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The application of advanced management accounting: does it improve company performance?

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**THE APPLICATION OF ADVANCED MANAGEMENT ACCOUNTING:
DOES IT IMPROVE COMPANY PERFORMANCE?**

A thesis submitted in fulfilment of the
requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

IMAM GHOZALI, Drs, MCom

Department of Accountancy

August 1995

I, **Imam Ghozali**, certify that this thesis has not been submitted previously as part of the requirements of another degree and that it is the product of my own independent research.

Signed: _____
Imam Ghozali

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THE APPLICATION OF ADVANCED MANAGEMENT ACCOUNTING: DOES IT IMPROVE COMPANY PERFORMANCE?

ABSTRACT

The major purposes of this study were twofold: (1) to determine the relationship between certain contextual variables of firm characteristics and the application of advanced management accounting techniques, and (2) to identify how firm performance is affected by contextual variables and the application of advanced management accounting techniques. Eight hypotheses were formulated to accomplish the study purpose

A questionnaire was developed to gather data. The sampling frame of the population was the Top 500 listed Australian companies. A pilot study of 100 questionnaires were sent to the respondents. Revised questionnaires were mailed to all Top 500 Australian companies. Two types of statistical analysis were adopted to test the hypotheses. Hypothesis one was tested using multiple logistic regression model. Hypotheses two through eight were tested using nonparametric statistical test, Mann-Whitney U test.

The study found that the extent of use of advanced management accounting techniques and firm size significantly reduce the probability the firm will perform above average performance of the sample firm. But the interaction variables provide evidence that any separation of size and capital intensity effect from the extent of the use of management accounting techniques is problematic. Looking at the interaction variables the results show that large firms that applied advanced management accounting techniques extensively significantly increase the probability the firm will perform above average performance of the sample firms. It is also true for high capital intensive firms that applied advanced management accounting techniques extensively.

The study also observed that contextual variables of firm characteristics influenced the application of management accounting techniques. Contextual variables age, type of industry, capital intensity, and leverage have significant influenced on the application of advanced management accounting techniques type I, II and III. Firm size has significant influence on the application of advanced management accounting techniques type I and III. Firm risk also only has significant influence on the application of advanced management accounting techniques type II and III. But in terms of ownership, there is no difference between public listed domestic firms and public listed foreign firms in applying management accounting techniques.

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CHAPTER I

INTRODUCTION

Management accounting systems (MAS) are designed to report information internally to managers. They need this information to plan, control, evaluate, and coordinate business activities, both domestically and internationally, and thus managers at all levels seek internally-developed and reported information to improve their decision-making. The relevance of organisational contextual variables to the design of management accounting system has been recognised in the accounting literature since the mid 1970s with studies by Bruns and Waterhouse (1975), Gordon and Miller (1976), Ansari (1977) and Waterhouse and Tiessen (1978). The aim of these studies was to identify the contextual variables which were seen as important consideration in the design of MAS. In those studies, the findings of contextual variables such as the external environment, organisational structure, organisation size, and production technology encouraged further research in management accounting.

Models adopting situational approaches to management accounting research have focused on two broad dimensions of the management accounting system:

1. the characteristics of management accounting system
2. the use of management accounting techniques

Chenhall and Morris (1986) examined the effect organisational structure, environmental uncertainty, and organisational interdependence on management accounting systems design. MAS design was defined in terms of the perceived usefulness of several information characteristics which may be associated with a

MAS. These characteristics were scope, timeliness, level of aggregation, and information which assists integration. Studies by Kwandwalla (1972) and Mak (1989) focused on the use of management accounting techniques. Kwandwalla (1972) observed the effect that the type of competition faced by a firm had on its use of management controls. He found that the sophistication of accounting and control systems was influenced by the intensity of the competition it faced. Mak (1989) examined whether the relationship between the sophistication of organisational control systems and financial performance was dependent on Perceived Environmental Uncertainty (PEU). He used Anthony's (1965) framework for analysing the control strategies. According to Anthony, there are three levels of control systems in organisations : (1) operational control systems, (2) management control systems and (3) strategic planning. Similar to the study conducted by Kwandwalla (1972), the sophistication of operational control systems is measured by the use of standard costs and variance analysis for control, operations research techniques for inventory control, and statistical sampling and related techniques for quality control. The management control systems is assessed by the use of internal auditing, systematic evaluation of managerial and senior personnel, and the establishment of cost centres and profit centres.

Some studies have focused on both dimensions. For example, Merchant (1981) examined the relationships between organisational context (size, diversity and degree of decentralisation), budgeting system characteristics and techniques, and various outcome variables. Amigoni (1978) developed a control system matrix with the usage of control system techniques (eg. ratio analysis and financial

modelling) as one dimension and control system characteristics or features (eg. detail and relevance) as the other.

Research on the contextual variables of the design of management accounting systems has focused on the external environment variable as a determining factor. In addition to the external environment, organisation design (including management accounting system design) should be consistent with the internal characteristics of the organisation. Two dimensions of internal characteristics of organisation that have been widely examined in research are size and technology (Perrow, 1967; Blau and Schoenherr, 1971; Kwandwalla, 1977; Merchant, 1984; Chenhall and Morris, 1986; Moores and Stuart, 1985; Moores and Duncan, 1989; Lal, 1991/1992). In addition to the size and technology, other internal characteristic factors such as type of ownership and control, age, risk, and leverage of firms need to be examined. This study focuses on the relationship between firm internal contextual variables and the extent use of management accounting techniques. The study also investigates the relationship between these two factors with firm financial performance.

Background and Motivation for the Research

Several studies have investigated the effect of contextual variables on the appropriate design of management accounting systems. Those studies concentrated on the contextual variables of external environment, technology and structure.

Environmental uncertainty has been recognised as an influential variable in the design of MAS. Govindarajan (1984) and Evans et. al., (1986) observed the influence of environmental uncertainty on information usage. Similarly, Gordon

and Narayanan (1984) and Chenhall and Morris (1986) examined the relationship between an organisation's environment and information characteristics. Gordon and Narayanan's study found that there was a significant relationship between Perceived Environment Uncertainty (PEU) and information characteristics. This result suggested that information characteristics were driven by PEU. Chenhall and Morris (1986) examined the direct and indirect effects of decentralisation, PEU and organisational interdependence on MAS design. The results provide strong evidence that the perceived usefulness of particular MAS characteristics is a function of the context in which the MAS operates.

Technology in terms of production techniques (eg. small batches, large batches, mass production and process production) is a factor that has long been recognised since Woodward (1965) as influencing the design of internal accounting system. Since then, a variety of studies have identified the association between different dimensions of technology and characteristics of MAS. The following associations are illustrative of the main findings: nature of technical process (standardised, mass production) with the increased sophistication of the management control system (Kwandwalla, 1977); degree of automation with formality of budget use (Merchant, 1984); the interdependence within production process with characteristics of information perceived to be useful (Chenhall and Morris, 1986).

Organisational structure is one of the primary considerations in establishing the overall control system within the organisation. There is evidence to suggest that structure of the organisation affect the design of MAS. Bruns and Waterhouse

(1975) found that large and technically sophisticated firms were associated with administrative control strategies defined by decentralisation and structuring with a strong emphasis on MAS, whereas small and dependent firms were associated with interpersonal control strategies described by centralisation and lack of autonomy. Chenhall and Morris (1986) also found that decentralisation had direct association with perceived usefulness of aggregated and integrated information.

The above studies showed that the contextual variables of internal firm characteristics have been subject to less attention in management accounting than external environment uncertainty, technology and structure. One of the internal firm characteristics variables that has been studied is organisational size. Other variables such as type of ownership and control, risk, age, capital intensity and firm leverage have been given much less attention. Studies on the association between firm size and MAS have found that size is related to increased use of more sophisticated and administrative MAS. Illustration of this findings includes: increased size was associated with sophistication of control and information system (Kwandwalla, 1977; Moores and Stuart, 1985); increased size with degree of formality associated with the budget process. In addition, many early researchers have tended to avoid considering the effects of contextual variables on organisational effectiveness. They did not directly incorporate performance into their conceptual frameworks. In cases where performance was directly examined, the result have been mixed. Therefore, a study to provide additional evidence of the effect of specific contextual variables of internal firm characteristics on the design of MAS and their relationship with firm financial performance is needed.

Statement of the Problem

Determining which factors influence firm level performance is not an easy task. The problem is extremely complex because a large number of influences on performance are at work. Some of these factors are external to the firm, while others are internal. This study focuses on the specific variables of internal firm characteristics on the application of advanced management accounting techniques and their relationship with firm financial performance.

It is desirable to have a conceptual model in order to understand the impact of the application of management accounting techniques on company performance. Figure 1 illustrates the basic framework for the study. It relates the application of management accounting techniques to the contextual variables of firm characteristics and explores how firm performance is affected by both of these.

