MASSco_3
Q12.4	recoded MAS : scope of information 4	MASSco_4
Q12.5a	recoded MAS : scope of information 5	MASSco_5
Q12.5b	recoded MAS : scope of information 6	MASSco_6
Q13.1	recoded MAS : timeliness of information 1	MASTim_1
Q13.2	recoded MAS : timeliness of information 2	MASTim_2

Q13.3	recoded MAS : timeliness of information 3	MASTim_3
Q13.4	recoded MAS : timeliness of information 4	MASTim_4
Q14.1	recoded MAS : aggregation of information 1	MASAgg_1
Q14.2	recoded MAS : aggregation of information 2	MASAgg_2
Q14.3	recoded MAS : aggregation of information 3	MASAgg_3
Q14.4a	recoded MAS : aggregation of information 4	MASAgg_4
Q14.4b	recoded MAS : aggregation of information 5	MASAgg_5
Q14.5	recoded MAS : aggregation of information 6	MASAgg_6
Q14.6	recoded MAS : aggregation of information 7	MASAgg_7
Q14.6a	recoded MAS : aggregation of information 8	MASAgg_8
Q14.6b	recoded MAS : aggregation of information 9	MASAgg_9
Q14.6c	recoded MAS : aggregation of information 10	MASAg_10
Q14.6d	recoded MAS : aggregation of information 11	MASAg_11
Q14.7	recoded MAS : aggregation of information 12	MASAg_12
Q15.1	recoded MAS : integration of information 1	MASInt_1
Q15.2	recoded MAS : integration of information 2	MASInt_2
Q15.3	recoded MAS : integration of information 3	MASInt_3

Q16.	Recoded management accounting practice/technique 1	MAPT1_1
Q17.	Recoded management accounting practice/technique 2	MAPT2_1
Q18.	Recoded management accounting practice/technique 3	MAPT3_1
Q19.	Recoded management accounting practice/technique 4	MAPT4_1
Q20.	Recoded management accounting practice/technique 5	MAPT5_1
Q21.	Recoded management accounting practice/technique 6	MAPT6_1
Q22.	Recoded management accounting practice/technique 7	MAPT7_1
Q23.	Recoded management accounting practice/technique 8	MAPT8_1
Q24.	Recoded management accounting practice/technique 9	MAPT9_1
Q25.	Recoded management accounting practice/technique 10	MAPT10_1
Q26.	Recoded management accounting practice/technique 11	MAPT11_1
Q27.	Recoded management accounting practice/technique 12	MAPT12_1
Q28.	Recoded management accounting practice/technique 13	MAPT13_1

Q29.	recoded management accounting practice/technique 14	MAPT14_1
Q30.	recoded management accounting practice/technique 15	MAPT15_1
Q31.	recoded management accounting practice/technique 16	MAPT16_1
Q32.	recoded management accounting practice/technique 17	MAPT17_1
Q33.	recoded management accounting practice/technique 18	MAPT18_1
Q34.	recoded management accounting practice/technique 19	MAPT19_1
Q35.	recoded management accounting practice/technique 20	MAPT20_1
Q36.	recoded management accounting practice/technique 21	MAPT21_1
Q37.	recoded management accounting practice/technique 22	MAPT22_1
Q38.	recoded management accounting practice/technique 23	MAPT23_1
Q39.	recoded management accounting practice/technique 24	MAPT24_1
Q40.	recoded management accounting practice/technique 25	MAPT25_1
Q41.	recoded management accounting practice/technique 26	MAPT26_1

Q42.	Recoded management accounting practice/technique 27	MAPT27_1
Q43.	Recoded management accounting practice/technique 28	MAPT28_1
Q44.	Recoded management accounting practice/technique 29	MAPT29_1
Q45.	Recoded management accounting practice/technique 30	MAPT30_1
Q46.	Recoded management accounting practice/technique 31	MAPT31_1
Q47.	Recoded management accounting practice/technique 32	MAPT32_1
Q48.	Recoded management accounting practice/technique 33	MAPT33_1
Q49.	Recoded management accounting practice/technique 34	MAPT34_1
Q50.	Recoded management accounting practice/technique 35	MAPT35_1
Q51.	Recoded management accounting practice/technique 36	MAPT36_1
Q52.	Recoded management accounting practice/technique 37	MAPT37_1
Q53.	Recoded management accounting practice/technique 38	MAPT38_1
Q54.	Recoded management accounting practice/technique 39	MAPT39_1

Q55.	recoded management accounting practice/technique 40	MAPT40_1
Q56.	recoded management accounting practice/technique 41	MAPT41_1
Q57.	recoded management accounting practice/technique 42	MAPT42_1
Q58.	recoded management accounting practice/technique 43	MAPT43_1
Q59.	recoded management accounting practice/technique 44	MAPT44_1
Q60.	recoded management accounting practice/technique 45	MAPT45_1
Q61.	recoded firm's return on investment	Firmre_1
Q62.	recoded firm's profit	Firmpr_1
Q63.	recoded firm's cash flow from operations	Firmca_1
Q64.	recoded firm's cost control	Firmco_1
Q65.	recoded firm's development of new products	Firmde_1
Q66.	recoded firm's sales volume	Firmsa_1
Q67.	recoded firm's market share	Firmma_1
Q68.	recoded firm's market development	Firmma_2
Q69.	recoded firm's personnel development	Firmpe_1

Q70.	recoded firm's political-public affairs	Firmpo_1
Q71.	recoded importance of return on investment	Import_1
Q72.	recoded importance of profit	Import_2
Q73.	recoded importance of cash flow from operations	Import_3
Q74.	recoded importance of cost control	Import_4
Q75.	recoded importance of development of new products	Import_5
Q76.	recoded importance of sales volume	Import_6
Q77.	recoded importance of market share	Import_7
Q78.	recoded importance of market development	Import_8
Q79.	recoded importance of personnel development	Import_9
Q80.	recoded importance of political-public affairs	Impor_10
Q81.	recoded institutional mimetic 1	Instit_1
Q82.	recoded institutional mimetic 2	Instit_2
Q83.	recoded institutional mimetic 3	Instit_3
Q84.	recoded institutional coercive 1	Instit_4
Q85.	recoded institutional coercive 2	Instit_5

Q86.	recoded institutional coercive 3	Instit_6
Q87.	recoded institutional normative 1	Instit_7
Q88.	recoded institutional normative 2	Instit_8
Q89.	recoded institutional normative 3	Instit_9
Q90.	recoded manufacturing strategy 1	Mfg.st_1
Q91.	recoded manufacturing strategy 2	Mfg.st_2
Q92.	recoded manufacturing strategy 3	Mfg.st_3
Q93.	recoded organizational interdependence 1	Org.in_1
Q94.	recoded organizational interdependence 2	Org.in_2
Q95.	recoded organizational interdependence 3	Org.in_3
Q96.	recoded decentralization 1	Decent_1
Q97.	recoded decentralization 2	Decent_2
Q98.	recoded decentralization 3	Decent_3
Q99.	recoded decentralization 4	Decent_4
Q100.	recoded decentralization 5	Decent_5
Q101.	recoded decentralization 6	Decent_6
Q102.	recoded decentralization 7	Decent_7

Q103.	recoded decentralization 8	Decent_8
Q104.	recoded decentralization 9	Decent_9
Q105.	recoded decentralization 10	Decen_10
Q106.	recoded decentralization 11	Decen_11
Q107.	recoded decentralization 12	Decen_12
Q108.	recoded decentralization 13	Decen_13
Q109.	recoded decentralization 14	Decen_14
Q110.	recoded decentralization 15	Decen_15
Q111.	recoded decentralization 16	Decen_16
Q112.	recoded decentralization 17	Decen_17
Q113.	recoded decentralization 18	Decen_18
Q114.	recoded decentralization 19	Decen_19
Q115.	recoded decentralization 20	Decen_20
Q116.	recoded decentralization 21	Decen_21
Q117.	recoded decentralization 22	Decen_22
Q118.	recoded decentralization 23	Decen_23
Q119.	recoded uncertainty 1	Uncert_1

Q120.	recoded uncertainty 2	Uncert_2
Q121.	recoded uncertainty 3	Uncert_3
-	cluster solution	Cluster
-	weighted average performance index	W.P. Index

5.4 Testing For Unidimensionalities Of Research Constructs And Dimensions

As stated under section 4.7 in chapter four of this thesis, the intention of this research is to utilise every single variable as far as possible. Grouping the variables together into factors of constructs or dimensions is considered incidental and secondary to the overall research scheme. Nonetheless, where sampling requirement for a statistical test is considered inadequate, factor analysis is necessary as a form of data reduction. This was the case in the factor analyses of management accounting systems' (MAS') presentation of information and management accounting practices/techniques (MAPT) to derive factorised independent variables that met the sample requirement of a multiple regression analysis with the weighted average performance index as the independent variable. All the identified factors would be subjected to tests of internal consistency to ensure they are reliable.

In order to measure a construct or dimension with multiple indicator variables, it is imperative to demonstrate that the variable items measure the same concept. This is known as testing for unidimensionality. Factor analysis and reliability measure are attempts to test for unidimensionality of scales.

5.4.1 Factor Analyses Of Research Constructs And Dimensions

In the number of sub-sub sections that follow, confirmatory and exploratory factor analyses on relevant continuous scales (i.e. management accounting systems' presentation of information dimensions and management accounting practice/technique constructs) will be reported. The principal component method was used where the criterion (random) eigenvalues were from parallel analyses. As mentioned in section 5.3 above, the treatment of missing values was by replacing with means. In generating criterion (random) eigenvalues, the number of subjects (cases) used was 127 and the number of replications was 100.

5.4.1.1 Factor Analysis Of Management Accounting Systems' Presentation of Information: Scope Of Information

The correlation matrix for the above dimension of the MAS' presentation of information construct showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.719. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.1 (1) Parallel Analysis Of Management Accounting Systems' Presentation Of Information: Scope Of Information

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	2.644	1.298	**Accept**
2	1.082	1.149	Reject

Therefore out of six variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis. The factor was called 'MAS Scope of Information' and the six variables that made up this factor were MASSco_1, MASSco_2, MASSco_3, MASSco_4, MASSco_5 and MASSco_6.

5.4.1.2 Factor Analysis Of Management Accounting Systems – Presentation Of Information: Timeliness Of Information

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.809. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.2 (1) Parallel Analysis Of Management Accounting Systems' Presentation Of Information: Timeliness Of Information

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	2.761	1.209	**Accept**
2	0.556	1.052	Reject

Therefore out of four variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis. The factor was called 'MAS Timeliness of Information ' and the four variables that made up this factor were MASTim_1, MASTim_2, MASTim_3 and MASTim_4.

5.4.1.3 Factor Analysis Of Management Accounting Systems – Presentation Of Information: Aggregation Of Information

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.887. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.3 (1) Parallel Analysis Of Management Accounting Systems' Presentation Of Information: Aggregation Of Information

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	5.665	1.548	**Accept**
2	1.225	1.391	Reject

Therefore out of twelve variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis. The factor was called 'MAS Aggregation of Information' and the twelve variables that made up this factor were MASAgg_1, MASAgg_2, MASAgg_3, MASAgg_4, MASAgg_5, MASAgg_6, MASAgg_7, MASAgg_8, MASAgg_9, MASAg_10, MASAg_11 and MASAg_12,

5.4.1.4 Factor Analysis Of Management Accounting Systems' Presentation Of Information: Integration Of Information

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.738. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.4 (1) Parallel Analysis Of Management Accounting Systems' Presentation Of Information: Integration Of Information

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	2.441	1.140	**Accept**
2	0.328	0.999	Reject

Therefore out of three variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis. The factor was called 'MAS Integration of Information' and the three variables that made up this factor were MASInt_1, MASInt_2 and MASInt_3.

5.4.1.5 Factor Analysis Of Management Accounting Practices/Techniques – Budgeting Techniques

The correlation matrix for the above dimension of management accounting practices/techniques showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.840. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.5 (1) Parallel Analysis Of Management Accounting Practices/ Techniques – Budgeting Techniques

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	4.090	1.421	**Accept**
2	1.122	1.294	Reject

Therefore out of nine variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis.

The nine variables that formed the single factor (one principal component) were MAPT1_1, MAPT5_1, MAPT6_1, MAPT7_1, MAPT8_1, MAPT10_1, MAPT36_1, MAPT42_1 and MAPT45_1. The factor is termed as "MAPT- Budgeting Techniques".

5.4.1.6 Factor Analysis Of Management Accounting Practices/Techniques – Performance Evaluation Techniques

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.896. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.6 (1) Parallel Analysis Of Management Accounting Practices/ Techniques – Performance Evaluation Techniques

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	8.776	1.784	**Accept**
2	1.797	1.628	**Accept**
3	1.152	1.520	Reject

Therefore out of twenty variables in the scale, **two components or factors** were identified. As such rotation procedure was undertaken in the factor analysis.

After varimax rotation, two factors (principal components) were identified. Subsequently, direct oblimin rotation was performed. Examination of the component correlation matrix table indicated that the two components were strongly correlated i.e. r = 0.512 which was above 0.3. Therefore, the results from the oblimin rotation will be reported instead of the varimax rotation.

Based on the pattern matrix table, out of the twenty variables factor analysed, the variables that made up the two factors or components in their order of loadings were:

Component 1 : MAPT34_1, MAPT15_1, MAPT32_1, MAPT16_1, MAPT39_1, MAPT33_1, MAPT27_1, MAPT9_1, MAPT38_1, MAPT21_1, MAPT13_1, MAPT25_1, MAPT26_1 and MAPT29_1 (i.e. fourteen variables). This component or factor is termed as "MAPT-Performance Benchmarking".

Component 2 : MAPT4_1, MAPT2_1, MAPT12_1, MAPT3_1, MAPT14_1 and MAPT11_1 (i.e. six variables). This component or factor is termed as "MAPT-Performance Evaluation".

Note that the results produced by the direct oblimin rotation were similar to those produced by the varimax rotation except that there were no cross loadings under direct oblimin.

5.4.1.7 Factor Analysis Of Management Accounting Practices/Techniques – Costing Techniques

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.844. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.7 (1) Parallel Analysis Of Management Accounting Practices/ Techniques – Costing Techniques

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	3.551	1.356	**Accept**
2	0.994	1.194	Reject

Therefore out of seven variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis.

The seven variables that formed the single factor (one principal component) were MAPT23_1, MAPT43_1, MAPT40_1, MAPT44_1, MAPT17_1, MAPT31_1 and MAPT22_1. The factor is termed as "MAPT-Costing Techniques".

5.4.1.8 Factor Analysis Of Management Accounting Practices/Techniques – Strategic Planning Techniques

The correlation matrix for this dimension showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.855. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.8 (1) Parallel Analysis Of Management Accounting Practices/ Techniques – Strategic Planning Techniques

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	3.668	1.316	**Accept**
2	0.810	1.155	Reject

Therefore out of six variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis.

The six variables that formed the single factor (one principal component) were MAPT18_1, MAPT20_1, MAPT30_1, MAPT37_1, MAPT19_1 and MAPT24_1. The factor is termed as "MAPT-Strategic Planning Techniques".

5.4.1.9 Factor Analysis Of Management Accounting Practices/Techniques – Quality Control Techniques

The correlation matrix for this dimension of management accounting practices/techniques showed that there were many coefficients of 0.3 and above, implying suitability for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.679. Since this exceeded 0.6, the sampling was adequate for factor analysis.

The significance value of the Bartlett's Test of Sphericity was 0.000. This meant that it was statistically significant at $p < 0.05$, indicating that the correlation matrix was factorable.

Table 5.4.1.9 (1) Parallel Analysis Of Management Accounting Practices/ Techniques – Quality Control Techniques

Component	Initial Eigenvalue	Random Eigenvalue	Decision (Accept if Initial Eigenvalue > Random Eigenvalue)
1	1.970	1.145	**Accept**
2	0.574	1.000	Reject

Therefore out of three variables in the scale, only **one component or factor** was identified. As such there was no need to embark on a rotation procedure in the factor analysis.

The three variables that formed the single factor (one principal component) were MAPT28_1, MAPT35_1 and MAPT41_1. The factor is termed as "MAPT-Quality Control Techniques".

5.4.2 Reliability Tests On Research Constructs And Dimensions

To test for internal consistency (reliability) of all continuous scales the Cronbach's alphas were computed. If the Cronbach's alpha is above 0.7, then the scale is considered reliable. Results on the reliability tests of all relevant dimensions used in this study are tabulated below.

Table 5.4.2 (1) Reliability Analyses Of Principal Components

Dimension (Variable Names)	No. of Items	Cronbach's Alpha	Reliable or not? (i.e. above 0.7 or not?)
MAS Scope of Information (MASSco_1 to MASSco_6)	6	0.731	Reliable
MAS Timeliness of Information (MASTim_1 to MASTim_4)	4	0.847	Reliable
MAS Aggregation of Information (MASAgg_1 to MASAg_12)	12	0.890	Reliable
MAS Integration of Information (MASInt_1 to MASInt_3)	3	0.885	Reliable
MAPT-Budgeting Techniques (MAPT 1_1, 5_1, 6_1, 7_1, 8_1, 10_1, 36_1, 42_1, 45_1)	9	0.843	Reliable
MAPT- "Performance Benchmarking" (MAPT 34_1, 15_1, 32_1, 16_1, 39_1, 33_1, 27_1, 9_1, 38_1, 21_1, 13_1, 25_1, 26_1, 29_1)	14	0.924	Reliable
MAPT- "Performance Evaluation" (MAPT 4_1, 2_1, 12_1, 3_1,1 4_1, 11_1)	6	0.837	Reliable
MAPT- Costing Techniques (MAPT 23_1, 43_1, 40_1, 44_1, 17_1, 31_1, 22_1)	7	0.837	Reliable
MAPT- Strategic Planning Techniques (MAPT 18_1, 20_1, 30_1, 37_1, 19_1, 24_1)	6	0.868	Reliable
MAPT- Quality Control Techniques (MAPT 28_1, 35_1, 41_1)	3	0.737	Reliable

5.4.3 Summary Of Factor Analyses And Reliability Tests On Research Constructs And Dimensions

The factor and reliable analyses of all the continuous scales above revealed the unidimensionality of each construct or dimension. Every dimension that made up management accounting systems' (MAS) presentation of information construct formed a separate factor with adequate sampling and factorable correlation matrix. These dimensions were MAS scope of information (comprising six variables), MAS timeliness of information (four variables), MAS aggregation of information (twelve variables) and MAS integration of information (three variables). It is interesting to note that even though MAS aggregation of information dimension consisted of twelve variables, it still emerged as one distinct factor as opposed to several factors. MAS integration of information dimension too neatly converged into one factor despite having very few variables (i.e. just three variables). Reliability test on each dimension also proved that all the dimensions were reliable. Hence, the unidimensionality of each dimension that made up the MAS presentation of information construct was confirmed. The results confirm the validity and reliability of previous researchers', such as Chenhall and Morris' (1986) four dimensions of the MAS' presentation of information construct within the Malaysian setting.

The management accounting practice/technique (MAPT) construct was tentatively divided into five dimensions after discussion with a content expert, Professor Dennis Taylor. This had enabled the requirement of at least five cases to one variable be met for factor analyses purpose. The tentative divisions were budgeting techniques (comprising of nine variables), performance evaluation techniques (twenty variables), costing techniques (seven variables), strategic planning techniques (six variables) and quality control techniques (three variables). After full factor analyses, budgeting techniques, costing techniques, strategic planning techniques and quality control techniques were retained as single factors. However, from performance evaluation techniques emerged two separate factors that were subsequently labelled as performance benchmarking (comprising fourteen variables) and performance evaluation (constituting six variables). The labels were far from arbitrary namesake. Instead they were carefully chosen based on the highest loading items on each of the components (factors) that were used to help identify the nature of the underlying latent variable represented by each component or factor. To assist in discussing the results of this study, titles for each factor were drafted so as to reflect the substance of the variables. All the factors identified were also proven to be reliable.

Insofar as this study is concerned, only factors that emerged from the MAS' presentation of information construct and management accounting practice/technique construct will be utilised in a subsequent alternative linear regression procedure, where the respective factors will be the independent variables against the weighted average performance index as the dependent variable. As justified in chapter four, other dimensions (i.e. institutional and contingency factor dimensions) will not be subjected to factor analyses, as they will not feature as factors in any subsequent statistical tests. Instead, each variable within the dimensions will be treated as a separate factor on its own right.

5.5 Weighted Average Performance Index

In this study, organizational performance is measured using a weighted average performance index. To derive this index, firstly, the summation of the product of a firm's relative performance and the corresponding performance importance is calculated. This numerator is then divided by a denominator in the form of a summation of the performance importance. The result is the individual firm's weighted average performance index. A firm's relative performance measures were given in part 1 of section E of the questionnaire (Q61 to Q70). The corresponding importance of performance measures were given in part 2 of section E (Q71 to Q80). Using SPSS 'transform' and 'compute variable' menu and sub-menu, it was possible to generate a synthesized variable of the weighted average performance index (W.P. Index).

Mathematically, the weighted average performance index can be represented as follows:

$$\text{W.P. Index} = \frac{\sum \text{(recoded firms' performance x recoded importance of performance)}}{\sum \text{(recoded importance of performance)}}$$

Numerically, the weighted average performance index is a continuous variable with possible values ranging from 0 to 7. Anything in between 0 to 0.9 could be construed as extremely low performance, 1 to 1.9 as very low, 2 to 2.9 as low, 3 to 3.9 as medium, 4 to 4.9 as high, 5 to 5.9 as very high and finally 6 to 7 as extremely high performance of an individual firm. Descriptive statistics indicated that the minimum and maximum performance indices of firms in this study were 1.47 and 6.80 respectively, with a mean of 4.732 and a fairly normal distribution. It should be noted that since all the Likert scales were converted to the weighted average performance index, the resulting index was a full fledged continuous variable that was totally different from the original scales it was derived from.

To test for normality the Kolmogorov-Smirnov z test was used on the weighted average performance index. If the Kolmogorov-Smirnov z test yielded a significance level of equal or less than 0.05, the distribution was considered not normal. A non significant result (significant value of more than 0.05) however, indicated normality of the distribution. From the findings, the weighted average performance index variable was found to be normally distributed where the p value was 0.081, i.e. not significant.

5.6 Cluster Analysis Of Management Accounting Systems' Presentation Of Information And Management Accounting Practices/Techniques

This study employed the two step cluster analysis available in SPSS version 12.0.1. There were seventy internal variables used in the two step cluster analysis procedure. Twenty five of the variables formed the construct, management accounting systems' presentation of information while another forty five were variables on the construct, management accounting practices/techniques. All of these variables were treated as continuous interval level variables by virtue of being Likert scales of at least seven categories. The variables were the recoded versions of the originals where recoding meant that all the missing values had been replaced by the mean scores. There were a number of important issues in cluster analysis to be resolved. Much of the issues have been determined and discussed in section 4.8 of chapter four. In the following sub-sections, some of the pertinent issues will be revisited with due emphasis on showing the many tabulations that are intended to show statistics that lead to the resolution of the various main issues. In sub-section 5.6.1, the issue of whether to standardize or not to standardize variables used in clustering is deliberated. In sub-section 5.6.2, the issue of multicollinearity among variables will be looked into. In sub-section 5.6.3, the clusters derived from the cluster analysis will be tested for reliability. Sub-section 5.6.4 will deal with the external validity of the cluster solution. Finally, the cluster differences will be tested in sub-section 5.6.5

5.6.1 Standardization Versus Non Standardization Of Clustering Variables

The issue of whether to standardize or not to standardize variables used in cluster analysis, needed to be resolved. The arguments had been put forward and discussed extensively in chapter four. Both analyses of using and not using standardization are options provided in SPSS version 12.0.1. The 'option' button under the two step cluster analysis offers 'to be standardized' as using standardization and alternatively 'assumed standardized' as not using standardization. Both options were selected separately and the results noted. Tables 5.6.1 (1) and 5.6.1 (2) summarize the results. Table 5.6.1 (1) presents Schwarz's Bayesian

Information Criteria (BIC) and BIC changes for both standardized and unstandardized variables for one to five clusters. BIC only declined from one to two cluster models. From two to five cluster models, the BIC started to rise gradually. Examination of the BIC changes showed that the only instance when the BIC changes started registering negative numbers was at the two cluster solution. It should be noted that where there are more than one instance of negative BIC changes then the most negative of them all is where the optimum cluster solution model is selected. If we were to produce the ratios of BIC changes and the ratios of distance measures, then both ratios would have reached their respective maximums at that level. In this study, it was not necessary to look at the ratio of BIC change and the ratio of distance measures as it was obvious that there was only one negative BIC at the two cluster level for both variables standardized and variables not standardized. As the number of clusters automatically generated is when the Schwarz's Bayesian Criterion (BIC) change starts registering a negative number, the most appropriate cluster level was two clusters for both standardized and unstandardized variables.

Table 5.6.1 (1) Results Of Two Step Cluster Analyses On The Full Sample

Number Of Clusters	Variables Standardized		Variables Not Standardized	
	Schwarz's Bayesian Criterion (BIC)	**BIC Change From Previous No. Of Clusters**	**Schwarz's Bayesian Criterion (BIC)**	**BIC Change From Previous No. Of Clusters**
1	6805.196		11879.299	
2	6406.522	-398.673	11480.626	-398.673
3	6788.439	381.917	11862.542	381.917
4	7191.638	403.199	12265.741	403.199
5	7735.233	543.595	12809.336	543.595

Table 5.6.1(2) Cluster Distribution For The Full Sample

	Variables Standardized		Variables Not Standardized	
	No. Of Cases (Respondents)	**Percentage Of Total Cases**	**No. Of Cases (Respondents)**	**Percentage Of Total Cases**
Cluster 1	39	30.7%	39	30.7%
Cluster 2	88	69.3%	88	69.3%
Total Cases	127	100%	127	100%

It was thus found that the two sets of cluster solutions did not differ at all irrespective of whether the variables were standardized or not. Both options generated the same two cluster solution, comprising of thirty nine cases (cluster one) and eighty eight cases (cluster two). As such, standardization of variables is not an issue in this study. Whether or not the variables are standardized does not cause the results obtained to differ.

5.6.2 Multicollinearity Among Clustering Variables

The SPSS version 12.0.1 does not provide the option for measuring Mahalanobis distance within the two step cluster analysis. However, as the clustering variables concerned also needed to be subjected to a multiple regression analysis with weighted performance index as the dependent variable, it was possible to check for multicollinearity among the variables using the variance inflation factor (VIF). In this study, all the VIF values concerned were found to be less than four. In fact, they were all below two, indicating that there is no problem with multicollinearity. The tabulation that shows information on the VIF will be produced in the section on multiple regression towards the end of this chapter.

5.6.3 Reliability Of The Cluster Solution

The reliability of the two cluster solution could be tested by dividing the sample into two halves. In this study, there is sufficient sample size to be split into two halves. The first sample half comprised of cases 1 to 63, while the second sample half constituted the remaining cases (i.e. cases 64 to 127). A separate two step cluster analysis was conducted on each sample half. It was found that the first sample half did not generate more than one cluster. The second sample half generated two clusters. This finding substantiated the fact that the cluster solution could not have exceeded two clusters, and thus reliability of the two cluster solution was assured. Table 5.6.3 (1) shows the results of the two step cluster solution for each sampling half.

Table 5.6.3 (1) Results Of The Cluster Analysis On Cases 1 To 63 and Cases 64 To 127 (Variables Standardized)

Number Of Clusters	For Cases 1 To 63		For Cases 64 To 127	
	Schwarz's Bayesian Criterion (BIC)	BIC Change From Previous No. Of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change From Previous No. Of Clusters
1	3601.678		3652.406	
2	3708.056	106.378	3585.011	-67.395
3	4099.389	391.333	4006.093	421.082
4	4493.163	393.773	4442.825	436.733
5	4965.226	472.063	4920.319	477.494

5.6.4 Validity Of The Cluster Solution

To establish criterion-related validity of the cluster solution, independent samples t-test, with the weighted performance index as the test variable and the cluster membership as the grouping variable, was undertaken. The independence samples t-test underlying assumptions needed to be met prior to analysis. These assumptions needed to be evaluated because the accuracy of test interpretation depends on whether assumptions are violated. The first two assumptions of requiring a scale level of measurement and random sampling were met by virtue of the research design. The third assumption requiring normal distribution was violated. However, the t-statistic has repeatedly and convincingly been shown to be practically immune to violations of the normality assumption (Rasch & Guiard, 2004). The fourth assumption was independence of groups. As the two cluster memberships comprised of distinct and separate individual cases, assumption four was satisfied. The last assumption was on the homogeneity of variance. To test for homogeneity of variance, SPSS uses the Levene test for equality of variances. If this test is significant ($p \leq 0.05$), then reject the null hypothesis, i.e. do not reject the alternative hypothesis that the variances are unequal. It follows that the unequal variance estimates are consulted. If the test is not significant ($p > 0.05$), then do not reject the null hypothesis that there are no significant differences between the variances of the groups (clusters). If this is the case, the equal variance estimates are consulted. In this study, equal variances were assumed, as the Levene's test had a probability of 0.381 (i.e. greater than 0.05). The corresponding two tail significant value of the t-test for equality of means was 0.001 (i.e. less than 0.05). Hence, there was a significant difference between the weighted average performance indices of the two clusters. Cluster two had a higher mean performance of 4.9302 compared with cluster one, with just 4.2850. In other words, cluster two performed better than cluster one. The two clusters then, were distinguished by virtue of an outside performance variable. Thus, criterion validity was established. Tables 5.6.4 (1) and 5.6.4 (2) illustrate the findings above with additional details.

Table 5.6.4 (1) Group Statistics On The t-Test Of The Cluster Solution With The Weighted Average Performance Index

	Number Of Cases	**Mean W.P. Index**	**Std. Deviation**	**Std. Error Of Mean**
Cluster 1	39	4.2850	0.88435	0.14161
Cluster 2	88	4.9302	1.05865	0.11285

Table 5.6.4 (2) Independent Samples t-Test Of The Cluster Solution With The Weighted Average Performance Index

	Levene's Test For Equality Of Variances		**t-Test For Equality Of Means**	
	F	Sig.	t	Sig (2-tailed)
W.P. Index – Equal Variances Assumed	0.772	0.381	-3.325	0.001
W.P. Index – Equal Variances Not Assumed			-3.563	0.001

5.6.5 Testing Cluster Differences

As the two clusters of firms could also be distinguished by their internal variables, it was also important to test the differences between the component variables that made up cluster one against the corresponding variables that made up cluster two. In other words, this test was to check if there was any significant difference between each variable that formed each cluster with the same variable that formed the other cluster. There were seventy internal variables used to distinguish the two clusters of firms. Twenty five of the recoded variables formed the construct, management accounting systems' presentation of information while another forty five were recoded variables on the construct, management accounting practices/techniques.

In this study, as the sample size was 127 (i.e. over 120), the z-test could be used. SPSS version 12.0.1 cannot run the z-test directly from the cluster analysis output data. As such, the relevant information generated by SPSS was exported to MS Excel spreadsheet and a z-test was undertaken. The underlying assumptions for large sample z-test for two independent means needed to be met prior to analysis. These assumptions needed to be evaluated because the accuracy of test interpretation depended on whether assumptions are violated. The first two assumptions of requiring scale level of measurement and random sampling were met by virtue of the research design. The third assumption requiring normal distribution for each cluster was violated. However, as the sample size for each cluster was large (i.e greater than thirty cases each), normal distribution could be approximated using the central limit theorem. In this study, cluster one comprised of thirty nine respondents and cluster two was composed of eighty eight respondents. Both were above the minimum thirty required and the central limit theorem applied. The fourth assumption was independence of groups. As the two cluster memberships comprised of distinct and separate individual cases, assumption four was satisfied. In short, there was no serious problem relating to the underlying assumptions that had to be met before the z-test was carried out. Moreover, it has long been established that moderate violations of parametric assumptions (including those of z-test) have little or no effect on substantive conclusions in most instances (e.g, Cohen, 1988).

It was found that the p values were all below 0.05 for each pair of variables tested indicating that there were significant differences between the mean scores of cluster one against cluster two. All the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables indicated higher mean readings for cluster two. Thus, cluster two, which was the better performing cluster of firms had respondents agreeing on the high extent of usefulness of all the management accounting systems' presentation of information variables. Respondents belonging to cluster two also concurred that the adoption of each management accounting practice/technique led to higher benefit gained by the firms. It thus appears that there is empirical evidence to suggest that those firms which considered management accounting systems' information attributes as more useful and claimed more benefit from practicing management accounting practices/techniques were the relatively better performing firms. They fell into cluster two. Detailed results of the z-test are shown in table 5.6.5 (1).

Table 5.6.5 (1) Testing Cluster Differences Using z-Test

Clustering Variable Names		Cluster				Sig.Diff. Between Means Of Clusters 1 And 2?
		1	2			
	No. Of Cases	39	88	z-Score	p-Value	
MASSco_1	Mean	3.795	5.523	6.004	0.000	Sig. Difference
	Std. Deviation	1.609	1.203			
MASSco_2	Mean	3.769	5.114	5.258	0.000	Sig. Difference
	Std. Deviation	1.327	1.334			
MASSco_3	Mean	4.436	5.705	4.994	0.000	Sig. Difference
	Std. Deviation	1.373	1.195			
MASSco_4	Mean	4.282	5.375	4.175	0.000	Sig. Difference
	Std. Deviation	1.413	1.235			
MASSco_5	Mean	4.590	5.540	3.020	0.001	Sig. Difference
	Std. Deviation	1.728	1.404			
MASSco_6	Mean	4.077	5.648	5.045	0.000	Sig. Difference
	Std. Deviation	1.707	1.398			
MASTim_1	Mean	5.000	6.068	5.011	0.000	Sig. Difference
	Std. Deviation	1.147	1.015			
MASTim_2	Mean	4.417	5.639	6.093	0.000	Sig. Difference
	Std. Deviation	1.049	1.029			
MASTim_3	Mean	4.487	5.880	5.456	0.000	Sig. Difference
	Std. Deviation	1.449	1.000			
MASTim_4	Mean	4.231	5.670	5.444	0.000	Sig. Difference
	Std. Deviation	1.459	1.162			
MASAgg_1	Mean	4.359	5.784	6.093	0.000	Sig. Difference
	Std. Deviation	1.328	0.915			
MASAgg_2	Mean	4.692	5.511	4.013	0.000	Sig. Difference
	Std. Deviation	1.080	1.017			
MASAgg_3	Mean	4.077	5.432	5.438	0.000	Sig. Difference
	Std. Deviation	1.365	1.122			
MASAgg_4	Mean	4.667	5.915	5.367	0.000	Sig. Difference
	Std. Deviation	1.284	1.020			
MASAgg_5	Mean	4.897	6.235	6.296	0.000	Sig. Difference
	Std. Deviation	1.209	0.818			
MASAgg_6	Mean	4.238	5.719	5.833	0.000	Sig. Difference
	Std. Deviation	1.445	0.980			
MASAgg_7	Mean	4.805	5.476	3.183	0.001	Sig. Difference
	Std. Deviation	1.246	0.637			
MASAgg_8	Mean	3.443	4.648	4.279	0.000	Sig. Difference
	Std. Deviation	1.433	1.532			
MASAgg_9	Mean	3.740	5.375	6.695	0.000	Sig. Difference
	Std. Deviation	1.268	1.271			
MASAg_10	Mean	4.234	5.523	4.965	0.000	Sig. Difference
	Std. Deviation	1.387	1.259			
MASAg_11	Mean	4.282	5.511	4.571	0.000	Sig. Difference
	Std. Deviation	1.503	1.124			

MASAg_12	**Mean**	4.718	5.656	3.499	0.000	**Sig. Difference**
	Std. Deviation	1.468	1.210			
MASInt_1	**Mean**	4.179	5.659	5.708	0.000	**Sig. Difference**
	Std. Deviation	1.485	0.969			
MASInt_2	**Mean**	4.154	5.659	6.377	0.000	**Sig. Difference**
	Std. Deviation	1.348	0.896			
MASInt_3	**Mean**	4.256	5.693	6.306	0.000	**Sig. Difference**
	Std. Deviation	1.229	1.076			
MAPT1_1	**Mean**	3.849	4.870	4.376	0.000	**Sig. Difference**
	Std. Deviation	1.176	1.292			
MAPT2_1	**Mean**	4.453	5.477	4.298	0.000	**Sig. Difference**
	Std. Deviation	1.282	1.136			
MAPT3_1	**Mean**	4.835	5.879	4.944	0.000	**Sig. Difference**
	Std. Deviation	1.150	0.970			
MAPT4_1	**Mean**	4.696	5.964	4.650	0.000	**Sig. Difference**
	Std. Deviation	1.573	0.981			
MAPT5_1	**Mean**	4.760	6.030	4.312	0.000	**Sig. Difference**
	Std. Deviation	1.703	1.045			
MAPT6_1	**Mean**	4.169	5.699	6.541	0.000	**Sig. Difference**
	Std. Deviation	1.312	0.962			
MAPT7_1	**Mean**	5.142	6.212	4.865	0.000	**Sig. Difference**
	Std. Deviation	1.239	0.891			
MAPT8_1	**Mean**	4.874	6.062	5.232	0.000	**Sig. Difference**
	Std. Deviation	1.296	0.865			
MAPT9_1	**Mean**	4.238	5.404	4.679	0.000	**Sig. Difference**
	Std. Deviation	1.389	1.054			
MAPT10_1	**Mean**	4.330	5.270	4.142	0.000	**Sig. Difference**
	Std. Deviation	1.262	0.968			
MAPT11_1	**Mean**	4.589	6.036	6.494	0.000	**Sig. Difference**
	Std. Deviation	1.279	0.824			
MAPT12_1	**Mean**	5.018	6.348	5.856	0.000	**Sig. Difference**
	Std. Deviation	1.302	0.847			
MAPT13_1	**Mean**	4.429	5.747	5.134	0.000	**Sig. Difference**
	Std. Deviation	1.485	0.911			
MAPT14_1	**Mean**	3.857	5.365	5.963	0.000	**Sig. Difference**
	Std. Deviation	1.387	1.137			
MAPT15_1	**Mean**	3.899	5.266	5.103	0.000	**Sig. Difference**
	Std. Deviation	1.495	1.125			
MAPT16_1	**Mean**	3.879	5.552	6.497	0.000	**Sig. Difference**
	Std. Deviation	1.478	0.954			
MAPT17_1	**Mean**	4.339	5.734	5.618	0.000	**Sig. Difference**
	Std. Deviation	1.399	1.006			
MAPT18_1	**Mean**	3.649	5.718	9.016	0.000	**Sig. Difference**
	Std. Deviation	1.297	0.915			
MAPT19_1	**Mean**	3.750	5.284	6.514	0.000	**Sig. Difference**
	Std. Deviation	1.330	0.944			
MAPT20_1	**Mean**	3.692	5.372	6.472	0.000	**Sig. Difference**
	Std. Deviation	1.446	1.100			
MAPT21_1	**Mean**	3.936	5.231	4.639	0.000	**Sig. Difference**
	Std. Deviation	1.564	1.158			

MAPT22_1	**Mean**	4.264	5.534	5.113	0.000	**Sig. Difference**
	Std. Deviation	1.317	1.233			
MAPT23_1	**Mean**	4.045	5.329	4.939	0.000	**Sig. Difference**
	Std. Deviation	1.390	1.262			
MAPT24_1	**Mean**	3.408	4.537	4.178	0.000	**Sig. Difference**
	Std. Deviation	1.502	1.159			
MAPT25_1	**Mean**	3.086	4.113	4.399	0.000	**Sig. Difference**
	Std. Deviation	1.287	1.025			
MAPT26_1	**Mean**	4.068	5.043	3.417	0.000	**Sig. Difference**
	Std. Deviation	1.654	0.990			
MAPT27_1	**Mean**	3.555	5.299	6.574	0.000	**Sig. Difference**
	Std. Deviation	1.496	1.069			
MAPT28_1	**Mean**	3.324	4.775	5.712	0.000	**Sig. Difference**
	Std. Deviation	1.427	1.042			
MAPT29_1	**Mean**	4.328	5.487	4.438	0.000	**Sig. Difference**
	Std. Deviation	1.500	0.961			
MAPT30_1	**Mean**	4.258	5.753	5.436	0.000	**Sig. Difference**
	Std. Deviation	1.607	0.910			
MAPT31_1	**Mean**	3.812	5.191	5.443	0.000	**Sig. Difference**
	Std. Deviation	1.447	0.962			
MAPT32_1	**Mean**	4.122	5.497	4.930	0.000	**Sig. Difference**
	Std. Deviation	1.614	0.985			
MAPT33_1	**Mean**	3.743	5.411	6.579	0.000	**Sig. Difference**
	Std. Deviation	1.437	0.997			
MAPT34_1	**Mean**	3.806	5.156	6.035	0.000	**Sig. Difference**
	Std. Deviation	1.246	0.951			
MAPT35_1	**Mean**	3.599	5.104	5.638	0.000	**Sig. Difference**
	Std. Deviation	1.514	1.052			
MAPT36_1	**Mean**	3.161	4.503	5.784	0.000	**Sig. Difference**
	Std. Deviation	1.263	1.067			
MAPT37_1	**Mean**	3.357	5.063	6.688	0.000	**Sig. Difference**
	Std. Deviation	1.396	1.152			
MAPT38_1	**Mean**	3.954	5.033	4.044	0.000	**Sig. Difference**
	Std. Deviation	1.459	1.210			
MAPT39_1	**Mean**	2.879	4.892	8.300	0.000	**Sig. Difference**
	Std. Deviation	1.347	1.041			
MAPT40_1	**Mean**	3.604	4.906	4.720	0.000	**Sig. Difference**
	Std. Deviation	1.502	1.265			
MAPT41_1	**Mean**	3.255	4.805	6.122	0.000	**Sig. Difference**
	Std. Deviation	1.376	1.171			
MAPT42_1	**Mean**	3.002	4.570	6.049	0.000	**Sig. Difference**
	Std. Deviation	1.388	1.253			
MAPT43_1	**Mean**	4.135	5.475	4.587	0.000	**Sig. Difference**
	Std. Deviation	1.629	1.237			
MAPT44_1	**Mean**	3.095	4.122	4.176	0.000	**Sig. Difference**
	Std. Deviation	1.364	1.059			
MAPT45_1	**Mean**	3.149	4.460	5.118	0.000	**Sig. Difference**
	Std. Deviation	1.374	1.230			

5.6.6 Summary Of The Cluster Analysis Results

Out of the twenty five recoded management accounting systems' presentation of information variables and forty five recoded management accounting practice/technique variables subjected to the two step cluster analysis of firms, two distinct clusters of firms were formed. Cluster one comprised of thirty nine firms (cases) while cluster two was a cluster of eighty eight firms. The issue of whether to standardize or not to standardize the clustering variables did not matter as both options generated the same two cluster solution. There was also no problem with multicollinearity among the clustering variables as evident from the variance inflation factors (VIF) that were well below four. The two cluster solution was proven to be reliable by virtue of the fact that repeating the cluster analysis on each half of the sample did not produce more than a two cluster solution. Validity of the two cluster solution was shown when the mean performance scores of the two clusters were proven to be significantly different using the independent samples t-test. Cluster two was found to be the better performing cluster relative to cluster one since cluster two had higher mean performance score. It was also found that all the twenty five recoded management accounting systems' presentation of information variables and the forty five recoded management accounting practice/technique variables indicated higher mean scores for cluster two. Hence, cluster two, which was the better performing cluster of firms had respondents agreeing on the high extent of usefulness of all the management accounting systems' presentation of information variables. Respondents belonging to cluster two also concurred that the adoption of each management accounting practice/technique led to higher benefit gained by the firms. It thus appears that there is empirical evidence to suggest that those firms which consider management accounting systems' information attributes as more useful and claim more benefit from practising management accounting practices/techniques are the relatively better performing firms.

5.7 Demographic Controls And Testing For Bias

Demographic controls and testing for bias have been extensively discussed in chapter four of this thesis under section 4.9 and its various sub-sections. The following will reiterate the gist of section 4.9 and its sub-sections with tabulation to illustrate the results of the statistical tests conducted. In this study, differences in responses purely and simply on demographic or background factors are not considered as causing bias. These variables were in fact treated as factors on their own right to be tested against the clusters of firms in order to discern any meaningful relationships.

However, the mail survey has been criticized for non-response bias. If respondents who respond differ substantially from those who do not, the results do not directly allow one to say how the entire sample would have responded which is certainly an important step before the sample is generalized to the population. In this study, the percentage of non-response is not known. All the responses were collected over a period of twelve weeks. The data collection exercise was called off after a period of sixteen weeks from the time of mailing. During keying-in of the data into the SPSS software, each questionnaire was given a serial identity, labelled as serial and a 'wave' number. Here, a wave is defined as those questionnaires that were received within a period of two weeks. Hence, those questionnaires collected in the first two weeks from the time of mailing would fall into wave one, and those collected in the last two weeks would be categorized as belonging to wave six. The first wave saw the largest number of responses, with a frequency of fifty eight and accounting for 45.7% of the 127 usable responses. The second, third, fourth, fifth and sixth waves registered frequencies of twenty one, sixteen, twenty, five and seven respectively.

To test for non-response bias, a variant of the extrapolation methods discussed in sub-section 4.9.3 in chapter four was adopted. It was assumed that later waves behaved more like non-response compared to earlier waves. In this study, to test for non-response bias, this chi square test for relatedness or independence was used. The waves and the clusters were treated as the rows and columns respectively. A chi square test requires three assumptions to be met. The first one is random sampling, i.e. all observations should be randomly sampled from the population of all possible observations. This assumption was considered fulfilled as the sampling was done as randomly as possible. The second assumption is the independence of observations, i.e. each observation should be generated by a different subject and no subject is counted twice. This assumption was met by virtue of the fact that each respondent was not double counted. The third assumption is regarding the size of expected frequencies. The lowest expected frequency in any cell should be five when the number of cells is less than ten and particularly when the total sample size is small[7], i.e. less than twenty. However, the observed frequencies can be any value,

[7] Some authors suggest a less stringent criteria: at least 80 per cent of cells should have expected frequencies of 5 or more. For a 1 by 2 or a 2 by 2 table, it is recommended that the expected frequency be at least 10. For a 2 by 2 table that violates this assumption, the Fisher's Exact Probability Test should be used instead of Pearson Chi Square.

including zero. If the total sample size is around 100, the minimum expected count for validity is one. In this study, the total sample size was 127 cases and as such, the minimum expected count for validity would be one. In the event, after running the crosstabulation and the subsequent chi square test, the minimum expected count was revealed to be 1.54. This was more than the minimum one required for validity. Hence, the third and the last assumption in chi square test for relatedness or independence was duly met.

Since this was a six by two crosstabulation, i.e. six waves by two clusters, and not a two by two table that violated the size of expected frequencies assumption, the Pearson's p-value was read instead of Fisher's p-value. The Pearson's p-value in this case was 0.196. Since the p-value was more than 0.05, there was no significant association between the waves of responses and the cluster membership. In other words, later waves were not significantly different from earlier waves. As later waves were deemed to resemble or reflect non-response, it was deduced that non-respondents would have responded in a manner not statistically dissimilar from respondents. This implied that there was no significant non-response bias. It followed that test procedures for estimating the direction and magnitude of non-response bias would be redundant and therefore, not carried out. The tables below highlight the pertinent results.

Table 5.7 (1) Wave By Cluster Number Crosstabulation (i.e. six by two Crosstabulation)

Wave	Observed Count Or Frequency In Cluster Number		Total
	Cluster 1	Cluster 2	
Wave 1	17	41	58
Wave 2	9	12	21
Wave 3	6	10	16
Wave 4	7	13	20
Wave 5	0	5	5
Wave 6	0	7	7
Total	39	88	127

Table 5.7 (2) Chi-Square Test Of Independence On Wave By Cluster Number

	Value	Significance (2-sided)
Pearson's Chi-Square	7.348[a]	0.196

a. 5 cells (41.7%) had expected count less than 5. The minimum expected count was 1.54.

In order to extract further evidence on the possibility of non-response bias, tests of significant differences between the waves and other continuous variables (recoded institutional, contingency and weighted performance index variables) were performed. Altogether there were forty two dependent variables to be tested against the six waves. These one-way between groups ANOVA with post-hoc comparisons require three assumptions to be met. The first assumption requiring the independence of groups was met by virtue of the fact that the six waves were independent of each other in terms of their memberships. The second assumption supposed that each population from which the samples had been drawn had a normal distribution or the sample was large enough to impose normal sampling distributions of means through the Central Limit Theorem. The results were mixed. The Kolmogorov-Smirnov p-values showed that some distributions were not normal while others were normal. However, as pointed out by authors such as Ferguson and Takane (2005), the F-test in ANOVA is robust even for moderate departures from multivariate normality, so this is among the less crucial assumption of ANOVA, assuming kurtosis is not extreme (from -1 to +2) and sample size is not very small (for example, less than five). From the data analyses, it was apparent that the kurtosis figures were not extreme and the smallest membership of a wave was five. Hence, the assumption of population normality could be disregarded. The third assumption concerned homogeneity of variance (equal variance assumption) where the scores in each group should have homogeneous variances, i.e. equal variances assumed. With the exception of a few, by and large, the tests of homogeneity of variances confirmed that the equal variance assumption was fulfilled for most dependent variables. The few dependent variables that did not register equal variances were not a cause for concern as ANOVA is robust for small and even moderate departures from homogeneity of variances (Box, 1954).

The ANOVA table reveals that with the exception of a few, most dependent variables were not significantly different between groups (waves), i.e. their F-statistics were mainly more than 0.05. Although there were a few dependent variables that had significant differences between the wave groups, such differences were not serious as the Tukey's HSD post-hoc tests suggested. The tests indicated where the few significant differences lay (i.e. where the p-values were less or equal to 0.05). It was found that in only five out of the total forty two dependent variables, which were very few indeed, significant differences were registered. These significant differences referred to the variables recoded institutional mimetic 1 (wave 4 versus wave 6), recoded institutional mimetic 2 (wave 2 versus wave 3), recoded decentralization 6 (wave 1 versus wave 2), recoded decentralization 7 (wave 1 versus wave 4), and finally, recoded decentralization 16 (wave 3 versus wave 4). It should also be pointed out that the crucial weighted performance index did not feature among the five variables. Clearly, none of these conclusively showed significant differences between early waves versus later waves. They were mainly odd ones out. As such, there was hardly enough evidence to suggest that earlier waves were significantly different from later waves. Taking an overall scenario, overwhelmingly it is safe to conclude that further tests of significant differences did not convincingly detect any evidence of non-response bias that merited attention. The full results of the additional tests are not tabulated because they are too extensive for the purpose of this research.

5.8 Testing For Significant Associations Between Cluster Solution And Ancillary Factors (Background Information And Manufacturing Management Methods)

As stated in the previous section, demographic or background factors will be treated as factors on their own accord. Each will be tested against the clusters of firms in order to discern any meaningful relationships. The conceptual model in sub-section 3.4.1 in chapter three, groups background information and manufacturing management methods as ancillary factors to be tested against the two clusters for any significant association. Again, as the ancillary factors and the clusters were two sets of categorical (discrete) variables, the chi square test for independence or relatedness is used to determine whether the two sets of variables are related. The ancillary factors will be the rows while the two clusters will form the columns of the crosstabulation. The following will reiterate the gist of section 4.10 in chapter four coupled with the necessary tabulations to further accentuate the arguments.

The chi square test compares the frequency of cases found in the various categories of one variable across the different categories of another variable. Percentages can also be solicited from the SPSS software. As with other statistical tests, the assumptions underlying the chi square test needed to be addressed first before the test findings could be considered valid. The first assumption of random sampling was, for practical purposes considered met, as all observations were more or less randomly sampled from the population of all possible observations. The second assumption of independent observations was fulfilled as each case could only be counted once, and thereby it could not have appeared in more than one category or group, and the data from one respondent could not influence the data from another respondent. The third assumption is regarding the size of expected frequencies. The lowest expected frequency in any cell should be five when the number of cells is less than ten and particularly when the total sample size is small, i.e. less than twenty. Some authors suggest a less stringent criteria: at least eighty per cent of cells should have expected frequencies of five or more. However, the observed frequencies can be any value, including zero. If the total sample size is around 100, the minimum expected count for validity of one is sufficient. When a two by two table is encountered by SPSS, the output from chi square includes an additional correction value (Yates correction for continuity). SPSS simply refers to it as continuity correction. This is designed to correct or compensate for what some writers feel is an overestimate of the chi square value when used with a two by two table. For a one by two or a two by two table, it is recommended that the expected frequency be at least ten. For a two by two table that violates this assumption, the Fisher's exact probability test should be used instead of Pearson chi square or Yates continuity correction. All these are provided as part of the output from chi square using the SPSS.

In this study, the total sample size was 127 cases and as such, the minimum expected count for validity was generally one. However, when the table was two rows by two columns, a more stringent minimum expected count of ten was used as recommended. Under such circumstance, if the computed minimum expected count equalled or exceeded ten, the chi-square was considered valid and the continuity correction's p-value was referred to. A minimum expected count below ten was still considered valid if Fisher's p-value was referred to instead of the continuity correction's p-value for a two by two table. In a situation where the minimum expected count fell below one and the table was not two rows by two columns, the chi square test was not valid. To rectify the situation, attempt was made to recode the variable values by collapsing variable value(s) with small observed frequencies into another adjacent value in order to increase observed frequencies. Once this was done, the new 'combined' variable value was relabelled appropriately to reflect its wider range.

Crosstabulations and chi square tests were performed on each variable that constituted background information and manufacturing management methods as the rows; the cluster number was set as the columns. There were ten questions that made up background information as contained in section A of the questionnaire. These questions were on gender, age, educational background, length of service, management level, remuneration, decision-making function, functional responsibility, area of operation and status of firm. Some of the questions stood as single variables while other questions were broken down into many separate variables to facilitate data input into the SPSS. Questions 3, 8 and 9 of the questionnaire were examples of itemised rating scales where respondents might answer more than once. As such, for statistical purposes each rating scale was treated as one question with two possible answers, i.e. yes (ticked) or no (not ticked). This gave rise to twenty seven variables for section A. The variable manufacturing management methods was a separate categorical (discrete) nominal variable as in section B of the questionnaire. For this variable, respondents were required to select one of three choices of unit and small batch production, large batch and mass production, and finally, continuous process production. Combining sections A and B, altogether there were twenty eight variables that constituted ancillary factors (background information and manufacturing management methods).

Table 5.8 (1) Chi-Square Test Of Independence On Background Information And Manufacturing Management Methods By Cluster Number

Variable Name	Row By Column	Minimum Expected Count (MEC)	Validity Of Test	Relevant p- Value	Significance
gender	2 By 2	12.59	MEC >10 ∴ Valid Using Continuity Correction	Continuity Correction 's p-Value Of 1.000	Not Significant
age	5 By 2	0.31	**MEC < 1 ∴ Not Valid**	**Required Recoding Since Test Was Not Valid**	

education.certificate	2 By 2	2.15	MEC < 10 ∴ Valid Using Fisher's Test	**Fisher's p-Value Of 0.028**	**Significant**
education.diploma	2 By 2	7.68	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.188	Not Significant
education.bachelors	2 By 2	4.91	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.075	Not Significant
education.masters	2 By 2	5.22	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.427	Not Significant
education.doctoral	2 By 2	0.31	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.693	Not Significant
education.professional	2 By 2	1.23	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.640	Not Significant
education.others	2 By 2	0.61	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.478	Not Significant
presentlengthofservice	5 By 2	3.99	MEC >1 ∴ Valid Using Pearson's Chi-Square	Pearson's p-Value Of 0.893	Not Significant
previouslengthofservice	5 By 2	0.32	**MEC <1 ∴ Not Valid**	**Required Recoding Since Test Was Not Valid**	
managementlevel	3 By 2	2.15	MEC >1 ∴ Valid Using Pearson's Chi-Square	Pearson's p-Value Of 0.344	Not Significant
remuneration	7 By 2	0.30	**MEC <1 ∴ Not Valid**	**Required Recoding Since Test Was Not Valid**	

decisionmaking	3 By 2	4.83	MEC >1 ∴Valid Using Pearson's Chi-Square	Pearson's p-Value Of 0.176	Not Significant
responsibility.acctg	2 By 2	7.06	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.397	Not Significant
responsibility.gen.mgt.	2 By 2	19.04	MEC >10 ∴Valid Using Continuity Correction	Continuity Correction's p-Value Of 0.574	Not Significant
responsibility.sales	2 By 2	4.61	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.261	Not Significant
responsibility.strategic	2 By 2	9.52	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.086	Not Significant
responsibility.production	2 By 2	3.38	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.284	Not Significant
responsibility.other	2 By 2	7.06	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.097	Not Significant
operation.mfg	2 By 2	14.43	MEC >10 ∴Valid Using Continuity Correction	Continuity Correction's p-Value Of 0.222	Not Significant
operation.retail	2 By 2	5.83	MEC <10 ∴Valid Using Fisher's Test	Fisher's p-Value Of 0.438	Not Significant

operation.wholesale	2 By 2	5.53	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.496	Not Significant
operation.services	2 By 2	11.36	MEC >10 ∴ Valid Using Continuity Correction	Continuity Correction 's p-Value Of 1.000	Not Significant
operation.other	2 By 2	3.99	MEC <10 ∴ Valid Using Fisher's Test	Fisher's p-Value Of 0.168	Not Significant
associateorsubsidiary	2 By 2	13.54	MEC >10 ∴ Valid Using Continuity Correction	Continuity Correction 's p-Value Of 1.000	Not Significant
decentralisedornot	2 By 2	13.38	MEC >10 ∴ Valid Using Continuity Correction	Continuity Correction 's p-Value Of 0.370	Not Significant
manufacturingmethod	3 By 2	8.03	MEC >1 ∴ Valid Using Pearson Chi-Square	Pearson's p-Value Of 0.215	Not Significant

Key: If $p > 0.05$, then not significant.
If $p \leq 0.05$, then significant.

After running the crosstabulations and the subsequent chi square tests, all the relevant p-values in table 5.8 (1) were more than 0.05 except for four variables, namely age, education-certificate(s), previous length of service and remuneration. The education-certificate(s) variable was found to have significant association with the cluster solution by virtue of the fact that its relevant Fisher's p-value was below 0.05. Age, previous length of service and remuneration were preliminarily found to be not valid for a chi-square test and as such, required recoding. Recoding for age meant that variable value 5 (labelled as 60 years old and above) was combined or 'collapsed' into variable value 4 (labelled as 50 to 59 years old). The decision to collapse variable value 5 was because it had very few observed counts relative to others. The new variable value 4 was relabelled 50 years old and above to reflect its new identity. Similarly, for previous length of service, variable value 1 (no experience in previous firms) and variable value 2 (less than 1 year experience in previous firms) were collapsed into variable value 3 (1 to 4 year experience in previous firms) to ensure that the new combined cells did not have such low observed counts. The recoded variable value 3 was relabelled 'up to 4 year experience in previous firms'. For the remuneration variable, variable values 5, 6 and 7 were collapsed into one and the recoded variable was subsequently relabelled as 'RM 20,000 and above' to suit its new categorization. The chi-square tests of independence were repeated on the recoded variables. The results are tabulated as follows.

Table 5.8 (2) Chi-Square Test Of Independence On Three Recoded Background Information (age, previouslengthofservice and remuneration) By Cluster Number

Variable Name	**Row By Column**	**Minimum Expected Count (MEC)**	**Validity Of Test**	**Relevant p- Value**	**Significance**
age	After Recoding became 4 By 2	1.84	MEC >1 ∴ Valid Using Pearson Chi-Square	Pearson's p-Value Of 0.929	Not Significant
previouslengthofservice	After Recoding became 3 By 2	8.96	MEC >1 ∴ Valid Using Pearson Chi-Square	**Pearson's p-Value Of 0.021**	**Significant**
remuneration	After Recoding became 5 By 2	1.80	MEC >1 ∴ Valid Using Pearson Chi-Square	Pearson's p-Value Of 0.122	Not Significant

Key: If $p > 0.05$, then not significant.
If $p \le 0.05$, then significant.

From the chi-square results of the three recoded variables as depicted in table 5.8 (2), it was found that only previous length of service came out significant. This meant that overall, except for education-certificate(s) and previous length of service, there were no significant associations between the variables and the clusters.

The minimum expected count for the education-certificate(s) versus cluster number was 2.15. This was above the required minimum of one for a sample size of 127. Hence, the chi square test was valid. Since this was a two by two table and the minimum expected count did not reach ten, the Fisher's exact test p-value would be read. The p-value was 0.028 which was lower than 0.05 indicating that there was a significant association between education-certificates and the cluster solution. Based on the frequencies in terms of percentages, it was revealed that 94.5% (i.e. 120 divided by 127) of respondents claimed that they did not have qualifications at the certificate level on top of their professional qualification (CIMA). Out of those who did not have certificate qualifications, a vast majority (71.7%) worked in firms belonging to cluster two, the better performing cluster. Of those who did have certificate level qualifications, only a minority worked in better performing firms (cluster two). Table 5.8 (3) below shows the relevant cross-tabulation. It thus appeared that having extra educational certificates to supplement the core professional qualification among respondents did not relate to better performing firms. This might seem to be ironic at a glance. However, those respondents in cluster two firms, while having no extra educational certificates, had an offsetting greater length of experience, as revealed in the next paragraph.

Table 5.8 (3) Education.certificate(s) By Cluster Number Crosstabulation (i.e. Two by Two Crosstabulation)

Education.certificate(s):		Observed Count Or Frequency In Cluster Number		Total
		Cluster 1	Cluster 2	
No	Count	34	86	120
	%Within Education.certificate(s)	28.3%	71.7%	100%
Yes	Count	5	2	7
	%Within Education.certificate(s)	71.4%	28.6%	100%
Total	Count	39	88	127
	%Within Education.certificate(s)	30.7%	69.3%	100%

The p-value for the previous length of service variable was also less than 0.05, indicating a significant association (Pearson's p-value = 0.040). Here, the Pearson's p-value was read as the table was five by two. However, the minimum expected count was only 0.32 which was less than one. As such, the result was not valid as chi square's third assumption was not met. On examination of the table on previous length of service against the clusters, it was noticed that frequencies for categories of 'no experience in previous firms' (variable value one) and 'less than one year experience in previous firms' (variable value 2) only registered one respondent each. These responses were too small to contribute to overall validity. As such, variable values 1 and 2 were collapsed into variable value 3 (the variable value label here was '1 to 4 year experience in previous firms'). To do this, the variable values with a range of 1 through 2 were recoded into the same variables (i.e. existing variable values) with a new value of 3. To make sense of the 'new' variable value 3, it was relabelled as 'up to 4 year experience in previous firms'. A chi square test of the recoded previous length of service against clusters was executed. This time it was a three by two table with a Pearson's p-value of 0.021. Since the p-value of 0.021 was lower than 0.05, there was still a significant association between the recoded previous length of service with the clusters. More importantly, the new minimum expected count was 8.96. This exceeded the minimum one required for validity. Hence, the recoded crosstabulation and the subsequent chi square test could safely be regarded as valid for analysis and interpretation. On examination of the crosstabulation, it was discovered that experienced respondents, i.e. those with five to nine year experience and those with above ten year experience were more into cluster two (the better performing cluster) compared to cluster one. The less experienced respondents, i.e. those with up to four year experience, were about evenly matched in their representations in the two clusters. Thus, the evidence suggested that the better performing cluster, i.e. cluster two, was well represented by much more experienced respondents. Table 5.8 (4) below highlights the important cross-tabulation.

Table 5.8 (4) Recoded Previouslengthofservice By Cluster Number Crosstabulation (i.e. Three by Two Crosstabulation)

Recoded Previouslengthofservice:		Observed Count Or Frequency In Cluster Number		Total
		Cluster 1	Cluster 2	
Up to 4 year experience in previous firms	Count	17	21	38
	%	44.7%	55.3%	100%
5 to 9 year experience in previous firms	Count	5	29	34
	%	14.7%	85.3%	100%
more than 10 year experience in previous firms	Count	10	18	28
	%	35.7%	64.3%	100%
Total	Count	32	68	100
	%	32.0%	68.0%	100%

5.8.1 Summary Of The Significance Testings Between Cluster Solution And Ancillary Factors (Background Information And Manufacturing Management Methods)

From the twenty eight variables that constituted ancillary factors (background information and manufacturing management methods) as per sections A and B of the questionnaire, only two came out as having significant associations with the cluster solution. The two variables were education-certificate(s) and previous length of service of respondents. The evidence suggested that having extra educational certificates to supplement the core professional qualification among respondents did not relate to better performing firms. Conventional wisdom would suggest that having accounting employees with additional qualifications is desirable to firms in most instances. The results may suggest that better performing management accountants are those who attained their professional credentials without having to go for transitional or intermediary certificates prior to qualifying. However, the more plausible explanation is that those respondents who have the professional qualification (CIMA) and no other educational certificates came through an earlier education system and have been in employment longer. Their more years of practical and managerial application of their professional qualification may be an explanation for their being in the better performing cluster of firms. In terms of the variable "previous length of service", it was found that the better performing cluster was well represented by much more experienced respondents. This was hardly surprising as experienced personnel are likely to be sought after in a typical high performing firm.

5.9 Testing For Significant Differences In The Mean Scores Of The Institutional And Contingency Factor Variables For The Cluster Solution

In this section, attempt is made to see if there is any significant difference between the two clusters and each of the interval variables that made up the institutional and contingency factors as contained in sections F and G of the questionnaire. The parametric independent samples t-test is appropriate for a single interval dependent and a dichotomous independent to test the difference of means. The independent samples t-test is used to compare the means of a criterion variable for two independent samples or groups. Here, the interval criterion dependent variable is each of the institutional and contingency variables, and the dichotomous independent groups are the two clusters[8]. When $p \leq 0.05$ a researcher concludes that the two groups are significantly different in their means.

The assumptions underlying the independent samples t-test need to be evaluated because the accuracy of test interpretation depends on whether any of the assumptions is violated. The first assumption requires that the dependent variable should be at the interval or ratio level of measurement. The Likert scale used to measure each institutional and contingency variable was treated as interval scale, ensuring compliance with the first assumption. The second assumption is random sampling. The sampling procedure was conducted in as random a manner as practically feasible so as to conform to the second assumption. The third assumption is that approximately normal distribution of the measure in the two groups is assumed. However, as pointed out in sub-section 4.6.3 in chapter four, the Kolmogorov-Smirnov z test for normality indicated non-normal distributions for the data relating to the two clusters (i.e. $p \leq 0.05$). Thus assumption three was violated. Fortunately, the technique is reasonably robust or tolerant of violation of normal distribution. With large enough sample sizes (e.g. 30+), the violation of this assumption should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996). In fact, as the sample size becomes bigger, the central limit theorem can be leveraged upon. This theorem states that as the size of a random sample increases, its distribution approximates a normal distribution. Moreover, Rasch and Guiard (2004) present impressive results both at the theoretical and the applied levels that show that the t-test is extremely robust against

[8] With polytomous independent variables, researchers would have used analysis of variance (ANOVA).

violations of the normality assumption. Indeed, the authors present a very concise and illustrative specification of the well known result (Bartlett, 1935) that the t-test has a non-parametric property over a parametric class consisting of normally distributed variables (Randless & Wolfe, 1979; von Eye, 1988). It has been said that the t-test is asymptotically non-parametric (cf. Lehmann, 1975). The fourth assumption is the independence of groups, i.e. participants should appear in only one group and these groups are unrelated. This assumption was met by virtue of the fact that cases (firms) belonging to cluster one could not have belonged to cluster two, and vice-versa. The fifth assumption requires roughly similar variances. This is a test for homogeneity of variance, also referred to as a test of homoscedasticity. In SPSS, homogeneity of variances is tested by Levene's test for equality of variances, with F value and corresponding significance. These are part of SPSS output for an independent samples t-test. The t-test may be unreliable when the two samples are unequal in size and also have unequal variances (see Gardner, 1975). What is required is for the test to be not significant (i.e. a significance level of greater than 0.05). If the significance value is equal to or less than 0.05, the variances for the two groups are not equal. Under this circumstance, the assumption of homogeneity of variance is violated. However, for t-tests this is not a problem as two sets of results are provided for, one for the situation where the assumption is not violated (equal variances assumed), and another, where the assumption is violated (equal variances not assumed). When equal variances are not assumed, the procedure provides for an alternative t value that compensates for the fact that the variances are not the same. SPSS selects the appropriate one automatically. The researcher only needs to consult whichever set of results selected by the software. In this study, the homogeneity of variance assumption was complied with (i.e. equal variances assumed) in all the independent samples t-tests conducted.

To find out whether there is a significant difference between the two groups (clusters), the two tailed significant value (p value) of the t-test for the equality of means was examined. If the p value is equal to or less than 0.05, then there is a significant difference in the mean scores of the dependent variable for each of the two groups (clusters). Otherwise, there is no significant difference between the two clusters.

Examination of the results revealed that, for all the nine variables that made up institutional factors (section F of the questionnaire), seven variables were found to have statistically significant differences in their mean scores for clusters one and two. The seven variables were identified as the recoded versions of institutional mimetic 1 (Q81), institutional mimetic 2 (Q82), institutional mimetic 3 (Q83), institutional coercive 3

(Q86), institutional normative 1 (Q87), institutional normative 2 (Q88) and institutional normative 3 (Q89). For every one of these seven variables, the mean score for cluster two was higher than the corresponding mean score for cluster one. This would suggest that those representing the better performing cluster (cluster two) tended to agree more on the seven statements that constituted the seven variables. It should be noted that only two recoded variables, viz. recoded institutional coercive 1 (Q84) and recoded institutional coercive 2 (Q85) did not register any significant mean differences between the two clusters. Question 84 of the questionnaire states that 'the firm must follow the costing and budgeting methods and management reporting formats dictated by an outside headquarters or oversight organization'. It thus appeared that pressure applied by an external party to dictate the bearing of the costing, budgeting and management reporting had no significant impact on whether a firm belonged to a better performing cluster (cluster two) or not (cluster one). Question 85 states that 'any substantial changes to the management accounting systems will arise from pressures applied by the top management, i.e. a top-down policy approach'. On a similar note, the influence wielded by top management on the management accounting systems did not significantly affect the mean scores of the two clusters. In other words, a top-down style of pressure from top management had no significant association with the cluster membership.

In table 5.9 (1) below, the higher mean score for cluster two in respect of each recoded institutional factor variable is apparent. The recoded institutional factor variables are represented by their variable names and not by their variable labels. In table 5.9 (2) below, it is shown that only seven out of the nine recoded institutional factor variables have their means significantly different between the two clusters. Table 5.9 (3) reproduces the full variable statements as per questionnaire on the seven variables with significantly different cluster means.

Table 5.9 (1) Group Statistics On The t-Test Of The Cluster Solution With The Recoded Institutional Factor Variables

Variable Name	Cluster	Mean Score	Std. Deviation	Std. Error Of Mean
Instit_1	Cluster 1	4.372	1.3831	0.2215
	Cluster 2	5.038	1.3978	0.1490
Instit_2	Cluster 1	3.701	1.4917	0.2389
	Cluster 2	4.301	1.4704	0.1567

Instit_3	Cluster 1	3.936	1.4427	0.2310
	Cluster 2	4.750	1.6117	0.1718
Instit_4	Cluster 1	3.880	1.5085	0.2416
	Cluster 2	4.207	1.7948	0.1913
Instit_5	Cluster 1	4.898	1.3138	0.2104
	Cluster 2	5.068	1.6456	0.1754
Instit_6	Cluster 1	4.593	1.5179	0.2431
	Cluster 2	5.364	1.1465	0.1222
Instit_7	Cluster 1	4.782	1.3884	0.2223
	Cluster 2	5.443	1.2490	0.1331
Instit_8	Cluster 1	3.680	1.5145	0.2425
	Cluster 2	4.530	1.5638	0.1667
Instit_9	Cluster 1	4.837	1.3168	0.2108
	Cluster 2	5.870	1.1730	0.1250

Table 5.9 (2) Independent Samples t-Test Of The Cluster Solution With The Recoded Institutional Factor Variables

Variable Name	Levene's Test For Equality Of Variances (Equal Variances Assumed)		t-Test For Equality Of Means		Significant Difference Between Means Of The 2 Clusters?
	F	Sig.	t	Sig (2-tailed)	
Instit_1	0.131	0.718	-2.485	0.014	**Significant**
Instit_2	0.036	0.849	-2.110	0.037	**Significant**
Instit_3	1.486	0.225	-2.709	0.008	**Significant**
Instit_4	3.568	0.061	-0.992	0.323	Not Significant
Instit_5	2.199	0.141	-0.570	0.569	Not Significant
Instit_6	5.957	0.016	-3.152	0.002	**Significant**
Instit_7	2.124	0.148	-2.660	0.009	**Significant**
Instit_8	0.015	0.903	-2.850	0.005	**Significant**
Instit_9	3.174	0.077	-4.405	0.000	**Significant**

Key: If $p > 0.05$, then not significant.
If $p \leq 0.05$, then significant.

Table 5.9 (3) Institutional Variable Statements With Significant Differences In Their Means For Clusters 1 And 2

Variable Name	Variable Statement As Per Questionnaire
Instit_1	The firm benefits by ensuring that it keeps up with best practices in management accounting used by its competitor(s).
Instit_2	The firm benefits by imitating, as much as possible, the costing and budgeting techniques of other firms in the industry.
Instit_3	It is better for the firm to use the most popular and widely used software package(s) for its management accounting systems.
Instit_6	There is a lot of attention given by management and directors to the way management control systems function.
Instit_7	The management accounting systems in the firm are designed and maintained almost entirely due to the expertise of the firm's own management accountants or consultants.
Instit_8	The firm relies strongly on CIMA or similar professional bodies for its ideas concerning management accounting and control techniques, which it considers using.
Instit_9	When the firm's senior management addresses issues relating to costing, budgeting methods and reporting, they depend heavily on the advice of the senior management accountant/financial controller.

As for the three recoded variables (i.e. where the missing values had been replaced by means) that made up the strategic manufacturing priority dimension of the contingency factor construct, all three of them were found to show significant differences in mean scores for the two clusters. In each case, cluster two (the better performing cluster) depicted a higher mean score relative to cluster one. This indicates that respondents representing firms in cluster two are more in agreement with giving emphasis on all the three manufacturing strategies embodied in the three variables. In other words, the better performing firms (cluster two) tended to agree more on emphasizing all the manufacturing strategies outlined.

As for the three recoded variables (the original missing values replaced by means) that formed the organizational interdependence dimension, none was found to be significantly different between the two clusters.

There were twenty three recoded variables that constituted organizational structure: decentralization dimension of the contingency factor construct. After subjecting them to the t-tests for equality of means with the two clusters, only two variables were observed to exhibit significant differences in mean scores for the two clusters. The two variables concerned were the recoded decentralization 2 and decentralization 3. Subsequent examination of the means indicated that cluster two (the better performing cluster) had higher mean scores relative to cluster one, for both variables. This meant that on average, respondents from the better performing firms seemed to agree more that their managers were given decision autonomy to appoint and promote supervisory staff from outside the firms.

The last dimension that constituted the contingency factor construct was perceived environmental uncertainty. There were three recoded variables under this dimension. After the t-tests were carried out, it was found that none of the three recoded variables revealed any significant difference in mean scores for the two clusters (i.e. all the p values were more than 0.05 for the t-test for equality of means sub-test, where equal variances were assumed).

Clearly, all the three corporate strategies of competing in technology/innovation, manufacturing competitively priced quality products and customer-centric approach seemed to contribute to better performing firms (i.e. firms in cluster two). Giving managers decision autonomy to appoint and promote supervisory staff too resulted in firms showing significantly better performance (cluster two firms). Tables 5.9 (4), 5.9 (5) and 5.9 (6) as shown below illustrate in detail the analyses that give rise to the points mentioned above.