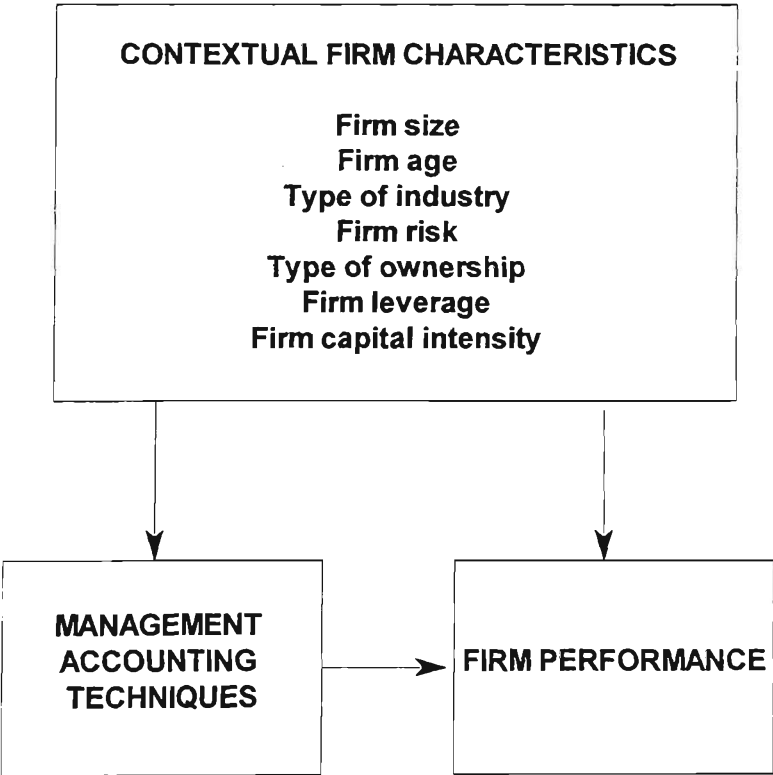


Fig. 1. Framework for the study

Firm Characteristics and Performance

Firm characteristics such as size, capital intensity, risk, leverage, and industry concentration have been discussed as important determinants of organisation performance. Firm size reflects the resources available to the organisation. The amount of economic activity the firm can engage in is directly influenced by corporate size. In addition, the ability to exploit the environment is a function of the amount of resources a corporation has. Therefore, firm size is expected to be positively associated with performance. The argument is that larger firms can take advantage of economies of scale enabling more efficient production and thereby increasing profitability. Moreover, larger firms have greater production capacity and should be able to generate greater sales; higher sales and greater efficiency should both contribute to a strong positive relationship between profit and size.

There have been several studies of the association between size and financial performance. Hall and Weis (1967) and Marcus (1969) found positive association between size and performance. Montgomery (1979) also argued that it is the significance of economies of scale which leads to better performance in the larger firm. However, these findings are in conflict with those produced by Whittington (1971) and Child (1974) in their studies of UK firms. Child (1974) reports that no relationship exists between size and performance. However, both Whittington and Child reveal that there were differences in technology and cost performance among industries that directly influence performance. Empirical

research on the association between firm performance and capital budgeting selection techniques also found that firm size is positively associated with performance (Klammer, 1973; Kim, 1982; and Pike, 1984).

Capital intensity can be interpreted as equivalent to what contextual theories refer to as technology. Technology determines the manner in which organisations transform inputs to outputs. One important aspect of technology that influences organisational productivity is the level of mechanisation. A highly mechanised technology means greater fixed investment in capital. Investment in capital assets per employee is expected to result in more efficient utilisation of inputs to outputs and thus reduced costs. The net effect should be to increase profit and profitability. Pike's study (1984) shows that capital intensity was positively associated with performance. Similarly Weiner and Mohoney (1981) also found that technology was highly associated with the rate of return on assets.

Studies on the influence of risk on performance have yielded conflicting results. Armour and Teece (1978) reported a negative relationship between return on equity and the variance in return on equity. Bowman (1980) also found negative association between risk and returns. In their research, Fiegenbaum and Thomas (1986) found no association between the systematic risk of a firm's stock returns - commonly known as beta- and returns measured using accounting data. In contrast, Fiegenbaum and Thomas (1988) and Jegers (1991) found a positive association between variance in returns (risk) and average return for firms whose return were above the median in their industry, and negative association for below median performers. In their study of capital budgeting techniques, Klammer

(1973), Kim (1982), and Pike (1984) reported that there was a positive relationship between risk and firm performance.

A firm's financial leverage also has an impact on its performance. Firm leverage represents the proportion of financing obtained via debt relative to equity financing (issuing stock). A firm's debt-to-equity ratio affects a company's ability to borrow and the cost of borrowing. Profit is expected to be negatively associated with leverage capital structure strategy because increasing debt creates a fixed financial obligation - interest. Grant and Jammie (1988) reported that high leverage is associated with low profitability. Weiner and Mahoney's (1981) study also found that capital structure strategy is inversely related to both profitability and stock prices.

Firm Characteristics and Management Accounting Techniques

Management accounting techniques used in a company are expected to be a function of the characteristics of the company. The classification of companies by some of their characteristics may reflect underlying differences in technology, financing, planning horizon, product and management structures. These differences may be a catalyst for companies to adopt and use specific management accounting techniques.

Studies by Merchant (1981, 1984) examined the effects of organisation size and structure on budgeting system design. He hypothesised that larger, more diverse, decentralised firms tend to use an administrative control strategy. These hypotheses were based on the premise that increasing size and diversity create

problems in social control, communication and coordination. As a result, larger, more diverse organisation would tend to decentralise and implement more administrative control strategies involving greater formalisation and budgeting sophistication. The overall results suggest that larger, more diverse, decentralised firms tend to place greater emphasis on formal budgeting.

Kwandwalla (1977) also observed the relationship between organisation size, as measured by sales revenue, and the sophistication of control and information system (CIS). Two aspects of control and information systems sophistication are investigated: internal and external. Kwandwalla (1977) defined internal CIS as the usage of sophisticated management controls for monitoring internal operations. These include such control of operations as internal audit, personnel evaluation, establishment of the standard costs of operations as well as the analysis of cost variations from these standards, and the use of accounting ratios to analyse operations. External CIS is defined as the extent to which the organisation engages in activities designed to secure vital environmental information. A significant relationship between organisation size and the sophistication of CIS was found and was explained by the assertion that as large organisations tend towards higher differentiation and involvement in a variety of markets and activities, more sophisticated control and information systems are needed.

Moore and Stuart (1985) and Lal (1991) adopted the same variables of control and information systems used by Kwandwalla (1977) and examined the relationship between size and CIS. Both studies support the evidence provided by

Kwandwalla (1977) who found a positive relationship between organisation size and CIS. Lal's (1991) study also indicates associations for the other dimensions of organisation size which includes number of employees, sales revenue and market capitalisation with both CIS internal and CIS external. These findings indicate that large organisations tend to place greater importance on CIS internal as a result of greater control and coordination problems, thus requiring more sophistication in the control system than smaller organisations. Larger organisations also tend to be involved in more diverse markets and activities and this may result in a greater need for a sophisticated information system which can provide information on the market, forecasts and so on.

Management Accounting Techniques and Performance

The association between the application of management accounting techniques and firm performance has received increasing attention in the literature. However, many studies concentrate on narrowly defined sets of management accounting techniques such as capital budgeting and long range planning. Ansoff et. al., (1970), Thune and House (1970), Herold (1972), Fulmer and Rue (1974), Malik and Karger (1975) focused their studies on the impact of comprehensive planning on financial performance.

Ansoff et al., (1970) investigated the relationship between formal planning and financial performance. They studied the impact of planning on the success of acquisitions in 93 American firms during the period 1946-1965. These firms were classified as either planners or non-planners and evaluated the performance of each

group using 21 different financial criteria. The result show that planners significantly outperform non-planners on virtually all financial criteria, including sales, earnings, earnings per share, and return on common equity.

Thune and House (1970) attempted to determine whether change in financial performance was associated with long range planning. To do this, they investigated the long range planning practices of 36 firms in six industries. Five performance measures were used: sales, stock prices, earning per share, return on common equity, and return on total capital employed. They found that the formal planners consistently outperformed the informal planners in drug, chemical, and machinery industries, but no clear association was found in the food, oil and steel industries. Herold (1972) replicated and extended Thune and House's study by introducing a new performance measure, ie. pretax profit. His findings completely supported those reported by Thune and House.

Another study investigating the relationship between formal planning and financial performance was conducted by Fulmer and Rue (1974). They surveyed 386 firms in the nondurable, durable and service industries to test the hypothesis that firms that use more sophisticated long range planning techniques exhibit better performance than do firms utilising less sophisticated techniques. The result did not reveal a systematic relationship between formal long range planning and financial performance. For durable goods industries, planners outperformed the non-planners; in the service industries, non-planners outperformed the planners; and in the nondurable industries, the results were mixed.

Malik and Karger (1975) observed the effects of formal integrated long range planning on firm performance for 38 firms in the chemical, drug, electronic, and machinery industries. The firms within each industrial grouping were divided into formal integrated long range planners and non-integrated planners, and their financial performance was compared using 13 different economic measures. The result indicated that formal planners outperformed non-planners on nine of 13 economic measures and the result were mixed for the other four measures.

A review of the empirical studies on the relationship between planning and firm performance disclosed conflicting findings. Similar conflicting results were also found in the study of the relationship between the use of capital budgeting techniques and firm performance (Klammer, 1973; Kim, 1982; Pike, 1984; Haka et. al., 1985 and Ho, 1992).

Klammer (1973) sent questionnaires to 386 of the manufacturing firms included on Compustat to test the association between firm performance and capital budgeting techniques. He regressed the operating rate of return with capital budgeting techniques and other controlling variables including size, risk, and capital intensity. His findings showed that there was no significant relationship between firm performance and the use of sophisticated capital budgeting techniques. Kim (1982) conducted two similar studies that had previously been conducted by Klammer. He found a positive relationship between the degree of sophistication of the budgeting process and firm performance. In contrast, other studies conducted by Pike (1984), Haka et. al (1985) and Ho (1992) support

Klammer' findings and found a negative relationship between the adoption of sophisticated budgeting selection techniques and firm performance.

Instead of studying specific techniques such as long range planning and capital budgeting techniques, MacNally and Eng (1980) and Mak (1989) attempted to investigate the relationship between various techniques and firm performance. MacNally and Eng (1980) surveyed companies listed on the New Zealand Stock Exchange and examined the relationship between the use of selected cost and management accounting and decision making techniques and two types of company characteristics: industry and output classification and financial data on size, growth, rate of return and capital intensity. The conclusion is that no statistically significant relationship was observed between industry and output groupings and the "use" or "non-use" of thirteen different cost and management accounting techniques. However, company size, rate of return and growth rate all provided some evidence of a positive relationship with the adoption or non-adoption of limited group of techniques.