Table 5.9 (4) Group Statistics On The t-Test Of The Cluster Solution With The Recoded Contingency Factor Variables

Variable Name	Cluster	Mean Score	Std. Deviation	Std. Error Of Mean
Mfg.st_1	Cluster 1	4.798	1.5546	0.2489
	Cluster 2	5.632	1.3930	0.1485
Mfg.st_2	Cluster 1	5.596	1.4838	0.2376
	Cluster 2	6.300	0.9104	0.0970

Mfg.st_3	Cluster 1	5.761	1.4860	0.2380
	Cluster 2	6.428	0.7807	0.0832
Org.in_1	Cluster 1	3.468	1.6074	0.2574
	Cluster 2	3.260	1.5719	0.1676
Org.in_2	Cluster 1	4.685	1.4636	0.2344
	Cluster 2	4.830	1.3428	0.1431
Org.in_3	Cluster 1	4.583	1.2768	0.2045
	Cluster 2	4.717	1.3300	0.1418
Decent_1	Cluster 1	4.902	1.3923	0.2229
	Cluster 2	5.307	1.3074	0.1394
Decent_2	Cluster 1	4.169	1.5832	0.2535
	Cluster 2	4.798	1.5600	0.1663
Decent_3	Cluster 1	4.537	1.3537	0.2168
	Cluster 2	5.101	1.4626	0.1559
Decent_4	Cluster 1	3.957	1.6545	0.2649
	Cluster 2	4.462	1.5367	0.1638
Decent_5	Cluster 1	3.088	1.5967	0.2557
	Cluster 2	3.566	1.6299	0.1737
Decent_6	Cluster 1	3.346	1.6065	0.2573
	Cluster 2	3.568	1.5279	0.1629
Decent_7	Cluster 1	3.878	1.4907	0.2387
	Cluster 2	4.173	1.5327	0.1634
Decent_8	Cluster 1	3.633	1.4938	0.2392
	Cluster 2	3.926	1.5373	0.1639
Decent_9	Cluster 1	3.982	1.5307	0.2451
	Cluster 2	4.219	1.5640	0.1667
Decen_10	Cluster 1	3.859	1.4809	0.2371
	Cluster 2	4.415	1.6010	0.1707
Decen_11	Cluster 1	4.029	1.6139	0.2584
	Cluster 2	4.160	1.6669	0.1777
Decen_12	Cluster 1	4.446	1.3829	0.2214
	Cluster 2	4.668	1.4653	0.1562
Decen_13	Cluster 1	4.518	1.4793	0.2369
	Cluster 2	4.832	1.2305	0.1312
Decen_14	Cluster 1	4.188	1.6522	0.2646
	Cluster 2	4.402	1.5790	0.1683
Decen_15	Cluster 1	4.715	1.3940	0.2232
	Cluster 2	5.057	1.1779	0.1256
Decen_16	Cluster 1	4.085	1.6126	0.2582
	Cluster 2	4.409	1.4827	0.1581
Decen_17	Cluster 1	4.397	1.7251	0.2762
	Cluster 2	4.523	1.4462	0.1542
Decen_18	Cluster 1	3.710	1.5368	0.2461
	Cluster 2	3.977	1.4931	0.1592
Decen_19	Cluster 1	4.100	1.6027	0.2566
	Cluster 2	3.920	1.4950	0.1594
Decen_20	Cluster 1	3.792	1.6248	0.2602
	Cluster 2	3.999	1.4384	0.1533
Decen_21	Cluster 1	3.917	1.6217	0.2597
	Cluster 2	4.409	1.4113	0.1504
Decen_22	Cluster 1	2.964	1.7326	0.2774

	Cluster 2	3.311	1.7569	0.1873
Decen_23	Cluster 1	3.794	1.7648	0.2826
	Cluster 2	4.068	1.6802	0.1791
Uncert_1	Cluster 1	4.056	1.4680	0.2351
	Cluster 2	4.104	1.5832	0.1688
Uncert_2	Cluster 1	4.219	1.4888	0.2384
	Cluster 2	4.161	1.7477	0.1863
Uncert_3	Cluster 1	4.014	1.5906	0.2547
	Cluster 2	4.381	1.6964	0.1808

Table 5.9 (5) Independent Samples t-Test Of The Cluster Solution With The Recoded Contingency Factor Variables

Variable Name	**Levene's Test For Equality Of Variances (Equal Variances Assumed)**		**t-Test For Equality Of Means**		**Significant Difference Between Means Of The 2 Clusters?**
	F	Sig.	t	Sig (2-tailed)	
Mfg.st_1	1.021	0.314	-3.002	0.003	**Significant**
Mfg.st_2	8.556	0.004	-3.279	0.001	**Significant**
Mfg.st_3	7.699	0.006	-3.314	0.001	**Significant**
Org.in_1	0.028	0.866	0.683	0.496	Not Significant
Org.in_2	0.116	0.734	-0.547	0.585	Not Significant
Org.in_3	0.139	0.710	-0.530	0.597	Not Significant
Decent_1	0.356	0.552	-1.577	0.117	Not Significant
Decent_2	0.553	0.459	-2.085	0.039	**Significant**
Decent_3	0.001	0.971	-2.053	0.042	**Significant**
Decent_4	0.230	0.632	-1.668	0.098	Not Significant
Decent_5	0.867	0.354	-1.536	0.127	Not Significant
Decent_6	0.058	0.810	-0.744	0.459	Not Significant
Decent_7	0.086	0.769	-1.009	0.315	Not Significant
Decent_8	0.043	0.836	-1.001	0.319	Not Significant
Decent_9	0.185	0.668	-0.794	0.429	Not Significant
Decen_10	0.637	0.426	-1.846	0.067	Not Significant
Decen_11	0.400	0.528	-0.415	0.679	Not Significant
Decen_12	0.072	0.788	-0.801	0.425	Not Significant
Decen_13	2.913	0.090	-1.244	0.216	Not Significant
Decen_14	0.000	1.000	-0.639	0.490	Not Significant
Decen_15	1.661	0.200	-1.422	0.157	Not Significant
Decen_16	0.761	0.385	-1.106	0.271	Not Significant
Decen_17	2.099	0.150	-0.425	0.671	Not Significant
Decen_18	0.220	0.640	-0.923	0.358	Not Significant
Decen_19	0.030	0.863	0.613	0.541	Not Significant
Decen_20	2.529	0.114	-0.721	0.472	Not Significant
Decen_21	1.848	0.177	-1.729	0.086	Not Significant
Decen_22	0.709	0.401	-1.031	0.305	Not Significant

Decen_23	0.477	0.491	-0.834	0.406	Not Significant
Uncert_1	0.063	0.802	-0.163	0.871	Not Significant
Uncert_2	1.456	0.230	0.179	0.858	Not Significant
Uncert_3	0.282	0.596	-1.147	0.254	Not Significant

Key: If $p > 0.05$, then not significant.
If $p \leq 0.05$, then significant.

Table 5.9 (6) Contingency Variable Statements With Significant Differences In Their Means For Clusters 1 And 2

Variable Name	Variable Statement As Per Questionnaire
Mfg.st_1	Your firm's manufacturing strategy emphasizes the need to compete in technological development and constant innovations.
Mfg.st_2	Your firm's manufacturing strategy emphasizes the need to manufacture products of a high quality at competitive prices.
Mfg.st_3	Your firm's manufacturing strategy emphasizes the need to respond to customers' requirements, giving priority to service and delivery.
Decent_2	Your managers have decision autonomy on the appointment of supervisory staff from outside the organization.
Decent_3	Your managers have decision autonomy on the promotion of supervisory staff.

As the better performing cluster (cluster two) comprises of manufacturing firms whose respondents perceived more usefulness of the whole gamut of management accounting systems' (MAS') information attributes and more benefit from adopting the whole range of management accounting practices/techniques (MAPT), it follows that the success of implementing MAS' information attributes and management accounting practices/techniques is contingent on having a manufacturing strategy (whatever it may be) and allowing managers the authority to select suitable supervisory staff (even promoting these staff). Other contingency factors do not seem to matter in contributing towards the success of implementing MAS' information attributes and management accounting practices/techniques with a view of achieving better performance.

5.9.1 Summary Of The Testing For Significant Differences In The Mean Scores Of The Institutional And Contingency Factor Variables For The Cluster Solution

Variables under institutional and contingency factor constructs were tested for significant differences in their mean scores for the two clusters of firms identified. Out of the three variables labelled as recoded institutional mimetic, all came out significant. Similarly, all the three variables labelled as recoded institutional normative also came out significant. However, only one variable among the three recoded institutional coercive variables turned out to be significant. Therefore, there was some empirical evidence to suggest that 'coercive' criteria did not generally have a strong impact on a firm's choice of management accounting system and practice/technique characteristics and by extension, the firm's performance. All the other seven variables related well to which cluster a firm belonged to. For each one of them, the mean score for cluster two was higher than the corresponding mean score for cluster one, indicating that those representing the better performing cluster (cluster two) tended to agree more on the seven statements that constituted the seven variables. As such, the evidence reveals that mimetic and normative influences in an institutional framework do have a bearing on a manufacturing concern's management accounting system and practice/technique characteristics that are linked to performance. Where respondents agreed on such influences bringing to bear upon them, a better firm's performance was significantly noted.

As for the contingency factor construct, all the three variables under strategic manufacturing priorities are found to be significant. However, none of the variables under organizational interdependence and perceived environmental uncertainty turned out to be significant. Out of twenty three variables under organizational structure: decentralization, only two were significant. For all the five significant variables, cluster two (the better performing cluster) depicted higher mean scores relative to cluster one. This denoted that respondents representing firms in cluster two (the better performing cluster) were more in agreement with putting emphasis on all the three manufacturing strategies outlined as well as giving managers decision autonomy to appoint and promote supervisory staff. Clearly, the evidence suggests that all the three corporate strategies of competing in technology/innovation, manufacturing competitively priced quality products and customer-centric approach seem to affect the development of a firm's management accounting systems and practices/techniques. Respondents who tended to agree more on advocating any one of those manufacturing strategies fell into cluster two. This was also the cluster whose respondents agree on the usefulness of MAS' information attributes and the benefit of adopting management accounting practices/techniques. By inference, it can be argued that the success of implementing management accounting system and practice/technique characteristics with a view of achieving better performance is contingent upon having a manufacturing strategy. Empowering managers decision autonomy to appoint and promote supervisory staff too resulted in firms with higher scores for management accounting system and practice/technique characteristics (i.e. cluster two firms). Again, this can be deduced as showing that significantly better performance among manufacturing firms is contingent upon managers being given decision autonomy to select and promote supervisory staff in order to make good of the use of management accounting systems' information attributes and benefit of management accounting practices/techniques. All other contingency variables were shown to have no significant association with cluster membership. As such, the influence of these non-significant variables did not impact on the firms' performance.

The above analyses only measured bivariate significant associations between each variable tested and the cluster solution. In the next section (section 5.10), results from a multivariate analysis are reported to elucidate the predictive power of the significant variables on the cluster solution in the context of a model fit.

5.10 Predicting The Cluster Membership Based On Values From The Ancillary, Institutional And Contingency Factor Variables

In this section, the analyses will go beyond bivariate tests of association into multivariate model building with a view to determining the predictive power of the independent institutional and contingency variables towards the dependent cluster membership. In this study, the dependent or response variable is the cluster solution. The independent variables or predictors are the significant background information identified in section 5.8 and all the significant institutional and contingency variables ascertained in section 5.9. Both the significant background information variables (education-certificates and the recoded previous length of service) are categorical independent variables. All the respective institutional and contingency variables are deemed continuous. For the purpose of this research, the multinomial logistic regression was chosen.

5.10.1 Testing Assumptions In The Multinomial Logistic Regression

The multinomial logistic regression has many assumptions that needed attention. The main assumptions are addressed below based on the relevant assumption testings performed. This section will furnish, where appropriate, supporting tabulations and/or diagrams (figures) to provide more information on the issues discussed.

1. *Meaningful coding.*

   For multinomial logistic regression, the dependent class of greatest interest should be the last class. Logistic regression is predicting the log odds of being in the class of greatest interest. In this study, as the stepwise logistic regression method is used within the multinomial logistic regression procedure, SPSS offers a chọice of 'reference category'. Since the dependent class of greatest interest is cluster two, being the better performing cluster, within the reference category, the first category is selected. This allows cluster two (the better performing cluster of firms) to be compared with cluster one. As for the independent variables, SPSS multinomial logistic regression will convert categorical variables into dummy variables automatically by leaving out the last category. However, researchers may create dummy variables manually so as to control which category is omitted and thus becomes the reference category. Due to the exploratory nature of this research (hence the stepwise method is opted for), the automatic conversion of any categorical independent variables into dummies is the preferred choice. There are only two categorical independent variables, viz., education-certificates and the recoded previous length of service. For education-certificates, category one or variable value one (i.e. when a respondent indicated 'yes') automatically becomes the reference category. Similarly, for the recoded previous length of service, category 5 or variable value 5 automatically defaults into being the reference category for the variable concerned. Category 5 with the variable value label of 'more than 10 year experience in previous firms' happens to be the last category for the categorical variable.

2. *Error terms are assumed to be independent (independent sampling).*

   Violations of this assumption can have serious effects. Violations will occur, for instance, in correlated samples and repeated measures designs, such as before-after or matched-pairs studies, cluster sampling, or time-series data. That is, subjects cannot provide for multiple observations at different time points.

In this study, the research design is such that subjects or cases could not be double counted at different times. Furthermore, to test for any serial correlations between the cases, a bivariate Pearson product-moment correlation for two continuous variables is used. The two continuous variables are the residuals and the lag residuals saved as separate variables. The lag residual variable is lag minus one, i.e. the first and the last values are not taken into consideration for correlation purposes. Examination of the correlation table shows that the number of cases (N) is well below the 127 usable responses. This is due to the treatment of missing values (see table 5.10.1 (1)).

Unlike the linear model assumed by ordinary least squares (OLS) regression, the non-linear model assumed by logistic regression requires a full set of data. Therefore SPSS provides only for listwise deletion of cases with missing data, using the remaining full dataset to calculate logistic parameters. By using listwise deletion, any case with missing data on any of the variables will be removed from the analysis[9]. This explains the lower number of cases analysed by the correlation procedure. However, the number of cases processed is not a cause for concern as it is still substantial.

The result also shows that the correlation between the residuals and lag residuals has a Pearson correlation coefficient (r) of 0.084. Cohen (1988) suggests the following guidelines: $r = \pm 0.1$ to ± 0.29 as indicating a small correlation; $r = \pm 0.30$ to ± 0.49 as having medium correlation and $r = \pm 0.5$ to ± 1.00 as showing large correlation. A +0.084 coefficient is very close to zero, indicating that there was almost no correlation or relationship between the residuals and lag residuals whatsoever. The two-tailed significance value (p value) is 0.473 (see table 5.10.1 (1)). As this is way above 0.05, the Pearson coefficient of correlation ($r = +0.084$) is not statistically significant. As such, the evidence suggests that there is no significant correlation between the residuals and the lag residuals. In other words, there are no serial correlations detected in the error terms (residuals). All these tests lead to the assumption of independent sampling being adequately satisfied. Table 5.10.1 (1) below highlights the findings.

[9] It should be noted that in this study, only the categorical variables from the background information and manufacturing management methods had some missing values left. All the missing values in the continuous institutional and contingency variables had been replaced by means. The listwise deletion by the logistic regression only applied to the categorical missing values that could not be replaced by means as a matter of principle.

Table 5.10.1 (1) Correlation Between Residuals And Lag Residuals Of The Multinomial Logistic Regression

		Residuals	Lag Residuals
Residuals	Correlation Coefficient	1.000	0.084
	2 Tailed Significance Value		0.473
	Number Of Cases	100	75
Lag Residuals	Correlation Coefficient	0.084	1.000
	2 Tailed Significance Value	0.473	
	Number Of Cases	75	99

3. *Linearity.*

Logistic regression does not require linear relationships between the independents and the dependent, as does ordinary least squares (OLS) regression, but it does assume a linear relationship between the logit of the independents and the dependent. When the assumption of linearity in the logits is violated, then logistic regression will underestimate the degree of relationship of the independents to the dependent and will lack power (generating Type II errors, thinking there is no relationship when there actually is). In this study, only the continuous predictors are tested for linearity with the logit. It is assumed that the concept of linearity with the logit does not extend to the single categorical predictor (recoded previous length of service). To test for linearity, a bivariate Pearson product-moment correlation for two continuous variables is used. The two continuous variables are the logit of the cluster solution and each of the continuous predictors (recoded institutional coercive3, institutional normative3 and manufacturing strategy3). The logit of the cluster solution is a logistic transformation of the cluster solution, which is the log (to base *e*) of the odds or likelihood ratio that the dependent variable is one. The three continuous predictors are also labelled as instit_6, instit_9 and mfg. st_3.

The correlation table (see table 5.10.1 (2)) shows that the number of cases (N) is well below the 127 usable responses. This again is due to the treatment of missing values. The non-linear model assumed by logistic regression requires a full set of data. Therefore SPSS provides only for listwise deletion of cases with missing data, using the remaining full dataset to calculate logistic parameters. By using listwise deletion, any case with missing data on any of the variables will be removed from the analysis.

This explains the lower number of cases analysed by the correlation procedure. However, the number of cases processed is not a cause for concern as it is still substantial. Note that there are four predictors, three of which are continuous predictors. This is ascertained from the likelihood ratio tests illustrated in sub-section 5.10.2 below under table 5.10.2 (2).

The result of the correlation procedure also shows that the correlations between the logit of the cluster solution and the continuous predictors have Pearson's correlation coefficients (r) of 0.386, 0.642 and 0.532 respectively (see table 5.10.1 (2)). Following Cohen (1988), the logit and the recoded institutional coercive 3 show a positive medium correlation of +0.386, the logit and the recoded institutional normative 3 have a positive large correlation with a coefficient of +0.642, and similarly, the logit exhibits a positive large correlation of +0.532 with the recoded manufacturing strategy 3. The two tailed significance values (p values) are all less than 0.05 for each continuous predictor. This means that all the Pearson coefficients of correlation stated above are statistically significant. As such, the evidence suggests that there are significant correlations between the logit of the cluster solution and the continuous predictors. These significant correlation values between the logit and the continuous predictor variables can be interpreted as indicating linearity between the logit of the cluster solution and the continuous independent (predictor) variables. Thus the assumption of a linear relationship between the logit and the independents is upheld.

Table 5.10.1 (2) Correlation Between Logit Of Cluster Solution And The Continuous Predictors Of The Multinomial Logistic Regression

		Logit	Instit_6	Instit_9	Mfg.st_3
Logit	Correlation Coefficient	1.000	0.386	0.642	0.532
	2 Tailed Significance Value		0.000	0.000	0.000
	Number Of Cases	100	100	100	100

4. *No multicollinearity.*

Multicollinearity in logistic regression models is a result of strong correlations between independent variables. The existence of multicollinearity inflates the variances of the parameter estimates. That may result, particularly for small and moderate sample sizes, in lack of statistical significance of individual independent variables while the overall model may be strongly significant. Multicollinearity may also result in wrong signs and magnitudes of regression coefficient estimates, and consequently in incorrect conclusions about relationships between independent and dependent variables. To the extent that one independent is a linear function of another independent, the problem of multicollinearity will occur in logistic regression, as it does in ordinary least squares (OLS) regression. As the independents increase in correlation with each other, the standard errors of the logit (effect) coefficients will become inflated. Multicollinearity does not change the estimates of the coefficients, only their reliability. High standard errors flag possible multicollinearity. There is no formal way in the logistic regression procedure of SPSS to test for multicollinearity. However, the widely advocated way is to use multicollinearity diagnostic statistics produced by linear regression analysis (collinearity diagnostics in SPSS linear regression).

For nominal independent variables, dummy variables should be created for each category except one (it will become a reference category). Use is made of the dependent variable from logistic regression analysis or any other variable that is not one of the independent variables, as a dependent variable in the linear regression. The collinearity diagnostic statistics are based on the independent variables only, so the choice of the dependent variable does not matter. Tolerance and variance inflation factor (VIF) are examined for each variable. Since for each independent variable, tolerance = $1 - R^2$, where R^2 is the coefficient of determination for the regression of that variable on all remaining independent variables, low values indicate high multivariate correlation. The variance inflation factor (VIF) is 1/tolerance, it is always ≥ 1 and it is the number of times the variance of the corresponding parameter estimate is increased due to multicollinearity as compared to if there were no multicollinearity.

In this study, the independent variables tested for multicollinearity are the recoded institutional coercive 3 (named as instit_6), institutional normative 3 (instit_9), manufacturing strategy 3 (mfg.st_3) and the recoded previous length of service. The previous length of service (an ordinal categorical variable) was recoded again[10] to transform it into a dummy variable so that it could be processed by the linear regression model. Category or variable value 3 (up to 4 year experience in previous

[10] The original previous length of service was recoded once to satisfy the assumption of the chi square test for independence or relatedness. This time, the recoded original was recoded again for the second time to turn it into a dummy variable suitable for a linear regression analysis.

firm) and category 4 (5 to 9 year experience in previous firm) were collapsed to form a new category 1 (value labeled as 'up to nine year experience in previous firm'). Category 5 (more than 10 year experience in previous firm) was recoded as category or variable value 0, the reference category. The new variable was named and labeled as dummy.previous.service.

On examining the collinearity statistics, all the VIF values concerned are found to be less than four. In fact, they are all below two, indicating that there is no problem with multicollinearity. Hence, the assumption of no multicollinearity among the independent variables in the logistic regression model is supported. Table 5.10.1 (3) below highlights the findings.

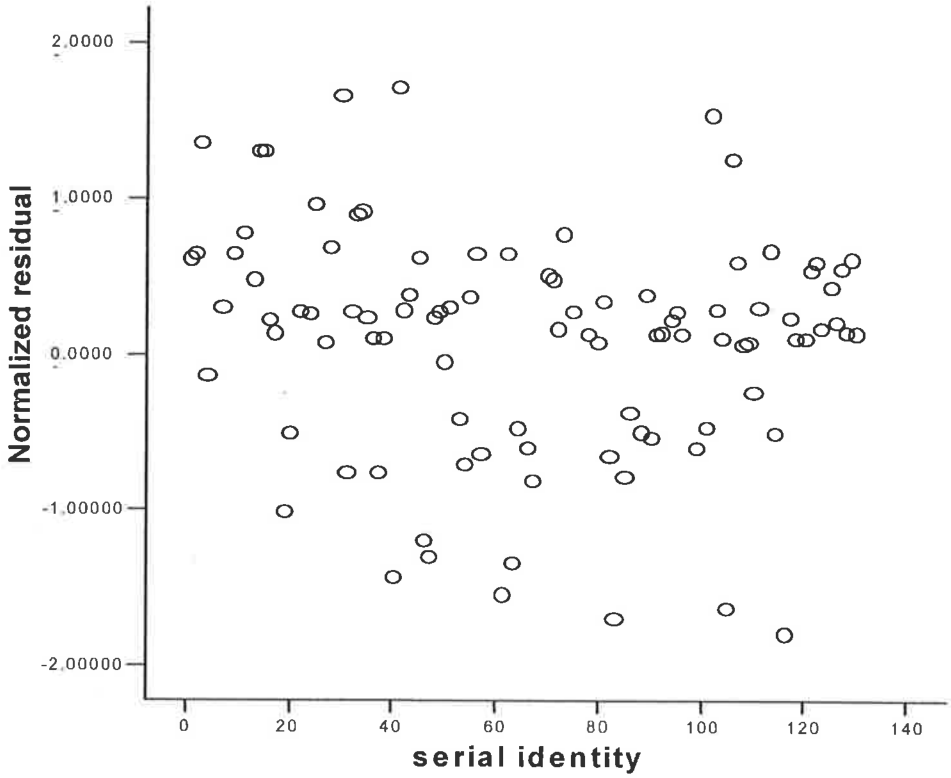
Table 5.10.1 (3) Collinearity Statistics Of The Predictors In The Multinomial Logistic Regression

	Collinearity Statistics
	Variance Inflation Factor (VIF)
dummypreviousservice (above10 years=0)	1.081
Instit_6	1.068
Instit_9	1.229
Mfg.st_3	1.220

5. *No outliers.*

As in ordinary least squares (OLS) regression, outliers can affect results significantly. The researcher should analyse standardized residuals for outliers and consider removing them or modelling them separately. Standardized residuals of >2.58 are outliers at the 0.01 level, which is the customary level.. Standardized residuals of >1.96 are outliers at the less-used 0.05 level. In this study, the standardized or normalized residual (error term) was saved as a separate variable and then plotted against the variable, serial (i.e. individual cases 1 to 127). The normalized residual and the serial form the y and x axes respectively. From the scatter plot, the residual values are found to lie between ± 2 (approximation of the more rigorous threshold of ± 1.96). Clearly, there are no outliers detected. Thus, the assumption of no outliers in the logistic regression model is met. The scatterplot is illustrated in figure 5.10.1 (1) below.

Figure 5.10.1 (1) Scatterplot Of Logistic Regression's Normalized Residual Against The Serial Identity



6. *Large samples.*

Unlike linear regression, logistic regression uses maximum likelihood estimation (MLE) rather than ordinary least squares (OLS) to derive parameters. MLE relies on large sample asymptotic normality, which means that the reliability of estimates declines when there are few cases for each observed combination of independent variables. That is, in small samples, one may get high standard errors. In the extreme, if there are too few cases in relation to the number of variables, it may be impossible to converge on a solution. Very high parameter estimates (logistic coefficients) may signal inadequate sample size. As a rule of thumb, Peduzzi *et al.* (1996) recommend a minimum of ten observations per parameter in the model.

In this study, as the forward entry stepwise regression method was chosen within the multinomial logistic regression procedure, the model began with no stepwise terms. At each step, the most significant term was added to the model until none of the stepwise terms left out of the model would have a statistically significant contribution if added to the model. Stepwise regression is a semi-automated process of building a model by successively adding or removing variables (depending on whether forward or backward method is chosen) into the model. Properly used, the stepwise regression option in SPSS is especially useful for sifting through large numbers of potential independent variables and/or fine-tuning a model by inserting variables in or out. Improperly used, it may converge on a poor model driven solely by statistics rather than a solid theoretical basis. Stepwise selection can either add or remove variables at any given stage of the search. Within the stepwise modelling, a number of methods are available for selection. For forward entry method, adding of variables one by one is executed. This is in contrast to the backward elimination where the method starts by entering all terms specified on the stepwise list into the model. Then at each step, the least significant stepwise term (variable) is removed from the model until all of the remaining stepwise terms have a statistically significant contribution to the model. Forward stepwise and backward stepwise methods are hybrids of the forward entry and backward elimination methods. All these methods involve a relatively small number of model builds, so they are not too slow to conduct. For the simplest forward and backward stepwise searches, variables are considered only one at a time and no backtracking is allowed, i.e. once a variable is selected for inclusion or deletion, the decision is irreversible.

When used with non-linear models, such as logistic regression, stepwise regression reduces the risk of overfitting the model to the data. Overfitting means that some of the relationships that appear statistically significant are actually just noise. It occurs when the complexity of the statistical model is too great for the amount of data available. A model with overfitting does not replicate well and will not reliably predict future responses. In other words, such a model is not good enough. To resolve the problem of overfitting, the rule of ten observations per variable is often used. This refers to the number of variables screened, not the number in the final model. By having a ratio of at least ten observations per variable in the model, overfitting the data will not be an issue. In this study, the forward entry method was opted for. Nau (2005) recommends that if there is a very large set of potential independent variables (as evident in this research) from which only a few are extracted in the end model, the forward method is generally preferred. The forward entry method is a simple model-building procedure. At each step after step zero, the entry statistic is computed for each effect eligible for entry in the model. If no effect has a value on the entry statistic that exceeds the specified critical value for model entry, then stepping is terminated, otherwise the effect with the largest value on the entry statistic is entered into the model. Stepping is also terminated if the maximum number of steps is reached.

Since the forward entry method used in this study is done by adding a small number of independent variables[11] and retaining only the predictors (i.e. by removing the non predictors), it is possible to adhere to the ten observations per variable rule. As eventually only four variables are identified as predictors, namely recoded previous length of service, institutional coercive3 (instit_6), institutional normative3 (instit_9) and manufacturing strategy3 (mfg. st_3), it follows that the minimum sample size needed is forty. There were at least 100 usable responses when the missing cases in the categorical variables were excluded. Therefore, Peduzzi *et al.* (1996) recommendation of minimum ten observations per parameter is adequately fulfilled. Thus, the sample size is large enough and as such, overfitting is not a concern. Moreover, as the logistic regression model is non-linear, the stepwise specification reduces the risk of overfitting the model to the data regardless of the sample size.

5.10.2 Interpreting The Results Of The Multinomial Logistic Regression

In the final analysis, the likelihood ratio test table (see table 5.10.2 (1)) reveals that there are four significant predictors from among the ancillary, institutional and contingency independent variables. The predictors to the cluster solution (dependent variable) are the recoded previous length of service, instit_6 (recoded institutional coercive3), instit_9 (recoded institutional normative3) and mfg.st_3 (recoded manufacturing strategy3). As the 'reference category' of the dependent variable (cluster solution) was set as 'first category', the logistic regression outputs would show the results of cluster two compared to cluster one. This means that a positive B or beta value in the parameter estimate table (see table 5.10.2 (2)) will indicate the higher the likelihood of the predictor being in cluster two, since cluster two is compared with cluster one. Conversely, if B or the beta value is negative, the predictor will be more likely to be in cluster one. Since the logistic regression is allowed to turn categorical independents automatically into dummy variables, the last category of the recoded previous length of service (category 5) is by default the baseline, i.e. the reference category for the categorical independents. Category

[11] The independent variables comprise of both factors (categorical variables) and covariates (continuous variables). The factors are all the ancillary variables while the covariates compose of all the institutional and contingency variables.

5 has a value label of 'more than 10 year experience in previous firms'. SPSS will set this parameter (its beta value or B) as zero because it is redundant.

From the final parameter estimate table (see table 5.10.2 (2)), it is found that category 3 (up to 4 year experience in previous firms) has a beta value of – 0.192 while category 4 (5 to 9 year experience in previous firms) has B of 2.885. Since category 3 has a Wald statistic that is not significant (i.e. $p > 0.05$), it follows that this category (up to 4 year experience in previous firms) is ignored for the purposes of interpretation. A Wald test is used to test the statistical significance of each coefficient (β) in the model. The SPSS output denotes β as B. Category 4 however has a significant Wald statistic. As the coefficient (B) for category 4 is positive (i.e. 2.885), it can be concluded that the more the previous experience, the more likely the respondents to be in cluster two (the better performing cluster). All the continuous predictors also have positive beta values and they can be accepted, as their Wald statistics are all significant ($p \leq 0.05$). Thus, for predictors recoded institutional coercive3, institutional normative3 and manufacturing strategy3, the higher the degree of agreement on each variable statement, the more likely the firm to be in cluster two (the better performing cluster). Table 5.10.2 (2) presents the results of the analysis.

Table 5.10.2 (1) Likelihood Ratio Tests Of The Multinomial Logistic Regression

Effect	-2 Log Likelihood Of Reduced Model	Chi-Square	p Value	Significance
Intercept	80.881	0.000		
previouslengthofservice	99.071	18.190	0.000	**Significant**
Instit_6	86.703	5.822	0.016	**Significant**
Instit_9	96.246	15.365	0.000	**Significant**
Mfg.st_3	86.187	5.306	0.021	**Significant**

Table 5.10.2 (2) Parameter Estimates Of The Multinomial Logistic Regression

	B	Wald	p Value	Significance
Intercept	-11.093	17.550	0.000	**Significant**
previouslengthofservice=3	-0.192	0.089	0.765	Not Significant
previouslengthofservice=4	2.885	8.297	0.004	**Significant**
previouslengthofservice=5	0			
Instit_6	0.486	5.208	0.022	**Significant**
Instit_9	0.943	12.318	0.000	**Significant**
Mfg.st_3	0.595	4.499	0.034	**Significant**

Once the model has been built and predictions produced, it is necessary to determine how effective that model is at predicting the dependent variable. This is referred to as goodness-of-fit. From the model fitting information table produced by SPSS (see table 5.10.2 (3)), the model chi square statistic is found to be significant (i.e. $p \leq 0.05$) indicating a good model fit. Statistically, this could be interpreted as the rejection of the null hypothesis that knowing the independents makes no difference in predicting the dependent in logistic regression. The goodness of fit table (Hosmer and Lemeshow's goodness of fit test) indicates p values of well above 0.05 (i.e. not significant). In the context of model fitting, this is desirable because when the goodness of fit statistics are greater than 0.05, there is no evidence to reject the null hypothesis that there is no difference between the observed and the model predicted values of the dependent. This means the model predicted values are not significantly different from what they ought to be, which are the observed values, implying that the model's estimates fit the data at an acceptable level. This does not mean that the model necessarily explains much of the variance in the dependent, only that however much or little it does explain is significant. As with other tests, as sample size gets larger, the goodness of fit test's power to detect differences from the null hypothesis improves. It is thus evidenced from both the model fitting information as well as the goodness of fit tables (tables 5.10.2 (3) and 5.10.2 (4)) produced by the SPSS that the model adequately fits the data. As such, the data are consistent with the model assumption.

Table 5.10.2 (3) Model Fitting Information Of The Multinomial Logistic Regression

Model	-2 Log Likelihood	Chi-Square	p Value	Significance
Intercept Only	125.374			
Final Model	80.881	44.493	0.000	**Significant**

Table 5.10.2 (4) Goodness-Of-Fit Of The Multinomial Logistic Regression

	Chi-Square	p Value	Significance
Pearson	87.642	0.665	Not significant
Deviance	80.881	0.830	Not significant

In section 5.8, it is found that out of twenty eight variables that form background information and manufacturing management methods, only two have significant associations with the clusters. The two are education-certificates and the recoded previous length of service. In this section 5.10, it is determined that out of the two variables, only one is a significant predictor to the clusters of firm. The significant predictor is the recoded previous length of service. Education-certificate(s) is found to be a non-predictor to the clusters of firm. The findings in section 5.8 conclude that respondents with more job experience in other firms prior to joining the present firms (i.e. those with five to nine year experience and those with above ten year experience) are better represented in cluster two (the better performing cluster). The results in this section 5.10 confirm that the recoded previous length of service has predictive power on the clusters too, where it is ascertained that the more the previous experience, the more likely the respondents to be in cluster two (the better performing cluster). Clearly, job experience in previous firms for professionals is a critical determinant of the better performing cluster of firms (cluster two). This provides empirical evidence on the importance of acquiring relevant working experience. It also supports the conventional wisdom of awarding higher remuneration that commensurate with experience. However, the findings suggest that remuneration per se is not significantly related to the clusters in a direct way. As such, it is fair to assume that the pattern of job-related payments and the motivation to work and perform have a complex relationship in the Malaysian manufacturing environment.

In section 5.9, it is found that there are twelve significant recoded institutional and contingency variables that have statistically different means for the two clusters. Out of the twelve significant recoded variables, seven are institutional variables and the remaining five are contingency variables. The contingency variables can be broken down into three strategic manufacturing priority variables and two organizational structure: decentralization variables. Invariably, all of them register cluster two (the better performing cluster) having higher mean scores compared to cluster one. This can be interpreted as respondents representing the better performing cluster (cluster two) on average, agreed more to all the statements that made up the significant variables. In this section 5.10, it is discovered that only two out of the seven institutional variables are predictors to the clusters. Also, only one of the five contingency variables turns out to be a significant predictor in a model where the cluster solution is the dependent variable. The predictor names and statements are shown in table 5.10.2 (5). It follows that for predictors recoded institutional coercive3 (instit_6), institutional normative3 (instit_9) and manufacturing strategy3 (mfg.st_3), the higher the degree of agreement on each variable statement, the more likely the firm to be in cluster two (the better performing cluster).

The variable instit_6 refers to the great deal of attention given by management on management control systems. It thus appears that, agreeing on giving a lot of managerial attention to the functioning of management control systems does contribute to the relatively better performing firms. Instit_9 relates to senior management's dependence on the advice given by management accountant/financial controller on costing, budgeting and reporting. The evidence suggests that agreeing on such dependence is a predictor to generally better management accounting system and practice/technique sophistication (firms in cluster two) and by extension, better performing firms. As such, in the Malaysian manufacturing environment, the role of the management accountant/financial controller is crucial to a firm's success in three key areas, viz. costing, budgeting methods and reporting.

The findings also reveal that none of the institutional mimetic variables comes out to be significant predictors. This is in contrast to the fact that all the institutional mimetic variables come out as having significant associations with the clusters, taken on an individual basis. It follows that overall, emulating what other firms are practising does not have a bearing on an individual firm's performance. However, some element of 'coerciveness' on the functioning of management control systems and the 'normative' standard of reliance on experts on key areas of costing, budgeting and reporting are all contributing factors to the relative management accounting system and practice/technique sophistication and by inference, the performance success of a firm.

Mfg.st_3 is a manufacturing strategy emphasizing the need to respond to customers' requirements, giving priority to service and delivery. The evidence therefore points to a customer-centric strategy as more related to management accounting system and practice/technique sophistication and performance achievement than technological innovations and product quality at competitive pricing. The practice of customer-centric manufacturing strategy has been proven to predict firms with more sophisticated management accounting systems and practices/techniques as well as better performance. None of the contingency variables under organizational interdependence, organizational structure: decentralization and perceived environmental uncertainty comes out as significant predictors to the clusters. It is, therefore, apparent that while allowing managers decision autonomy to appoint and promote supervisory staff (as in decent_2 and decent_3), have individually significant associations with the clusters (see section 5.9), such decision autonomy in an overall scheme of things, does not predict the membership of the clusters. Customer oriented manufacturing strategy is the only identified significant contingency predictor to better performing firms in the Malaysian scenario.

Table 5.10.2 (5) Variable Statements Identified As Predictors To The Two Cluster Solution In The Multinomial Logistic Regression

Variable Name	Variable Statement As Per Questionnaire
previouslengthofservice	respondent's length of service in previous firm(s).
Instit_6	There is a lot of attention given by management and directors to the way management control systems function.
Instit_9	When the firm's senior management addresses issues relating to costing, budgeting methods and reporting, they depend heavily on the advice of the senior management accountant/financial controller.
Mfg.st_3	Your firm's manufacturing strategy emphasizes the need to respond to customers' requirements, giving priority to service and delivery.

5.10.3 Summary Of The Results Of The Multinomial Logistic Regression

Out of the two background and manufacturing management variables that have significant associations with the clusters, only one is found to be a significant predictor to the clusters in a logistic regression modelling. The significant predictor is the recoded previous length of service. The evidence shows that the more the respondents' experience working in previous firms, the more the likelihood the respondents to be in the better performing cluster (cluster two) relative to the respondents' peers. As such, having management accountants with longer relevant work experience in previous organizations will result in firms having more belief in the usefulness of MAS and the benefit of management accounting practices/techniques and consequently, can predict better performing firms.

Out of the seven institutional variables that have significantly different means for the two clusters, only two turn out to be significant predictors to the clusters in a logistic regression modelling. Although all three of the institutional mimetic variables have significant associations with the clusters as evident in section 5.9, none is found to be a predictor to the clusters. The sole institutional coercive variable (instit_6) that comes out as having a significant association with the clusters, also emerges as a predictor to the clusters. This confirms that management focus on the functionality of management control systems can predict manufacturing firms with more sophisticated management accounting systems and practices/techniques and by extension, the better performing firms. All three institutional normative variables are found to have significant associations with the clusters. This is shown in section 5.9. However, only one of the three institutional normative variables is identified as a significant predictor to the clusters. The predictor variable is instit_9. This provides evidence that top management's reliance on internal expertise on matters relating to costing, budgeting and reporting is crucial in predicting manufacturing firms with more sophisticated management accounting systems and practices/techniques and by inference, the better performing firms.

Tests of association on the contingency variables reveal that five contingency variables have significant associations with the clusters. These compose of all three of the strategic manufacturing priority variables and two organizational structure: decentralization variables. The results are explained in section 5.9. Out of the 3 strategic variables, only one is found to be a significant predictor to the clusters. The single predictor is mfg.st_3. Clearly, this shows that adopting a manufacturing strategy based on responding to customers' requirements, giving priority to service and delivery, is a predictor of management accounting system and practice/technique sophistication in manufacturing firms which will lead to better performance. None of the two organizational structure: decentralization variables is identified as a significant predictor to the clusters.

5.11 Predicting Performance Based On Values From The Management Accounting Systems' Presentation Of Information And Management Accounting Practice/Technique Variables

In this section, attempt will be made to bridge the gap left by sub-sections 5.6.4 and 5.6.5. Section 5.6.4 confirms that cluster two performs better than cluster one based on their mean performance indices. In section 5.6.5, all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables (altogether seventy variables) indicate higher mean readings for cluster two (the better performing firms). This implies that those firms which regard management accounting systems' information attributes as more useful and claim more benefit from practising management accounting practices/techniques are the relatively better performing firms. The gap is to ascertain if any of the seventy variables can predict or explain performance, irrespective of the cluster solution. Based on the data consideration, this is best done by way of a multiple linear regression.

5.11.1 Testing Assumptions In The Multiple Linear Regression Procedure For The Seventy Variables (Items)

A number of assumptions underpin the use of multiple linear regression. In this study, the main assumptions are adequately met and no transformation of variables is required. The assumptions and assumption testings are explained below.

1. *Linearity.*

   Regression analysis is a linear procedure. To the extent non-linear relationships are present, conventional regression analysis will underestimate the relationship. That is, R^2 will underestimate the variance explained overall and the betas will underestimate the importance of the variables involved in the non-linear relationship. Substantial violation of linearity thus means regression results may be more or less unusable.

Checking that the linearity assumption is met is an essential research task when use of regression models is contemplated.

- Partial regression plots are often used to assess non-linearity. These are simply plots of each independent on the x-axis against the dependent on the y-axis. Curvature in the pattern of points in a partial regression plot shows that there is a non-linear relationship between the dependent and any one of the independents taken individually. Note, however, that whereas partial regression plots are preferred for illuminating cases with high leverage, partial residual plots are preferred for illuminating non-linearities. In this study, four partial regression plots are produced as four independent variables are identified as significant predictors. In each plot, the y-axis is the observed weighted average performance index (the dependent variable) and the x-axis is the predicted value of the predictor. The four identified predictors are MAPT39_1 (recoded owners' or shareholders' value analysis), MAPT21_1 (recoded performance evaluation: non-financial measures), MAPT9_1 (recoded performance evaluation: ongoing supplier evaluation) and MAPT17_1 (recoded cost-volume-profit analysis). The adjective 'recoded' means that the original missing values were replaced by means. From the four partial regression plots, it is observed that in each case, the points do not exhibit serious curvature. As such, it seems that there is no evidence to suggest that the relationship between the dependent weighted average performance index and any one of the four independents (predictors) taken individually is non-linear. Thus, the assumption of linearity between the dependent variable and independent variables (predictors) is upheld. The four partial regression plots are illustrated below.

Figure 5.11.1 (1) Partial Regression Plot Of Weighted Average Performance Index Against MAPT39_1

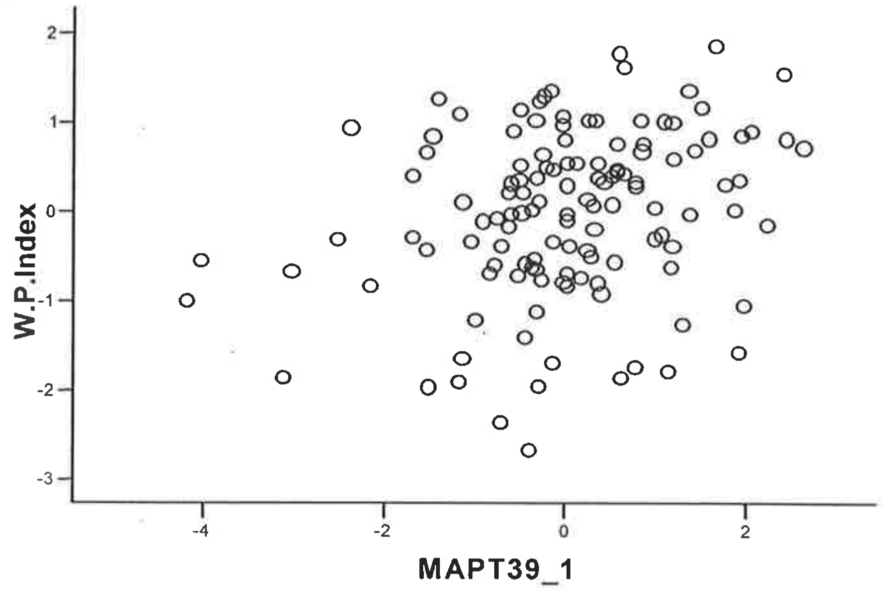


Figure 5.11.1 (2) Partial Regression Plot Of Weighted Average Performance Index Against MAPT21_1

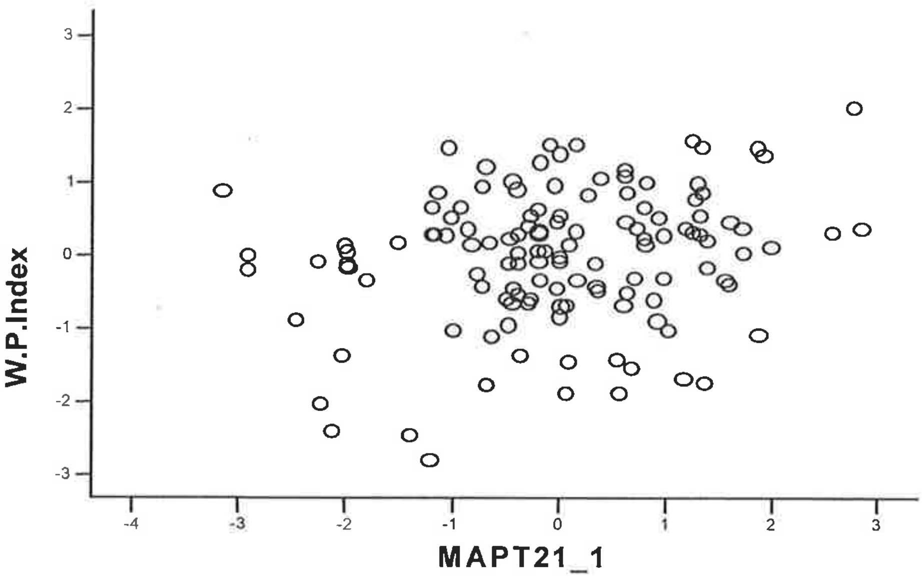


Figure 5.11.1 (3) Partial Regression Plot Of Weighted Average Performance Index Against MAPT9_1

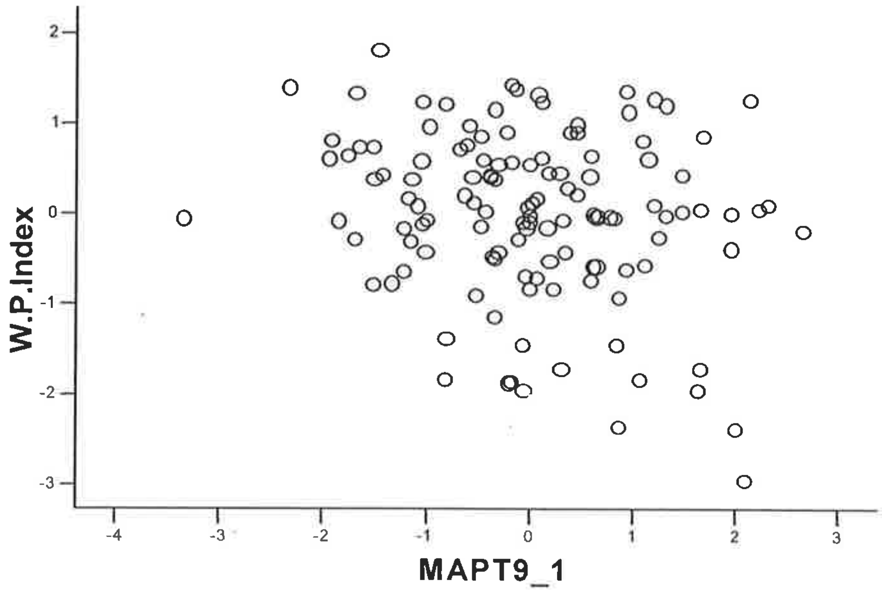
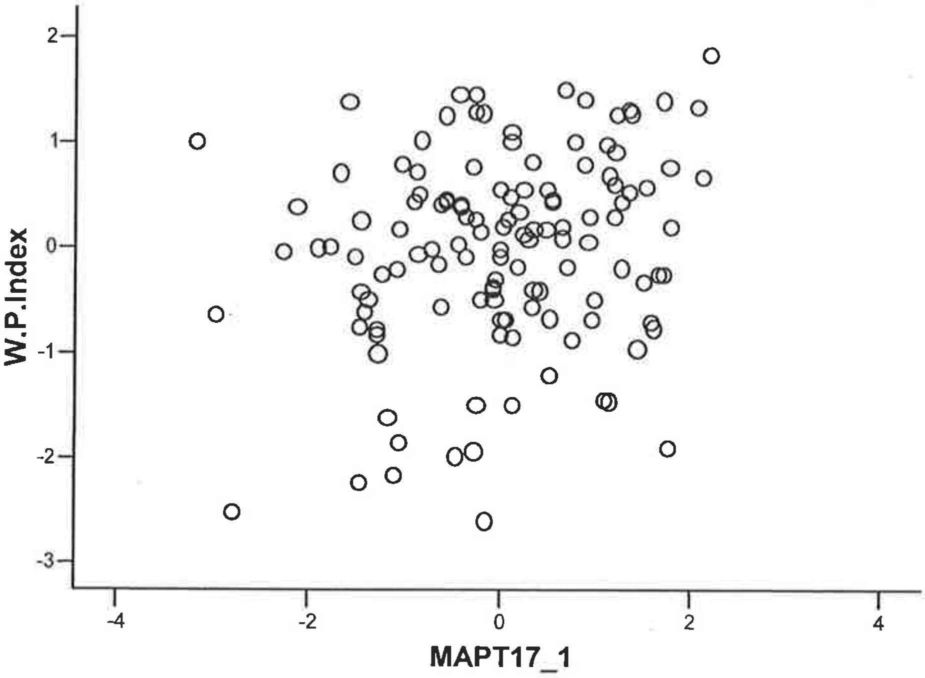


Figure 5.11.1 (4) Partial Regression Plot Of Weighted Average Performance Index Against MAPT17_1



2. *No overfitting*

Larger samples are better than smaller samples (all other things being equal) because larger samples tend to minimize the probability of errors, maximize the accuracy of population estimates, and increase the generalizability of the results. However, published sample size guidelines tend to take a number of different opinions. This is problematic because statistical procedures that create optimised linear combinations of variables such as multiple regression tend to overfit the data. This means that these procedures optimise the fit of the model with the given data; yet no sample is perfectly reflective of the population. Thus, this overfitting can result in erroneous conclusions if models fit to one data set are applied to others. In multiple regression this manifests itself as inflated R^2 (shrinkage) and misestimated variable regression coefficients (Cohen & Cohen, 1983). The ultimate concern is error. At the end of the analysis, if one has too small a sample size, errors of inference can easily occur. Also, adding variables to the equation while hoping that each addition significantly increases R^2 will pose a temptation to add too many variables just to increase R^2 by trivial amounts. Such overfitting trains the model to fit noise in the data rather than true underlying relationships. Subsequent application of the model to other data may well see substantial drops in R^2. As noted, there are many different opinions as to the minimum sample size one should use in prediction research. The general process for creating a prediction equation involves gathering relevant data from a large, representative sample from the population. What constitutes large is open to debate, and while guidelines for general applications of regression are as small as $50 + 8m$, where m = number of predictors (Tabachnick & Fidell, 2001), guidelines for prediction equations are more stringent due to the need to generalize beyond a given sample. While some authors have suggested that fifteen subjects per predictor as sufficient (Park & Dudycha, 1974; Pedhazur, 1997), others have suggested minimum total sample (e.g., 400, see Pedhazur, 1997), a minimum of forty subjects (cases) per predictor (Cohen and Cohen, 1983; Tabachnick & Fidell, 2001). Of course, as the goal is a stable regression equation that is representative of the population regression equation, more is better. In multiple regression texts some authors (e.g., Pedhazur, 1997) suggest subject (case) to independent variable ratios of 15:1 or 30:1 when generalization is critical. There are also researchers that recommend an ideal case to independent variable ratio of 20:1,that is twenty cases (subjects) for every independent variable in the model. The lowest ratio allowed in the literature is 5:1 (i.e. just five cases for every independent variable in the model).

In this study, as the predictors emerging from the final model of the stepwise method are four predictors, it seems that a ratio 30:1 can be complied with. This means that thirty cases multiplied by the four predictors will yield a figure of 120, which is just below the usable sample size of 127. There are few commentators on multiple regression who would argue that minimum total sample *N* is a superior guideline than the ratio of subjects to independent variables. However, many agree that multiple regression experiences shrinkage, the over-fitting of the estimates to the data (Bobko & Schemmer, 1984) and suffers from lack of generalizability and inflated error rates when sample size is too small. The ratio of 30:1 in this study may not satisfy the most stringent requirement for a stepwise multiple regression. Nonetheless, the ratio is supported by some authors such as Pedhazur (1997).

Cross-validation is a strategy to avoid overfitting. Under cross-validation, a sample (typically 60% to 80%) is taken for purposes of training the model, then the hold-out sample (the other 20% to 40%) is used to test the stability of R^2. This may be done iteratively for each alternative model until stable results are achieved. In this study, a 60% sample was taken for model training purposes (i.e. tested first) and the remaining 40% sample treated as hold-out sample to be tested subsequently. It is found that the R^2 for the 60% model training sample is 0.278 as compared to an R^2 of 0.255 for the 40% hold-out sample. As the two figures are close, the R^2 results are stable. Thus, cross validation in this study, further dispels any sign of overfitting. Table 5.11.1 (1) illustrates the points made above.

Table 5.11.1 (1) Cross Validating The Training And Hold-Out Samples In The Multiple Regression For The Seventy Variables (Items)

'Training' Sample (60%)	'Hold-Out' Sample (40%)
R^2	R^2
0.278	0.255

3. *Absence of multicollinearity*

In regression when several predictors (regressors) are highly correlated, this problem is called multicollinearity or collinearity. When things are related, they are linearly dependent on each other because one can nicely fit a straight regression line to pass through many data points of those variables. Collinearity simply means co-dependence. Co-dependence of predictors is detrimental because it can bias the outcome. Collinearity is problematic when the purpose is explanation rather than mere prediction. Collinearity makes it more difficult to achieve significance of the collinear parameters. However, if such estimates are statistically significant, they are as reliable as any other variables in a model. Even if they are not significant,, the sum of the coefficient is likely to be reliable. In this case, increasing the sample size is a viable remedy for collinearity when prediction instead of explanation is the goal (Leahy, 2001). However, if the goal is explanation, measures other than increasing the sample size are needed. The absence of multicollinearity is essential to a multiple regression model. Multicollinearity will cause the variances to be high. These inflated variances are quite detrimental to regression because some variables add very little or even no new and independent information to the model (Belsley, Kuh & Welsch, 1980).

Although Schroeder, Sjoquist and Stephan (1986) assert that there is no statistical test that can determine whether or not multicollinearity really is a problem, there are still several ways for detecting multicollinearity such as a matrix of bivariate correlation and the regression of each independent variable in the equation on all other independent variables (Berry and Feldman, 1985). Nonetheless, the former approach lacks sensitivity to multiple correlations while the latter cannot tell much about the influence of regressors to variances.

The issue of dummy variables does not arise in this study, as there are no categorical independent variables that need to be transformed into dummy variables. As stated above under assumption 4, the ratio of cases to predictors is just above thirty times (i.e. 127 cases divided by four predictors in the final model). Hence, there are a lot more observations (cases) than predictors. Even if all the seventy variables in the initial model were included (i.e. all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables), there were still be more observations (cases) than variables (i.e. 127 cases were more than the seventy odd variables). As such, multicollinerity could not have arisen out of fewer observations (cases) than variables.

In this study, the independent variables tested for multicollinearity were the recoded owners' (shareholders') value analysis (named as MAPT39_1), performance evaluation: non-financial measures (MAPT21_1), performance evaluation: ongoing supplier evaluation (MAPT9_1) and the recoded cost-volume-profit analysis (MAPT17_1). On examining the collinearity statistics, all the VIF values concerned were found to be less than four. In fact, they are all below two, indicating that there is no problem with multicollinearity. Hence, the assumption of no multicollinearity among the independent variables in the multiple linear regression model is supported. Table 5.11.1(2) highlights the relevant collinearity statistics of the four identified predictors.

Table 5.11.1 (2) Collinearity Statistics Of The Predictors In The Multiple Regression For The Seventy Variables (Items)

Predictor Name	Tolerance	Variance Inflation Factor (VIF)
MAPT39_1	0.684	1.461
MAPT21_1	0.710	1.408
MAPT9_1	0.728	1.374
MAPT17_1	0.744	1.345

There is another way to test for multicollinerity, SPSS linear regression procedure also provides for collinearity diagnostic table as part of its outputs. The collinearity diagnostics table is another way of assessing if there is too much multicollinearity in the model. To simplify, crossproducts of the independent variables are factored. High eigenvalues indicate dimensions (factors), which account for a lot of the variance in the crossproduct matrix. Eigenvalues close to zero indicate dimensions which explain little variance. Multiple eigenvalues close to zero indicate an ill-conditioned crossproduct matrix, meaning there is a problem with multicollinearity. The condition index summarizes the findings, and a common rule of thumb is that a condition index over fifteen indicates a possible multicollinearity problem and a condition index over thirty suggests a serious multicollinearity problem. If a factor has a high condition index, one looks in the variance proportions column to see if it accounts for a sizable proportion of variance in two or more variables. If it does, multicollinearity is a problem. In this study, multicollinearity is again proven not to be a problem. All the condition indices in the final model (model 4) are below fifteen. Table 5.11.1 (3) below shows the pertinent condition indices.

Table 5.11.1 (3) Collinearity Diagnostics Of The Predictors In The Multiple Regression For The Seventy Variables (Items)

Final Model	Dimension (Crossproduct Matrix Of Independents)	Condition Index
Model 4	1	1.000
	2	8.900
	3	10.297
	4	11.592
	5	13.529

4. *Same underlying distribution*

The same underlying distribution is assumed for all variables. To the extent that an independent variable has a different underlying distribution compared to the dependent (bimodal vs. normal, for instance), then a unit increase in the independent will have non-linear impacts on the dependent. Even when independent/dependent data pairs are ordered perfectly, unit increases in the independent cannot be associated with fixed linear changes in the dependent. For instance, perfect ordering of a bimodal independent with a normal dependent will generate an s-shaped scatterplot not amenable to a linear solution. Linear regression will underestimate the correlation of the independent and dependent when they come from different underlying distributions. To chart the distributions, histograms with normal curves were requested from the SPSS software. A histogram is a graphical way of presenting a frequency distribution. It is constructed by first selecting a number of 'intervals' to be used. The choice is between reducing the information sufficiently while still providing enough variability to picture the shape of the distribution. Most computer programs that construct histograms allow the selection of the number of intervals, as well as their width. If the number of intervals to be used is not specified, the program will make the decision based on the data it has. Histograms are representations of distributions for which the concentration is on how often any particular value arises. Typically the histogram is represented as a graph with observed values along the horizontal axis and their frequency--the number of times that a particular value arises--along the vertical axis. A graph very similar to a histogram is the bar chart. Bar charts are often used for qualitative or categorical data, although they can be used quite effectively with quantitative data if the number of unique scores in the data set is not large. Bar charts can be used quite effectively with quantitative data as well but some problems may occur.

In this study, five histograms with normal curves are solicited from SPSS as the entire dependent and predictor variables are considered to be at the interval (also continuous) level of measurement. The histograms show frequency distributions of the dependent variable (weighted average performance index) and the four predictors (MAPT9_1, MAPT 17_1, MAPT21_1, and MAPT39_1). A normal curve is also overlaid on each histogram. Data may be skewed to the left or right. If the histogram shows a long tail of data on the left side of the histogram, the data is termed left or negatively skewed. If a tail appears on the right side, the data is termed right or positively skewed. Data should not typically appear skewed. Data that are seriously skewed either to the left or right may be an indication that there are inconsistencies in the procedure. Decisions may need to be made to determine the appropriateness of the direction of the skew. It should be noted, however, that some processed data are, by nature, skewed. Data may be clustered on opposite ends of the scale or may display two or more peaks indicating serious inconsistencies in the procedure or the measurement of a mixture of two or more distinct groups that behave very differently.

From the five histograms, it is apparent that all the underlying distributions are similar for all the variables (dependent and predictor variables). It is also noticed that the underlying distributions are slightly skewed to the left (slight negative skew) and all have a single mode each. The mode is the value that occurs most frequently in a distribution. The slight negative skew is not a cause for concern (not serious) and the single mode indicates that each distribution is fairly normal. As such, the assumption of having the same underlying distribution for all variables is met and no transformations to force all variables to a normal distribution are necessary. The histograms (with normal curves) are illustrated in the figures 5.11.1 (5) to 5.11.1 (9) below.

Figure 5.11.1 (5) Histogram With Normal Curve Of W.P. Index

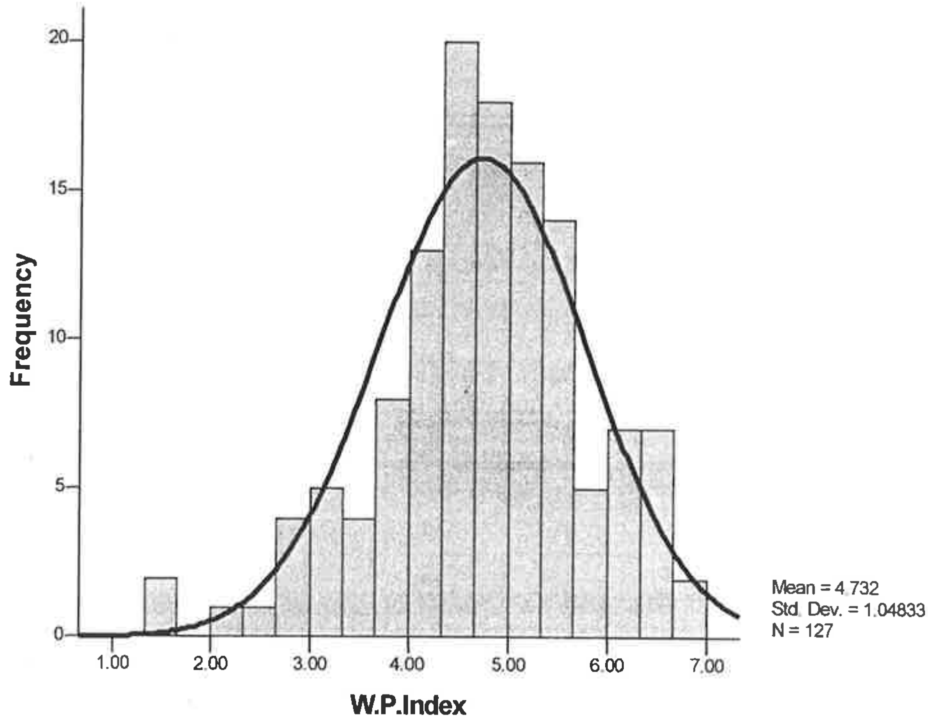


Figure 5.11.1 (6) Histogram With Normal Curve Of MAPT39_1

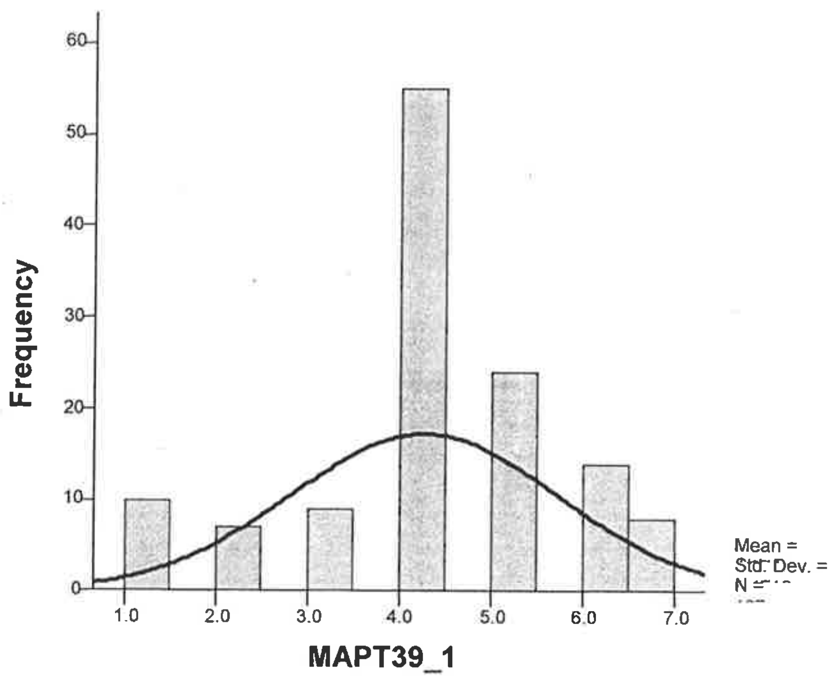


Figure 5.11.1 (7) Histogram With Normal Curve Of MAPT21_1

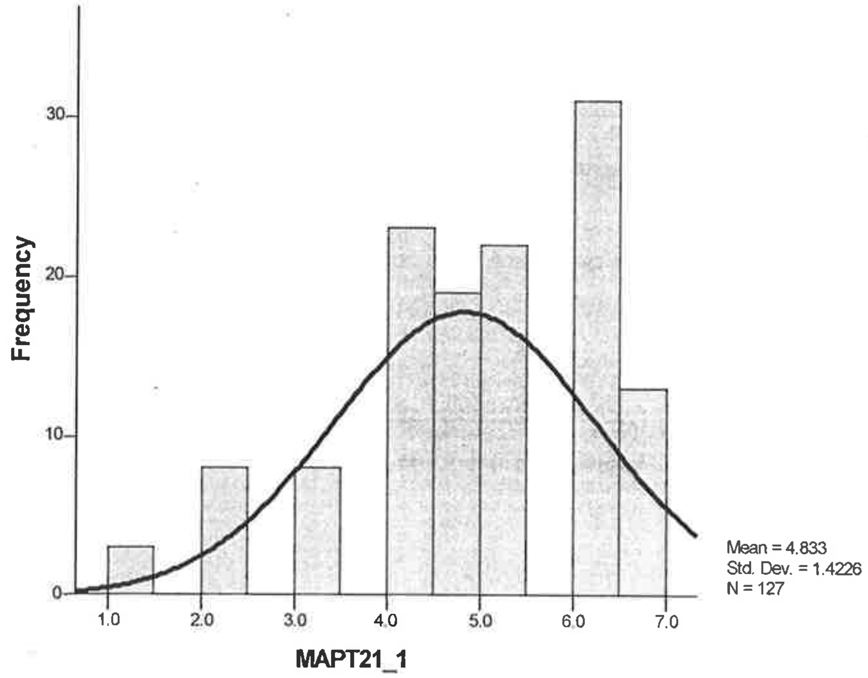


Figure 5.11.1 (8) Histogram With Normal Curve Of MAPT9_1

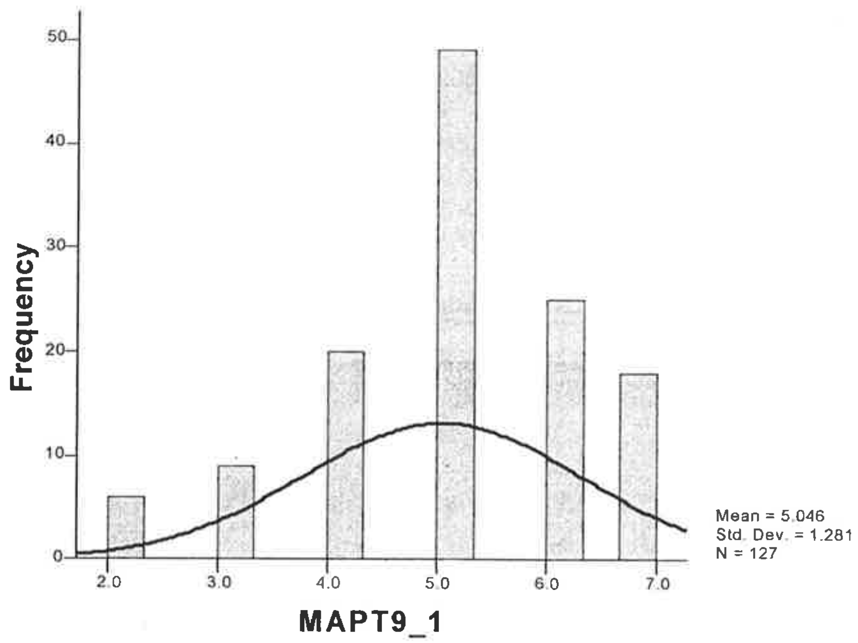
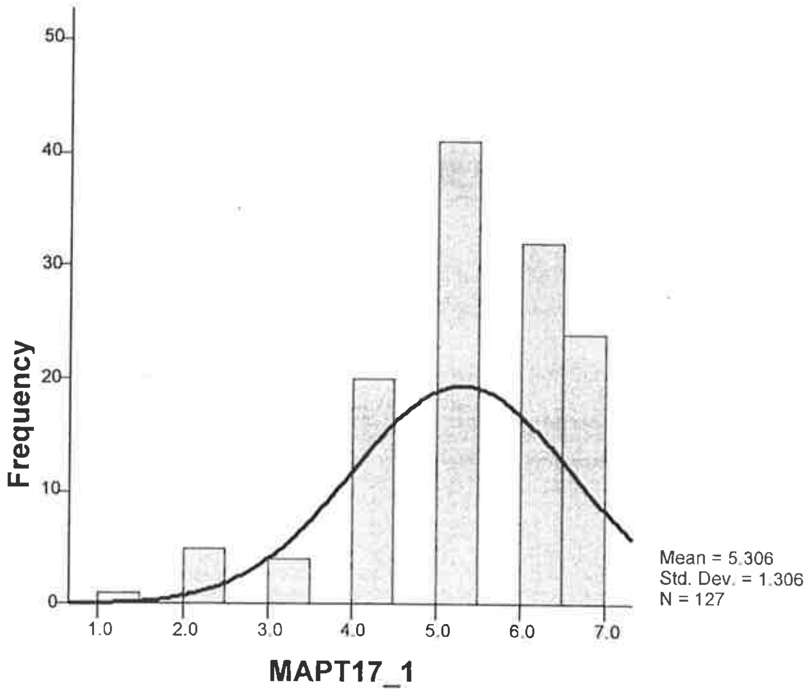


Figure 5.11.1 (9) Histogram With Normal Curve Of MAPT17_1



5. *Homoscedasticity (residuals have constant variance)*

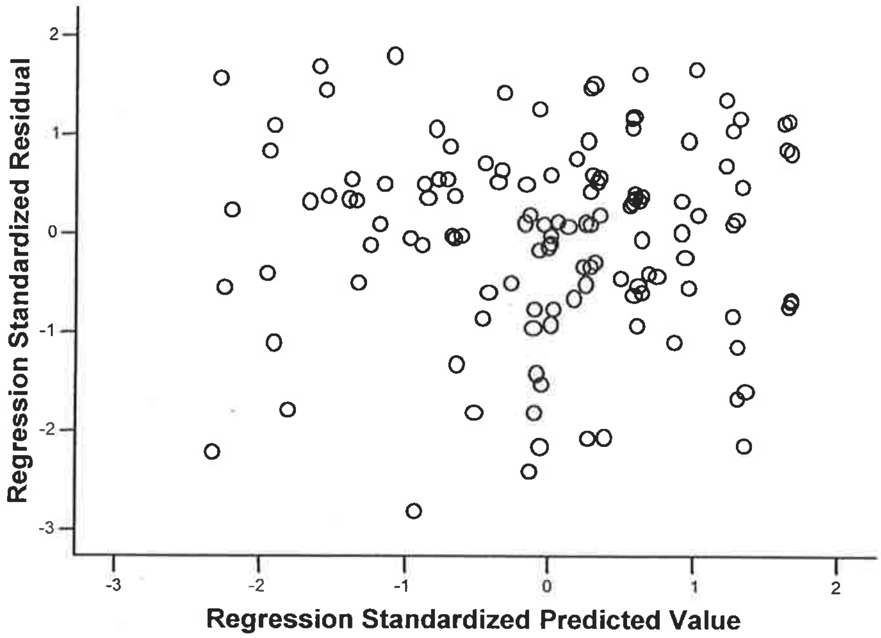
Homoscedasticity means that the variance of error term (residuals) is the same across all levels of the independent variables. When the variance of error term (residuals) differs at different values of the independent variables, heteroscedasticity is indicated. In other words, when the error term variance appears constant, the data are considered homoscedastic, otherwise, the data are said to be heteroscedastic. This assumption can be checked by visual examination of a plot of the regression standardized residuals (the errors) by the regression standardized predicted value. Therefore, one can check homoscedasticity by looking at the same simple residual plot or scatterplot delved into under the linearity and normality assumptions. In other words, non-constant error variance can be observed by requesting a simple residual plot (scatterplot). Ideally, residuals are randomly scattered around zero (the horizontal line), providing a relatively even distribution. Heteroscedasticity is indicated when the residuals are not evenly scattered around the line. There are many forms heteroscedasticity can take, such as a bow-tie or fan shape. In other words, a homoscedastic model will display a cloud of dots, whereas lack of homoscedasticity will be characterized by a pattern such as a funnel shape, indicating greater error as the dependent increases. Non-constant error variance can indicate the need to respecify the model to include omitted independent variables. The researcher should test to assure that the residuals (error term) are dispersed randomly throughout the range of the estimated dependent. Put another way, the variance of residual errors should be constant for all values of the independent(s). If not, separate models may be required for the different ranges. Also, when the homoscedasticity assumption is violated conventionally computed confidence intervals and conventional t-tests for ordinary least squares (OLS) estimators can no longer be justified (Berry, 1993). However, moderate violations of homoscedasticity have only minor impact on regression estimates (Fox, 2005). According to Berry and Feldman (1985), slight heteroscedasticity has little effect on significance tests; however, when heteroscedasticity is marked, it can lead to serious distortion of findings and seriously weaken the analysis, thus increasing the possibility of a Type I error (thinking there is a relationship when there really is not). When the plot of residuals appears to deviate substantially from normal, more formal tests for heteroscedasticity should be performed. Possible tests for this are the Goldfeld-Quandt test when the error term either decreases or increases consistently as the value of the dependent variable increases as shown in the fan-shaped plot or the Glejser tests for heteroscedasticity when the error term has small variances at central observations and larger variance at the extremes of the observations as in the bow tie-shaped plot (Berry & Feldman, 1985). Heteroscedasiticy may occur when some variables are skewed and others are not. Thus, checking that the data are normally distributed should cut down on the problem of heteroscedasticity. In cases where skewness is present in the independent variables, transformation of variables can reduce the heteroscedasticity.

Under assumption 4 (same underlying distribution), the histograms (and normality curves) of the variables concerned indicate that the distributions are fairly normal with a minor negative skew (slightly skewed to the left). The skew is not major and it applies to all variables. Therefore, it can be deduced that no heteroscedasticity is detected as a result of skewness. As such, transformation of variables is unnecessary.

Also, the simple residual plot (scatterplot) of regression standardized residual (y-axis) against the regression standardized predicted value (x-axis) shows a random pattern (i.e. neither a curve nor a funnel shape), indicating that the relationship is homoscedastic with no non-linearity (i.e. fairly linear). These data however are not perfectly normally distributed in that the residuals above the zero line appear slightly less spread out than those below the zero line. Nevertheless, they do appear to be fairly normally distributed.

In addition to the graphic examination of the data, the data's normality can also be statistically examined. Specifically, statistical programs such as the SPSS will calculate the skewness and kurtosis for each variable; an extreme value for either one indicates that the data are not normally distributed. Skewness is a measure of how symmetrical the data are; a skewed variable is one whose mean is not in the middle of the distribution (i.e. the mean and median are quite different). Kurtosis has to do with how peaked the distribution is, either too peaked or too flat. Extreme values for skewness and kurtosis are values greater than +3 or less than -3. The simple residual plot (scatterplot) reveals that all points are within ± 3 on both axes, indicating that there is no problem with skewness and kurtosis. Figure 5.11.1 (10) shows the simple residual plot of regression standardized residual against regression standardized predicted value.

Figure 5.11.1 (10) Simple Residual Plot Of The Multiple Regression For The Seventy Variables (Items)



As mentioned earlier, since the distributions of the variables are fairly normal, there is no need to transform any of the variables. The fairly normal distributions of the variables also signal that heteroscedasticity is not a problem. Like the assumption of linearity, violation of the assumption of homoscedasticity does not invalidate the regression so much as weaken it. Lack of homoscedasticity may mean firstly, there is an interaction effect between a measured independent variable and an unmeasured independent variable not in the model; or secondly, that some independent variables are skewed while others are not. As such, violations of homoscedasticity do not undermine the p values that emerge. Instead, such violations usually limit power of the model, often arise when one of the variables may not be normally distributed, which is not a shortfall in itself and may indicate that an important interaction, or moderation, has been overlooked. One method of dealing with hetereoscedasticity is to select the weighted least squares regression option. This causes cases with smaller residuals to be weighted more in calculating the b coefficients. In this study, such measure is not necessary as there is no evidence of heteroscedasticity in the multiple linear regression model.

- *No outliers*

  Outliers are a form of violation of homoscedasticity. Detected in the analysis of residuals and leverage statistics, these are cases representing high residuals (errors), which are clear exceptions to the regression explanation. The set of outliers may suggest/require a separate explanation. To deal with outliers, the researcher may remove them from analysis and seek to explain them on a separate basis, or transforms may be used which tend to pull in outliers. The presence of outliers can be detected from the scatterplot (simple residual plot). Tabachnick and Fidell (2001) define outliers as cases that have standardized residuals (as displayed in the scatterplot) of more than 3.3 or less than – 3.3. Studentized residuals are very similar to standardized residuals and follow the t distribution. These are used in plots of standardized or studentized predicted values versus observed values. From the scatterplot (see figure 5.11.1 (10)), all points are shown to be within ± 3 on both axes. As such, no outliers are detected from the scatterplot.

  The standardized residual values can also be extracted from the residual statistics generated by the SPSS stepwise multiple (linear) regression procedure. The residuals statistics table contains summary data regarding the residuals (the difference between actual or observed and predicted values). Standardized residual is the raw residual divided by the standard deviation of residuals. From the residual statistic table, the minimum standardized residual value is computed as –2.801 and the maximum standardized residual value is 1.815. Thus, in this study, all the standardized residual values are proven to lie within ± 3 (i.e. within 3 standard deviations above and below the mean residual). This means that there are no outliers present in the prediction. No treatment of outliers is therefore needed.

The deleted residual and studentized residual rows in the residuals statistics table have to do with coefficients when the model is recomputed over and over, dropping one case from the analysis each time. The bottom three rows of the residuals statistics table are measures of the influence of the minimum, maximum, and mean cases on the model. Mahalanobis distance is (n-1) times leverage (the bottom row), which is a measure of case influence. Cook's distance measures how much the b coefficients change when a case is dropped. Cases with leverage values less than 0.2 are not a problem, but cases with leverage values of 0.5 or higher may be unduly influential in the model and should be examined. In this study, it does not appear that there are problem cases since the maximum leverage is only 0.143 which is below 0.2. Moreover, in this research, the maximum Cook's distance is 0.137. As such, there are no cases with Cook's distance exceeding one. Therefore, there are no cases that tend to either influence the outcome inordinately or yield values that differ markedly from others. The casewise diagnostics table is a listing of outlier cases where the prediction is three standard deviations or more from the mean value of the dependent. The researcher can look at these cases to consider if they merit a separate model, or if they reflect measurement errors. Either way, the researcher may decide to drop these cases from analysis. Again, in this study, there are no cases where the standardized residuals are below –3 or above 3. It follows that the casewise diagnostics table does not list any outliers. Extracts of the residual statistics are tabulated below (table 5.11.1 (4)).