The main weakness of MacNally's study is that each cost and management accounting technique and decision making technique has been categorised into whether the techniques is or is not used by a company. No attempt has been made to establish a score for how "intensively" a company uses specific techniques. Rather, the study considered whether the major techniques are implemented in practice and what relationship, if any, they have with company performance.

One of the primary objectives of Mak's (1989) study was to examine whether the relationship between the sophistication of organisational control

systems and financial performance was dependent on PEU. The control systems included in the study were based on Anthony's (1965) framework of control systems. The measurement of control system variables were adapted from the studies by Kwandwalla (1977). Operational control system variables were measured by the use of standard costs and variance analysis for cost control, operation research techniques for inventory control, and statistical sampling and related techniques for quality control. Management control systems were assessed by the use of internal auditing, systematic evaluation of managerial and senior personnel, establishment of cost centres and profit centres. Strategic planning variables were measured by the use of long-range forecasting of technology, sales, profit and markets, planning of long term investments, systematic search and evaluation procedures for new investments, and market research for studying customer preferences, price and demand analysis. His findings showed that measures of fit between PEU and sophistication of the operational and management control systems were not related to financial performance, while fit between PEU and the sophistication of strategic planning was only weakly associated with financial performance. A surprising finding was that firms facing greater environmental uncertainty employ more sophisticated operational controls systems.

Previous research has not attempted to study the impact of firm characteristics contextual variables on the use of a wide range of management accounting techniques and the relationship of these techniques with the firm's financial performance. Further empirical based research is therefore required to

extend and update this more comprehensive approach, concentrating on the relationship between firm characteristics, application of advanced management accounting techniques and the performance of firms. The intent of this study is to determine the extent and manner in which advanced management accounting techniques employed by Australian companies are dependent on firm characteristics and the relationship between these techniques and the company's performance. More specifically, the research is designed to answer the following research questions:

1. Do the application of advanced management accounting techniques influence the performance of Australian companies?
2. Do company characteristics such as size, age, type of industry, capital intensity, risk, leverage and type of company ownership influence the application of advanced management accounting techniques?

Purpose of Study

The primary purpose of this study is to determine whether there is significant positive relationship between the application of advanced management accounting techniques and the company's performance.

A secondary purpose is to identify the following items:

1. The extent and types of advanced management accounting techniques applied by the Australian public companies.
2. The relationship between the size of company and the extent of application of advanced management accounting techniques.

3. The relationship between the age of company and the extent of application of advanced management accounting techniques.
4. The relationship between the type of industry and the extent of application of advanced management accounting techniques.
5. The relationship between the capital intensity of the company and the extent of application of advanced management accounting techniques.
6. The relationship between the risk of the company and the extent of application of advanced management accounting techniques.
7. The relationship between the type of company ownership and the extent of application of advanced management accounting techniques.
8. The relationship between the company's leverage and the extent of application of advanced management accounting techniques.

The term advanced management accounting techniques in this study includes three types of techniques. The first type consists of those techniques that the frequency of its application depends on company's activities. These techniques can be applied many times or not at all within one year. Included in these techniques are decision tree analysis, relevant cost analysis, capital budgeting, linear programming, net-work analysis, inventory control models, just in time inventory and sensitivity analysis.

The second type comprises those techniques that the frequency of its application is periodical or at regular interval. These techniques can be applied monthly, quarterly, semi annually, and annually. These techniques include variance analysis, break-even analysis, contribution reporting, inventory turn over

analysis, account receivable turnover analysis, aging of account receivable, gross profit analysis and other financial ratio analysis.

The third type consists of those techniques that the frequency of its application is continuous for one year and these techniques can be either used or not used. These techniques include responsibility accounting, transfer pricing, standard costing, activity based costing, operating budget, flexible budget, appropriation budget, performance budget and fixed budget.

Firm performance is measured by an adjusted operating rate of return. The rate of return is calculated by dividing the operating income by the operating assets at year end. To be comparable for each company, the operating income must be adjusted by the differences in the application of accounting principles and procedures and the differences in the methods of financing investment. Therefore, an adjusted operating income is defined as income before taxes, financial expenses, and depreciation.

Firm contextual characteristics used as independent variables are organisation size, age, type of industry, capital intensity, risk, type of ownership, and firm's leverage. The following definitions are used for these firm's characteristics:

1. Size is measured by the average operating assets of the firm for six year period, 1987-1992. Size is grouped further into large firm and medium/small firm based on its median value. If it is above the sample median, it is considered as large firm and vice versa.

2. Age is measured from the year of incorporation. If a firm has been in business more than 28 years (median value), it is considered as old firm and if it is in business less than or equal to 28 years will be treated as new firm.
3. Type of industry is divided into two categories: manufacturing firm and non-manufacturing firm.
4. Capital intensity is measured by yearly depreciation expenses divided by the yearly operating assets for each of the six year period, 1987-1992.
5. Risk is measured by the standard deviation of the firm's adjusted operating rate of return for the six years period, 1987-1992.
6. Type of ownership is divided into two categories public domestic listed firm and public foreign listed firm.
7. Leverage is measured by the ratio between total debts and equities for each of the six years period, 1987-1992.

Variables of capital intensity, risk, and leverage are grouped further into high and low categories based on median values. If it is above the sample median value, it is defined as high and if it is below or equal its median value it is defined as low. Further details of definition of the variables used in this study can be seen in Chapter III.

Statements of Hypotheses

Based on the study purpose above, there are eight hypotheses proposed to be tested.

Hypothesis one:

H01: There is no significant relationship between application of advanced management accounting techniques and the company's performance.

H11: There is significant relationship between application of advanced management accounting techniques and the company's performance.

Hypothesis two:

H02: There is no significant difference in the application of advanced management accounting techniques between large companies and small companies.

H12: Advanced management accounting techniques are applied more extensively in large companies than in small companies.

Hypothesis three:

H03: There is no significant difference in the extent of application of advanced management accounting techniques between old companies and new companies.

H13: Advanced management accounting techniques are applied more extensively in old companies than in new companies.

Hypothesis four:

H04: There is no significant difference in the application of advanced management accounting techniques between manufacturing and non-manufacturing companies.

H14: Advanced management accounting techniques are applied more extensively in manufacturing companies than in non-manufacturing companies.

Hypothesis five:

H05: There is no significant difference in the application of advanced management accounting techniques between companies that have high capital intensity

and low capital intensity.

H15: Advanced management accounting techniques are applied more extensively in companies that have high capital intensity than companies that have low

capital intensity.

Hypothesis six:

H06: There is no significant difference in the application of advanced management accounting techniques between high risk companies and low risk companies.

H16: Advanced management accounting techniques are applied more extensively in high risk companies than in low risk companies.

Hypothesis seven:

H07: There is no significant difference in the application of advanced management accounting techniques between public domestic companies and public foreign companies.

H17: Advanced management accounting techniques are applied more extensively in public foreign companies than in public domestic companies.

Hypothesis eight:

H08: There is no significant difference in the application of advanced management accounting techniques between high leverage companies and low leverage companies.

H18: Advanced management accounting techniques are applied more extensive in high leverage companies than in low leverage companies.

Research Method

The primary research methods used in this study are a review of literature and a questionnaire survey.

The purpose of the review of literature is, first to provide an in depth understanding of the general trend in the studies of management accounting practice and how this practice is affected by the firm contextual variables. Second, to provide background for the reader of the study who has an interest in the topic and third, to obtained in depth understanding of advanced management accounting techniques to be included in the questionnaires.

The purpose of the questionnaire is to obtain data which are analysed for the purpose of validating the hypotheses of the study. A complete description of the methodology for the study are provided in Chapter III.

Contribution of the Study

This study is designed to add to the theoretical framework by developing a model that explains some of the factors influencing the company's performance. This study should also explain the variables that influence the application of advanced management accounting techniques used by publicly listed companies in practice. Such a theoretical framework would help to explain why firms select particular management accounting techniques.

Assumptions and Limitations

This study involves some basic assumptions and limitations.

Assumptions

The first assumption relates to the measurement of the frequency of application of advanced management accounting techniques in each surveyed company. In this study, the frequency of application of advanced management accounting techniques is assumed to be measurable with the scale employed as defined previously.

The second assumption is that chief accounting officers are in a position to know which advanced management accounting techniques are employed in their companies now, and have been employed since 1986.

Limitations

This study has several limitations. The first limitation is that there are some advanced management accounting techniques which are not included in this study, therefore conclusions can be made only with respect to the techniques included in the study.

The second limitation is that the frequency of application of advanced management accounting techniques may actually be influenced by variables other than those considered in this study.

Finally, the use of a questionnaire to gather data carries certain limitations. It introduces the possibility that the respondents may place different interpretations on the questions than did the researcher. To overcome this limitation, a pilot study was conducted to test the questionnaire.

Organisation of the Study

This study contains six chapters. Chapter I provides the background and motivation of the study, statement of problem, the purpose of the study, the hypothesis to be tested and the methodology used in conducting the study as well as the contribution and limitations of the study.

Chapter II contains a review of the previous surveys that have a closer relationship to the subject of this study. The first part reviews the findings of the survey of the application of management accounting techniques in practice. The second part examines the relationship between the application of management accounting techniques and the firm contextual characteristics. The third part discusses the relationship between the application of management accounting techniques, firm contextual characteristic variables and the company's performance.

Chapter III is concerned with the methodology and research design of the study. This chapter includes a description of the study, definition and operational measure of the variables, population, sampling frame, data collection method, and the development of hypotheses. The statistical methods used in the study are also described

Chapter IV presents the result from the questionnaires and the application of advanced management accounting techniques used by respondents. This chapter is divided into three parts. The first part presents the result of pilot study and full scale study, including testing of nonresponse bias. The second part describes the

profile of the respondents, and the last part presents the result of the application of management accounting techniques by respondents.