Table 5.11.1 (4) Residual Statistics Of The Multiple Regression For The Seventy Variables (Items)

	Minimum	Maximum
Standardized Residual	-2.801	1.815
Studentized Residual	-2.860	1.868
Deleted Residual	-2.68077	1.84384
Mahalanobis Distance	0.000	18.055
Cook's Distance	0.000	0.137
Centred Leverage Value	0.000	0.143

6. *Normally distributed residual errors*

Errors, represented by the residuals, should be normally distributed for each set of values of the independents. A histogram of standardized residuals should show a roughly normal curve. An alternative for the same purpose is the normal probability plot, with the observed cumulative probabilities of occurrence of the standardized residuals on the y axis and of expected normal probabilities of occurrence on the x axis, such that a 45-degree line will appear when observed conforms to normally expected. The central limit theorem assumes that even when error is not normally distributed, when sample size is large, the sampling distribution of the b coefficient will still be normal. Therefore violations of this assumption usually have little or no impact on substantive conclusions for large samples, but when sample size is small, tests of normality are important.

In this study, normality of the residuals (errors) is ascertained using three methods, namely, descriptive statistics, Kolmogorov-Smirnov test (or the Shapiro-Wilks' W test of normality) and by examining the histogram of regression standardized residuals. An important aspect of the description of the residual errors is the shape of its distribution, which shows the frequency of values from different ranges of the residuals. Typically, the aim is to see how well the distribution can be approximated by the normal distribution. Simple descriptive statistics can provide some information relevant to this issue. For example, if the skewness, which measures the deviation of the distribution from symmetry, is clearly different from zero, then that distribution is asymmetrical, while normal distributions are perfectly symmetrical. Asymmetrical distribution is a distribution when split in half at its mean (or median) will result in the distribution of values on the two sides of this central point not being the same (i.e. not symmetrical). Such distribution will be considered skewed.

In this study, the descriptive statistics of the residual errors indicate a skewness of – 0.410, which is a slight negative skew. However, a rule-of-thumb for skewness is to divide the value by its standard error to generate a z score. In this case, – 0.410 is divided by its standard error of 0.217 to give a z score of – 1.889. Since the z score is well within ± 3, there is no problem with skewness that necessitates transformation. Moreover, regression is robust in the face of some deviation from the assumption of normally distributed residual errors, and for this study, the small negative skewness (i.e. slightly skewed to the left) should not affect substantive conclusions. Descriptive statistics of the residual errors are tabulated below (table 5.11.1 (5)).

Table 5.11.1 (5) Descriptive Statistics Of The Residual Errors Of The Multiple Regression For The Seventy Variables (Items)

Unstandardized Residual	**Statistic**	**Std. Error**	**z score**
Mean	0.0547461	0.075507	
95% Confidence: Lower Bound	-0.0947159		
Interval For Mean: Upper Bound	0.2042081		
Skewness	-0.410	0.217	-1.889

More precise information can be obtained by performing one of the tests of normality to determine the probability that the sample set comes from a normally distributed population of observations (e.g. the so-called Kolmogorov-Smirnov test, or the Shapiro-Wilks' W test). The Kolmogorov-Smirnov test of normality of the unstandardized residuals generates a significance value (p value) of 0.2. As this p value for the normality test is more than 0.05, it follows that there is no significant departure from normality for the residuals. Therefore, the residuals are normally distributed. Table 5.11.1 (6) shows results of the normality test.

Table 5.11.1 (6) Normality Test On The Residuals Of The Multiple Regression For The Seventy Variables (Items)

	Kolmogorov-Smirnov	
	Statistic	p Value
Unstandardized Residual	0.068	0.200

7. *Independent observations (absence of autocorrelation) leading to uncorrelated error terms.*

Current values should not be correlated with previous values in a data series. This is often a problem with time series data, where many variables tend to increment over time such that knowing the value of the current observation helps one estimate the value of the previous observation. Spatial autocorrelation can also be a problem when units of analysis are geographic units and knowing the value for a given area helps one estimate the value of the adjacent area. That is, each observation should be independent of each other observation if the error terms are not to be correlated, which would in turn lead to biased estimates of standard deviations and significance. Autocorrelation can be tested in a number of ways. One way is to examine the Durbin-Watson coefficient, d. This coefficient can be extracted directly from SPSS under the multiple linear regression procedure. It will be shown in the model summary table of the SPSS's outputs. Alternatively, the d value has an association p probability value for various significance cut-offs (e.g. 0.05). For a given level of significance such as 0.05, there is an upper and a lower d value limit. If the computed Durbin-Watson d value for a given series is more than the upper limit, the null hypothesis of no autocorrelation is not rejected and it is assumed that errors are serially uncorrelated. If the computed d value is less than the lower limit, the null hypothesis is rejected and it is assumed that errors are serially correlated. If the computed value is in between the two limits, the result is inconclusive. For a graphical test of serial independence, a plot of residuals on the y-axis against the sequence of cases (the case identity variable or called serial identity in this study) on the x-axis should show no pattern, indicating independence of errors.

In this study, the Durbin-Watson coefficient is used. The Durbin-Watson coefficient (d) tests for autocorrelation. The value of d ranges from zero to four. Values close to zero indicate extreme positive autocorrelation; close to four indicate extreme negative autocorrelation; and close to two indicate no serial autocorrelation. As a rule of thumb, d should be between 1.5 and 2.5 to indicate independence of observations. Positive autocorrelation means standard errors of the b coefficients are too small. Negative autocorrelation means standard errors are too large. It is found that the Durbin-Watson coefficient in this study is 1.993, which is very close to two, indicating no serial autocorrelation. Consequently, there is independence of observations. When autocorrelation is present, one may choose to use generalized least-squares (GLS) estimation rather than the usual ordinary least squares (OLS). As autocorrelation is not present in this study, such a measure is not pursued. The Durbin-Watson coefficient is produced in table 5.11.2 (2) under sub-section 5.11.2 below.

5.11.2 Presenting The Results Of The Multiple Linear Regression Procedure For The Seventy Variables (Items)

SPSS produces a number of outputs that facilitate interpretations. In the variables entered/removed table, four significant predictors come out from the analysis of the final model. The four predictors are the recoded MAPT39, MAPT21, MAPT9 and MAPT17 (named as MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1 respectively). It is thus evident that out of the seventy variables tested as independent variables (i.e. all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables), only four emerge as significant predictors using the stepwise multiple regression procedure. All the four predictors are among the recoded management accounting practice/technique variables, and no predictor is identified from the management accounting systems' presentation of information variables.

The regression (prediction) equation of the final model of this study can be extracted from the coefficient table (see table 5.11.2 (1)) of the SPSS's outputs. The table gives the b (or B) and beta (or β) coefficients, for each model step. The b coefficients are the unstandardized coefficients whereas the beta coefficients are the standardized coefficients. The b coefficients and the constant are used to create the prediction (regression) equation. For the final model step (model 4), the prediction or regression equation is as follows:

Predicted W.P. index = 2.994 + 0.209 (MAPT39_1) + 0.172 (MAPT21_1) – 0.182 (MAPT9_1) + 0.175 (MAPT17_1).

where:

Predicted W.P. index was the predicted weighted average performance index,

MAPT39_1 was the recoded owners' (shareholders') value analysis,

MAPT21_1 was the recoded performance evaluation: non-financial measures,

MAPT9_1 was the recoded performance evaluation: ongoing suppliers evaluation, &

MAPT17_1 was the recoded cost-volume-profit analysis.

The b (or B) values explain the relationship between the dependent variable and each predictor. If the value is positive, there is a positive relationship between the predictor and the outcome (dependent). Conversely, a negative coefficient represents a negative relationship. In this study, only the MAPT9_1 predictor has a negative coefficient. The b values also explain to what degree each predictor affects the outcome (dependent variable) if the effects of all other predictors are held constant. Each of these b values has an associated standard error indicating to what extent these b values vary across different samples, and these standard errors are used to determine whether or not the b value differs significantly from zero using the t statistics. Therefore, if the t-test associated with a b value is significant (i.e. $p \leq 0.05$) then that predictor is making a significant contribution to the model. The smaller the p value is (i.e. the larger the value of t), the greater the contribution of that predictor. In this study, all the t values that test the significance of each b coefficient are below 0.05 (i.e. significant). As such, all the predictors are making significant contributions to the final model (model 4).

The beta (or β) coefficients are the standardized regression coefficients. Their relative absolute magnitudes for a given model step reflect their relative importance in predicting the dependent variable. Betas are only compared within a model, not between. Moreover, betas are highly influenced by misspecification of the model. Adding or subtracting variables in the equation will affect the size of the betas. These betas (standardized versions of the b values) are in many ways easier to interpret because they are not dependent on the units of measurement of the variables. Betas measure the number of standard deviations that the outcome (dependent variable) will change as a result of one standard deviation change in the predictor. Betas (β) therefore are all measured in standard deviation units and so are directly comparable. As such, they provide a better insight into the importance of a predictor in the model. In this study, betas for the four predictors MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1 are 0.294, 0.234, -0.223 and 0.219

respectively. These imply that all the four predictors have fairly similar impact in the model. However, MAPT39_1 has slightly more positive impact than MAPT21_1, which in turn has marginally more positive impact than MAPT17_1. MAPT9_1 however, has a negative impact in the model. The coefficient table is produced below.

Table 5.11.2 (1) Coefficients Of The Multiple Linear Regression With Four Variable Predictors

Predictor In Final Model	B	Beta	t	p Value
Constant	2.994		7.209	0.000
MAPT39_1	0.209	0.294	3.112	0.002
MAPT21_1	0.172	0.234	2.526	0.013
MAPT9_1	-0.182	-0.223	-2.436	0.016
MAPT17_1	0.175	0.219	2.415	0.017

Another important output of the multiple linear regression procedure is the model summary table. Table 5.11.2 (2) below only depicts results from the final model (model 4) that are relevant for interpretation purposes. One indicator from the model summary table (see table 5.11.2 (2)) of the SPSS's outputs is the standard error of the estimate. The standard error of the estimate is a measure of error of predicting the dependent variable (criterion variable). When the relationship between the predictor variable (independent variable) and the criterion variable (dependent variable) is perfect (i.e. $r = 1$ or $r = -1$), the standard error of the estimate will be equal to zero. When the coefficient of correlation is 0 (i.e. $r = 0$), the standard error of the estimate will be equal to the standard deviation of the criterion variable. The model summary table (table 5.11.2 (2)) shows that the standard error of the estimate is 0.91816. As the 95% confidence interval is selected (0.05 significance level), this means that we can be 95% confident that the actual value of the weighted average performance index (dependent variable) is within plus or minus 1.80 (i.e. 1.96 x 0.91816) band from the predicted value.

The R^2 value is the variance explained by the model divided by the total variance, both explained and unexplained. High R^2 values indicate that a model explains a large portion of the data variability, while a low R^2 value indicates the opposite. From the model summary table of the SPSS's outputs (see table 5.11.2 (2)), the R^2 value is 0.257. As R^2 is the percent of the dependent explained by the independents, it follows that the four significant predictors (MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1) in the final model together explain about 25.7% of the variation in the dependent variable (weighted average performance index). Therefore, other variables not included in the analysis explain 74.3% (i.e. 100% minus 25.7%) of the variance in the weighted average performance index. It is not known how much the predictors share common variance with the unmeasured independent variables. That is outside the ambit of this study and will pose a challenge to future research. The R^2 value for a multiple regression however, can be made arbitrarily high simply by including more and more predictors in the model.

Adjusted R^2 value is a standard, arbitrary downward adjustment to penalize for the possibility that, with many independents, some of the variance may be due to chance. The more the independents, the more the adjustment penalty. The adjusted R^2 is one of several statistics that attempts to compensate for this artificial increase in accuracy. The adjusted R^2 gives some idea of how well the final model generalizes and ideally its value should be the same, or very close to, the value of R^2. A large difference between the R^2 and the adjusted R^2 could also be due to the fact that a relatively small number of observations are being predicted with a relatively large number of variables. This certainly is not the case in this study as the ratio of cases to predictors is adequate at roughly 30:1. In this research, the adjusted R^2 for the final model is 0.233. The difference between the R^2 of 0.257 and adjusted R^2 of 0.233 is 0.024. This 0.024 or 2.4% shrinkage is small. As such, although a large number of independent variables (seventy of them) were tested by the stepwise multiple regression procedure, it appears that the final model's R^2 is not adversely affected. The shrinkage also means that if the model were derived from the population rather than a sample it would account for approximately 2.4% less variance in the outcome.

Table 5.11.2 (2) Final Model Summary Table Of The Multiple Linear Regression With Four Variable Predictors

Final Model	R^2	Adjusted R^2	Std. Error Of The Estimate	Durbin-Watson Coefficient
Model 4	0.257	0.233	0.91816	1.993

It is possible to have a regression model that is significant overall by the F test, but where a particular coefficient is not significant. The F statistic can be read from the ANOVA table of the SPSS's stepwise multiple regression outputs. The ANOVA table tests the overall significance of the model (that is, of the regression equation), for all model steps. If the significance of the F value is below 0.05, the models for each step are significant. In this study, the p value of the F statistic is less than 0.05 (i.e. significant) indicating that overall the model fit is good. Table 5.11.2 (3) illustrates the point made.

Table 5.11.2 (3) ANOVA Table Of The Multiple Linear Regression With Four Variable Predictors

Final Model	Sum Of Squares	Mean Square	F	p Value
Regression	35.624	8.906	10.564	0.000
Residual	102.849	0.843		
Total	138.473			

5.11.3 Interpreting The Results Of The Multiple Linear Regression Procedure For The Seventy Variables (Items)

The findings reveal that out of the seventy variables tested as independent variables (i.e. all the twenty five management accounting systems' presentation of information variables and the forty five management accounting practice/technique variables), only four emerge as significant predictors to the weighted average performance index. The four predictors are the recoded MAPT39, MAPT21, MAPT9 and MAPT17 (named as MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1 respectively). MAPT39_1 refers to owners' (shareholders') value analysis. MAPT21_1 is performance evaluation: non-financial measures. MAPT9_1 is a variable on performance evaluation: ongoing suppliers' evaluation. MAPT17_1 is stated in the questionnaire as cost-volume-profit analysis. All the four predictors are among the recoded management accounting practice/technique variables, and no predictor is identified from the management accounting systems' presentation of information variables. Judging by the beta coefficients, the four predictors have fairly similar impact on the model. MAPT39_1 has slightly more positive impact than MAPT21_1, which in turn has marginally more positive impact than MAPT17_1. MAPT9_1 however, has a negative impact in the model. The four predictors also explain

25.7% of the variation in the firms' performance, measured by the weighted average performance index (the dependent variable).

The identification of owners' (shareholders') value analysis as one of the predictors to performance ties in closely with the importance of the measure globally. Throughout the late 1980s and 1990s there were a growing number of concerns raised about traditional accounting measures. These criticisms were primarily concerned with the scope for subjectivity that even the most comprehensive accounting standards allow. A number of consultants recognised these problems. As a result, they turned to the concept of shareholder value and how this could be created and sustained. This has, in turn, led to the development of a number of value metrics, the most significant of which is the owners' (shareholders') value analysis. Shareholders' value analysis is advocated by a number of consultants and has been adopted by companies around the world. It is argued that shareholders' value analysis can be used for numerous purposes, including valuation, strategy, evaluation and the monitoring of performance. This study provides further evidence of the predictive capability of owners' (shareholders') value analysis on a firm's performance. It seems that the higher the level of benefits agreed upon by respondents on the use of owners' (shareholders') value analysis, the higher the corresponding performance of the firm in question.

Since owners' (shareholders') value analysis is inextricably linked to performance evaluation, it is not surprising to note that two performance evaluation techniques also emerge as significant predictors to performance. However, while non-financial measures have a positive contribution to predicting performance, ongoing suppliers evaluation contributes negatively to predicting performance. It is therefore quite clear that manufacturing firms in Malaysia have embraced non-financial measures as tools alongside the traditional financial measures, and the benefit of the adoption adds positive value to performance. However, ongoing suppliers evaluation has an opposite effect on performance. It is fair to speculate that Malaysian manufacturers do not see the benefit of continuous assessment of their suppliers as having to do with the betterment of performance. On the contrary, the respondents saw such a practice as detrimental to improving performance. One possible reason could be the Asian way of running a business, where long term relationship with both suppliers and customers are paramount. Ongoing evaluation of suppliers is considered unnecessary as the emphasis is based on long term trust. This also ties in very well with customer oriented strategy that has been identified as significant predictor to the better performing cluster of firms.

The last predictor to performance is a traditional management accounting practice of cost-volume-profit analysis. As this is widely regarded as a tool for short-term decision-making in a competitive environment, the predictors have both long term as well as short term elements. As such, Malaysian manufacturers seem to indicate that the high benefit of using cost-volume-profit analysis has positive impact of predicting higher performance. It could also be construed that even in a shorter time frame, the manufacturing environment in Malaysia is highly competitive, necessitating the adoption of vital management accounting practice of cost-volume-profit analysis.

5.12 Predicting Performance Using Dimensions Rather Than Variables For Management Accounting Systems' Presentation Of Information And Management Accounting Practices/Techniques

As explained in the assumption of no overfitting above, larger samples are better than smaller samples (all other things being equal) because larger samples tend to minimize the probability of errors, maximize the accuracy of population estimates, and increase the generalizability of the results. According to Tabachnick and Fidell (2001), for stepwise regression, $N \geq 40m$ is a rule of thumb (m being the number of predictors). If Tabachnick and Fidell (2001) guidelines were to be used, it would seem that for stepwise multiple regression employed in this study, the minimum sample size required would have been 160, as 40 x 4 predictors =160. Thus, the usable sample size of 127 in this study would have fallen short of requirement.

One way to follow these stricter guidelines on sample size is to use constructs or dimensions rather than individual variables as the independent variables. As explained in section 5.4 above, factor analyses and reliability tests on the recoded management accounting systems' presentation of information dimensions and management accounting practice/technique construct have identified latent dimensions. As such it would be useful to test reliable factors (principal components) as alternative independent variables in the multiple regression modelling. In this section, an alternative stepwise multiple regression procedure will be conducted to supplement the above stepwise multiple regression. This time the independent variables are the reliable dimensions of the management accounting systems' presentation of information and management accounting practices/techniques. The dependent variable will still be the weighted average performance index.

Based on the results of factor analyses and reliability tests discussed in section 5.4, the four dimensions that make up management accounting systems' (MAS) presentation of information are confirmed. Factor analyses and the subsequent reliability tests on the management accounting practice/technique construct unravel six latent dimensions. Therefore, there are ten independent factors tested in the model (i.e. four dimensions from the recoded management accounting systems' presentation of information construct and six dimensions from management accounting practice/technique construct).

5.12.1 Presenting The Results Of The Multiple Linear Regression Procedure For The Ten Dimensions (Factors)

The results of the stepwise multiple regression procedure show that the only significant predictor to the weighted average performance index is the performance benchmarking factor (comprising of the recoded MAPT34, MAPT15, MAPT32, MAPT16, MAPT39, MAPT33, MAPT27, MAPT9, MAPT38, MAPT21, MAPT13, MAPT25, MAPT26, and MAPT29). Except for MAPT17, all the significant predictors in the stepwise multiple regression of variables (as opposed to dimensions as predictors) can be found within the performance benchmarking dimension. The former significant predictors within the performance benchmarking dimension are the recoded MAPT39, MAPT21 and MAPT9.

The regression (prediction) equation of the single factor predictor model can be extracted from the coefficient table (see table 5.12.1 (1)) of the SPSS's outputs. The table gives the b (or B) and beta (or β) coefficients. The b coefficient is the unstandardized coefficient whereas the beta coefficient is the standardized coefficients. The b coefficient and the constant are used to create the prediction (regression) equation. For the single predictor factor model, the prediction or regression equation is as follows:

Predicted W.P. Index = **4.732 + 0.417 (Performance Benchmarking)**

where,

Predicted W.P. Index was the predicted weighted average performance index,

Performance Benchmarking was the performance benchmarking dimension of the management accounting practice/technique construct.

In this study, the t value that tests the significance of the b coefficient is below 0.05 (i.e. significant). As such, the single predictor factor is making a significant contribution to the model. In this single factor predictor model, the beta (standardized coefficient) for the sole factor predictor (performance benchmarking dimension of the management accounting practice/technique construct) is 0.398. This means that the sole predictor (performance benchmarking dimension) has a positive impact in the model.

Multicollinearity cannot have arisen out of fewer observations (cases) than variables, since there are 127 cases compared to the ten independent factors. More importantly is the fact that the outcome of this stepwise multiple regression exercise is a single factor predictor model. A single factor predictor model means that there is only one independent predictor variable. As such, multicollinearity cannot have existed as the concept of multicollinearity only extends to at least two independent predictor variables. Therefore, analyses of the variance inflation factor (VIF) and the condition index (another test result for multicollinearity) will not be reported for this multiple regression exercise as they are considered to be redundant.

Table 5.12.1 (1) Coefficients Of The Multiple Linear Regression With A Single Factor Predictor

Predictor In Final Model	B	Beta	t	p Value
Constant	4.732		55.229	0.000
Performance Benchmarking Factor	0.417	0.398	4.850	0.000

The above regression equation needs to be adjusted by the standard error of the estimate. The model summary table (table 5.12.1 (2)) shows that the standard error of the estimate is 0.96557. The standard error of the estimate is a measure of error of predicting the dependent variable (criterion variable). As the 95% confidence interval is selected (5% level of significance), this means that we can be 95% confident that the actual value of the weighted average performance index (dependent variable) is within plus or minus 1.89 (i.e. 1.96 x 0.96557) band from the predicted value. Therefore, at 0.05 level of significance, the estimate is the one from the above equation plus or minus 1.89 (i.e. 1.96 x 0.96557).

The model summary table (table 5.12.1 (2)) of the SPSS's outputs indicates that R^2 is 0.158 with a comparable adjusted R^2 value of 0.152. As R^2 is the percent of the dependent explained by the independents, it follows that the only significant predictor factor (performance benchmarking dimension of the management accounting practice/technique construct) explains about 15.8% of the variation in the dependent variable (weighted average performance index). Again, it is not known how much the predictor shares common variance with the unmeasured independent variables. That is outside the ambit of this study and will pose a challenge to future research. However, explaining 15.8% of the variance in the dependent variable is less than 25.7% recorded in the earlier stepwise multiple regression of variables. It seems that the four predictors (recoded MAPT39, MAPT21, MAPT9 and MAPT17) in the earlier multiple regression exercise explain more variance in the dependent variable than the single predictor factor (performance benchmarking dimension of the management accounting practice/technique construct) model.

The adjusted R^2 gives some idea of how well the final model generalizes and ideally its value should be the same, or very close to, the value of R^2. The adjusted R^2 value of 0.152 in this single predictor factor model yields a very small shrinkage of 0.6% (i.e. 15.8% less 15.2%). Thus the adjusted R^2 is very close to R^2 and the model generalizes well.

The Durbin-Watson coefficient tests for autocorrelation, which is part of the multiple regression's assumption of independent observations. From table 5.12.1 (2) below, the Durbin-Watson coefficient is 2.089. Since this coefficient is in between 1.5 and 2.5, the assumption of independent observations is complied with. Thus, there is no serial autocorrelation in the model.

Table 5.12.1 (2) Final Model Summary Table Of The Multiple Linear Regression With A Single Factor Predictor

Final Model	R^2	Adjusted R^2	Std. Error Of The Estimate	Durbin-Watson Coefficient
Model 1	0.158	0.152	0.96557	2.089

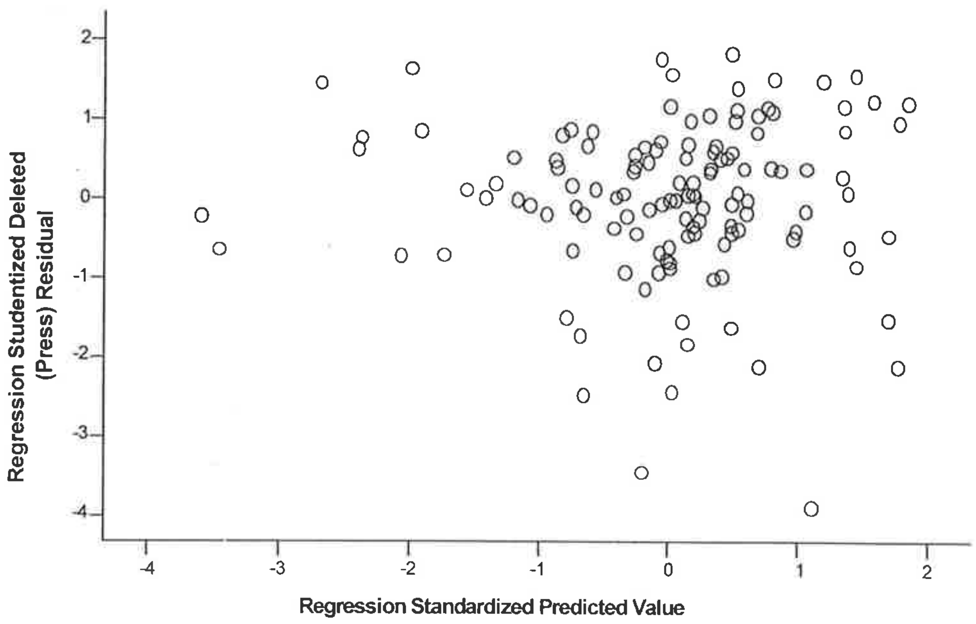
In this single predictor factor model, the p value of the F statistic is less than 0.05 (i.e. significant) indicating that overall the model fit is good. This is shown in the ANOVA table below (table 5.12.1(3)). The ANOVA table tests the overall significance of the model (i.e. the regression equation).

Table 5.12.1 (3) ANOVA Table Of The Multiple Linear Regression With A Single Factor Predictor

Final Model	Sum Of Squares	Mean Square	F	p Value
Regression	21.933	21.933	23.525	0.000
Residual	116.540	0.932		
Total	138.473			

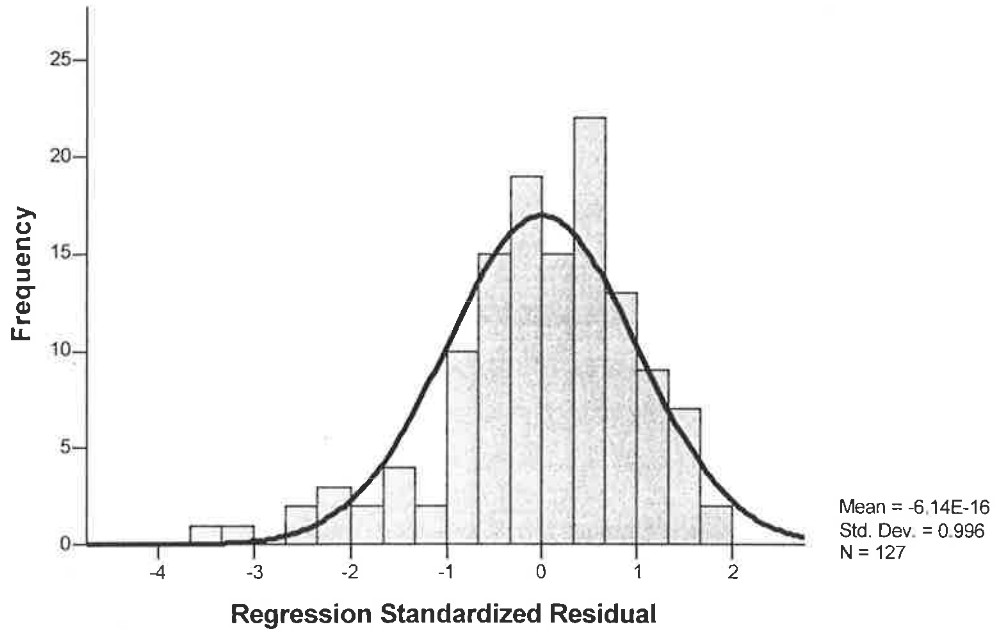
Also, the simple residual plot (scatterplot) of regression studentized deleted residual (vertical axis) against the regression standardized predicted value (horizontal axis) shows a random pattern (i.e. neither a curve nor a funnel shape), indicating that the relationship is homoscedastic with no non-linearity (i.e. fairly linear). The scatterplot is illustrated in figure 5.12.1 (1) below. Non-linearity would be indicated had the residual values formed a curve. Non-normality is shown when residual values are not equally above and below the y-axis zero line. These data (i.e. from the scatterplot) however, are not perfectly normally distributed in that the residuals above the zero line appear slightly less spread out than those below the zero line. Nevertheless, they do appear to be fairly normally distributed. In addition to the graphic examination of the data, the data's normality can also be statistically examined. Specifically, statistical programs such as the SPSS will calculate the skewness and kurtosis for each variable; an extreme value for either one indicates that the data are not normally distributed. Skewness is a measure of how symmetrical the data are; a skewed variable is one whose mean is not in the middle of the distribution (i.e. the mean and median are quite different). Kurtosis has to do with how peaked the distribution is, either too peaked or too flat. Extreme values for skewness and kurtosis are values greater than +3 or less than -3. Except for two residual values, the simple residual plot (scatterplot) as per figure 5.12.1 (1) reveals that virtually all residual value points are within ± 3 on both axes, indicating that there is no serious problem with skewness and kurtosis.

Figure 5.12.1 (1) Scatterplot Of Regression Studentized Deleted Residual Against Regression Standardized Predicted Value Of The Multiple Linear Regression With A Single Factor Predictor



An examination of the histogram of regression standardized residuals (see figure 5.12.1 (2) below) shows a slight negative skew (slightly skewed to the left). Kurtosis is not indicated. The fairly normal distribution of the residuals (coupled with no definite pattern in the dispersion) also signal that heteroscedasticity is not a problem. Moreover, regression is robust in the face of some deviation from the assumption of normally distributed residual errors and the small negative skewness (i.e. slightly skewed to the left) should not affect substantive conclusions.

Figure 5.12.1 (2) Histogram Of Regression Standardized Residual Of The Multiple Linear Regression With A Single Factor Predictor



However, two outliers are spotted from the simple residual plot (scatterplot) as in figure 5.12.1 (1). Tabachnick and Fidell (2001) define outliers as cases that have a standardized residuals (as displayed in the scatterplot) of more than 3.3 or less than – 3.3. To identify the outlying cases, the casewise diagnostic table (see table 5.12.1 (4)) of the SPSS's outputs are referred to. The table lists two cases with standardized residuals of less than -3. They are case number 35 and case number 59. Only case number 35 has a standardized residual of less than -3.3. It was decided to experiment with removing the outlier (case number 35). The stepwise multiple regression procedure was repeated without case number 35 (the outlier). The corresponding casewise diagnostics indicated the presence of a 'new' outlier (case number 58). Again, it was decided to delete case number 58 (the new outlier) and the stepwise multiple regression procedure was re-run. There was no outlier indicated this time. The results without the two outliers (i.e. case number 35 and case number 58 deleted) showed that performance benchmarking dimension of the management accounting practice/technique remained as the only predictor factor. R^2 however improved slightly from 15.8% previously, to 20.8%. Standard error of the estimate also improved marginally from the former 0.96557 to 0.87218. Overall, removing the two outliers did not seem to have a significant influence on the model. The predictive capacity of the model remained the same. As such, it was finally decided to maintain the full sample size of 127 cases without deleting any case.

Table 5.12.1 (4) Casewise Diagnostics Of The Multiple Regression With A Single Factor Predictor (127 Cases)

Case Number	Std. Residual	W.P. Index	Predicted Value	Residual
35	-3.655	1.66	5.1896	-3.52935
59	-3.287	1.47	4.6445	-3.17395

Examination of the residual statistic table (see table 5.12.1 (5)) of SPSS's outputs may explain why the outliers did not have much impact on the model. Cook's distance measures how much the b coefficients change when a case is dropped. It was discovered that there was no case with Cook's distance exceeding one, by virtue of the fact that the maximum Cook's distance was 0.121. Therefore, there were no cases that tended to either influence the outcome inordinately or yielded values that differed markedly from the others. Moreover, all cases have centred leverage values of lower than 0.2. Cases with leverage values less than 0.2 are not a problem, but cases with leverage values of 0.5 or higher may be unduly influential in the model and should be examined. In this single predictor factor model, it does not appear that there are problem cases since the maximum leverage is only 0.103. In other words, there are no influential scores.

Table 5.12.1 (5) Residual Statistics Of The Multiple Regression With A Single Factor Predictor (127 Cases)

	Minimum	Maximum
Standardized Residual	-3.655	1.807
Studentized Residual	-3.687	1.816
Deleted Residual	-3.59191	1.76177
Mahalanobis Distance	0.000	12.966
Cook's Distance	0.000	0.121
Centred Leverage Value	0.000	0.103

5.12.2 Interpreting The Results Of The Multiple Linear Regression Procedure For The Ten Dimensions (Factors)

Out of the ten dimensions (factors) treated as independent variables in the stepwise multiple regression procedure, only one significant predictor to the weighted average performance index emerges. The single predictor is the 'performance benchmarking' factor (comprising of the recoded MAPT34, MAPT15, MAPT32, MAPT16, MAPT39, MAPT33, MAPT27, MAPT9, MAPT38, MAPT21, MAPT13, MAPT25, MAPT26, and MAPT29). Except for MAPT17 (cost-volume-profit analysis), all the significant predictors in the stepwise multiple regression of variables (as opposed to dimensions as predictors) can be found within the performance benchmarking dimension. The former significant predictors within the performance benchmarking dimension are the recoded MAPT39, MAPT21 and MAPT9. Table 5.12.2 (1) below outlines the variable names and their respective descriptions under the 'performance benchmarking' factor or dimension.

Table 5.12.2 (1) Variable Descriptions Under The 'Performance Benchmarking' Factor

Variable Name	Variable Description As Per Questionnaire
MAPT34_1	Benchmarking of management processes.
MAPT15_1	Performance evaluation: team performance.
MAPT32_1	Benchmarking with outside organizations.
MAPT16_1	Benchmarking for operational processes.
MAPT39_1	Owners' (shareholders') value analysis.
MAPT33_1	Benchmarking of product characteristics.
MAPT27_1	Benchmarking with the wider organization.
MAPT9_1	Performance evaluation: ongoing suppliers evaluations.
MAPT38_1	Performance evaluation: employees' attitudes.
MAPT21_1	Performance evaluation: non-financial measures.
MAPT13_1	Performance evaluation: customer satisfaction surveys.

MAPT25_1	Performance evaluation: residual income.
MAPT26_1	Performance evaluation: balanced scorecard.
MAPT29_1	Performance evaluation: qualitative measures.

In this single factor predictor model, the beta (standardized coefficient) for the sole factor predictor (performance benchmarking dimension of the management accounting practice/technique construct) is 0.398. This means that the sole predictor (performance benchmarking dimension) has a positive impact in the model. It should be noted that MAPT9_1 (performance evaluation: ongoing suppliers evaluation) has a negative coefficient in the previous model of four variable predictors (see section 5.11). The other three variable predictors however have positive coefficients.

Even though the model generalizes well, as evidenced by the very small shrinkage of 0.6% (R^2 less adjusted R^2), the only significant factor predictor (performance benchmarking dimension of the management accounting practice/technique construct) explains just about 15.8% of the variation in the dependent variable (weighted average performance index). This is less than 25.7% recorded in the earlier stepwise multiple regression of variables. It seems that the four predictors (recoded MAPT39, MAPT21, MAPT9 and MAPT17) in the earlier multiple regression exercise explain more variance in the dependent variable than the single factor predictor (performance benchmarking dimension of the management accounting practice/technique construct) model. As such, the earlier multiple regression model of four variable predictors is considered a better model and will be used for final interpretation purposes. Nonetheless, this single factor predictor model does highlight the latent role of benchmarking as a dimension in predicting performance. Benchmarking should be seen as complementing owners' (shareholders') value analysis and non-financial measures of performance evaluation as a subtle practice that could predict a firm's performance. Cost-volume-profit analysis understandably does not feature in the single factor predictor model, as cost-volume-profit analysis is the only variable predictor in the previous model that is not under the performance benchmarking factor. It does not mean that cost-volume-profit analysis is less important as the previous four variable predictor model contributes more to explaining the variance in the weighted average performance index. One possible reason why none of the benchmarking variables appears in the four-variable-predictor model, is the fact that benchmarking can only be performed if comparative figures are available for scrutiny. In normal circumstances, such management accounting information remains private and confidential within a firm and is not made available to the public. Therefore, benchmarking can be regarded as more of a refined art of 'intelligence' gathering rather than a straightforward performance comparison. As such, benchmarking in this study will be treated as merely a latent dimension within the main four variable predictors identified. It follows that while benchmarking is desirable, very often it is impractical. In contrast, all the other four variable predictors are well within the capability of the firm to practise and the statistics show that these four variable predictors contribute significantly to explaining the variance in the weighted average performance index.

Another reason why the single factor predictor model does not compare favourably with the four-variable-predictor model is the presence of outliers in the former. Deleting the outliers (case numbers 35 and 58) did not fundamentally change the predictive capacity of the model. It only improved R^2 slightly from 15.8% to 20.8%, and marginally improved the standard error of the estimate from 0.96557 to 0.87218. This improved R^2 of 20.8% was still short of the recorded 25.7% variance explained in the four-variable-predictor model. Therefore, not only was the single factor predictor model tainted by a few outliers, removing the outlying cases did not contribute much to improving the model either. This could easily be explained by the fact that examination of the Cook's distance and the centred leverage values did not reveal any influential score. An outlier is only problematic if it is an influential score at the same time. As such, the two outliers identified are not influential scores and removing the two outliers would have minimal impact on the outcome of the model. Conversely, the four-variable-predictor model (as in section 5.11) is free of outliers, yet yielding comparatively higher power to predict a firm's performance.

5.12.3 Summary Of The Results Of The Multiple Linear Regression

In order to test whether management accounting systems' presentation of information and management accounting practice/technique could predict the weighted average performance index, two multiple linear regression modellings were developed.

The first modelling met the sampling requirement of some writers such as Pedhazur (1997). This modelling tested all the management accounting systems' presentation of information and management accounting practice/technique variables and found that only four of them were significant predictors to the weighted average performance index. The four predictors are MAPT39_1, MAPT21_1, MAPT9_1 and MAPT17_1. MAPT39_1 refers to owners' (shareholders') value analysis. MAPT21_1 is performance evaluation: non-financial measures. MAPT9_1 is a variable on performance evaluation: ongoing suppliers' evaluation. MAPT17_1 is stated in the questionnaire as cost-volume-profit analysis. Except for MAPT9_1, the other three predictors all have positive impact on the model (i.e. positive coefficients). The four predictors also explain 25.7% of the variation in the firms' weighted average performance index (the dependent variable).

The second (alternative) modelling was intended to meet the more stringent sampling requirement espoused by Tabachnick and Fidell (2001). Instead of testing all the seventy variables that made up management accounting systems' (MAS) presentation of information and management accounting practice/technique, this second modelling used the ten factor analysed dimensions of the MAS presentation of information and management accounting practices/techniques. Out of the ten dimensions (factors) treated as independent variables in the multiple regression modelling, only one significant predictor to the weighted average performance index emerged. The single predictor was the 'performance benchmarking' factor (comprising of MAPT34_1, MAPT15_1, MAPT32_1, MAPT16_1, MAPT39_1, MAPT33_1, MAPT27_1, MAPT9_1, MAPT38_1, MAPT21_1, MAPT13_1, MAPT25_1, MAPT26_1, and MAPT29_1).

Except for MAPT17_1 (cost-volume-profit analysis), all the significant predictors in the first modelling could be found within the performance benchmarking factor. The single factor predictor was shown to have positive impact on the model by virtue of having a positive coefficient. However, the second modelling was found to explain less variance in the firms' weighted average performance index relative to the first modelling, even after taking into account the effect of outlying cases. As such, the decision was made to accept the first modelling for interpretation purposes in lieu of the second modelling. Nevertheless, the benchmarking aspect of the second modelling will be brought in to temper the discussion on the first modelling. Although detailed interpretations have been discussed in sub-sections 5.11.3 and 5.12.2, the core arguments will be reiterated in chapter six with a view to addressing the research hypotheses and answering the research questions put forward in chapter three.

5.13 Summary

This chapter five is a logical extension of chapter four. While chapter four emphasizes the issues related to the selection of research methods and analytical techniques with some key findings disclosed, chapter five unravels the full results of data analyses with supporting tabulations and figures. Chapter five also presents the tests of all the major assumptions underlying the use of statistical techniques employed in this study. The results of the main assumption testings confirm that the underlying assumptions are adequately met and except for a few recodings, no major data transformation is required. These assumption testings are deemed essential before the results of the main statistical tests are accepted. Once data analysis was performed, attempt was made to interpret the findings based on available information and some practical considerations.

In order to legitimise the survey questionnaire that was prepared and to gain some off-the-cuff inputs, the study started by interviewing five professionals familiar with accounting in the manufacturing environment. These professionals while testifying to the face validity of the survey questionnaire also provided some general responses that are summarized in appendix two. A specimen of the interview sheet showing all the questions posed during the interview sessions accompanies this thesis in appendix one. As all the interviewees were satisfied with the questions used in the survey questionnaire, the pre-testing stage was considered successful in retaining the use of the survey questionnaire in its entirety without the need of any modification.

The crux of the data analysis was the clustering of management accounting systems' presentation of information and management accounting practice/technique variables. The two-cluster solution is clearly indicated and issues related to cluster analysis resolved via ample discussion supported by the use of numerous tabulations. Importantly, the two-cluster solution was criterion validated with the weighted average performance index. The result proves that one of the two clusters (cluster two) performs significantly better than the other cluster (cluster one). It is also shown that for each of the management accounting systems' presentation of information and management accounting practice/technique variable indicators, the mean of cluster two is significantly higher than the mean of cluster one. This means that those firms which consider management accounting systems' information attributes as more useful and claim more benefit from practising management accounting practices/techniques are the relatively better performing firms (i.e. belonging to cluster two). The issue of non-response in this survey was also dealt with. The evidence does not show non-response as contributing to bias in this study.

Once the two clusters of firms were established, attempts were made to test for significant associations between the clusters and the background information, manufacturing management methods, institutional factor indicators and the contingency factor indicators. It is found that only a number of variable indicators come out as having significant associations with the two clusters. The variable indicators are education-certificate(s), previous length of service, seven out of nine institutional variables and five out of thirty two contingency variables. All these significantly associated variables were then subjected to an appropriate multivariate modelling where the weighted average performance index was the dependent variable. Only four of those variables appear to be significant predictors to the weighted average performance index. The four predictors can be summarized as previous length of service, customer oriented manufacturing strategy, managerial focus on management control systems and lastly, top management reliance on experts' advice on costing, budgeting and reporting.

It was also considered pertinent to identify the predictive capacity of the management accounting systems' (MAS) presentation of information and management accounting practices/techniques on the weighted average performance index. Two alternative models were developed. The first model tested all the MAS presentation of information and management accounting practice/technique variables as independents against the weighted average performance index as the dependent. The second model tested the factor analysed dimensions of MAS presentation of information and management accounting practices/techniques against the weighted average performance index. In the final analysis, it is found that only four variables emerge as significant predictors to the performance index. The four predictors are owners' (shareholders') value analysis, performance evaluation: non-financial measures, cost-volume-profit analysis and performance evaluation: ongoing suppliers evaluation. With the exception of performance evaluation: ongoing suppliers evaluation, all the predictors have a positive impact on the weighted average performance index. These four predictors are identified in the first model. In the second model, it is discovered that performance benchmarking can be treated as a latent dimension underlying the four predictors with an overall positive impact.

All the main findings in this chapter five will further be revisited in chapter six with the intention of answering the research questions, meeting the research objectives and consummating the research hypotheses.

CHAPTER SIX

CONCLUSION

6.1 Introduction

While the full results and subsequent discussion have been elaborated in chapter five, this chapter six will revisit the main results with the intention of wrapping up the core findings in terms of how they have met the study's research objectives. As a caution, various limitations of the study will be addressed with a view of highlighting some of the pitfalls of over-relying on the empirical evidence produced by this study. To connect the study's findings with the underlying theoretical perspectives and practical considerations, a separate section is provided on implications of the study. To conclude, this chapter will suggest some prospective directions for future research.

This chapter is divided into six sections. Section 6.2 will recapitulate the findings in terms of their testing of the hypotheses, meeting of the research objectives, and answering the research questions posed in chapter three. While there will be some elements of repetition, the essential findings will be summed up and put back into their research contexts. .

In section 6.3, the main limitations of the study will be discussed. The limitations are divided into limitations embodied in the selected theories, limitations embodied in the design and administration of the survey, limitations of the data analyses and limitations of scope in interpreting the results. All these will be explained separately in the various sub-sections and sub-sub-sections. These limitations will impose some caveats on the findings and temper the interpretations. The contributions of this study in adding to the existing body of knowledge can then be seen in a more credible light.

The implications for theory and practice will ensue in section 6.4. As both contingency and institutional theories have been invoked in this study, interpreting the findings from these two theoretical perspectives is necessary. As such, the relevance of the key findings in relation to the germane aspects of the theoretical foundations will be examined. Some practical implications will also be discussed.

Section 6.5 will provide some directions for future research projects that could take cues from this study. Some paths will be suggested that are practical and plausible as possible follow-ups to this study. Finally, section 6.6 will summarize the important points in this chapter.

6.2 Recapitulating And Interpreting The Findings

In chapter three, based on the research problem outlined, a set of five broad research questions are promulgated. From these five broad research questions, seven specific research objectives are proposed that bring the research to a more applied focus. Once the conceptual model is constructed, eleven refined research hypotheses are developed to be tested empirically. In this concluding chapter, the results and their interpretations will be addressed in the order of more specific to more general. Thus, sub-section 6.2.1 will focus on the hypothesis tests and their specific interpretations and sub-section 6.2.2 will provide broader interpretations of the findings in relation to the research questions, discussed in parallel with the research objectives.

6.2.1 The Hypothesis Tests And Their Interpretations

This section sets out the results of tests of each of the eleven hypotheses posed in this study and a discussion of the results' meanings in a practical context.

Hypothesis 1

Mean organizational performance (weighted average performance index) does not differ between the management accounting typological cluster groups of firms.

Results reveal a significant difference between the weighted average performance indices of the two typological clusters of firms. Therefore, H_O is rejected. This finding shows that the use of management accounting (when conceived from its wide range of systems, techniques and practices) has a positive effect on the performance of manufacturing firms. Firms whose managers tend to place higher usefulness on management accounting systems' information (in terms of it being broad in scope, timely in its availability, disaggregated in content and integrated to decision-making) and also perceive a benefit from adopting a wide variety of management accounting practices and techniques are found to work in higher performing firms. Those firms whose managers see less usefulness or benefit from management accounting, but rely on other decision-support methods, fall into a lower performing manufacturing group of firms.

This finding suggests that a more sophisticated knowledge and use of management accounting in carrying out management tasks is a critical reason for achieving better organisational performance in the manufacturing industries.

Hypothesis 2

Each of the individual items of management accounting systems' information attributes and management accounting practices/techniques does not significantly differ between the management accounting typological cluster groups.

Results show a significant difference between the cluster groups in the case of all twenty five management accounting systems' attributes and all forty five management accounting system and practice/technique items. One cluster of firms is consistently higher, on average, on perceived usefulness and benefits of each of the seventy management accounting items than the other cluster group. The null hypothesis is rejected. This two-cluster solution provides a typology of management accountants working in the manufacturing industry. It reveals that those management accountants who are willing to embrace their discipline's wide offering of systems, techniques and practices tend to do so right across the full array of items, not just in selected areas. This type of practising management accountant sees relatively greater usefulness and benefits from the entire range of aspects of their management accounting discipline, compared to the alternative group of management accountants. This alternative typological group has a relatively lower willingness to embrace any areas of management accounting, not even selected areas.

Although all management accountants surveyed in this study are qualified current members of CIMA working in the manufacturing industry, they fall into two contrasting types. On the one hand, there is the sophisticated management accounting users, who are convinced about the advantages of all types of applications from their discipline. On the other hand, there is the reluctant management accounting users, who are sceptical about the net benefits of all types of applications from their discipline. The results of this study reveal no in-between typological group of management accountants.

Hypothesis 3

The background of respondents and respondents' firms are not significantly different between the management accounting typological cluster groups.

Based on bivariate analyses, the evidence shows that the respondents' gender, age, management level, remuneration, decision-making function and functional area of responsibility are not significantly different between the cluster groups. Similarly, the respondents' firms' area of operation, manufacturing management method and status (i.e. whether an associate or subsidiary) are also not significantly different between the cluster groups. However, the level of educational qualification and the previous length of service of respondents are significantly different demographics for respondent management accountants between the two cluster groups. The null hypothesis is rejected for these two respondent-background variables only.

The interesting aspect of this finding is that those subjects having extra educational certificates from university in addition to their primary CIMA professional qualification (which all respondents hold), together with shorter length of experience, fall into the group of management accountants who tend to be reluctant and more sceptical users of management accounting systems, techniques and practices. Alternatively, those respondents who tend to be more accepting of the benefits of a wide range of management accounting techniques and practices will tend to have the direct CIMA qualification, without other university-based certificates. They would have come through an earlier education system and have been in employment longer. This finding suggests that management accountants become more willing users and more readily accepting the advantages of the full range of management accounting systems and practices/techniques if they have only been exposed to traditional professional-body training and have been in practice longer. Based on multivariate analysis (logistic regression), the results reveal that the significant predictor of cluster group is previous length of service only. This multivariate result indicates that, for management accountants to hold a university qualification is not a compelling reason to find them located in better performing firms. Rather, length of work experience in different firms is the primary factor.

Hypothesis 4

The type of strategic manufacturing priority emphasized by firms does not significantly differ between the management accounting typological cluster groups.

On a bivariate basis, all the three variables under strategic manufacturing priorities exhibit significant differences in their mean scores for the two clusters of firms. Therefore, the null hypothesis is rejected. Respondents in the cluster group that embraces and believes in a wide range of management accounting applications are more in agreement with putting emphasis on each one of the three types of strategic manufacturing priorities – viz., competing in technology/innovation, manufacturing competitively priced quality products, and taking a customer-centric approach. This cluster group also has been found, in the test of hypothesis 1, to contain the better performing firms. These bivariate analysis results suggest that emphasis on any one of the three manufacturing strategies requires the firm to have a more embracing acceptance of management accounting systems, techniques and practices and, in turn, contributes to their better performance.

Results from multivariate analysis give fewer significant relationships between the strategic manufacturing priorities and the typological clusters. Only one strategy, the customer-centric approach, is found to be a significant predictor to the clusters. This result needs further interpretation. Firms adopting a manufacturing strategy of responding to customers' requirements and giving priority to customer service and delivery, are significantly related to the cluster that has management accountants willing to embrace all areas of management accounting systems and management accounting practices/techniques. These areas include not only balanced scorecard and customer satisfaction surveys, but also techniques less relevant to customer service, such as various costing, budgeting and benchmarking techniques. The inference is that management accountants working in customer-centric manufacturing firms, and who widely embrace the systems, techniques and practices offered by their discipline, will be convinced that the fulfilment of a customer-centric strategy requires management accounting systems and practices/techniques that support more general product and service pricing and quality requirements as well as direct methods of responding to customer requests.

Hypothesis 5

The attributes of organizational interdependence of firms do not significantly differ between the management accounting typological cluster groups.

The results show that, on a bivariate basis, none of the variables under organizational interdependence turns out to have significant association with the typological clusters. A multivariate analysis also confirms that none of the organizational interdependence variables are significant predictor to the clusters of firms. Therefore, the null hypothesis is not rejected.

The suggestion of this finding is that the way a manufacturing firm structures itself for its production processes is not an influence on whether the firm's management accountants are of a type that embraces and believes in a wide range of applications of management accounting systems and practices/techniques in the firm or is reluctant and sceptical about such applications. Thus, the extent to which outputs are exchanged between units of the organization, or whether that exchange is sequential or reciprocal, does not have an impact on the management accounting typological clusters. Organizational interdependence may affect transfer pricing and performance measures at the operating unit level, but is not a sufficient contingency factor to significantly influence orientations of management accountants and, by extension, organizational performance.

Hypothesis 6

The attributes of decentralization of organizational structure do not significantly differ between the management accounting typological cluster groups.

On a bivariate analysis, it was found that only two of the twenty three variables used to measure decentralization of organization structure have significant associations with the clusters of firms. For these two variables, H_O is rejected. For the rest of the variables do not reject H_O. The decentralization variables most significantly associated with the clusters were found to be management autonomy in staffing decisions. Thus, respondents representing firms in cluster two (the better performing cluster) are more in agreement on giving managers decision autonomy to appoint and promote supervisory staff. Clearly, the evidence suggests that empowering managers with decision autonomy to appoint and promote supervisory staff results in firms showing significantly better performance. All other organizational structure: decentralization variables are shown to have no significant association with cluster membership. As such, the influence of these non-significant variables does not impact on the firms' cluster membership and by extension their relative performance.

On a multivariate level however, none of the twenty three decentralization variables was identified as a significant predictor to the clusters. Therefore, H_O is not rejected. It follows that while autonomy of managers to appoint and promote supervisory staff is significantly association with the cluster membership, such manager autonomy is not a predictor of the membership of the two clusters.

Research hypothesis 7

Attributes of perceived environmental uncertainty do not significantly relate to the management accounting cluster solution.

On a bivariate basis, none of the three variables under perceived environmental uncertainty turns out to have a significant association with the cluster membership.

The multivariate analysis also verifies that none of these variables is a significant predictor of the membership of the management accounting clusters of firms. For these three variables, H_O is not rejected. Hence, the evidence points to the fact that the contingency factor of perceived environmental uncertainty does not help to predict the membership of the typological clusters of firms and by inference their relative performance.

Research hypothesis 8

Mimetic isomorphic influences do not significantly relate to the membership of the management accounting clusters of firms.

The results, on a bivariate basis, reveal that the three institutional mimetic variables tested for significant differences in their mean scores for the two clusters of firms, all come out significant. Therefore, for all these variables, H_O is rejected. This finding means that mimetic influences in an institutional framework do have a bearing on a manufacturing concern's cluster membership and thus its relative performance. The three mimetic influences specified in the questionnaire, which are significantly associated with the better performing cluster of firms, are: (1) emulating the best management accounting practices of competitor firms, (2) imitating the costing and budgeting techniques of other firms in similar industry segment, and (3) adopting the most popular software packages for management accounting systems.

On a multivariate basis however, none of the three mimetic influences is found to be a predictor to the management accounting clusters of firms. For the three variables, do not reject H_O. Thus on a model fit scenario, the institutional mimetic isomorphic influences have no capacity to predict the cluster membership and its relative performance. It appears that emulating or imitating other firms for purposes of legitimacy cannot explain in which typological cluster a firm belongs to.

Research hypothesis 9

Coercive isomorphic influences do not significantly relate to the membership of the management accounting clusters of firms.

On a bivariate basis, out of the three institutional coercive variables tested for significant differences in their mean scores for the two clusters of firms, only one variable comes out significant. The variable is regarding the high level of attention given by top management to the way management control systems function. For this variable, reject H_O. For the other two variables, do not reject H_O.

On a multivariate basis, the variable also proves to be a predictor to the clusters of firms. As such, for this variable, reject H_O. For the other two variables, do not reject H_O. This result confirms that a lot of attention given by top management to aspects of the functionality of management control systems is a coercive influence that can predict cluster membership and better performing firms. Therefore, the empirical evidence in this study reveals that 'coercive' isomorphic pressures do not tend to predict a firm's cluster membership other than the coercive pressure of close top management attention to management control systems.

Research hypothesis 10

Normative isomorphic influences do not significantly relate to the membership of the management accounting clusters of firms.

Results on a bivariate basis show that all the three institutional normative variables indicate significant differences in their mean scores for the two clusters of firms. Therefore, for these three variables, reject H_O. As such, it is found that normative influences in an institutional framework do have a bearing on a manufacturing concern's cluster membership and its relative performance. The three institutional normative influences are: (1) the role of the firms' experts in designing and maintaining management accounting systems, (2) the reliance on professional bodies for ideas on management accounting and control techniques, and (3) senior management's dependence on the management accountant/financial controller when it comes to costing, budgeting and reporting.

On a multivariate basis however, only one of the three institutional normative variables is identified as a significant predictor to the clusters of firms. For this variable, reject H_O. The variable is about top management's reliance on internal expertise on matters relating to costing, budgeting and reporting.. Where respondents agree more on such reliance on internal expertise, a better performing cluster of firms can be predicted.

Research hypothesis 11

There is no significant relationship between management accounting systems' information attributes or management accounting practices/techniques and the weighted average performance index.

Results reveal that out of the seventy management accounting system and management accounting practice/technique independent variables tested, only four are found to be significant predictors to the weighted average performance index. The four predictors all come from management accounting practices/techniques, i.e. no predictor emerges from management accounting systems' information attributes. For all these four predictors, reject H_O. For the rest, do not reject H_O. The four management accounting practice/technique predictors are: (1) owners' (shareholders') value analysis, (2) performance evaluation: non-financial measures, (3) performance evaluation: ongoing suppliers' evaluation, and (4) cost-volume-profit analysis. Except for performance evaluation: ongoing suppliers' evaluation, the other three predictors all have positive impact on the model. This means the more the indicative benefit of adopting the three management accounting practices/techniques, the higher the weighted average performance index. The four predictors should also be seen in the context of benchmarking a firm with best practice.

6.2.2 Answering The Research Questions

Although the findings concerned with testing the specific hypotheses have been summarized and discussed, the broader research objectives and research questions also need to be revisited. These broad research objectives and questions parallel each other, so a summary of the answers of this study to the research questions is deemed sufficient.

Research question 1

What is the nature and extent of diversity and stability of management accounting systems' information attributes and management accounting practices/techniques used in various sectors of the manufacturing industry in Malaysia?

Answering research question 1

Research question 1 did not need hypothesis testing. It was satisfactorily deduced from the analysis of the transcripts of the interviews. On the nature of management accounting systems' (MAS') information, overall MAS' information varies from firm to firm depending on the circumstances and the management hierarchy level. The information generated is useful for management purposes even though the contexts of use may vary between organizations. Regarding the types of management accounting practices/techniques (MAPT) used in manufacturing firms, there are many different types of such practices/techniques in use. The diversity of management accounting systems' information attributes was said to vary from firm to firm. Similarly for the management accounting practices/techniques, their perceived usefulness was said to be diverse by the interviewees. In terms of the stability of use of management accounting systems'' information attributes, the interviewees contended that this was dependent on management policy. The use of management accounting practices/techniques in manufacturing was considered by the interviewees to be generally fairly stable.

Research question 2

What particular types of management accounting systems' information attributes and management accounting practices/techniques cluster together to form a discernable management accounting typology of firms for application in manufacturing management?

Answering research question 2

Results from the cluster analysis establish two typological clusters of firms based on the clustering variables of the management accountants' perceived usefulness of management accounting systems' information attributes and perceived benefits of management accounting practices/techniques. These two clusters of firms are discernable as both of them inter alia, have significantly different mean scores for each management accounting system and practice/technique item studied.

Research question 3

Can the member firms in the typology of clusters formed be differentiated on the basis of their organizational performance?

Answering research question 3

Not only do the two clusters have different performance measures, cluster two is shown to perform significantly better than cluster one. Therefore cluster two ranks higher than cluster one in terms of performance.

Research question 4

Can a firm's membership of a particular typology cluster be explained by any of the firm's background information, manufacturing management method, internal and external contingency or institutional isomorphic factor[12]?

Answering research question 4

Manufacturing management method does not have any significant association with the clusters of firms. Nonetheless, there are two background information variables that have significant associations with the clusters of firms. However only one can explain or predict the membership of each typological cluster of firms. The significant predictor is

[12] Note that this research question 4 is divided into three separate research objectives (separating the background/manufacturing methods, contingency factors and institutional factors) in chapter 3.

the previous length of service. The more the respondents' experiences working in previous firms, the more the likelihood the respondents will be in the better performing cluster (cluster two) relative to the respondents' peers. As such, having management accountants with longer relevant work experience in previous organizations will result in firms having more belief in the usefulness of management accounting systems' information attributes and the benefit accrued in adopting management accounting practices/techniques and consequently results in the ability to predict better performing firms.

A firm's membership of a better performing cluster can also be explained by one contingency factor, i.e. a manufacturing strategy emphasizing the need to respond to customers' requirements with priority to service and delivery. There are two institutional influences that can explain the management accounting typological clusters. The influences are, first, giving top level attention to the way management control systems function, and secondly, depending on internal experts' advice on costing, budgeting and reporting.

Research question 5

Can organizational performance be explained directly by any of the management accounting systems' information attributes and management accounting practices/techniques?

Answering research question 5

Among the clustering variables, there are four predictors to organizational performance. The four predictors all come from management accounting practices/techniques, i.e. no predictor emerges from management accounting systems' information attributes. The four management accounting practice/technique predictors are owners' (shareholders') value analysis, performance evaluation: non-financial measures, performance evaluation: ongoing suppliers' evaluation, and cost-volume-profit analysis. Except for ongoing suppliers' evaluation, the other three predictors all have positive explanatory effect on organizational performance. This means the more the indicative benefit of adopting the three management accounting practices/techniques, the higher the organizational performance is. The four predictors should also be seen in the context of benchmarking a firm with best practice.

6.3 Limitations Of The Study

The findings and conclusions from this study should be appreciated with the following limitations in mind:

- Limitations embodied in the selected theories;
- Limitations embodied in the design and administration of the survey;
- Limitations of the data analyses; and
- Limitations of scope in interpreting the results.

The above limitations will be elaborated upon in subsequent sub-sections.

6.3.1 Limitations Embodied In The Selected Theories

Limitations surround the nature and scope of the theories selected in this study. Aspects of institutional and contingency theories, which have been relied upon in this study, are not devoid of criticism. This criticism has also been levelled at attempts to operationalize some of the constructs and dimensions arising from these theories. These limitations are extensively reviewed in chapter two under sections 2.9 and 2.10. Section 2.9 discusses the limitations of contingency theory while section 2.10 deliberates on the limitations of the institutional theory.

6.3.2 Limitations Embodied In The Design And Administration Of The Survey

Robson (1996, p.125) is of the opinion that,

> Researchers tend to have strong, frequently polarized, views about the place and importance of surveys. Some see the survey as *the* central 'real world' strategy.....Others view surveys as generating large amounts of data of dubious value.....The findings are seen as a product of largely uninvolved respondents whose answers owe more to some unknown mixture of politeness, boredom, desire to be seen in a good light, etc. than their true feelings, beliefs or behaviour.

However, the trustworthiness of data collected from field surveys depends largely upon how carefully the questionnaire is designed and how proficiently it is administered. The question of comprehensibility of the questionnaire will be relevant to the problem of internal validity. In this study, all variable measures apart from the institutional isomorphic influences are replications of previously developed and tested instruments. To the extent that they have been well tested, the matter of comprehensibility should be satisfied. This lack of prior testing of the institutional isomorphic influences does not present a limitation of internal validity as these influences are adaptations of those drawn from various literature sources. Besides, pre-testing of the research instruments did not expose any serious apprehension that warranted a reconstruction. The instruments are proven to be comprehensible to respondents. Furthermore, the use of technical terms does not appear to undermine comprehensibility as one of the obvious manifestations of incomprehensibility is the refusal to answer, otherwise known as missing values. In sub-section 4.6.1, it is explained that missing values in the returned questionnaires were relatively small and those pertaining to the Likert scales were consequently ironed out by replacing them with means. Another telltale sign of lack of understanding is deliberate annotation made by the respondents such as a question mark or other comments indicating confusion. Such an annotation is not evident in the returned questionnaires.

Most scale scores used in the questionnaire are Likert scales. As pointed out by Brownell (1995,p.41), Likert scale scores are obtained by summing the responses to all items and this "summation is based on the premise that all items tap a single construct and that each item will introduce some random measurement error which will partially or completely cancel out in the summation". He further cautions that "when developing a new scale....the researcher is urged to give painstaking attention to the question of unidimensionality" (p.41). However, as detailed in chapters five and six, not all the research items were subjected to factor analyses. Insofar as the need to use constructs or dimensions rather than individual indicators, factor analyses were applied to the items management accounting systems' information attributes and management accounting practices/techniques to verify that these dimensions were measured in a unidimensional way. Such factor analysis serves to ensure that all items included in a principal component correlate highly with each other.

Nevertheless, perceptual differences between people and groups are a major problem area for many fields of study. According to Lau and Shani (1988), perceptions are pervasive in management and recognition of their existence is of major importance in understanding organizational behaviour. They argue that determinants of perception are primarily internal to the individual, rather than arising from observed external objects or social interaction. Internal factors can be divided into physiological, past experience, and psychological categories. Codes of past experience, as well as motivational and defensive processes can filter and greatly distort what the individual is perceiving (Lau and Shani, 1988). In addition, they contend that goals and needs are, at a specific time, major determinants in perception. Lau and Shani (1988) also refers to the "psychology of opposites" – a phrase for denial which can affect how an individual perceives certain behaviours of self and others. About perceptual differences, they contend that no one perceives with complete objectivity. The determinants of perception are in operation all the time. The limitation of surveys that collect data on perceptual differences is related to the fact that most people rely on the meanings coming from their codes without realising that the perceptions are primarily from internal determinants rather than the external world.

Respondents may also be subjected to social desirability bias or halo effect which may cause them to over-rate the firms they are working in. The halo effect refers to a cognitive bias whereby the perception of a particular trait is influenced by the perception of the former traits in a sequence of interpretations. The only mitigating factor against this social desirability bias is the fact that the research is endorsed by the Chartered Institute of Management Accountants (CIMA), Malaysia Division, and the cover letter makes a personal appeal for an honest response, whatever it may be. The cover letter is included in appendix three of this thesis. It should also be noted that most members of prestigious professional bodies, including CIMA understand the virtue of abiding by a stringent code of ethics including integrity and objectivity. Since all respondents are members of CIMA, there is a greater likelihood that their responses reflect ethical standards of honesty.

Turning to the administration of the questionnaire, this study has faced practical difficulties in fully identifying and accessing part of the target population. The sampling frame is all members of the Charted Institute of Management Accountants (CIMA), Malaysia Division. However, only those working in manufacturing or had experience working in manufacturing concerns were solicited to respond. As CIMA Malaysia Division did not give a breakdown of members working in the various sectors, it was impossible to determine how many and who worked in the manufacturing sector per se. It is therefore not known what the actual response rate is, as the real figure of those working in manufacturing was not made available. This necessitated a non-probability sampling design (quota sampling), being drawn from selected manufacturing industry segments. This design possesses the basic shortcomings of high variable error and lacks the characteristics to estimate this error. Nonetheless, in view of the relatively poor response, this sampling design is adequate to satisfactorily answer the research questions. It should be noted that a non-probability sampling design has been used extensively in social science researches.

Nevertheless, the findings of this study may not be generalisable to the whole population of manufacturing companies. In as much as companies in selected manufacturing segments as well as large companies adopt a greater range of management accounting systems and practices/techniques, it is likely that the sample will represent more sophisticated management accounting than the total population of manufacturers. Getting a very high response rate is inherently and intrinsically difficult in mail survey type research. The sample selection therefore, can be viewed as being what Robson (1996, p.141) refers to as "accidental .... but also .... dimensional sampling". That is, dimensions of the population thought to be of importance in the survey have been included in the sampling procedure. It remains, however, that doubts about the representativeness of the Malaysian sample exist which limits the external validity of the findings.

The limitations of cross-sectional, questionnaire-based research apply to this study. To a certain extent, requiring respondents to opine on statements or descriptions that were applicable 'over the past three years' as opposed to current situation ameliorated part of the cross-sectional deficiency. The sample of management accountants was taken from the Malaysian environment. This suggests that the results of the study may have limited external validity beyond the country setting of this study. In relation to internal validity, problems of errors in measurement associated with any survey data, particularly systematic errors due to respondents showing leniency, acquiescence, range restriction, partitioning or other forms of bias, apply to this study. In particular, the use of a self-reported performance measure may have produced higher means due to leniency error, and lower standard deviations due to restricted range error. Further, the management accountants' responses are based on their own beliefs, which may not correlate with more objective overall organizational beliefs.

One possible disadvantage of an exploratory research, as adopted in this study, may be that there are important variables that have not been taken into account in this study. There may exist other factors that may have a stronger impact on the clusters of firms and their respective performance. The moderating effects of possible interaction terms are also ignored. Another limitation may be that the results are not generalizable beyond the population from which the study is drawn. It is not possible to produce a lengthy questionnaire as this may cause respondent fatigue and reduce response rate. The right balance between a comprehensive questionnaire, which tends to be long, and an abridged one, which may be incomplete, is a matter of personal judgement. Such a judgement is definitely a limitation.

As already mentioned, the use of self-rated performance measures may be a limiting factor. Self-ratings may have high mean values and lower variability error in their scores (Mia, 1993; Chong, 1996). A management accountant's perception of a firm's performance may not have captured the true performance.

Limitations of the study may include non-response bias. Respondents who are indolent or disinterested may not have responded or responded half-heartedly. However, in this study, statistical test on non-response bias using a variant of the extrapolation methods indicate that non-response bias is not a problem.

The administration of the questionnaire was not in the hands of the researcher in all cases. In all cases, the precise respondents were not identified and remained anonymous. Due to confidentiality requirement, the Chartered Institute of Management Accountants (CIMA), Malaysia Division had not divulged the identities of the respondents. Therefore, the effects of some lack of control such as any influence by a third party on the respondents' when making personal contact with them may have further threatened the collected data's internal validity.

Another limitation is that data have been analysed in this study, and conclusions have been drawn, on the basis of a single research method, i.e. field survey. This raises the issue of "common method variance" (Podsakoff, 1986). Spector *et al.* (1997) have argued that the most effective way to overcome common method variance, other than methodological weaknesses is to test ideas with different methods. For example, an experimental verification could be provided of the relationships found in a survey method. This study, however, has not undertaken a multiple method approach. In defence of a single survey method, evidence indicates that people often accurately perceive their social environment (Balzer and Sulsky, 1992) and that common method variance may not be a much of an artefact as previously assumed (Bass and Avilio, 1990).

6.3.3 Limitations Of The Data Analyses

Limitations of the data analyses will be dwelt upon under limitation of the multinomial logistic regression, limitations of the multiple linear regression, and limitation of specifying the stepwise model for the regression procedures.

6.3.3.1 Limitation Of The Multinomial Logistic Regression Procedure

In the use of multinomial logistic regression, as is the case in this study, the assumptions underlying the multinomial logistic regression procedure need to be adhered to. All the major assumptions are fully met as explained in chapter five. However, there is one assumption that has to be disregarded due to the exploratory nature of this research. The fact that this assumption of additivity has to be disregarded can be seen as imposing some limitation to the data analysis. Nevertheless, ignoring this assumption can also be justified to a certain extent. The following discussion elaborates on the assumption of additivity in the multinomial logistic regression exercise and the need for this assumption to be disregarded in this study.

- *The assumption of additivity in multinomial logistic regression*

  Like ordinary least squares (OLS) regression, logistic regression does not account for interaction effects except when interaction terms (usually products of standardized independents) are created as additional variables in the analysis. This can be done by using the categorical covariates option in SPSS's logistic regression procedure. An interaction occurs when the magnitude of the effect of one independent variable (x) on a dependent variable (y) varies as a function of a second independent variable (z). This is also known as a moderation effect, although some have more strict criteria for moderation effects than for interactions. An interaction effect represents an association not accounted for by the main effects. In this study, the model assumes the lack of interaction between any two given variables in their effects on the response. The lack of interaction term in this model implies a common value of the odds ratio. In fact, due to the large number of variables processed by the exploratory forward entry stepwise method in the beginning, the number of possible interaction permutations would have been too numerous to make sense of. Such interaction effects would have been far too complex and very hard to comprehend and interpret. Moreover, group effects and interaction effects are not reducible to readily identifiable individual characteristics or easy-to-see organizational factors (Aiken & West, 1991; Kreft & DeLeeuw, 1998; Raudenbush and Bryk, 2002). In the absence of well-developed theory, such effects are difficult to anticipate and often go undetected (Velicer, 1972; Baron & Kenny, 1986; Jaccard, Turrisi, and Wan, 1990; Iversen, 1991; Snijders and Bosker, 1999). From the statistical modelling and analysis, this study highlights that the main effects model fits the data well and no interaction terms are needed. The SPSS model fitting information table produces a significance value (p value) of less than 0.05, showing a good model fitting. Besides, the goodness-of-fit table shows that the chi square values are not significant (i.e. more than 0.05). Therefore, the model adequately fits the data. In other words, the data are consistent with the model assumption. Since the tested model seems to show a good fit, the main effects model fits adequately and no additional interactions need to be added. According to the classification table generated by SPSS, overall 82.0% of the cases used to create the model, are classified correctly. This is a relatively high level of classification, denoting a good model. In short, while acknowledging additivity as part of model construction, this study has decided to disregard interaction effects without jeopardising a good model fit. This is justifiable due to the exploratory nature of this research and the absence of solid theory to support the inclusion of any interaction term.

6.3.3.2 Limitations Of The Multiple Linear Regression Procedure

The use of multiple regression in this study is also subjected to a number of underlying assumptions. All the main assumptions are adequately satisfied as explained in chapter five. However, the assumption of non-recursivity is disregarded partly because the aim of this study is predictive rather than structural testing. Besides, it is not possible to run a valid structural equation modelling due to insufficient samples. Like multinomial logistic regression mentioned above, the assumption of additivity in the multiple linear regression exercise is also waived. The reason being is that this study is largely exploratory in nature and prior determination of interaction terms based on theory is out of the question. Moreover, the main effect model fits adequately and no additional interactions need to be added in this research. Yet another assumption disregarded is the assumption requiring population error term to be uncorrelated with each of the independents. Since the population regression line is not known for the sample data, the assumption must be assessed by theory. However, due to the exploratory nature of this research, there is no concrete theory to base any assumption on the correlations between the population error term and the independent variables. In defence, judging by the research design, it is unlikely that the dependent (weighted average performance index) is also a cause of one or more of the independents (management accounting systems' presentation of information and management accounting practice/technique variables). Detailed discussion on the disregarded assumptions is as follows.

- *Assumption of non-recursivity in multiple linear regression*

  The dependent cannot also be a cause of one or more of the independents. This is also called the assumption of non-simultaneity or absence of joint dependence. Violation of this assumption causes regression estimates to be biased and means significance tests will be unreliable. Confirmatory factor analysis can test this. Confirmatory factor analysis (CFA) may be used to confirm that the indicators sort themselves into factors corresponding to how the researcher has linked the indicators to the latent variables. There are two approaches to confirmatory factor analysis, namely the traditional approach and the structural equation modelling approach. Confirmatory factor analysis plays an important role in structural equation modeling (SEM). CFA models in SEM are used among other things to assess the role of measurement error in the model, to validate a multifactorial model and to determine group effects on the factors. While SEM is typically used to model causal relationships among latent variables (factors), it is equally possible to use SEM to explore CFA measurement models. This is done by removing from the model all straight arrows connecting latent variables, adding curved arrows representing covariance between every pair of latent variables, and leaving in the straight arrows from each latent variable to its indicator variables as well as leaving in the straight arrows from error and disturbance terms to their respective variables. Such a measurement model is run like any other model and is evaluated like other models, using goodness of fit measures generated by the SEM package, such as AMOS (Analysis of Moment Structures). Using SEM, CFA models can be explored with or without the assumption of certain correlations among the error terms of the indicator variables. Such measurement error terms represent causes of variance due to unmeasured variables as well as random measurement error. Depending on theory, it may well be that the researcher should assume unmeasured causal variables will be shared by indicators or will correlate, and thus SEM testing may well be merited. That is, including correlated measurement error in the model tests the possibility that indicator variables correlate not just because of being caused by a common factor, but also due to common or correlated unmeasured variables. This possibility would be ruled out if the fit of the model specifying uncorrelated error terms was as good as the model with correlated error specified. In this way, testing of the confirmatory factor model may well be a desirable validation stage preliminary to the main use of SEM to model the causal relations among latent variables. In this study, confirmatory factor analysis using the structural equation modelling approach suggested above is not employed since it is considered not important as the aim is more predictive, rather than structural testing. Besides, the main assumption requiring large sample size to support structural equation modelling is not adequately met. As such, the assumption of non-recursivity in this multiple regression exercise is disregarded.

- *Assumption of additivity in multiple linear regression*

Likewise, multiple regression does not account for interaction effects, although interaction terms (usually products of standardized independents) may be created as additional variables in the analysis. An interaction effect represents an association not accounted for by the main effects. An interaction occurs when the magnitude of the effect of one independent variable (x) on a dependent variable (y) varies as a function of a second independent variable (z). Interaction effects are sometimes called moderator (moderation) effects because the interacting third variable, which changes the relation between two original variables, is a moderator variable that moderates the original relationship. However, some writers have more strict criteria for moderator or moderation effects than for interactions. Interaction terms may be added to the model to incorporate the joint effect of two variables on a dependent variable over and above their separate effects. One adds interaction terms to the model as cross products of the standardized independents and/or dummy independents, typically placing them after the simple main effects independent variables. Cross product interaction terms may be highly correlated (multicollinear) with the corresponding simple independent variables in the regression equation, creating problems with assessing the relative importance of main effects and interaction effects. The significance of an interaction effect is the same as for any other variable, except in the case of a set of dummy variables representing a single ordinal variable. When an ordinal variable has been entered as a set of dummy variables, the interaction of another variable with the ordinal variable will involve multiple interaction terms. In this case the F test of the significance of the interaction of the two variables is the significance of the change of R^2 of the equation with the interaction terms and the equation without the set of terms associated with the ordinal variable. An alternative common approach to interactions is to run separate regressions for each level of the interacting variable. As in the case of adding non-linear transforms, adding interaction terms runs the danger of overfitting the model to what are, in fact, chance variations in the data. Such terms should be added only when there are theoretical reasons for doing so. That is, significant but small interaction effects from interaction terms not added on a theoretical basis may be artefacts of overfitting. Such artefacts are unlikely to be replicable on other datasets. In this study, as there are many independent variables to start with, an exploratory cross-sectional approach is adopted to determine which predictors are significant predictors. This is done using the commonly used stepwise method. In stepwise multiple regression, the computer runs many regression analyses adding and subtracting predictors that are significant. It then prints a final equation with the predictors that are significant. This is generally considered a very exploratory approach and is often criticized. It turns out that this approach is not very good at coming up with the best set of predictors. Usually the goal is to find a combination of predictors that will account for the maximum amount of variance in the dependent variable. However, as there is no firm theoretical foundation to base the model in this study, an exploratory approach is deemed appropriate. Although an exploratory approach is generally discouraged, in many circumstances the approach is the only alternative. Without the guidance of a theory, it would be impossible to conjure any interaction term. Besides, the main effect model fits adequately and no additional interactions need to be added in this research. The problem associated with interaction effects in this multiple linear regression is thus avoided.