Chapter V presents the evaluation of the study's hypotheses. The first part provides the result of data testing which includes test of randomness and reliability test. The second part describes the findings of the hypotheses testing.

Chapter VI provides the conclusions drawn from the study. It includes the limitations of the study and suggestions for further related research.

CHAPTER II

RELATED LITERATURE REVIEW

A comprehensive search of the literature survey reveals that several studies have been undertaken to investigate the extent to which management accounting techniques are being applied in practice. However, no attempts were made in these studies to examine the relationship between the application of various management accounting techniques and the company performance. This chapter reviews the previous surveys that have a close relationship to the subject of this dissertation. The chapter is divided into three parts. The first part reviews the findings of the survey of the application of management accounting techniques in practice. The second part examines the relationship between the application of management accounting techniques and the characteristics of the company. Finally, the third part discusses the relationship between the application of management accounting techniques, characteristics of the companies and the companies' performance.

THE APPLICATION OF MANAGEMENT ACCOUNTING TECHNIQUES

Measuring the extent to which companies employ selected management accounting techniques has been the general theme of several studies over the past decade. Most of the studies basically concentrate on a narrowly defined set of management accounting techniques such as capital budgeting, quantitative techniques or operation research models, and other techniques associated with management accounting.

Capital Budgeting Techniques

A thorough review of the literature concerning the application of capital budgeting techniques reveals that research in Australia [McMahon (1981), Lilleyman (1984), Freeman and Hobbes (1991)], the UK [Pike (1988), Pike and Sharp (1989), Ho and Pike (1992)], the US [Kim and Farragher (1981), Schall, Sundem and Geijsbeek (1978), Klammer and Walker (1984)], and New Zealand [Patterson (1989)] has suggested that the usage of sophisticated investment procedures has increased over time. The sophistication includes discounted cash flows (DCF), risk adjusted discount rate, sensitivity and probability analysis.

McMahon (1981) surveyed the 200 largest public companies in terms of market capitalisation, listed on the Sydney Stock Exchange, and 20 large private companies. A response rate of 48.2 percent (106 companies) was achieved. He found that there was no significant change in the use of payback period and accounting rate of return during the 1970s compared to the results of earlier surveys of Australian practice [Burke (1971), Meredith (1964, 1965) and Smyth and Burke (1968)]. However, there has been a marked increase in use of discounted cash flow techniques. The survey also sought to discover the extent to which Australian companies used formal methods of risk analysis in capital investment decision making. Out of 78 companies which indicated use of DCF techniques, approximately 53 percent used formal risk evaluation techniques. The most popular formal risk evaluation techniques amongst large Australian

companies were sensitivity analysis, simulation and measure expected variation in return.

Lilleyman (1984) sampled 371 organisations selected from three sources: first, 250 public companies randomly selected from Industrial and Oil and Mining listings on the Australian Stock Exchanges; second, 60 private companies randomly selected from the Australian Business, Top 500 1982; and third, 61 government and semi-government organisations drawn from the various State Government listings. Ninety-eight valid responses were received, a response rate of 26.4 percent. The result indicates that, notwithstanding extensive support of the more sophisticated DCF techniques, the traditional payback method is used by more respondents than any other method. However, the usage ratio for the DCF techniques, either the internal rate of return (IRR) method or the net present value (NPV) method, is high and the respondents regarded these techniques as being the most important in evaluating capital expenditure proposals. The most popular tools for the risk assessment of forecasted future cash flows or expected profits is sensitivity analysis. The actual proportions were: sensitivity analysis (61%); risk analysis (50%); simulation and financial modelling (44%). Overall the results of this survey are in accord with the earlier Australian surveys and support their observations of the higher importance being attached to DCF evaluation techniques, use of quantitative risk assessment and simulation techniques.

Freeman and Hobbes (1991) observed changes in capital budgeting techniques in Australia between 1979 and 1989. They sampled two groups of companies. One group comprised the top 150 Australian companies and the second

group, companies ranked 351st to 500th as ranked on the BIS Top 1000 Corporate Database. Comparing their result to those McMahon (1989), shows that DCF techniques are now used more widely. It is also suggested that IRR and NPV rate equally as the primary techniques for large Australian companies.

The trend towards greater sophistication in investment selection techniques and control process in the UK has been documented by Pike (1988). Based on a sample of 100 large UK firms, he examined the capital budgeting practices employed over an 11-year period (1975 - 1986). Unlike most earlier studies, significant increases in capital budgeting sophistication were noted. There was a dramatic increase in the extent to which firms formally analyse project risk, that is from 26 percent in 1975 to 86 percent in 1986. The most popular risk analysis technique approach involves testing the sensitivity of critical investment inputs and underlying economic assumptions. A strong movement towards the application of probability analysis is also witnessed, most notably by the larger firms surveyed. The capital investment evaluation techniques employed by responding companies between 1975 and 1986 shows that DFC techniques have greatly increased in usage from 58 percent to 84 percent.

Pike and Sharp (1989) investigated trends in the use of management science techniques for capital investment decisions based on three surveys conducted on the same 100 large UK firms between 1975 and 1986. The survey was conducted at two points in time. In 1980-81 a survey was conducted on the 208 largest UK companies. Respondents were requested to indicate current practices and those in use five years earlier. During 1986 the same survey was distributed to the firms

participating in the 1980-81 survey. The management science techniques asked in this survey consist of DFC methods, sensitivity analysis, probability analysis, computer simulation, beta analysis, decision theory, mathematical programming and critical path analysis. The research findings show that DFC methods have greatly increased in popularity since 1975, the NPV method more than doubling in usage over that period. The most commonly found method for assessing risk is sensitivity analysis. This method was used by 28 percent of responding firms in 1975 and grew to 72 percent in 1986. Critical path analysis also continues to grow in popularity, almost one-half of the sample applying it to certain types of capital projects compared to only one-fifth in 1975. It is an interesting point to note that the use of the various management science techniques has been significantly affected by the development of microcomputer-based decision support systems in recent years. Survey result show that 58 percent of responding firms use a computer package or financial modelling system for at least some capital budgeting decisions.

Ho and Pike (1992) studied the impact that probabilistic risk analysis (PRA) techniques may have in the corporate capital budgeting context. Basically there are two risks handling techniques utilised in larger firms. First, simple risk adjustment (SRA) methods based on deterministic estimations and intuitive adjustments to either the underlying cash flows or the evaluation model. Secondly, probabilistic risk analysis (PRA) techniques based on a comprehensive awareness of the risks associated with critical variables and their probabilities. Commonly PRA techniques include basic probability analysis, decision tree analysis, and

Monte Carlo simulation. The previous survey indicated that the use of simple and probabilistic risk handling methods was found in larger US and UK firms [Klammer and Walker (1984), Pike (1988)]. It shows broadly similar usage frequency for the two countries, with increasing use of all the risk analysis techniques, but a predilection for SRA methods. Ho and Pike found on their study that SRA and PRA are used by 83 percent and 30 percent of sample firms respectively, which confirmed the results of earlier studies. They found no evidence that the use of probabilistic risk analysis (PRA) techniques led to a reduction in capital expenditures within firms.

Similar studies to those done in the UK, the survey of capital budgeting practice in the U.S. shows continuing increase in the use of sophisticated capital budgeting techniques. Schall et. al. (1978) surveyed 407 large U.S. firms and 189 responses were achieved with 46.4 percent response rate. The survey result indicated that over 86 percent of the respondents use either IRR or NPV or both. This finding shows the increasing sophistication in capital budgeting techniques pointed out by Klammer (1972) and confirmed by Fremgren (1973). Klammer found only 57 percent of the firms using discounting methods. Risk analysis is also becoming more sophisticated. Schall et al., found that 78 percent of the firms adjust the capital budgeting techniques for risk by shortening the payback period, raising the required rate of return or raising the discount rate. While Klammer reported that 39 percent of the firms were using some specific formal method for dealing with risk, Fremgren reported that 67 percent of the firms considered risk and uncertainty explicitly in the analysis of capital investment proposals.

Kim and Farragher (1981) sampled 200 firms in the 1979 Fortune 1000 and the questionnaire requested information regarding 1975 and 1979 usage of quantitative tools applicable to project evaluation, risk assessment, risk adjustment and of management science techniques. They observed there appears to be a continuing trend towards greater usage of DCF techniques as primary evaluation techniques. Payback is still important, but mainly as a secondary evaluation technique. In the use of quantitative risk assessment, companies do not seem to be as sophisticated as earlier studies indicated. However, whether looking at earlier studies or this study, the degree of sophistication is increasing with sensitivity analysis being the most popular tool. There was not much use of management science techniques.

In an attempt to investigate the trend towards greater use of sophisticated capital budgeting techniques, Klammer and Walker (1984) compare the results of three separate questionnaire surveys conducted in 1970, 1975, and 1980. They noted that the use of discounting techniques has risen while the use of non-discounting techniques has fallen for all project types. For example, the use of discounting as a primary standard for decisions on existing operations has risen from 35 percent in 1965 to 75 percent in 1980; over the same period the use of simple rate of return has fallen from 30 percent to 10 percent. Regarding risk analysis and management science techniques, the number of respondents who indicate their firms have incorporated a specific formal risk analysis method has risen rapidly, from 19 percent in 1960 to 59 percent in 1980. A number of firms use more than one of the risk evaluation techniques. However, sensitivity analysis

is the most widely adopted risk evaluation method. The study also shows the strong trend toward the use of one or more management science techniques. The number of respondents who indicated that their firm used at least one such technique grew from 13 percent in 1960 to 70 percent in 1980. Other than sensitivity analysis, the respondents used linear or non-linear programming, computer simulation, probability theory, decision theory, and critical path analysis.