- *Assumption requiring population error term to be uncorrelated with each of the independents in multiple regression*

  This is the assumption of mean independence, that the mean error term is independent of the independent variables. This is a critical regression assumption which, when violated, may lead to substantive misinterpretation of output. The (population) error term, which is the difference between the actual values of the dependent and those estimated by the population regression equation, should be uncorrelated with each of the independent variables. Since the population regression line is not known for sample data, the assumption must be assessed by theory. Specifically, one must be confident that the dependent is not also a cause of one or more of the independents, and that the variables not included in the equation are not causes of the dependent and correlated with the variables, which are included. Either circumstance would violate the assumption of uncorrelated error term. One common type of correlated error term occurs due to selection bias with regard to membership in the independent variable group (representing membership in a treatment versus a comparison group). When there is correlated error term, conventional computation of standard deviations, t-tests, and significance are biased and cannot be used validly. In this study, the multiple regression model is an exploratory one. As the population regression line is not known for the sample data, the assumption must be assessed by theory. However, there is no concrete theory to base any assumption on the correlations between the population error term and the independent variables[13]. Even so, the research design does not allow for much selection bias, as the samples are, for practical purposes, random reflection of their populations. It is also unlikely that the dependent (weighted average performance index) is also a cause of one or more of the independents (management accounting systems' presentation of information and management accounting practice/technique variables).

6.3.3.3 Limitation Of The Stepwise Model In Regression Procedures

Both the multinomial logistic regression and multiple linear regression procedures employed in this study specify a stepwise model. The stepwise model is not without criticism even though the choice of this model is justifiable in this study. The following arguments illustrate the point and reiterate the stance made in this research.

Stepwise regression, supported by SPSS, is used in the exploratory phase of research or for purposes of pure prediction. It is not recommended for theory testing (Menard 1995). Theory testing is the testing of a-priori theories or hypotheses of the relationships between variables. In the theory testing stage the researcher should base selection of the variables on theory, not on a computer algorithm. Menard (1995, p.54) writes,

> there appears to be general agreement that the use of computer-controlled stepwise procedures to select variables is inappropriate for theory testing because it capitalizes on random variations in the data and produces results

[13] Note that the residual error, i.e. the difference between observed values and those estimated by the sample regression equation, will always be uncorrelated and therefore the lack of correlation of the residuals with the independents is not a valid test of this assumption.

that tend to be idiosyncratic and difficult to replicate in any sample other than the sample in which they were originally obtained.

With respect to multinomial logistic regression, those who use this procedure often focus on step chi square output in SPSS, which represents the change in model chi square (likelihood ratio) at each step. Exploratory testing on the other hand makes no a-priori assumptions regarding the relationships between the variables, thus the goal is to discover relationships. As this study is exploratory in nature, the stepwise logistic regression procedure employed is appropriate. The procedure is also defensible because there is no previous research on the subject matter on which to base hypothesis. Moreover, causality is not of interest.

Likewise in multiple linear regression, the nominal 0.05 significance level used at each step in stepwise regression is subject to inflation, such that the real significance level by the last step may be much worse, even below 0.50, dramatically increasing the chances of Type I errors, i.e. thinking there is a relationship when there really is not (Draper, Guttman, & Lapczak, 1979). For this reason, Fox (1991) strongly recommends any stepwise model be subjected to cross validation. Since this study is exploratory in nature, the use of stepwise multiple regression is justified. The SPSS 12.0.1 tutorial states that ' if, however, you have many predictors and no idea where to start, running a stepwise analysis and adjusting the selected model provides better prediction than no model at all '. Moreover, cross-validation of 60% training sample as against 40% hold-out sample reveals stable R^2 results, indicating an absence of overfitting (see sub-section 5.11.1 in chapter five).

6.3.4 Limitations Of Scope In Interpreting The Results

Although questionnaire surveys serve to highlight statistical relationships between formally measured variables, they do not reveal the informal arrangements that exist, or how these may affect behaviours in organizations. A complementary approach to regression analyses is the adoption of interpretative methods, particularly case studies, to provide a more complete appreciation of the effects of the institutional and contingency variables on the clusters of firms and the roles management accounting plays in determining a firm's performance.

Further, the results must be interpreted within the confines of the hypotheses that have been generated. Possibilities exist for alternative specifications, such as structural equation modelling. Structural equation modelling (SEM) grows out of and serves purposes similar to multiple regression, but in a more powerful way which takes into account the modelling of interactions, non-linearities, correlated independents, measurement error, correlated error terms, multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators. SEM may be used as a more powerful alternative to multiple regression, path analysis, factor analysis, time series analysis, and analysis of covariance. That is, these procedures may be seen as special cases of SEM, or, to put it another way, SEM is an extension of the general linear model (GLM) of which multiple regression is a part. In this study, structural equation modelling is not pursued, as the sample size is too small. In the literature, sample sizes commonly run 200-400 for models with 10-15 indicators. With over ten variables, sample size under 200 generally means parameter estimates are unstable and significance tests lack power.

The role of personal factors such as locus of control, personality or tolerance for ambiguity, was not addressed in this study. Such factors are likely to have an impact on the determination of self-rated responses. These variables were beyond the scope of this study, but could be utilized to benefit future research as an extension of this study.

As with any empirical studies, the results can be generalized only to the population from which the sample was drawn. However, this limitation to the generalizability of the findings is mitigated because the population may be considered as archetypical of other manufacturing firms in an increasingly globalised environment where technology and technical know-hows flow seamlessly with capital from one country to another country.

6.4 Implications For Theory And Practice

Although this study is exploratory in nature, it still has implications for multiple-theory modelling of selected institutional isomorphic and contingency factors on a systems approach typology of firms employing management accounting. Ultimately, to be relevant in an increasingly competitive environment, a firm needs to perform and performance measures form a vital link in the modelling. While this study has executed multiple-theory-based empirical research within the purview of management accounting as applicable in the manufacturing industry, its approach may have implications for the study of management accounting in other industries, albeit with some modifications.

According to Ulrich and Barney (1984), the lack of comparison and integration among perspectives often results in an under-examining of many important similarities and differences among organizational perspectives. Similarly, Hirsch *et al.* (1987) argue that strength of organizational research is its polyglot of theories that yield a more realistic view of organizations. There has been a dearth of empirical research grounded in multiple theories when it comes to multiple approaches in analysing data. The work of Van de Ven and Drazin (1985) outlines three approaches to analysing data under a contingency framework, based on alternative definitions of 'fit', namely, the selection, interaction and systems approaches. Many researchers have been critical of selection and interaction approaches, arguing that they provide only partial depictions of relationships between variables of interest and fail to consider the coherence or fit of the whole system (Van de Ven & Drazin, 1985; Drazin & Van de Ven, 1985; Selto *et al.*, 1995). Conversely, the systems approach takes a holistic view of fit, by considering the internal consistency between multiple variables. As the systems' approach in this study results in the formation of clusters of organizations based on their emphasis on management accounting systems' presentation of information and management accounting practices/techniques, further application of the selection approach using contingency, institutional and other variables can be effected on an enriched data set of clusters. In turn these organizational groups can be pivoted to the all important performance measures. As such, this study provides a step forward in the application of not just multiple theories but also multiple approaches to organizational research.

A number of implications can be elicited from this study. First, consider the practical implication of understanding the broad diversity and stability of management accounting systems and practices/techniques in the Malaysian manufacturing industry. This sheds some light on the dynamism of management accounting in practice where a range of systems attributes, practices or techniques are at the disposal of management as tools of the trade. It also highlights that despite the variety, choice is a matter of pragmatism, necessity and need. Management are fully aware of what is in store and are at liberty to exercise sound discretion on how best to execute this battery of management accounting systems' information attributes and management accounting practices/techniques. In an increasingly globalized world where some countries can leverage on low wages to enhance competitiveness, other nations can only synergise on the development of human capital to provide the edge. This can be complementary, as movement of financial capital will inevitably lead to a certain degree of talent mobility. As a result of an increasingly liberal market place the world over, what may be seen in years ahead will be a convergent of similar management practices in divergent cultural imperatives. This could provide fodder for planners as extra input to decision making. This appreciation of dynamism can overcome a claim made by Kimberley and Miles (1980) that most management accounting systems studies have focused on static relationships between variables, with little attempt to address the 'dynamic quality of organizational life' and thus fail to provide evidence of processes and reasons for which management accounting systems might change.

Another implication of this research is to broaden the scope of contingency studies employing the systems approach. An organization is often interpreted as a configuration or archetype of different characteristics. According to Meyer, Tsui and Hinings (1993), organizational configurations refer to any 'multidimensional' configuration of conceptually distinct characteristics that commonly occur together. Numerous dimensions of external context and internal organizational characteristics have been said to cluster into configurations (Moores and Yuen, 2001). Child (1977) suggests that every organization is located within a particular configuration of contingencies derived from its own context. To achieve congruence, an appropriate design is the one which best suits the contextual and operational contingencies that apply. To be internally consistent, organizations must have tightly interdependent and mutually supportive parts (Miller, 1996). Different types of configurations have emerged in the organizational theory literature. Gordon and Miller (1976) encourage broader configurations that represent typical agglomerations (also known as archetypal firms) of environmental, organizational and decision-making attributes. As firms develop, more complex structures and more sophisticated decision-making styles prevail. To cope with these changes, organizations have little choice but to be more information-based (Miller and Friesen, 1983). The contribution of this study is to provide evidence to support the existence of two clusters of manufacturing firms based on their management accounting systems' information attributes and management accounting practices/techniques. Generally when management accounting systems' information attributes are deemed more useful in carrying out the overall tasks of firms, and management accounting practices/techniques are adopted with more benefit gained, then a separate cluster of firms is formed.

The central theme of contingency theory is that all components of an organization must fit well with each other or the organization will not perform optimally (Perrow, 1967). An extensive contingency theory literature has defined essential organizational elements and has explored their interrelationships and effects on performance. Theoretically, each organization has its own optimal configuration or best fit. Deviation from that ideal fit (which is misfit) should cause a host of problems which, in turn, should lead to poor performance. In addition, an organization's context may be internally inconsistent, and optimal performance may not be possible with any pattern of structure and control (Gresov, 1989). However, empirical tests of contingency theory have produced mixed results, with as many studies finding significant correlations between measures of fit and performance as not. These mixed results have invited a salvo of criticisms on the past operationalizations of fit itself (for example, Schoonhoven, 1982; Van de Ven and Drazin, 1985) as ad hoc. However, there are clear advantages of the contingency theory as well. As pointed out by Selto *et al.* (1995), the advantages include a rich descriptive framework, plentiful opportunities for measurement and observation, explicit linking of organizational characteristics and performance, and an extensive, supportive theoretical literature. Any contingency study, then, must exploit a rich framework and mitigate threats to validity. Selto *et al.* (1995) further argue that past contingency studies in the aggregate suffer from lack of standardization, which impedes cross-study comparisons.

Exploiting the wide array of advantages of contingency theory, this study provides an opportunity to add to the contingency literature by building on past developments and bringing in new institutional contexts with a view of linking them to organizational performance. If the results of this study are anything to go by, then there is empirical evidence to support that member firms from the cluster which agree more on the usefulness of management accounting systems' information attributes and the benefit gained from employing management accounting practices/techniques, are the ones independently proven to perform significantly better than the rest. Moreover, a firm's membership of a better performing cluster can be explained by the longer relevant work experiences of its accountants and a manufacturing strategy emphasizing on the need to respond to customers' requirements with priority to service and delivery. Higher organizational performance can also be explained in the context of benchmarking owners' (shareholders') value, non-financial measures and cost-volume-profit analysis. However, ongoing suppliers' evaluation has a negative explanatory effect on organizational performance. These findings could have significant implication for decision-makers within the manufacturing sector in their quest to improve performance.

This study also co-opts the institutional theory alongside the contingency theory. The adoption of institutional theory in management accounting research is quite uncommon, more so in profit-making manufacturing industry. The view on the appropriateness of institutional theory as applicable in a technically oriented manufacturing industry with a profit-making motive is rather mixed. One implication of this study is to support the view that institutional theory can indeed be applied in profit making and technically based manufacturing firms. The following discussion clarifies the polemic.

As Covaleski *et al.* (1996, p.11) note:

> The general theme of the institutional perspective is that an organization's survival requires it to conform to social norms of acceptable behaviour as much as to achieve high levels of production efficiency.

On a similar note, Scott (1987) argues that theories portraying organizations as primarily technical systems are incomplete, and thus are inadequate for explaining organizational change. He asserts this observing that:

> Institutional theorists have directed attention to the importance of symbolic aspects of organizations and their environments. They reflect and advance a growing awareness that no organization is just a technical system ... All social systems – hence, all organizations – exist in an institutional environment that defines and delimits social reality. (*ibid,* p.507)

It is apparent that profit-making organizations, particularly in regulated industries, can also be subjected to a high level of institutional and economic pressures simultaneously. However, this observation goes against much of the new institutional theory (Carruthers, 1995; Orrù *et al.,* 1991). Public agencies and not-for-profit organizations are portrayed as being primarily shaped by technical requirements (DiMaggio and Powell, 1983). Implicitly, some new institutional theory researchers infer that neo-classical economic theory (or other market-oriented theories) should study profit-making organizations, whereas not-for-profit organizations should be investigated through the new institutional theory. As such, the relative scarcity of institutional theory studies on organizations operating in both technical and institutional environments (see for examples, Carmona, 1998; Dacin, 1997) may be due to misunderstandings and confusion about the focus of the new institutional theory, especially the assumption that profit-making organizations are immune from institutional pressures (Powell, 1991). This phenomenon is contradicted by Scott (1995) who argues that profit-oriented organizations can be concurrently subjected to technical and institutional pressures. Hence, the new institutional theory can underlie empirical investigations in all organizational settings. As Carruthers (1995, p.318) states, "institutional effects are visible even in technical environments" and "institutional arrangements operate at the core of technically dominated environments". Similarly, Orrù *et al.*(1991) note, after studying organizational isomorphism within private businesses in East Asia (p.32), that:

> The institutional approach need not be limited in its application to organizational environments where institutionalisation is most predictable; rather, institutional arrangements have a paramount role and can be observed at the very core of market-regulated, technically dominated environments.

This gives rise to the view that efficiency and institutional pressures are not dichotomous (Fennell and Alexander, 1987). Legitimacy needs not be gained inevitably at the expense of efficiency and vice versa (Meyer and Rowan, 1991). As Powell (1991, p.187) claims, "even the most efficiency-minded organizations rely on socially constructed beliefs such as more is better". In this study, there is empirical evidence to support the view that some institutional isomorphic influences not only have significant associations with groups of firms employing a wide array of management accounting systems and practices/techniques, but can also predict the group membership. This provides credence on the notion that institutional theory has application in efficiency conscious, profit driven and highly technical manufacturing concerns. If the findings of this study is anything to be banked on, then it appears that the concept of achieving legitimacy has tentacle that extend far beyond the stereotype depiction of some pure theorists.

The new institutional theory draws attention to how organizational practices, including management accounting, are expressions of the social environments in which organizations operate (Covaleski *et al.,* 1996). DiMaggio and Powell (1983) suggest that organizational characteristics become increasingly isomorphic with the predominant characteristics of their environments. Jones and Dugdale (2002) discuss issues on managerial knowledge creation examining why certain techniques, espoused by business school academics in coalition with consultants, rise to prominence. Whilst an actor network approach is not adopted in this study, it is apparent that like-minded consultants advise all stakeholders in the industry such as regulators, professional bodies and individual firms, which would then accelerate the process of isomorphism in the manufacturing industry.

The institutional pressure occurs through coercive, mimetic and normative isomorphism. Coercive isomorphism involves the 'political' influence of institutions upon dependent organizations, which compels them to follow practices reflecting cultural expectations to gain legitimacy (DiMaggio and Powell, 1983). In contrast, mimetic isomorphism emanates from organizations imitating practices of organizations perceived as successful and legitimate. A third mechanism of organizational change stems primarily from professional pressures and is known as normative isomorphism. In the field of accounting, professional bodies and regulators reinforce normative expectations and impose standards, rules and values on organizations. Normative isomorphism is also encouraged through filtering of personnel. In this case, professional bodies and regulators serve as gatekeepers determining who should be allowed into the profession. Normative isomorphism can also result from the type of 'experts' that organizations rely on to implement reforms (i.e. management consultants, management gurus etc).

This study provides empirical evidence to suggest that some mimetic, coercive and normative isomorphic influences do have significant associations with clusters of manufacturing firms employing management accounting systems and practices/techniques. As far as this study goes, two particular isomorphic influences stand as predictors to the clusters of manufacturing firms. The two are giving top managerial attention to the way management control systems function, and depending on internal experts' advice on costing, budgeting and reporting. Arguably, the former is coercive while the latter is normative. As the two clusters of manufacturing firms are invariably linked to organizational performance, the evidence points to the direction that agreeing more on the two respective isomorphic influences does predict better performing manufacturing firms. This has implication on decision-makers intending to harness institutional isomorphic influences as extra inputs to further understand the intricate relationship of achieving legitimacy while at the same time improving organizational performance.

6.5 Directions For Future Research

In general future opportunities exist for an extension and refinement of the conceptual and empirical content of this study. Future multi-paradigm modelling could take on many variations in the modelling of relationships between constructs and their measures. The modelling and testing of other relationships between the variables in this study could be pursued in further research. For example, three-way interactions between predictors have not been modelled or tested in this study.

Although aspects of institutional and contingency theories are used in tandem in this study, it did not embrace other major theories underpinning the organizational research literature, including agency and resource dependency theories and testing of other relationships between the variables.

Further evidence is required from other settings in order to consider any generalizations of the core findings of this study. However, replications of survey-based contingency studies have come under criticism because they are said to provide only limited insight into organizational realities (Selto *et al.*, 1995). Further research could adopt qualitative methods to relate the variables in this study to the interplay between other variables that may have influence the model substantially. In other words, future research could use the significant variables studied in this research and link them to other pertinent variables. Otley (1980) observes that many of the issues regarding the development of accounting systems and the relationship with the organization's different environments are political rather than technical.

The data analysis approach taken in this study is based on a cross-sectional survey. There are advantages of this approach. Firstly, through this method it is possible to gather data from a sample of the population. Another advantage is that it is often possible to check the validity of the survey data (Kerlinger, 1986). The disadvantage of this approach is that change over time is not captured and data is collected in a structured, closed-question manner. Such a limitation can be overcome as is suggested by Chia (1995, p.827),

> Perhaps longitudinal studies and case study style research may serve to complement the present cross-sectional approach.

The findings in this study could be given a much greater depth of interpretation if further research into management accounting systems and management accounting practices/techniques in the manufacturing industry can gather data through a case study or ethnographic approach. Case study research could embellish the survey findings of this study and better identify and interpret the peculiarities of behaviour and practices occurring in organizations.

The effects of management accounting systems' information adequacy on decision-making by management accountants could have been investigated in field settings with a quasi-experimental design (Cook and Campbell, 1979). Moreover, the sources of data can be multiple. Further research in this area can look at the problem of management accounting systems' information adequacy through more objective sources such as ratings from supervisors and personnel records so as to overcome the problem of common method variance (Spector, 1987).

Alternatively, future research could take the approach of longitudinal studies. As causal relationships are more important than associations, longitudinal studies may be more valuable than cross-sectional studies because in longitudinal studies the interaction of variables over time can be observed. Such longitudinal studies are also useful in illustrating the processes through which management accounting systems and practices/techniques develop and change in response to organizational pressures. However, such an approach may not be appropriate for revealing power structures which are difficult to observe and more so if the researcher is relying on the only one interest group such as the senior management for access to information and individuals.

The difficulty of longitudinal research has prompted Gambling (1978) to suggest methodologies that are anthropological in nature. Such methodologies facilitate a close contact between the researcher and the organization. The validity of the findings will be increased when findings are fed back to research subjects and changes based on those findings are attempted to be introduced and monitored. A multi-disciplinary approach is suggested by researchers such as Otley (1980). But Otley (1980) does recognize that such multi-disciplinary research approaches may be only illuminative and may not be concerned with the rigorous testing of pre-determined hypotheses. Otley (1980) also suggests case studies as another methodology to be adopted in place of the survey approach. This will be advantageous because case studies involve a small number of organizations which can be carefully selected so as to provide a range of values on chosen contingent variables and at the same time other variables can be controlled as much as possible. Also in this approach there can be a close contact between the researcher and the organization over a long period of time. However, Otley (1980) does recognize that in such an intensive approach only a few cases can be studied at a time and this may hamper the development of contingency studies that requires a large number of cases to have validity. But he suggests that the case-study method can still be adopted because more insight will be obtained at the exploratory stage of research.

Future research can be conducted using samples from other industrialising or industrialised developed countries and undertaking a comparative study. It may be time consuming and expensive to design and adopt a full range of management accounting systems and practices/techniques after taking into consideration the technological development and culture of the environment in which the organization is functioning. However, such an exercise is necessary for a better understanding of effective performance of organizations. So benefits may override the costs. Otley (1980) observes that many issues regarding the development of accounting systems and the relationship with the organization's different environments are political rather than technical. Such issues can be explored using a case study approach.

Harrison and McKinnon (1998) argues that future studies can reveal a higher level of understanding of the complex interplays of culture, human meaning and action in management accounting processes and contexts if mail surveys can be supported by other methods more capable of eliciting the meanings and understandings of human action in complex management accounting and organizational contexts.

Although Otley (1994) has been critical of the continued use of contingency literature, he still recognizes that a contingency framework is more relevant to modern day organizations because of increased uncertainty faced by these organizations. He also points out that there is a greater need for a contingency framework to help organizations control their future. However, contingency literature has been limited by traditional utilisation of contingency frameworks rather than the concepts behind them. Future research could use more robust frameworks. In this respect, Hopwood's (1978, p.26) opinion is that the frameworks in the contingency literature should be used with "theoretical and empirical caution". Future research could use the variables studied in this research and link them to more complete contingency frameworks.

Chapman (1997) suggests that future research should take a comprehensive approach. He suggests that the comprehensive approach should be based on an investigation of operational processes of organizations. Chapman comments (1997, p.202),

> The direct observation of such organizational processes through the traditional contingency questionnaire has previously been considered too difficult and unreliable to be worth the attempt. The development of a comprehensive view of the contingent nature of accounting would seem to depend on the effort however.

This study manages to substantiate that in order to achieve legitimacy, even profit making, technically oriented manufacturing firms are subjected to institutional isomorphic influences in the forms of mimetic, coercive and normative isomorphism. However, to ensure reasonably good response rate, the institutional isomorphic items in the survey questionnaire have been kept abridged. Surprisingly, few studies actually have examined correlations between length of questionnaires and rates of response, and those studies that have done so generally have yielded confusing results. Berdie (1973, p.278) notes:

> Common sense suggests that the shorter the questionnaire, the more likely a high response rate, and persons studying questionnaire efficiency have tended to accept this belief in spite of little empirical evidence to support it.

Moreover, there is evidence that response quality declines near the end of a long questionnaire (Tull and Hawkins, 1990). Nonetheless, this provides opportunity for future research to be more targeted and thus creates more space for the expansion of indicators constituting mimetic, coercive and normative isomorphism. For that matter, indicators for contingency factors too can be broadened.

In short, this study generates many possibilities for further research. These possibilities range from strengthening the variables measures and research design, to extending the theoretical and empirical models so as to embrace other constructs and contexts in different settings.

6.6 Summary

This chapter six is the final chapter of the thesis. It starts by revisiting the research hypotheses, objectives and questions as per chapter three. These are then matched with the relevant findings in chapter five. The approach is to start with addressing the more detailed hypotheses, then progressively satisfying and answering the less specific objectives and questions respectively. Invariably, most are reiteration of the germane results in the context of wrapping up the study.

Based on the analysis of interviews, it is determined that the nature, diversity and stability of management accounting systems' information attributes not only differ from one firm to another, but are also dictated by management policy. From the data analyses of the survey questionnaires, it is discovered that there are two distinct clusters of manufacturing firms whereby one is on average, comprised of better performing firms. These two clusters of manufacturing firms can also be distinguished by the fact that the better performing cluster of firms generally find it more useful to use a broad ranging management accounting systems' information attributes and agree on the higher benefit gained from adopting a wide array of management accounting practices/techniques.

Moreover, there is empirical evidence to support hypotheses that the two clusters of manufacturing firms have significant relationships with some of the background, contingency and institutional indicators used in this study. There are reasons to believe that the better performing cluster can be explained by the longer relevant work experiences of their accountants, and a contingency indicator, viz., a manufacturing strategy emphasizing the need to respond to customers' requirements with priority to service and delivery. Membership of the better performing cluster of firms can also be explained by two institutional isomorphic influences. They are giving top-level attention to the way management control systems function and, depending on internal experts' advice on costing, budgeting and reporting. It appears that some coercive and normative isomorphism may have a role to play in predicting a better performing cluster of firms. The study also unravels the fact that higher organizational performance can be explained in the context of benchmarking owners' (shareholders') value, non-financial measures and cost-volume-profit analysis. However, ongoing suppliers' evaluation has a negative explanatory effect on organizational performance. If the findings of this study are anything to go by, there is circumstantial evidence to suggest that management accounting systems' information attributes may not directly impact on organizational performance even though a few management accounting practices/techniques do explain organizational performance, at least in the Malaysian manufacturing industry.

However, the findings need to be tempered by a host of limitations of the study. These limitations are divided into four, namely limitations embodied in the selected theories, limitations embodied in the design and administration of the survey, limitations of the data analyses and limitations of scope in interpreting the results.

This study also outlines some implications for theory and practice. It has been proved that tenets of the contingency and institutional theories are applicable to this study. The findings from this study will help to further consolidate the understanding of contingency and institutional frameworks based on fresh research design drawing from a vast literature of prior work. The empirical evidence generated could enrich the existing body of knowledge by showing how a management accounting typology within contingency and institutional frameworks can be linked to organizational performance in the Malaysian manufacturing industry setting. This will undoubtedly have some practical implications on decision makers and other interested parties.

Finally, this chapter provides some cues on potential research projects that can be undertaken based on the outcomes of this study. As the contingency and institutional theories underpinning this study are in a constant state of construction and refinement, the scope for extending and enriching elements of this study in future research, within the contingency, institutional and for that matter, other theoretical frameworks, are wide.

LIST OF APPENDICES

Appendices one to five are enclosed in the following pages. A page divider precedes each appendix.

APPENDIX ONE

QUALITATIVE INTERVIEW AND PRE-TESTING OF SURVEY QUESTIONNAIRE SHEET

Qualitative Interview And Pre-Testing Of Survey Questionnaire Sheet

Research Title:
A Performance Linked Management Accounting Typology Within Contingency And Institutional Frameworks In The Malaysian Manufacturing Industry

Instructions:

Please spend some time reading through the questions. I shall later repeat the questions verbally and prompt you to reply. Kindly convey your answers orally in order. Your answers may relate to your organization or other manufacturing organizations in general. To facilitate analysis, this interview will be recorded on tape.

Questions 1 to 3 are generally about the respondent.

Question 1

Do you agree voluntarily to take part in this Doctoral research ?

Question 2

Are you comfortable with the subject of Management Accounting ?

Question 3

Would you recommend other persons within this organization who you think are well versed in Management Accounting and are willing to participate ?

Questions 4 to 6 are regarding management accounting systems' presentation of information.

Question 4

Tell me what you know about the ways and means management accounting systems' information is being relayed ? You may like to discuss on the level of details, the coverage and the frequency of such information.

Question 5

How diverse is the presentation of management accounting systems' information ?

Question 6

Do you think that management keeps changing the way management accounting systems' information is presented after a certain period of time?

Questions 7 to 12 are regarding management accounting practices/techniques.

Question 7

Tell me what you know about different types of management accounting practices/techniques used in a manufacturing firm.

Question 8

How diverse are the management accounting practices/techniques used in a manufacturing concern?

Question 9

How stable is the use of a variety of management accounting practices/techniques over a certain period of time?

Question 10

Which management accounting practices/techniques would remain the same over many years?

Question 11

Which management accounting practices/techniques will be regularly developing or modified over time?

Question 12

Which management accounting practices/techniques are brought in, but then quickly discontinued / dropped?

Questions 13 to 17 are regarding institutional factors.

Question 13

Tell me whether your organization tries to achieve similar ends or similar objectives compared to other similar organizations.

Question 14

In order to seek legitimacy, does your organization attempt to look alike and act likes other similar organizations in many ways?

Question 15

Tell me whether your organization endeavours to be similar or to conform with other organizations or regulations due to all sorts of pressure.

Question 16

Does your organization try to be similar or to conform with others because of the need to follow what others are doing?

Question 17

In your opinion, do professionals within your organization exhibit much similarity compared to their counterparts in other organizations?

Questions 18 to 22 are regarding contingency factors.

Question 18

What do you know about factors that may be the main causes to bring about adjustments or changes to management accounting as a whole ? Could you name some of them ?

Question 19

One of the factors that is often said to affect management accounting is manufacturing strategy. To your mind , in what ways does manufacturing strategy affect management accounting .

Question 20

Another factor that is often said to affect management accounting is perceived environmental uncertainty. To your mind , in what ways does perceived environmental uncertainty affect management accounting .

Question 21

Organizational interdependence is often quoted to have affected management accounting. Perhaps you could tell me, in your own words, how organizational interdependence affects management accounting.

Question 22

Organizational structure is yet another factor that affects management accounting. In your opinion, how does it affect management accounting ?

Questions 23 and 24 are regarding your views on how to improve the survey questionnaire (pre-testing of questionnaire).

Question 23

Have a good look at the draft survey questionnaire that I have prepared. It is based on established literature. Do you think that in general it is understood by an experienced management accountant or manager ? Please feel free to re-word, scrap, combine or add new items to the list in the questionnaire.

Question 24

Is there anything else you would like to comment on ?

THANK YOU VERY MUCH FOR YOUR COOPERATION.

APPENDIX TWO

DETAILS OF THE INTERVIEWEES AND GIST OF THE INTERVIEWS

Details of the interviewees and gist of the interviews are as follows:

Table A.2 (1) Designation Of Interviewee 1

Interviewee 1	
Name:	Associate Professor Kanagaratnam Rajendran
Date of interview:	7 September 2004
Present position:	Associate Professor
Present workplace:	Faculty of Accountancy, Universiti Teknologi Mara, 40450 Shah Alam, Selangor. Malaysia.

Table A.2 (2) Designation Of Interviewee 2

Interviewee 2	
Name:	Mr Hur Tze Huan
Date of interview:	26 September 2004
Present position:	Managing Director
Present workplace:	Evergreen Business Management Consultants Sdn. Bhd., No. 51, Jalan BU 12/8, Bandar Utama, 47800 Petaling Jaya, Selangor. Malaysia.

Table A.2 (3) Designation Of Interviewee 3

Interviewee 3	
Name:	Mr. Ibrahim Hitam
Date of interview:	28 September 2004
Present position:	Section Head
Present workplace:	Perusahaan Otomobil Nasional Berhad (Proton), Kawasan Perindustrian HICOM, Batu 3, Peti Surat 7100, 40918 Shah Alam, Selangor. Malaysia.

Table A.2 (4) Designation Of Interviewee 4

Interviewee 4	
Name:	Mr. Mohamad Azmi Ismail
Date of interview:	17 May 2005
Present position:	Managing Director
Present workplace:	Competent Alliance Sdn. Bhd., No. 37, Jalan 20, Off Jalan Bukit Kemuning, Batu 8, Seksyen 32, 40460 Shah Alam, Selangor. Malaysia.

Table A.2 (5) Designation Of Interviewee 5

Interviewee 5	
Name:	Mr. Lukman Ibrahim
Date of interview:	17 May 2005
Present position:	Senior General Manager, Corporate Services Division
Present workplace:	PHN Industry Sdn. Bhd., Lot PT 75-77, Jalan 26/6, Kawasan Perindustrian HICOM, Seksyen 26, Peti Surat 7306, 40710 Shah Alam, Selangor. Malaysia.

The following is the summary or excerpt of the qualitative interview sessions with five professionals in management accounting in five different organizations/firms in Malaysia. Only the essence of their arguments will be outlined in this section. The full interviews with these five professionals have been separately transcribed. The summaries in this appendix are drawn from these full transcripts. A copy of the qualitative interview and pre-testing of survey questionnaire sheet is enclosed in appendix one of this thesis.

Questions 1 to 3 were questions designed to confirm the agreement to be interviewed and the capability and capacity of each interviewee to answer the remaining questions. The agreements to be interviewed had generally been sought in advance of the interview, and approvals obtained. As such questions 1 to 3 of the qualitative interview sheet were regarded as superfluous given the fact that the interviewees had already given their official consent to be interviewed. Besides, preliminary informal conversation prior to the commencement of each interview session often sought to confirm the willingness and the ability to give an interview on the subject matters. Only after this protocol had been observed and consent affirmed, the interview proper was carried out for each session.

Therefore, being superfluous and sometimes skipped, questions 1 to 3 would not be analysed in this section.

Questions 4 to 6 were concerned with management accounting systems' presentation of information. Details of each question and the summary response of each interviewee will be outlined below. The essence of the overall response for each question will also be inferred or deduced (shown in the summary row).

Table A.2 (6) Feedback From Interview Question 4

Question 4:	Tell me what you know about the ways and means management accounting systems' information is being relayed ? You may like to discuss on the level of details, the coverage and the frequency of such information.
Interviewee 1:	Generally this depends on the circumstances. Sometimes reports are prepared on an ad-hoc basis, at other times on a working basis. If a report is needed urgently, the working report is pre-determined. If the reports are ad-hoc in nature, rough and ready answer would suffice rather than too accurate an answer provided that the reports provide the right answers. However, it also depends on the hierarchy level. Depending on the situation, reports can be summarized or detailed. Frequency of reporting can also vary from one organization to the other.
Interviewee 2:	Many different types of reports are prepared. These include monthly reports, half yearly reports and annual reports. If required weekly reports are also made. The bases vary from total basis, balance sheet basis and cash flow basis.

Interviewee 3:	Management accounting systems' information reports on company's performance. The published reports are highly summarized and relevant. However, exception reports contain a lot of information on the company's performance, such as inventory and sales volume for the purpose of thorough investigation. Generally, the reports are produced monthly.
Interviewee 4:	Management accounting systems' information is a tool for an organization to present the status of its accounts, especially in managing cash flows.
Interviewee 5:	The management accounting systems' information is based on both past and present to enable better decision making for the future. One must not just rely on management accounting systems; instead one should incorporate other systems as well to make better use of information. Management accounting systems also vary from one company to another company. Some firms have more efficient management accounting systems compared to others. If a management accounting system is not timely enough, it will not be very useful. The information has to be accurate as well. Other systems that need to be integrated with the management accounting systems include human resource system and production system. Examples of information from a human resource system are manpower information and payroll information which can lead us into measuring human capital productivity, not in terms of cost but in terms of manpower. Production system for example encompasses material management system. Things like inventory levels, physical levels and obsolete inventories need to tally so that information is correlated and congruent. Only then better decisions can be made. A timely and integrated information system will enable better understanding on efficiency, effectiveness and productivity which

	also leads to better decision making process.
Summary:	Management accounting systems' information varies from firm to firm and is contingent on the circumstances and the hierarchy level. The types, frequencies and complexities of the reports may also differ between firms. The information generated is useful for management purposes even though the contexts of use may vary between organizations.

Table A.2 (7) Feedback From Interview Question 5

Question 5:	How diverse is the presentation of management accounting systems' information?
Interviewee 1:	It can vary from company to company as well as from country to country. Sometimes the environment can be highly competitive. Management accounting reports may have to show each product's profitability.
Interviewee 2:	Management accounting systems' information takes many form such as product standard costs, variable and fixed costs, income statement, marginal costing, break even analysis and standard financial management prepared on a regular and monthly bases.
Interviewee 3:	The management accounting systems' information can be in the forms of financial information, productivity information and other information as per management environment, such as the efficient use of resources or product costing in terms of materials, labour and

	overheads. Quality information critical for management targets to satisfy customers such as quality improvement are also produced based on several data systems.
Interviewee 4:	Depending on the nature of the business or organization, the presentation of management accounting systems' information can be very wide. The information is especially important for a chief executive officer to make decisions on expenditure or investment in special programs.
Interviewee 5:	Traditionally, the presentation of management accounting systems' information is very narrow in many organizations. Where conventional or traditional method is still relied upon, management accounting systems' information is still very narrow. However, nowadays management accounting systems tend to be at the top of activities. For instance, the finance costing function can be undertaken at different areas and levels but integrated at the top. In that sense, the scope of information in terms of application is very wide and diverse. New practices like 'kaizen', lean system and just in time inventory requires different reports from different areas to be fed to the top. This information then needs to be validated by say, inventory evaluation. Thus, the management accounting systems' information is being applied diversely outside the scope of the traditional finance function.
Summary:	The diversity of the presentation of the management accounting systems' information does vary from one firm to another firm. Sometimes the presentation can be very diverse indeed.

Table A.2 (8) Feedback From Interview Question 6

Question 6:	Do you think that management keeps changing the way management accounting systems' information is presented after a certain period of time?
Interviewee 1:	No. However, management can change the nature of information they need based on the critical success factors.
Interviewee 2:	No, not in this company.
Interviewee 3:	From my experience, yes. Market environment can change rapidly, so likewise, information presentation should be flexible to suit risky environment and not on a permanent basis. The right resources and the right information is always needed to inform management of all relevant changes to the environment in order to meet the requirements of the customers.
Interviewee 4:	Generally the changes are not so fast except in information technology where security and audit issues like unauthorized access and audit programs need to be updated from time to time. Increased automation also results in the minimal use of staff.
Interviewee 5:	Yes, I think so. We should be keeping abreast of the latest developments and be prepared to change the way we do things. You should synchronize yourselves to new changes.
Summary:	Yes and no. It is the firm's prerogative to change the way in which

	management accounting systems' information is being presented over a period of time. Management will independently decide on the need and nature of such a change.

Questions 7 to 12 related to management accounting practices/techniques. Details of each question and the summary response of each interviewee will be outlined below. The gist of the overall response for each question will also be inferred or deduced. However, interviewee 5 had to abandon the interview at question 9 due to urgent commitment.

Table A.2 (9) Feedback From Interview Question 7

Question 7:	Tell me what you know about different types of management accounting practices/techniques used in a manufacturing firm.
Interviewee 1:	This is contingent on the manufacturing methods practised to provide the right information for the right action, for example just in time. Some common practices are standard costing, variance analysis and budgeting control.
Interviewee 2:	Among them are standard costing system, variable costing, absorption costing, marginal costing, activity based costing, product costing and target costing.
Interviewee 3:	There are twenty seven types of management accounting practices and probably a combination of certain techniques used in this company. Among them are costing, budgeting, local strategic management, quality, quality improvement, target quality management, financial benchmarking and product benchmarking.

Interviewee 4:	Management accounting practices/techniques must take into account that in manufacturing there are a lot of moving items. Apart from valuing items like fixed assets and overheads, regular stocktaking of raw materials, work in process and finished goods at different stages of completion will ensure precision in reporting. Reconciliation of the values generated by the systems with actual values is also required.
Interviewee 5:	All the items in your list of management accounting practices/techniques are relevant, except for a few items.
Summary:	There are many different types of management accounting practices/techniques used in a manufacturing firm.