Patterson (1989) examined the investment decision criteria used by listed New Zealand companies. He sent a questionnaire in 1988 to the Corporate Secretary of all 260 companies traded on the New Zealand Stock Exchange and replies were received from 160 companies. From this study he observed that 63 percent of the responding firms replied that they used quantitative techniques and the methods most frequently used are the two accounting based procedures, accounting rate of return (ARR) and payback period (PBP). However, one or more of the DCF procedures (NPV, IRR and PI) was used at least "sometimes" by 74 percent of the firms. Comparison with McMahon's (1981) Australian companies sample indicates possibly greater use of ARR and PBP by New Zealand firms. More than three-quarter of the responding firms (78%) stated that they attempted to assess project risk. Comparison with McNally's (1979) study of New Zealand firms again provides some indication of increasing analytical sophistication over the past decade, since in the earlier period only 48 percent of respondent firms attempted to assess project risks.

Some studies in the area of capital budgeting attempt to determine whether there is any relationship between the use of sophisticated selection techniques and firm performance [Christy (1966); Klammer (1973); Kim (1975,1982); Pike (1984); Haka et al., (1985); Ho (1992)]. These studies assume that theoretically a firm should perform better if it employs sophisticated techniques than if it uses naive techniques. However, the evidence shows that those research findings have produced mixed result. The surveys result are summarised in Table 1.

Christy (1966) showed that earnings per share trends were not significantly different for companies using different kinds of standards for selecting capital projects. Klammer (1973) sent questionnaire to 369 of the manufacturing firms included on Compustat and 184 firms replied and returned the questionnaires. In testing the association of firm performance and capital budgeting techniques, he used multiple regression analysis. The dependent variable is operating rate of return which is measured by dividing the operating income by the operating assets at year end. The independent variables are capital budgeting techniques and other controlling variables such as size, risk, and capital intensity. His findings support a previous study by Christy (1966) that there was no significant relationship between profit performance and the use of sophisticated capital budgeting techniques, but other controlling variables such as firm size and risk were positively related to performance.

In contrast Kim (1975, 1982) conducted two similar studies that has been done by Klammer. The first study used average earnings per share to measure the firm performance and the second study used operating rate of return.

TABLE 1
SUMMARY OF THE PREVIOUS RESEARCH ON THE RELATIONSHIP
BETWEEN FIRM PERFORMANCE AND CAPITAL BUDGETING
SELECTION TECHNIQUES

Author	Performance Measure	Research Method	Result
Christy (1966)	Earning per share trend	Cross-classified for groups of firms based on earning per share trend with capital budgeting techniques.	No relationship between earnings per share trend and the use of sophisticated capital budgeting techniques.
Klammer (1973)	Operating rate of return	Multiple regression: Independent variables- capital budgeting process, size, risk and capital intensity.	No significant relationship between profit performance and the use of sophisticated capital budgeting techniques, but size and risk were positively related to performance.
Kim (1975)	Average earnings per share	Multiple regression: Independent variables- degree of sophistication of capital budgeting process, size, risk and capital intensity.	Positive relationship between degree of sophistication of the capital budgeting process, and firm performance.
Kim (1982)	Operating rate of return	Multiple regression: Independent variables- degree of sophistication of the capital budgeting process, size, risk, and capital intensity.	Positive relationship between degree of sophistication of the capital budgeting process, firm performance, size and risk.
Pike (1984)	Average operating rate of return	Multiple regression: Independent variables- degree of sophistication in capital budgeting process, size, risk, capital intensity, and industry classification.	Negative relationship between degree of sophistication in capital budgeting process and firm performance. While size, risk and capital intensity are positively associated with performance.
Haka et. al (1985)	Relative market return	Interrupted time-series tests of relative market returns on firms that adopted sophisticated selection techniques versus a control group of firms that employed naive techniques.	There is no long-run effects on relative market returns for firms that adopted sophisticated selection techniques, but there is short-run positive effects.
Ho (1992)	Operating rate of return	Matched-pair interrupted time-series of the earnings performance of firms that adopted probabilistic risk analysis versus a control group of firms that employed simple risk adjustment.	There is no significant changes in relative performance of firms adopting probabilistic risk analysis.

By using a multiple regression model, he regressed the firm performance to the independent variables- degree of sophistication of the capital budgeting process, size, risk, and capital intensity. He discovered there were positive relationships between firm performance and the degree of sophistication of budgeting process, size, and risk.

Pike (1984) argued that previous studies defined capital budgeting somewhat narrowly and measured sophistication in terms of the use or non-use of specific techniques and therefore were unable to establish any clear relationship existing between the capital budgeting practices adopted and firm performance. To overcome this problem, he carried out a similar study, but with capital budgeting viewed in a wider context which refers to the whole system for the rational utilisation of capital resources within a firm. He divided capital budgeting system into procedures and techniques. Procedures cover such areas as planning, administration and control; while techniques are subdivided to include evaluation methods, risk analysis techniques and management science techniques. The survey asked a variety of questions directly related to assessing the extent to which these components of the investment system were employed in 1975 and 1980. The questionnaires were sent to finance directors and controllers in 208 of the largest 300 UK quoted companies during Autumn 1980 and total of 178 responses was received, a response rate of 83.7 percent. The survey results are surprising in that there was significant negative association between the level of capital budgeting sophistication and firm performance, but size, risk, and capital intensity were positively associated with firm performance. This finding supports Klammer

(1973) which observed in his study that 'the more sophisticated techniques generally have negative signs'.

Haka, Gordon, and Pinches (1985) criticised the previous studies, claiming they suffered from numerous theoretical, statistical, and data collection problems. They observed previous studies have depended on mailed questionnaires which have several limitations. Further, the studies relied primarily on cross-sectional designs. A pure cross-sectional design cannot control for many firm-specific factors. To overcome these problems, they conducted interrupted time-series tests of relative market returns on firms that adopted sophisticated techniques versus a control group of firms employing naive methods by controlling for the differences in systematic risk, industry effects, and size. The study results show that the adoption of sophisticated capital budgeting selection techniques have no long-run effects on firm relative market returns, but there was short-run positive effect on firm relative market returns.

Ho (1992) studied the impact of using risk analysis in capital budgeting on firms earning performance. He used similar experimental design to that adopted by Haka et al., (1985) that, matched-pair interrupted time-series analysis. He argued that previous studies did not consider the risk aspect and except Haka et al. (1985), those studies also failed to control extraneous variables that could have influenced the performance. By comparing the earnings performance of firms that adopted probabilistic risk analysis versus a control group of firms that employed simple risk adjustment techniques, results of matched-pair interrupted time-series

analysis indicate that firms adopting probabilistic risk analysis experienced no significant changes in relative performance.

Quantitative Techniques

A number of surveys of practice have been published concerning the extent of use of quantitative techniques or operations research models, some from a management accounting perspective and some from an operations research perspective. The term "quantitative techniques" encompasses a wide variety of mathematically and statistically oriented methods that are useful in business applications. The term generally includes some or all the following: linear programming, sensitivity analysis, inventory models, simulation, game theory, regression analysis, queuing theory, network analysis, statistical analysis, correlation analysis, factor analysis, analysis of variance, discriminant analysis, canonical analysis, statistical sampling, and heuristic programming.

Gaither (1975) points out that formal operations research studies were first conducted by the British for military applications in World War II. After the war, many operations research team members left military service and went back to universities and private industry. During this time, the experience gained in the military was transferred to the business and university environments. The technological development of the 1950s and 1960s served to facilitate the expansion of the use of the quantitative techniques. Along with this expansion came a growing body of literature related to the techniques in general and to the use of specific techniques in connection with applications in business and industry. A number of surveys in many different countries have been conducted over the

past two decades concerning the extent of their usage in practice. The surveys are summarised in Table 2.

Vatter (1967) surveyed the extent and nature of the use of operations research techniques in American companies. He discovered that 40 percent of the companies surveyed locate the formal operations research activities under accounting department responsibility. The degree to which operations research techniques were used by companies shows that critical path scheduling received the highest rank. Statistical sampling and inventory models received slightly more emphasis than regression analysis and linear programming. Factor analysis received the lowest rank. An industry break-down of techniques used indicates that the most consistent and thorough use of operations research techniques were in the "scientific" group of industries such as drugs, chemical and petroleum, electronic and aerospace companies.

Lonnstedt (1973) studied 12 companies listed on the Stockholm Stock Exchange known to be using operations research. The desired information was obtained partly from the operational researchers and partly from the users. An examination of the problem areas where operations research was used indicates that co-ordination problems are most common (37%) among the 107 projects studied. Production problems are responsible for 22 percent and inventory problems for 19 percent of the total number of solution proposal investigated. The most widely used operations research techniques to solve the problem was network planning (37%). This was followed by simulation technique (27%), linear programming (16%) and other techniques (20%).

TABLE 2
SUMMARY OF SURVEYS CONDUCTED ON THE EXTENT OF USAGE
OF OPERATIONS RESEARCH TECHNIQUES

Author	Sample Selection	Major Findings
Vatter (1967)	Member of the Financial Executives Institute	Frequently used techniques being critical path scheduling, statistical sampling and inventory models, regression analysis and linear programming.
Lonnstedt (1973)	12 companies listed on the Stockholm Stock Exchange	Among the 107 operation research projects studied, network planning (37%), simulation (27%), linear programming (16%), and inventory theory were the most widely used techniques.
Gaither (1975)	Manufacturing firms in the Midwest USA	More than one-half of the using firms used the first five ranked techniques: PERT, CPM, linear programming, exponential smoothing and regression analysis, and computer simulation.
Green, Newsom and Jones (1977)	Vice Presidents for production, Fortune 500	The results show a pessimistic view concerning the extent of usage. Frequent and extensive used techniques by 25% respondents were network analysis, inventory models and linear programming.
Kiani-Aslani (1977-1978)	Controllers of Fortune 500	Ninety six percent of the respondents used the quantitative methods taught in management accounting course. The techniques were used primarily for operation management.
Thomas & DaCosta (1979)	400 large private corporations	The most frequently used techniques were statistical analysis (93%), simulation (84%), linear programming (79%), and PERT/CPM (70%).
Forgionne (1983)	500 corporate executives from the 1500 largest US corporations listed in the EIS Directory	Statistical analysis, simulation, PERT/CPM and linear programming were used fairly extensively. The most popular areas of application were project planning and inventory analysis.
Kwong (1986)	Malaysian and Singaporean organisations listed in the Asian Computer Yearbook 1981-82	The Malaysian survey shows computer simulation was the most frequently used technique and followed by regression analysis, financial forecasting, PERT'/CPM, and time series analysis. The functional area using the greatest number of techniques were planning, accounting/finance and marketing. The Singaporean survey shows financial forecasting was the most frequently used techniques and followed by sales forecasting, inventory models, computer simulation and cost benefit analysis. The area using greatest number of techniques were planning, production and accounting, finance.