Table A.2 (10) Feedback From Interview Question 8

Question 8:	How diverse are the management accounting practices/techniques used in a manufacturing concern?
Interviewee 1:	It is diverse because the nature of manufacturing is diverse. Depending on the nature of manufacturing process, the right types of accounts and the right type of management accounting systems and controls need to be instituted.
Interviewee 2:	It is diverse.

Interviewee 3:	Quite a lot (diverse). For example, in terms of products, we have product quality, accounting targets, total quality management, quality control, costing etc.
Interviewee 4:	Depending on the manufacturing industries, management accounting practices/techniques can be diverse. The main task is to value assets and that may require technical/engineering people assisting accounting personnel in carrying out the asset valuation exercise.
Interviewee 5:	It is diverse.
Summary:	The use of management accounting practices/techniques in a manufacturing concern is diverse in nature.

Table A.2 (11) Feedback From Interview Question 9

Question 9:	How stable is the use of a variety of management accounting practices/techniques over a certain period of time?
Interviewee 1:	It remains stable over a long period of time because many decisions need to be made routinely.

Interviewee 2:	They are very stable.
Interviewee 3:	They are stable to maintain stringent criteria on quality. This can be reflected in budgeting and costing. The rest of the management targets like planning and strategic decision-making are also utilized consistently.
Interviewee 4:	Based on my experience, the use of management accounting practices/techniques over a certain period of time is quite consistent and does not change a lot. This makes the practices/techniques easier to follow. The basic informational outputs coming out of the practices/techniques are generally the same.
Interviewee 5:	- *not available* –
Summary:	The use of a variety of management accounting practices/techniques over a certain period of time is stable for a number of reasons.

Table A.2 (12) Feedback From Interview Question 10

Question 10:	Which management accounting practices/techniques would remain the same over many years?
Interviewee 1:	It is doubtful that management accounting practices/techniques would remain the same for many years as circumstances may

	change.
Interviewee 2:	Many management accounting practices/techniques remain the same year after year.
Interviewee 3:	One example is budgeting. This includes short-term planning, long term planning and strategic decision-making. Various targets on total quality management, improving quality standards, just in time, and other practices on the management of parts or components are dictated by top management consistently.
Interviewee 4:	Budgeting and product costing techniques would remain the same over many years. This will influence pricing and the level of revenues.
Interviewee 5:	*- not available –*
Summary:	A number of management accounting practices/techniques would remain the same over many years. One example is budgeting.

Table A.2 (13) Feedback From Interview Question 11

Question 11:	Which management accounting practices/techniques will be regularly developing or modified over time?
Interviewee 1:	The practices/techniques are not static and can develop according to

	the demand of the situation.
Interviewee 2:	Management accounting practices employing standard costing.
Interviewee 3:	These are subject to the environment. For example, costs, costing techniques and costing structures are dependent on the industry itself. Quite sensitive areas like customers' demand and overhead cost management will over time develop into new approaches.
Interviewee 4:	I have not encountered any management accounting practice/technique that is regularly developing or modified over time.
Interviewee 5:	- *not available* –
Summary:	Some management accounting practices/techniques will be regularly developing or modified over time according to changing needs.

Table A.2 (14) Feedback From Interview Question 12

Question 12:	Which management accounting practices/techniques are brought in, but then quickly discontinued / dropped?

Interviewee 1:	Not easy to answer. A number of factors are involved including empowerment to change etc.
Interviewee 2:	To my knowledge, there are no such practices being brought in and then dropped.
Interviewee 3:	Not sure if there is any such management accounting practice or technique.
Interviewee 4:	I am not aware of any.
Interviewee 5:	*- not available –*
Summary:	The interviewees are unsure or unaware of any management accounting practice/technique being brought in, but then being quickly discontinued or dropped.

Questions 13 to 17 were concerned with institutional factors. Details of each question and the summary response of each interviewee will be outlined below. The essence of the overall response for each question will also be inferred or deduced.

Table A.2 (15) Feedback From Interview Question 13

Question 13:	Tell me whether your organization tries to achieve similar ends or similar objectives compared to other similar organizations.

Interviewee 1:	In the short term, generally an organization's objective is to survive, to grow and to make short-term profit. In the long term, an organization wants a long-term profitability and growth, so in that respect each organization remains similar to each other.
Interviewee 2:	Yes, with respect to the competitors. Most organizations try to make as much money and garner as much market share as possible.
Interviewee 3:	Yes, we benchmark our company against the best in the same industry.
Interviewee 4:	Yes, we follow other similar organizations that have the best practices.
Interviewee 5:	*- not available –*
Summary:	Yes, an organization tries to achieve similar ends or similar objectives compared to other similar organizations.

Table A.2 (16) Feedback From Interview Question 14

Question 14:	In order to seek legitimacy, does your organization attempt to look alike and act likes other similar organizations in many ways?
Interviewee 1:	No, organizations want to be distinct from other organizations in

	resource allocation based on their experiences and requirements.
Interviewee 2:	Industry leaders look at what their competitors do but not necessarily copy their competitors.
Interviewee 3:	Yes, in terms of quality, manufacturing processes and efficiency, we benchmark our company against the standards set by the industry leader.
Interviewee 4:	Normally our organization looks at other successful organizations as these organizations have proven themselves. Treating these organizations as mentors, we determine their successful formulas or practices that can be followed.
Interviewee 5:	- *not available* –
Summary:	Yes and no. An organization will attempt to look alike and act likes other similar organizations only if it contributes to the organization's betterment.

Table A.2 (17) Feedback From Interview Question 15

Question 15:	Tell me whether your organization endeavours to be similar or to conform with other organizations or regulations due to all sorts of pressure.
Interviewee 1:	Yes, in that respect a company will conform with legislations just

	like other companies.
Interviewee 2:	No, since an industry leader expects other firms to look at it as a role model.
Interviewee 3:	No, we benchmark our company against another better company not because of pressure but willingly in order to improve our company.
Interviewee 4:	We follow what have been practised over a long time. We abide by the ground rules and regulations. Where there are pressures such as during an economic crisis, we will find ways to ensure our company continues to perform. This will include cost cutting, downsizing and multitasking.
Interviewee 5:	- *not available* –
Summary:	Yes and no. An organization will not always try to be similar or to conform with other organizations due to pressure unless if the pressure comes in the form of regulations.

Table A.2 (18) Feedback From Interview Question 16

Question 16:	Does your organization try to be similar or to conform with others because of the need to follow what others are doing?
Interviewee 1:	Sometimes it depends on the nature of the organization. The nature

	of management attitudes of these companies will determine whether they want to follow the trends or not.
Interviewee 2:	No.
Interviewee 3:	No, we don't need to follow what others are doing. We benchmark to better our own products.
Interviewee 4:	Only in some cases; not all cases. It all depends on our company's environment and the necessity to abide by the regulations.
Interviewee 5:	- *not available* –
Summary:	Yes and no. An organization will not always try to be similar or to conform with others because of the need to follow what others are doing.

Table A.2 (19) Feedback From Interview Question 17

Question 17:	In your opinion, do professionals within your organization exhibit much similarity compared to their counterparts in other organizations?
Interviewee 1:	Yes, I can say most of the professionals behave similarly although they are working in different companies except for some individual differences but on professional opinions they agree.

Interviewee 2:	No, not similar to their counterparts in other organizations but the professionals do try and compare and copy their counterparts in other operations within the same organization.
Interviewee 3:	Yes, in the sense that every professional in any organization will act in the same manner so as to contribute his/her best for the fullest benefit of the organization he or she is in. These professionals will consistently show or demonstrate their capabilities to fulfil their responsibilities.
Interviewee 4:	Yes, in most cases these professionals are similar because they come from the same nature of businesses. For example, the way professionals work, their objectives and thinking are similar to their counterparts in other organizations.
Interviewee 5:	*- not available –*
Summary:	Yes, professionals in an organization will exhibit much similarity compared to their counterparts in other organizations or within the same organization.

Questions 18 to 22 related to contingency factors. Details of each question and the summary response of each interviewee will be outlined below. The gist of the overall response for each question will also be inferred or deduced.

Table A.2 (20) Feedback From Interview Question 18

Question 18:	What do you know about factors that may be the main causes to

	bring about adjustments or changes to management accounting as a whole? Could you name some of them?
Interviewee 1:	Competitive pressure is the major factor to bring about changes to management accounting. Other factors are not significant. With competition, better information and better impact are needed.
Interviewee 2:	Anything that affects costs or have tax implications.
Interviewee 3:	The main factors are related to quality, which are focused on customers' satisfaction. So, in order to meet customers' requirements that will always or consistently change over time, adjustments to management accounting may need to be made.
Interviewee 4:	One of the factors to bring about adjustments or changes to management accounting is competitive pressure. We need to take into consideration competitors costing and selling strategies. Technology is another factor. Technology can help us access information, correct mistakes and make decisions at a faster rate.
Interviewee 5:	- *not available* –
Summary:	A number of factors can be the main causes to bring about adjustments or changes to management accounting as a whole. These factors include competition, cost control, tax implications, quality, customers' satisfaction, pricing strategy and technology.

Table A.2 (21) Feedback From Interview Question 19

Question 19:	One of the factors that is often said to affect management accounting is manufacturing strategy. To your mind , in what ways does manufacturing strategy affect management accounting .
Interviewee 1:	Manufacturing strategy impacts manufacturing methods and philosophy. This will affect among other things the cost structure and thereby management accounting.
Interviewee 2:	Manufacturing strategy affects management accounting in the sense that manufactured goods are not just transferred to other departments within the same organization but are also manufactured on contract basis for other companies or exported overseas.
Interviewee 3:	Manufacturing strategy affects management accounting in a lot of ways. Manufacturing strategy affects the outputs of management accounting. Manufacturing strategy has to be coherent with the company's objectives. Therefore, the strategy has to achieve the various targets of the company from resource allocation to management decision-making.
Interviewee 4:	Manufacturing strategy affects management accounting because manufacturing involves the combination of a lot of resources. These resources are generally known as the four 'M's – man, materials, machines and methods. The combination of the four Ms must achieve the best results, such as the right material specifications and product quality. Manufacturing strategy should also be cost effective. To ensure the sourcing of materials, work in process and the product outputs are right, functions like material planning and controlling, production planning and controlling, finished goods

	management and delivery to customers must be considered.
Interviewee 5:	*- not available –*
Summary:	Manufacturing strategy affects management accounting in many ways. It may affect the cost structure, the internal or external market, the firm's objectives and targets, the resource allocation and the decision making process.

Table A.2 (22) Feedback From Interview Question 20

Question 20:	Another factor that is often said to affect management accounting is perceived environmental uncertainty. To your mind , in what ways does perceived environmental uncertainty affect management accounting .
Interviewee 1:	Nobody can predict the future, so we are going to deal with future estimates and future conditions of business. Future economic and political conditions entail minimising the risks associated with future dealings. Companies must decide on whether they can afford to take the risks given the uncertainties and the level of competition.
Interviewee 2:	Overall, market demand and market size affect management accounting. Demand may be seasonal and purchasing power may be different from a country to another country. The feasibility of a product may be affected by this market or environmental uncertainty.

Interviewee 3:	Perceived environmental uncertainty can take many forms such as changing customers' satisfaction levels and macro-economic factors affecting suppliers' behaviour. They affect management accounting since they impact on the management information reporting formats.
Interviewee 4:	Perceived environmental uncertainty manifests itself in a number of ways. For instance, the clients' expectation of the value added products results in manufacturing moving to low production cost countries. So, manufacturing needs to adjust itself to suit market trends, to target other market segments or to improve on branding. Perceived environmental uncertainty requires management accounting to respond by producing quality products at cheaper prices.
Interviewee 5:	*- not available –*
Summary:	Perceived environmental uncertainty affects management accounting in a number of ways. It affects future estimates and future conditions of business. Firms must decide on whether they are willing to take the risks associated with the uncertainty. Changing market conditions can be the results of season, trend, purchasing power, customers' expectation and a host of other macro-economic factors. Management accounting must account for all the uncertainty in order to be relevant for decision-making, planning and control.

Table A.2 (23) Feedback From Interview Question 21

Question 21:	Organizational interdependence is often quoted to have affected management accounting. Perhaps you could tell me, in your own words, how organizational interdependence affects management accounting.
Interviewee 1:	Basically we have different functions. You have the finance function, you have the marketing function, you have the production function etc. These different departments cannot be viewed as a collection of many departments. They must be coordinated properly. Each department must know whatever features preferred by the customers. All these things must be incorporated in terms of products, so there must be coordination between marketing department and the production department for example. Without this coordination, you will not be able to satisfy the customers.
Interviewee 2:	Organizational interdependence affects management accounting in a number of ways. Where contract manufacturing is undertaken for some products, the joint costs need to be apportioned accurately. Similarly, parts of the company's requirements can also be contracted out to outsiders and the problem with transfer pricing or cost apportionment must also be taken care of.
Interviewee 3:	In a manufacturing process, one process will actually serve other areas that in turn serve yet other areas. This process starts from raw materials until the finished products. So, along the way management accounting practices ensure that the desired results are generated and reported. This is how organizational interdependence affects management accounting.

Interviewee 4:	Organizational interdependence does affect management accounting. The production process involves many workstations. The whole process must be efficient and effective. Organizational interdependence is especially true in many manufacturing firms where one workstation is actually a customer of another workstation. Servicing a customer can also mean servicing another workstation. A lot of procedures are designed to serve this purpose, which includes standard time, process balancing and capacity planning. The accountants may need to work with other personnel to coordinate the interdependency.
Interviewee 5:	- *not available* –
Summary:	Organizational interdependence affects management accounting in several ways. It will affect the task of coordinating all the various departments or divisions within an organization. Where contract manufacturing is undertaken, the joint costs need to be apportioned accurately. Where jobs are contracted out to outsiders, the problems with transfer pricing and cost apportionment require due consideration. Where one department needs to service other departments, then the issues of efficiency and effectiveness leading to goal congruence need to be resolved. Management accounting must be able to address all these problems and issues.

Table A.2 (24) Feedback From Interview Question 22

Question 22:	Organizational structure is yet another factor that affects management accounting. In your opinion, how does it affect management accounting?

Interviewee 1:	Decentralization or centralization in my opinion is a matter of degree. You cannot completely decentralize an organization or you cannot completely centralize your organization; your degree varies depending on the needs of the organization.
Interviewee 2:	Where the organizational structure is vast and complex, the management accounting practices can be standardized to make them easier to follow. For example the standard costing systems for a range of products can be standardized for all divisions within the organization. This will facilitate compliance with existing framework and improve error detection and correction.
Interviewee 3:	Decentralization or centralization affects management accounting in a number of areas such as costing, budgetary control and the behavioural problem management. Each particular sub-structure needs to relate to the whole organizational structure.
Interviewee 4:	The decision whether to centralize or decentralize depends on the organization itself. A big organization is better centralized with the limits of authority specifically defined. Whether to centralize or decentralize will affect management accounting in many ways. A good control system should be in place to oversee the various departments. For a cost centre, the spending priority and limits should be clearly spelt out. In terms of decision making and control, centralization is better than decentralization. However, decentralization is better when faster decision makings are required. For example, each department should be given enough authority to make small spending in order to smoothen its day to day operations without hitches. It will be too slow and costly to refer everything to the head office as one hitch will cause the whole line to stall. But centralization too can lead to faster decision making if proper

	delegation of authority is mapped out. Ultimately, what matters is profit, not centralization or decentralization.
Interviewee 5:	*- not available –*
Summary:	Organizational structure is to do with whether an organization is decentralized or not. An organization can be partially decentralized. There are merits and demerits of decentralization versus centralization. Management accounting must respond to differing organizational structures by instituting standard business practices and sound frameworks to facilitate decision making, planning and control in order to achieve the organizational overall objectives.

Questions 23 and 24 were concerned with the interviewees' views on how to improve the survey questionnaire (pre-testing of questionnaire). Details of each question and the summary response of each interviewee will be outlined below. The gist of the overall response for each question will also be inferred or deduced.

Table A.2 (25) Feedback From Interview Question 23

Question 23:	Have a good look at the draft survey questionnaire that I have prepared. It is based on established literature. Do you think that in general it is understood by an experienced management accountant or manager? Please feel free to re-word, scrap, combine or add new items to the list in the questionnaire.

Interviewee 1:	It is OK. People can read it and understand it and respond to it. You may like to include capital turnover as another performance indicator. Apart from that, other aspects are very appropriate for the respondents to respond.
Interviewee 2:	The questionnaire is very comprehensive and it should serve its purpose. I don't think I have anything to add to the questionnaire.
Interviewee 3:	The questionnaire is very detailed. It covers a lot of management accounting areas like management accounting information and techniques. I think the questionnaire is really fair and good in content.
Interviewee 4:	The questionnaire is quite straightforward and easy to understand. It is a good questionnaire packed with many questions and details. I am not sure if some of the questions overlap with each other. Overall, the questionnaire is complete and comprehensive enough.
Interviewee 5:	- *not available* –
Summary:	The questionnaire is appropriate, comprehensive, detailed, fair, good in content, straightforward and easy to understand. It should serve its purpose.

Table A.2 (26) Feedback From Interview Question 24

Question 24:	Is there anything else you would like to comment on?
Interviewee 1:	I think you have covered most of the areas with your questionnaire and I don't have anymore to comment on this.
Interviewee 2:	I think management accounting is one area that not many people are engaged in at the PhD level.
Interviewee 3:	Yes, I would like to comment on a number of things. Management accounting is a very wide discipline and is still moving forward. Management accounting is still open to new improvements and new scopes of doing things. The discipline is constantly changing and evolving. Techniques are moving towards the efficient use of resources. These encompass areas like cost control, productivity and quality. Benchmarking of key performance indicators, including the major ratios is one example. However, unlike financial accounting information, management accounting information and practices of other companies are not publicly disclosed. This makes it difficult to benchmark the performance of one company against another company.
Interviewee 4:	It looks like the questionnaire has covered everything relevant. I hope that you are able to get enough samples for your statistical testings.
Interviewee 5:	- *not available* –

Summary:	The questionnaire has covered most relevant areas. Management accounting is a suitable area for a PhD research as it is a very wide discipline that is gradually changing and evolving. However, unlike financial accounting, management accounting information and practices are not publicly disclosed. Getting enough samples for statistical testings can be a challenge.

APPENDIX THREE

COVER LETTER ACCOMPANYING SURVEY QUESTIONNAIRE

November 20, 2004

Dear CIMA member,

You are very special for being selected as a respondent. Your assistance is desperately needed for this research. It can mean the success or the failure of this study. I can truly understand that in this fast moving world, people simply do not have the time to spare for anything other than their careers. Filling in questionnaires is another one of those mundane boring chores that can safely be relegated down the priority list, but your twenty minute sacrifice means a lot here. If you are working in manufacturing or have ample experience in manufacturing previously, then you are more than qualified to participate.

If in case, should some of the questions be deemed too sensitive or encroach into confidential territory, be rest assured that your response will be treated with the strictest confidence. No identity will be revealed and only statistical aggregations will be reported. What I need is nothing more than your honest response, whatever it may be.

At the end of the day, it is hoped that this research will contribute towards a better understanding of management accounting practices in the Malaysian manufacturing industry. You would have played a role in adding to this fountain of knowledge.

Please find enclosed a set of questionnaire for you to fill in. The questions may seem somewhat long but answering requires little more than mere ticking and circling. I hope you find it interesting. For your convenience, please send it back using the stamped self-addressed envelope enclosed. If you are afraid that you may never answer the questionnaire, my request is for you to answer it right away promptly.

Your participation means a lot to me. I may not be able to return the favour beyond expressing my heartfelt appreciation. Nonetheless please accept this humble token of appreciation. Thank you very much indeed.

Yours faithfully,

Anuar Nawawi,
Researcher,
CIMA-UiTM Asian Management Accounting Research Centre (AMARC).

APPENDIX FOUR

SURVEY QUESTIONNAIRE

SECTION A: BACKGROUND INFORMATION

Please tick in the relevant box(es)

Q1. Your gender is:

Male ☐ Female ☐

Q2. Your age is:

Less than 30 years ☐ 30 to 39 years ☐

40-49 years ☐ 50 to 59 years ☐

60 and above ☐

Q3. Your educational background *(you may tick more than one box as appropriate):*

Certificate(s) ☐ Diploma ☐

Bachelors Degree ☐ Masters Degree ☐

Doctoral Degree ☐ Professional Qualification(s) ☐

Others (please specify) ☐

....

....

....

Q4. Your length of service *(tick one box in each column)*

	In present firm	In previous firm (s)
No experience at all	☐	☐
Less than 1 yr. experience	☐	☐
1-4 year experience	☐	☐
5-9 year experience	☐	☐
10 yr. or more experience	☐	☐

Q5. Your current management level within your company:

Top management ☐

Middle management ☐

Lower management ☐

Q6. Your monthly remuneration level is:

Less than RM 5,000 ☐

RM 5,000 to less than RM 10,000 ☐

RM 10,000 to less than RM 15,000 ☐

RM 15,000 to less than RM 20,000 ☐

RM 20,000 to less than RM 25,000 ☐

RM 25,000 to less than RM 30,000 ☐

RM 30,000 or more ☐

Q7. Your decision-making function:

Exclusively line (decision-making) function ☐

Exclusively staff (advisory) function ☐

A combination of line and staff function ☐

Q8. What is your functional area of responsibility *(you may tick more than one box):*

Accounting/finance	☐	General management	☐
Sales/marketing	☐	Top strategic management	☐
Production/manufacturing	☐	Other (please specify)	☐

....

....

....

Q9. Your firm's main area of operation *(you may tick more than one box):*

Manufacturing/production ☐ Retail trading ☐

Wholesale trading ☐ Services ☐

Other (please specify) ☐

....
....
....
....

Q10 Status of your firm *(please tick yes or no):*

Is your firm an associate/ subsidiary ? *Yes* ☐ *No* ☐

Is your firm de-centralised in operation? *Yes* ☐ *No* ☐

SECTION B: MANUFACTURING MANAGEMENT METHODS

The following statements relate to the ***manufacturing management methods*** *of your firm* ***over the past three years****. Please select just ONE which you consider the MOST DOMINANT production method in your organization, by ticking the corresponding box.*

Q11. Which ONE of these manufacturing methods best described as the MAIN production method employed by your firm?

Unit and small batch production method ☐

Large batch and mass production method ☐

Continuous process production method ☐

SECTION C: MANAGEMENT ACCOUNTING SYSTEMS – PRESENTATION OF INFORMATION

The following questions relate to the ***management accounting systems-presentation of information*** *of your firm* ***over the past three years****. Please rate the extent to which the following information items would be useful to you in carrying out the overall tasks of your firm. Indicate the appropriate degree of usefulness on each presentation characteristic by circling a number from 1 to 7.*

Not useful at all			Quite useful			Useful to a great extent
1	2	3	4	5	6	7

Q12. *Scope of Information*

1. Information which relates to possible future events (if historical information is most suitable for your needs, mark the lower end of the scale).	1	2	3	4	5	6	7
2. Quantification of the likelihood of future events occurring (e.g., probability estimates).	1	2	3	4	5	6	7
3. Non-economic information, such as customer preferences, employee attitudes, labour relations, attitudes of government and consumer bodies, competitive threats, etc.	1	2	3	4	5	6	7
4. Information on broad factors external to your organization, such as economic conditions, population growth, technological developments, etc.	1	2	3	4	5	6	7
5. Non-financial information that relates to the following areas:							
(a) production information such as output rates, scrap levels, machine efficiency, employee absenteeism, etc.	1	2	3	4	5	6	7

(b) market information such as market size, growth share, etc. (If you find that a financial interpretation of production and marketing information is most useful for your needs, please mark the lower end of the scale).	1	2	3	4	5	6	7

Q13. *Timeliness of Information*

1. Requested information to arrive immediately upon request.	1	2	3	4	5	6	7
2. Information supplied to you automatically upon its receipt into information systems or as soon as processing is completed.	1	2	3	4	5	6	7
3. Reports are provided frequently on a systematic, regular basis: e.g., daily reports, weekly reports (for less frequent reporting, mark lower end of scale).	1	2	3	4	5	6	7
4. There is no delay between an event occurring and relevant information being reported to you.	1	2	3	4	5	6	7

Q14. *Aggregation of Information*

1. Information provided on the different sections or functional areas in your organization, such as marketing and production, or sales, cost, or profit centres.	1	2	3	4	5	6	7
2. Information on the effect of events on particular time periods (e.g., monthly/ quarterly/ annual summaries, trends, comparisons, etc.)	1	2	3	4	5	6	7

3.	Information which has been processed to show the influence of events on different functions, such as marketing or production associated with particular activities or tasks.	1	2	3	4	5	6	7
4.	Information on the effect of different sections' activities on summary reports such as profit, cost, revenue reports for:							
	(a) your particular sections	1	2	3	4	5	6	7
	(b) the overall organization	1	2	3	4	5	6	7
5.	Information in forms which enable you to conduct "what-if" analysis.	1	2	3	4	5	6	7
6.	Information in formats suitable for input into decision models such as:	1	2	3	4	5	6	7
	(a) discounted cash flow analysis	1	2	3	4	5	6	7
	(b) incremental or marginal analysis	1	2	3	4	5	6	7
	(c) inventory analysis	1	2	3	4	5	6	7
	(d) credit policy analysis	1	2	3	4	5	6	7
7.	Costs separated into fixed and variable components.	1	2	3	4	5	6	7

Q15. *Integration of Information*

1.	Information on the impact that your decision will have throughout your department, and the influence of other individuals' decisions on your area of responsibility.	1	2	3	4	5	6	7
2.	Precise targets for the activities of all sections within your department.	1	2	3	4	5	6	7

3.	Information that relates to the impact that your decisions have on the performance of your department.	1	2	3	4	5	6	7

SECTION D: MANAGEMENT ACCOUNTING PRACTICES/TECHNIQUES

The following statements relate to the ***management accounting practices/ techniques*** *of your firm* ***over the past three years****. In case of adoption, please indicate the appropriate degree of benefits gained by the firm from each practice/technique by circling a number from 1 to 7. Encircle 0 for non-adoption.*

No benefit			Medium benefit			High benefit	Not adopted
1	2	3	4	5	6	7	0

Q16.	*Budgeting to plan day-to-day operations*	1	2	3	4	5	6	7	0
Q17.	*Performance evaluation: return on investment*	1	2	3	4	5	6	7	0
Q18.	*Performance evaluation: budget variance analysis*	1	2	3	4	5	6	7	0
Q19.	*Performance evaluation: divisional profit*	1	2	3	4	5	6	7	0
Q20.	*Budgeting for planning cash flows*	1	2	3	4	5	6	7	0
Q21.	*Budgeting for coordinating activities across business units*	1	2	3	4	5	6	7	0
Q22.	*Budgeting for controlling costs*	1	2	3	4	5	6	7	0

Q23.	*Budgeting for planning financial position*	1	2	3	4	5	6	7	0
Q24.	*Performance evaluation: ongoing suppliers evaluations*	1	2	3	4	5	6	7	0
Q25.	*Capital budgeting tools*	1	2	3	4	5	6	7	0
Q26.	*Performance evaluation: controlling profit*	1	2	3	4	5	6	7	0
Q27.	*Product profitability analysis*	1	2	3	4	5	6	7	0
Q28.	*Performance evaluation: customer satisfaction surveys*	1	2	3	4	5	6	7	0
Q29.	*Performance evaluation: cash flow return on investment*	1	2	3	4	5	6	7	0
Q30.	*Performance evaluation: team performance*	1	2	3	4	5	6	7	0
Q31.	*Benchmarking for operational processes*	1	2	3	4	5	6	7	0
Q32.	*Cost-volume-profit analysis*	1	2	3	4	5	6	7	0
Q33.	*Formal strategic planning*	1	2	3	4	5	6	7	0
Q34.	*Long range forecasting*	1	2	3	4	5	6	7	0
Q35.	*Strategic plans developed separate from budgets*	1	2	3	4	5	6	7	0
Q36.	*Performance evaluation: non-financial measures*	1	2	3	4	5	6	7	0

Q37.	*Product costing: variable costing*	1	2	3	4	5	6	7	0
Q38.	*Product costing: absorption costing*	1	2	3	4	5	6	7	0
Q39.	*Product life cycle analysis*	1	2	3	4	5	6	7	0
Q40.	*Performance evaluation: residual income*	1	2	3	4	5	6	7	0
Q41.	*Performance evaluation: balanced scorecard*	1	2	3	4	5	6	7	0
Q42.	*Benchmarking with the wider organization*	1	2	3	4	5	6	7	0
Q43.	*Operational research techniques*	1	2	3	4	5	6	7	0
Q44.	*Performance evaluation: qualitative measures*	1	2	3	4	5	6	7	0
Q45.	*Strategic plans developed with budgets*	1	2	3	4	5	6	7	0
Q46.	*Target costing*	1	2	3	4	5	6	7	0
Q47.	*Benchmarking with outside organizations*	1	2	3	4	5	6	7	0
Q48.	*Benchmarking of product characteristics*	1	2	3	4	5	6	7	0
Q49.	*Benchmarking of management processes*	1	2	3	4	5	6	7	0
Q50.	*Value chain analysis*	1	2	3	4	5	6	7	0

Q51.	*Budgeting for compensating managers*	1	2	3	4	5	6	7	0
Q52.	*Benchmarking of strategic priorities*	1	2	3	4	5	6	7	0
Q53.	*Performance evaluation: employees attitudes*	1	2	3	4	5	6	7	0
Q54.	*Owners' value analysis*	1	2	3	4	5	6	7	0
Q55.	*Activity based costing*	1	2	3	4	5	6	7	0
Q56.	*Activity based management*	1	2	3	4	5	6	7	0
Q57.	*Activity based budgeting*	1	2	3	4	5	6	7	0
Q58.	*Standard costing*	1	2	3	4	5	6	7	0
Q59.	*Back flush costing*	1	2	3	4	5	6	7	0
Q60.	*Zero base budgeting*	1	2	3	4	5	6	7	0

SECTION E: ORGANIZATIONAL PERFORMANCE

Part 1

The following dimensions relate to your firm's performance ***over the past three years****. For each dimension, please rate your firm's performance relative to corporate standards by circling a number from 0 to 7.*

Significantly below average			Average			Significantly above average	Not sure
1	2	3	4	5	6	7	0

Q61.	*Return on investment*	1	2	3	4	5	6	7	0
Q62.	*Profit*	1	2	3	4	5	6	7	0

Q63.	*Cash flow from operations*	1	2	3	4	5	6	7	0
Q64.	*Cost control*	1	2	3	4	5	6	7	0
Q65.	*Development of new products*	1	2	3	4	5	6	7	0
Q66.	*Sales volume*	1	2	3	4	5	6	7	0
Q67.	*Market share*	1	2	3	4	5	6	7	0
Q68.	*Market development*	1	2	3	4	5	6	7	0
Q69.	*Personnel development*	1	2	3	4	5	6	7	0
Q70.	*Political-public affairs*	1	2	3	4	5	6	7	0

Part 2

The following dimensions are again the same ones used above which measure your firm's performance ***over the past three years****. This time, please rate the relative importance superiors attach to each dimension, when determining the incentive bonus of a manager, by circling a number from 0 to 5.*

Not important	Quite important	Important	Very important	Extremely important	Not sure
1	2	3	4	5	0

Q71.	*Return on investment*	1	2	3	4	5	0
Q72.	*Profit*	1	2	3	4	5	0
Q73.	*Cash flow from operations*	1	2	3	4	5	0
Q74.	*Cost control*	1	2	3	4	5	0
Q75.	*Development of new products*	1	2	3	4	5	0
Q76.	*Sales volume*	1	2	3	4	5	0
Q77.	*Market share*	1	2	3	4	5	0
Q78.	*Market development*	1	2	3	4	5	0
Q79.	*Personnel development*	1	2	3	4	5	0
Q80.	*Political-public affairs*	1	2	3	4	5	0

SECTION F: INSTITUTIONAL FACTORS

The following statements relate to the institutional influences that may affect the development of your firm's management accounting practices and systems. Please circle the number which best represents your opinion or perception regarding the following factors.

Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree	Not relevant
1	2	3	4	5	6	7	0

Q81.	*The firm benefits by ensuring that it keeps up with best practices in management accounting used by its competitor(s).*	1	2	3	4	5	6	7	0
Q82.	*The firm benefits by imitating, as much as possible, the costing and budgeting techniques of other firms in the industry.*	1	2	3	4	5	6	7	0
Q83.	*It is better for the firm to use the most popular and widely used software package(s) for its management accounting systems.*	1	2	3	4	5	6	7	0
Q84.	*The firm must follow the costing and budgeting methods and management reporting formats dictated by an outside headquarters or oversight organization.*	1	2	3	4	5	6	7	0
Q85.	*Any substantial changes to the management accounting systems will arise from pressures applied by the top management, i.e. a top-down policy approach.*	1	2	3	4	5	6	7	0
Q86.	*There is a lot of attention given by management and directors to the way management control systems function.*	1	2	3	4	5	6	7	0

Q87.	*The management accounting systems in the firm are designed and maintained almost entirely due to the expertise of the firm's own management accountants or consultants.*	1	2	3	4	5	6	7	0
Q88.	*The firm relies strongly on CIMA or similar professional bodies for its ideas concerning management accounting and control techniques, which it considers using.*	1	2	3	4	5	6	7	0
Q89.	*When the firm's senior management addresses issues relating to costing, budgeting methods and reporting, they depend heavily on the advice of the senior management accountant/financial controller.*	1	2	3	4	5	6	7	0

SECTION G: CONTINGENCY FACTORS

The following statements relate to the contingency factors that may affect the development of your firm's management accounting practices and systems. Please circle the number which best represents your opinion or perception regarding the following factors.

Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree	Not relevant
1	2	3	4	5	6	7	0

Strategic Manufacturing Priorities

Q90.	*Your firm's manufacturing strategy emphasizes the need to **compete in technological development and constant innovations.***	1	2	3	4	5	6	7	0
Q91.	*Your firm's manufacturing strategy emphasizes the need to **manufacture products of a high quality at competitive prices.***	1	2	3	4	5	6	7	0

Q92.	*Your firm's manufacturing strategy emphasize the need to **respond to customers' requirements, giving priority to service and delivery.***	1	2	3	4	5	6	7	0

Organizational Interdependence

Q93.	*There is no exchange of output that takes place between units of your organization.*	1	2	3	4	5	6	7	0
Q94.	*There is a **sequential** exchange of output between units of your organization.*	1	2	3	4	5	6	7	0
Q95.	*There is a **reciprocal** exchange of output between units of your organization.*	1	2	3	4	5	6	7	0

Organizational Structure: Decentralization

Q96.	*Your managers have decision autonomy **on supervisory establishment.***	1	2	3	4	5	6	7	0
Q97.	*Your managers have decision autonomy **on the appointment of supervisory staff from outside the organization.***	1	2	3	4	5	6	7	0
Q98.	*Your managers have decision autonomy **on the promotion of supervisory staff.***	1	2	3	4	5	6	7	0
Q99.	*Your managers have decision autonomy **on the salaries of supervisory staff.***	1	2	3	4	5	6	7	0
Q100.	*Your managers have decision autonomy **to spend unbudgeted or unallocated money on capital items.***	1	2	3	4	5	6	7	0

Q101.	*Your managers have decision autonomy **to spend unbudgeted or unallocated money on revenue items.***	1	2	3	4	5	6	7	0
Q102.	*Your managers have decision autonomy **on what type, or what brand, new equipment is to be.***	1	2	3	4	5	6	7	0
Q103.	*Your managers have decision autonomy **to determine a new product or service.***	1	2	3	4	5	6	7	0
Q104.	*Your managers have decision autonomy **to determine marketing territories covered.***	1	2	3	4	5	6	7	0
Q105.	*Your managers have decision autonomy **on the extent and type of market to be aimed for.***	1	2	3	4	5	6	7	0
Q106.	*Your managers have decision autonomy **on what shall be costed.***	1	2	3	4	5	6	7	0
Q107.	*Your managers have decision autonomy **on what shall be inspected.***	1	2	3	4	5	6	7	0
Q108.	*Your managers have decision autonomy **on what operations shall be work studied.***	1	2	3	4	5	6	7	0
Q109.	*Your managers have decision autonomy **to dismiss a supervisor.***	1	2	3	4	5	6	7	0
Q110.	*Your managers have decision autonomy **on the training methods to be used.***	1	2	3	4	5	6	7	0
Q111.	*Your managers have decision autonomy **on the buying procedures.***	1	2	3	4	5	6	7	0

Q112.	*Your managers have decision autonomy **as to which suppliers of materials to be used.***	1	2	3	4	5	6	7	0
Q113.	*Your managers have decision autonomy **on what and how many welfare facilities are to be provided.***	1	2	3	4	5	6	7	0
Q114.	*Your managers have decision autonomy **on the price of the output.***	1	2	3	4	5	6	7	0
Q115.	*Your managers have decision autonomy **to alter responsibilities /areas of work of specialist departments.***	1	2	3	4	5	6	7	0
Q116.	*Your managers have decision autonomy **to alter responsibilities /areas of work of line departments.***	1	2	3	4	5	6	7	0
Q117.	*Your managers have decision autonomy **to create a new department.***	1	2	3	4	5	6	7	0
Q118.	*Your managers have decision autonomy **to create a new job.***	1	2	3	4	5	6	7	0

Perceived Environmental Uncertainty

Q119.	*In your firm, there is a lack of information regarding the environmental factors associated with a given decision-making situation.*	1	2	3	4	5	6	7	0
Q120.	*In your firm ,the outcome of a specified decision in terms of how much the organization would lose if the decision were incorrect, is not known.*	1	2	3	4	5	6	7	0

Q121.	*In your firm, there is an inability to assign probabilities with confidence as to how the environment will affect success or failure.*	1	2	3	4	5	6	7	0

THANK YOU FOR YOUR PARTICIPATION IN THIS SURVEY

Kindly return the completed questionnaire using the enclosed stamped, self-addressed envelope within one month of receipt,

or send to:

Anuar Nawawi,
c/o Professor Dr. Normah Omar,
CIMA-UiTM Asian Management Accounting Research Centre (AMARC),
Faculty of Accountancy,
SAAS Building,
40450, UiTM, Shah Alam.
Selangor.

APPENDIX FIVE

PHOTOCOPY OF RESPONSE INDUCEMENT (FOLDABLE TABLE CALENDAR)

CIMA - UITM
A M A R C
Asian Management Accounting Research Centre

2005

CIMA - UITM
A M A R C
Asian Management Accounting Research Centre

Public Holidays 2005

New Year's Day	1 Jan
Hari Raya Qurban*	21 Jan
Thaipusam	Jan 25
Federal Teritory	Feb 1
Chinese New Year	9-10 Feb
Awal Muharam	10 Feb
Birthday of Prophet Muhammad	21 Apr
Labour Day	1 May
Wesak Day	May 22
Birthday of DYMM SPB Yang Dipertuan Agong	4 Jun
Hari Kebangsaan	31 Aug
Deepavali *	1 Nov
Hari Raya Puasa*	3-4 Nov
Birthday of Selangor	17 Dec
Christmas Day	25 Dec

JAN

S	M	T	W	T	F	S
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

MAC

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FEB

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

APR

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

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