Gaither (1975) sampled 500 US companies in an attempt to explore the extent of usage of operations research techniques, the types of problems to which they were applied, and the nature of the problems encountered in their use. The survey resulted in a 55 percent response rate (275 companies). Only 48.4 percent of the respondent companies (133 companies) used one or more operation research techniques. Over two-thirds of those companies used PERT and critical path method, and over one-half used linear programming, exponential smoothing and regression analysis, and computer simulation. The primary areas of use were in production planning and control, project planning and control, and inventory analysis and control. The major problem encountered in using operations research techniques primarily was production personnel are inadequately trained.

Green, Newsom and Jones (1977) focused their study on the extent of usage of quantitative techniques in production/operations management in large US corporations. They sampled vice-presidents of production in the Fortune 500 companies included in the 1973 listing. The result of the study shows a pessimistic view concerning the extent of usage since nine out of 19 techniques asked were not being used at all by 60 percent or more of the responding companies. Only seven of the 19 techniques were of frequent use or extensive use by 25 percent of the respondents. The techniques such as network analysis, inventory models and linear programming were considered to have high applicability to production/operation management. Time series analysis, regression and correlation

analysis, analysis of variance, and statistical sampling were used for specialised applicability to production /operations management.

Kiani-Aslani (1977-1978) attempted to demonstrate that US accountants generally use the quantitative techniques set out in textbooks. He found that 96 percent of company accountants in his sample of US companies taken from Fortune 500 used the quantitative methods taught in the management accounting course. Some of the techniques were used primarily for operations management, rather than in accounting applications. He also found that usage was positively correlated with the size of the company and education level of the accountant.

Thomas and DaCosta (1979) investigated the utilisation of operations research in the contemporary large US corporations. They sampled 420 companies consisting of industrial corporations, banks, financial institutions and the largest saving and loan organisations. A total 150 companies returned the questionnaires for a response rate 36 percent. Their findings indicate that 93 percent of the respondents use statistical analysis, 84 percent use simulation, 79 percent use linear programming, and 70 percent use PERT/CPM. Forecasting, production scheduling, and inventory control are the most frequent areas of application.

Forgionne (1983) conducted a similar study which identifies the extent of usage and areas of application of operations research in large American corporations. He surveyed 500 corporate executives from the 1500 largest American companies listed in the EIS Directory. His findings show that Statistical analysis, simulation, PERT/CPM and linear programming were used fairly extensively by the respondents. The most popular areas of application, in order,

were project planning and inventory analysis. The major benefits from implementing operations research techniques were generation of useful data which accounts for 82.3 percent of respondents, helping to define the problem 74.2 percent, identify relevant policies 61.3 percent, and provides a useful test laboratory 51.6 percent. This study also indicates that inadequate data and the completion time required for operations research projects appear to be important implementation problems.

Unlike previous studies which focused their study in developed countries, Kwong (1986) examined various aspects of the use of computer-based operations research in organisations in Malaysia and Singapore. He surveyed 106 organisations in Singapore and 212 organisations in Malaysia which were listed in the Asian Computer Yearbook 1981/1982 as using computers. The Malaysian survey found that 55 out of the 198 responding organisations were using some form of operations research technique. The most prolific users were the petroleum and energy sector. The degree of use of operations research techniques indicates that computer simulation was the most frequently used technique, adopted by nearly half of the user organisations. This was followed by regression analysis (25 users), financial forecasting (25 users), PERT/CPM (18 users) and time series analysis (18 users). Inventory models, linear programming and transportation models were used in about a quarter of the user organisations. The functional areas using the greatest number of operations research techniques was planning, followed by accounting/finance and marketing.

The Singapore survey found that only a quarter of the responding organisations were using at least one operations research technique, with government departments and petroleum companies being the most prolific user sectors. The degree of usage technique shows that financial forecasting was the most frequently used technique, adopted by nearly half of the users. This was followed by sales forecasting (11 users), inventory models, computer simulation and cost benefit analysis, each which had nine users. Linear programming and transportation models were used by only three and one of the users respectively. The functional areas using the greatest number of techniques was planning, followed by production and accounting/finance.

Other Management Accounting Techniques

A comprehensive search of the literature survey on the application of various management accounting techniques other than capital budgeting and quantitative techniques reveals that some studies have been conducted to investigate the extent to which these techniques are being used in practice.

Chiu (1973) conducted his research in Taiwan as a doctoral dissertation. He examined the relationship between the personal attributes of the controller and the usage or non-usage of nine selected management accounting techniques. His findings show that the traditional management accounting techniques such as operating budgeting, capital budgeting, cost-volume-profit analysis and standard costing had been widely accepted and applied in Taiwanese medium and large manufacturing firms. The extent of use of responsibility accounting techniques was reported to be low.

In the area of budgeting control systems, three studies have been conducted by Imhoff (1978), Lyall, Okoh and Puxty (1990), and Ntow (1991). Imhoff sampled 105 publicly-traded companies included in NYSE and AMEX. A total 53 responses were received from the 102 deliverable questionnaires with a response rate of 52 percent. He discovered that 74 percent of the firms responding used budgets as a significant factor in the evaluation of an individual manager's performance. Eighty-one percent of those firms which use the budget as a performance measure used flexible budgets. In addition most firms which did not use budget for performance evaluation used flexible budget. It seems that the flexible budget techniques is used frequently and independently of whether or not the budget is used to evaluate the performance of managers. Imhoff also found that a standard cost system was frequently used in the development of the budget. Of the 53 firms surveyed, 32 had standard cost systems and 31 of those used the standard cost as a basis for budgeting.

Lyall et al., (1990) directed their studies toward assessing the extent to which manufacturing change had affected traditional standard costing and budgetary control systems. The study was conducted by sending 2,000 questionnaires to a range of commercial and industrial organisation, from which 423 usable replies, covering a wide cross-section of UK companies, were received. The study observed that 76 percent of respondent companies used standard costing, while 94 percent operated budgetary control systems. All of the companies interviewed used budgets for control purposes and there was a noticeable similarity in the length of their budget periods. All used one year with

some companies updating after six months. In responding to the change in production technology, companies have responded by adapting their existing standard costing systems rather than abandoning the systems altogether. Reported changes in production technology had generally taken the form of replacing labour with machines. This had switched the emphasis from labour variances to overhead variances.

Ntow's study (1991) was primarily concerned with a comparison of budgetary control systems in American and Japanese manufacturing firms. He examined and compared some variables considered important in budgetary preparation and performance evaluation. Those variables were budgetary goals, budget attributes or type of budgets prepared, forecasting methods, and performance evaluation. His finding indicates that most of the firms used types of budgets such as static budgets, flexible budgets, standard budgets, contingency budgets, and simulated budgets. In term of budget attributes, the study tries to test a hypothesis whether there are significant differences in the budgetary attributes of American and Japanese manufacturing firms. The result indicated that the differences in the preferences of each group of managers for each budget type were not significant in four out of five types. There is a significant difference in the preference for simulated budgets. The results suggest that while Japanese managers prefer the use of simulated budgets, American managers prefer the use of flexible budgets. In preparing their budgets, Japanese managers prefer the use of sophisticated quantitative models such as decision trees, linear programming and time series (especially sales, cash, capital and master budgets), while their

American counterparts rely on estimates based on historical data and intuition (such as production budgets).

Beside Ntow's study, there are two other studies which attempt to investigate the Japanese management accounting practice. Shield, Chow, Kato and Nakagawa (1991) conducted a comparative survey of management accounting practices in the U.S. and Japan. The survey covered topic such as cost accounting system design, short-term decision making, and management control. In the area of cost accounting systems, several differences between the Japanese and U.S. firms are apparent. Compared to U.S. firms, Japanese firms use more direct material and less manufacturing overhead resource. There is about the same use of direct costing and full costing in both countries, though the Japanese firms report more frequent use of process costing to accumulate product cost. In the two countries, cost-volume-profit analysis is widely use as a short-term decision making technique. For operational control, U.S. firms more often use standard costs while Japanese firms more frequently use actual costs. In both countries the primary purpose of using standard costs is similar, for control and pricing policy. In setting transfer prices Japanese firms rely more on cost plus and actual full cost while U.S. firms more frequently use negotiation and reference to market prices.

Yoshikawa, Innes and Mitchel (1989) conducted a similar study comparing management accounting practices of companies based in Japan and Scotland. The study sampled 200 Scottish companies and 500 Japanese companies. The research findings show that Japanese companies rated the preparation of financial statements as the most important purpose of cost accounting while Scottish

companies rank cost control and cost reduction as primary purpose of cost accounting. This finding is very interesting since Johnson and Kaplan (1987) and others have criticised Western management accountants for being too concerned with producing information for the preparation of financial statements. In the area of budgeting and standard costing the results once again indicate that standard costing was primarily used for the preparation of financial statements rather than for cost control in Japan. It is also significant that cost reduction ranks highly in the Japanese use of standard costs. Japanese companies lack comprehensive approach in the budgeting process. The concept of the master budget is absent in over 50 percent of the Japanese companies. Furthermore, Japanese companies produced less detailed budgets, typically segmenting on a six-month basis. Variable or direct costing was not popular with the Japanese companies, with only 31% using this type of information. In contrast, 48 percent of the Scottish respondents claimed to use it.

The 1980s have witnessed a revolution in manufacturing practices and an increased emphasis on quality. Companies have recently faced intense global competition, advanced technologies, and enhanced consumer expectations. These environments have a significant influence on management accounting practice. Manufacturing firms have moved to adopt new philosophies and techniques, including just-in-time (JIT), total quality control (TQC), flexible manufacturing system (FMS), computer integrated manufacturing (CIM), and optimized production technologies (OPT). Many surveys have been done to investigate the

impact of these changes in manufacturing process to the management accounting practice.

Green and Amenkhienan (1992) explored the accounting innovations that U.S. manufacturing firms were adopting to compete in the new marketplace. To do this, they sampled 610 manufacturing firms believed to be involved in advanced manufacturing technologies. The results show that firms largely continue to rely on outmoded accounting methods. However respondents generally acknowledge the need to update existing systems for product costing in the light of new competitive challenges. Some changes reported include installation of material requirements planning II (MRP II) systems, use activity based costing (ABC) methods, activity driver accounting. It is particularly interesting to note that 45 percent of the respondents reported having adopted activity based costing (at least to some degree) in their plants.

Cohen and Paquette (1991) conducted a similar survey to the Green's study. They sampled 500 plant and divisional controllers randomly selected from a database provided by National Association of Accountants (NAA). They found that controllers still considered traditional accounting methods useful even if their companies have implemented advanced manufacturing techniques. This survey result supports Green's findings. The survey shows that 67 percent of the respondents indicated that standard costing was the most widely used cost system in their companies. The respondents continue to use some form of direct labour for allocating overhead. It is indicated 62 percent of the companies surveyed use either direct labour hours or direct labour dollars as the primary basis for

allocating overhead. Even though traditional accounting methods continued to be used, 26 percent of the companies surveyed employed just-in-time inventory systems. This figure leads to a conclusion that there has been a relatively large shift by U.S. companies to JIT which represents a change in manufacturing processes.

Murphy and Braund (1990) undertook a survey which was designed to gain an impression of the views of UK management accountants regarding the effects of new/advanced technology on management accounting. To do this they sampled 263 members of Chartered Institute of Management Accountant (CIMA), working in a broad cross-section of industry where new technology is used. The survey findings show that five years ago labour based allocation method were being used by 61 percent of respondents and currently they are used by 54 percent of respondents. The other significant trend is the growth in machine hour rate, from 11 percent five years ago, to 16 percent now. These findings support Kaplan's argument (1987) of the inappropriateness of the use of labour based allocation methods in advanced manufacturing environments. The effect of the introduction of "new technology" on the use of management accounting techniques shows just-in-time being used by 62 percent of respondents, followed by strategic management accounting being used by 47 percent of respondents, and activity based costing being used by 26 percent of respondents.

Scarborough, Nanni and Sakurai (1991) observed several important Japanese management accounting practices used in advanced Factory Automation (FA) manufacturing environments. They sampled 492 controllers of companies in four

industries: electronic equipment, transportation equipment, chemical products, and iron and steel manufacturing, listed on the Tokyo, Osaka and Nagoya stock exchanges. Two hundred and twenty-four responses were received with a response rate of 46 percent. The results revealed that Japanese management accounting systems for product costing and inventory evaluation did not employ newer or more innovative methods than western manufacturers used. Instead, the firms surveyed appear to have put their innovating effort into cost analysis for decision making and cost control by use of unique management accounting techniques such as target costing, budget systems, and engineering/performance enhancement methods. Japanese firms in the survey have not done anything radical in their cost accounting system. They do not employ ABC methods; they have not even eliminated direct labour as an overhead allocation basis. Direct labour was still used as an allocation basis by about one-quarter (28%) of the companies surveyed, more than half (55%) of the companies surveyed used both direct labour and machine hours as bases. In the area of cost analysis and planning, Japanese firms still use two traditional management accounting techniques and several new techniques. The traditional areas are investment decision and marginal analysis. The new techniques include target costing, TQC, value engineering (VE), JIT, material requirement planning (MRP/MRP II), and production logistic methods.

RELATIONSHIP BETWEEN MANAGEMENT ACCOUNTING TECHNIQUES AND CHARACTERISTICS OF THE COMPANIES

Management accounting techniques and concepts used in a company are a function of the characteristics of the company and the environment in which the company operates. The classification of companies by its characteristics may reflect underlying differences in technology, financing, planning horizons, products and management structures. These differences may be a catalyst for companies to adopt and use specific management accounting and decision making techniques. The purpose of this section is to examine the relationship between the application of management accounting techniques and the characteristics of the companies.

Organisation Size

The size and development stage of a company will affect the management accounting techniques selected for use. In a small company, a manager or owner may make decisions intuitively, based on informal observation of its operations. As the company grows in size, the manager may find it necessary to develop a budget of the company's operations. If the company grows further in size and complexity, it may become necessary to introduce standard costs in connection with actual cost and to introduce transfer pricing for its profit center. At some point, operations research staff may be added for the purpose of analysing special projects, or alternatively operations research techniques may simply be utilised where appropriate by operations research specialists. It is clear that there should

be a positive association between application of management accounting techniques and the size of companies.

A number of studies have tested the relationship between the use of more sophisticated quantitative evaluation techniques and the size of the company. More and Reichert (1983) analysed the association between 23 financial management techniques and the size of the companies, measured by their total assets. The results indicate that out of the 23 techniques, 11 techniques appear to be directly related to company size. Size related financial techniques include sales forecasting models, cash and inventory management models, statistical credit scoring models, internal rate of return, and all of the forecasting/ operation research techniques such as financial modeling and simulation, optimal transportation modeling, linear programming, goal programming, and PERT. Only two techniques, profit margin analysis and payback period, appear to be inversely related to company size.

In the area of capital budgeting, Schall et al., (1978) found that there is a slight tendency for larger companies to use more sophisticated techniques. Similar findings have been reported by Kim and Farragher (1981) reporting a tendency for larger firms to be slightly more sophisticated. For New Zealand companies McNally and Eng (1980) and Patterson (1989) found a positive association between company size and the use of sophisticated quantitative techniques. By analysing Australian companies Freeman and Hobbes (1991) also discovered that there is a significant correlation between company size and the sophistication of capital budgeting techniques.

In the area of operations research techniques several studies have been conducted to categorise the usage of operations research techniques by company size (measured by revenues or number of employees). The surveys by Vatter (1967), Radnor and Neal (1973), and Gaither (1975) suggest that size and extent of operations research techniques use are positively related. Of firms responding to Vatter's survey, the 30 companies with revenue over \$1 billion reported 100 percent use. In Gaither's survey the five largest firms measured by number of employee (over 5000) reported 100 percent use. In each case, the percentages dropped as firm size decreased (to 52% in Vatter's study and 41% in Gaither's study). Radnor and Neal (1973) found operations research activity in 104 of 108 firms with annual revenue in excess of \$500 million. They concluded that firms with annual revenue less than \$400 million were much less likely to use operations research techniques.

Type of Industry

Industry types and output classification of the companies will affect the selection of management accounting techniques for use within a firm and also the manner in which the techniques are used. This argument is based on the premise that classifying a company into a particular group was a surrogate for identifying more fundamental organisation differences and in turn differences in the need for specific cost and management accounting and decision making techniques. In a similar way, grouping companies into output categories, from a few similar products to many dissimilar products, may reflect different degrees of corporate

complexity and in turn different pressures to adopt specific management accounting techniques.

Fulmer and Rue (1973) examined the planning activities of the three categories of U.S. firms: (1) durables, (2) service, and (3) non-durables, and related the planning efforts to financial success. Firms were classified into four long range planning categories according to the comprehensiveness of their planning process. The results show that there were differences in the percentage of companies using long range planning in the three broad industry groups of durables, non-durables and services. However, no statistical tests of significance were reported. Kim and Farragher (1981) also discovered that firms in "technologically-oriented" industries tend to be more advanced in the use of sophisticated capital budgeting practice.

Moore and Reichert (1983) identified several industry groups including 1) textiles, apparel, and vinyl flooring, 2) metal product fabrication, 3) shipbuilding, railroad, and transportation equipment, and 4) publishing that under utilised modern financial management techniques. The metal product fabrication industry was an infrequent user of working capital techniques, The textiles, apparel and vinyl flooring group plus the shipbuilding, railroads, and transportation equipment industry reported a marked lack of interest in operations research procedures such as PERT, linear programming, and transportation modeling. These industry groups also reported infrequent use of time adjusted capital budgeting techniques. In contrast to the industry groups mentioned above, the respondents in the computer and office equipment industry appear to be leaders in the utilisation of

modern financial techniques. Firms in the aerospace and motor vehicle industries, and pharmaceutical, soap, and cosmetic groups reported above average utilisation rates for a number of important financial techniques.

It is interesting to note that McNally and Eng (1980) found no significant differences between classes of industry or categories of output identified for the usage of any thirteen management accounting techniques. According to McNally and Eng (1980) there were several reasons that may contribute to the absence of statistical differences between industry and output categories for the adoption of specific techniques. First, for a number of techniques included in the survey, the level of usage was either very high or very low, therefore reducing the likelihood of discerning a statistically significant difference. Second, the classification into 'use' and 'non-use' of a technique was too simplistic. Therefore, a measure of intensity of use may be required to identify a difference related to industry and output grouping. Third, the industry grouping used may be too broad, and the output grouping too ill-defined.

The use of operations research techniques by industry group was also reported in the previous surveys. Gaither's study (1975) of manufacturing firms shows highest use in the group containing paper, primary metals, chemicals, and petroleum. This finding is consistent with Vatter's study (1967) that the most consistent users of operations research techniques were in the chemical, petroleum, drug, electronic, and aerospace industry. None of the surveys that reported the percentage of responding firms that were service organisations

provide any conclusive evidence of differences between service and manufacturing firms in operations research use.

Firm Capital Intensity and Risk

Another company characteristic which may influence a firm's choice of management accounting techniques are capital intensity and risk of a firm. A more capital intensive and riskier firm may be more likely to adopt the more sophisticated techniques. In their study of capital budgeting practice, Kim and Farragher (1981) concluded that larger capital intensive firms are more likely to employ sophisticated capital budgeting practices than smaller low capital intensity firms. In terms of risk, measured by the coefficient of variation of the rate of return on assets, the data fail to show a clear-cut relationship between risk and capital budgeting practice. Lower-risk companies appear to make greater use of sophisticated techniques than higher-risk companies. In the area of management science techniques, which includes decision theory, PERT, linear programming, and goal programming, the results indicate that lower-risk companies used management science techniques more than higher-risk companies. This leads to the speculation that management science techniques may be helpful in reducing the overall riskiness of the company.

Kim and Farragher's findings (1981) is consistent with Radnor and Neal's study (1970) and Petry's study (1975). Radnor and Neal detected that capital intensive industries tended to utilise operations research techniques to a greater extent than labour intensive industries. Petry (1975) surveyed the use of multiple measures of project worth. He found that capital intensive industries typically used

several alternative methods to measure project worth, even though his research found no evidence that individual analytical techniques were being used more or less frequently by either capital or labour intensive industries.

RELATIONSHIP BETWEEN MANAGEMENT ACCOUNTING TECHNIQUES, COMPANIES' CHARACTERISTICS AND COMPANIES' PERFORMANCE

To determine what factors influence the level of firms performance is not simple. The problem is extremely complex because a large number of influences on performance are at work. Some of these factors are quantifiable and others are unquantifiable; some are external to the firm others are internal and managerial. This section tries to observe some variables which may influence firm performance and to examine some empirical surveys that have been undertaken regarding this issue.

There are many different theoretical propositions on the determinants of firm performance. According to Child (1974) most of these can be categorised under two approaches: universalistic and contingency approach. Both universalistic and contingency perspectives assume that it is possible to identify certain factors which will in some degree determine levels of firm performance. The universalistic theory argues that the presence of certain attributes will, of itself, be conducive to superior performance in most, if not all, circumstances, while contingency theory contains the proposition that the attributes favourable to

higher performance will alter according to the circumstances under which a company is operating.

Contingency theories first became prominent as a means of explaining variations in organisation structure. Contingency theory postulates that the effectiveness of the organisation in coping with the demands of its environment is contingent upon the elements of its various subsystems...being designed in accordance with the demands of the environment with which they interact (Burrell and Morgan, 1979). A survey of the literature reveals that organisation design is contingent on environmental uncertainty (Burns and Stalker, 1961; Duncan, 1972; Lawrence and Lorsch, 1967; Thompson, 1967), technology (Woodward, 1965; Perrow, 1967), and organisation size (Blau and Schoenherr, 1971; Child, 1974). Several authors have used a contingency perspective in designing management accounting systems (Gordon and Miller, 1976; Hayes, 1977; Waterhouse and Tiessen, 1978) and others also employed this perspective to understand the differences in corporate financial reporting system (Thomas, 1986, 1991), and to explain the determinants of performance in companies (Child, 1974; Hill, 1988; Weiner and Mahoney, 1981; Hamilton and Shergill, 1989, 1992; Datta, Rajagopalan and Rasheed, 1991; Covin, Prescott and Slevin, 1990).

The Contingent Variables and Their Relationship with Firms Performance

The contingency theories of management accounting identify a number of different types of variables. Gordon and Miller (1976) provide a framework comprising: (a) environment; (b) organisation; and (c) decision-making style. Similarly Hayes (1977) cites three major contingencies, which consist of: (a)

environmental; (b) interdependence; and (c) internal. Waterhouse and Tiessen (1978) develop a model based on two contextual variables technology and environment. Thomas (1986, 1992) in studying the contingency theory of corporate reporting postulated that there are four variables that may affect corporate financial reporting system, which consist of: (1) societal variables; (2) the environment of the enterprise; (3) organisational characteristics; and (4) user characteristics and other sources of information. Studies on the contingency theories of firm performance also indicated a number of different classes of variables. Child (1974) found that environment, organisation and technology influence company performance. Several authors discovered that organisation structure, control type and strategy also affect company performance (Hill, 1988; Hamilton and Shergill, 1989, 1992; Data, Rajagopalan and Rasheed, 1991). Based on the literature described above it can be postulated that there are two types of contingent variables that may influence firms performance, namely (1) the environment of the firm; (2) characteristics of the firm. The interrelationship between the two variables and their effect on the application of management accounting techniques and firm performance can be depicted in Figure 1.

The Environment of The Firm

The environment of the firms is conceptualised in a manner consistent with Duncan (1972) that is in terms of perceived uncertainty. It is characterised as having at least two dimensions, a stable-dynamic dimension and a homogeneous-heterogeneous dimension. The static-dynamic dimension is defined as the extent to which factors are subject to change over time. It is an important contributor to uncertainty in decision making. Whereas the homogenous-heterogenous dimension

can be defined in terms of the degree to which the factors in the decision unit's internal and external environment are few in number and similar to one another. It has therefore been suggested that factors in the organisation's environment might be mapped on a certainty continuum ranging from highly predictable to highly unpredictable.

The effect of the environment on management accounting design is well documented in the literature. Piper (1978) demonstrates that the complexity of the task faced by an organisation is relevant to defining an appropriate financial control structure. Daft and MacIntosh (1978) identify task variety and task knowledge as factors which affect the design of an appropriate management information system. Studies conducted by Hopwood (1972) and Otley (1978) also show that the structure of the organisation affects the manner in which budgetary information is best used.

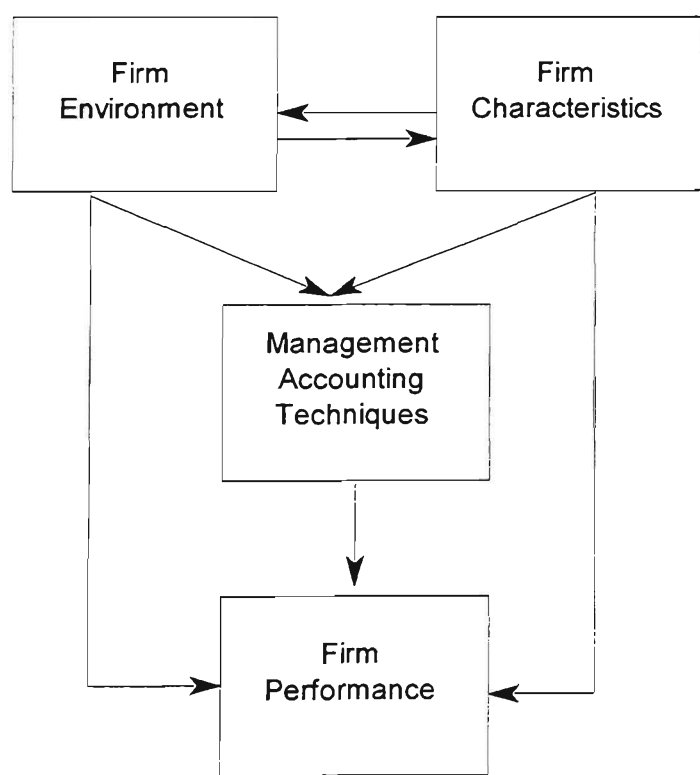


Figure 1.
The Relationship between Management Accounting Techniques, Firm Characteristics and Firm Performance

Kwandwalla (1972) examined the effect that type of competition faced by a firm had on its use of management controls and concluded that the sophistication of accounting and control system was influenced by the intensity of the competition faced.

In addition to empirically based work there has also been theoretical speculation as to the nature of a contingency theory of accounting information system. Gordon and Miller (1976) suggested that environment, organisational characteristic and decision making style were the main contingent variables for the design of accounting information systems. Waterhouse and Tiessen (1978) proposed a much simpler framework to identify control requirements of various organisational types and their management accounting systems implications. Two main types of contingent variables are suggested: environment and technology.

There is considerable research which suggests that environment influences company performance. Lieberman and O'Connor (1972) found that environment which was represented by year and industry, influence organisational performance. Weiner and Mahoney (1981) also detected that environmental variables- GNP, industry sales, industry competition- affect companies performance even though the relationships were not as strong as originally expected. Research on the corporate diversification strategy shows that degree of diversification affects firm performance. Many of these studies have been based on firms diversifying through mergers and becoming so-called conglomerate firms. Based on accounting measures of profitability, Reid (1968), Prosper and Smith

(1971), Holzmann, Coperland, and Hayya (1975) found conglomerates to be less profitable than non conglomerates. Melicher and Rush (1973), however, found no difference in the performance of conglomerates and specialised firms in the basic industries abandoned by the conglomerates. Study in Australia by McDougall and Round (1984) also found that there was no significant difference in profitability between diversifying and non-diversifying firms. Belkaoui and Pavlik (1992) found that both profit and market capitalisation are be positively related to related and unrelated diversification. However, the positive relationship is higher with related as opposed to unrelated diversification, when assets are used as a control variable. In term of organisation structure, Hamilton and Shergill (1989, 1992) detected that companies which have adopted the multidivisional (M-form) structure do outperform other companies in terms of both growth and profitability.

The Characteristics of The Firm

Firm characteristics such as size, capital intensity, risk, leverage, and industry concentration have been discussed as important determinants of organisation performance. Firm size reflect the resources available to the organisation. The amount of economic activity the firm can engage in is directly influenced by corporate size. In addition, the ability to exploit the environment is a function of the amount of resources a corporation has. Therefore firm size is expected to be positively associated with performance. The argument is that larger firms can take advantage of economies of scale enabling more efficient production and thereby increasing the profitability. Moreover, larger firms have greater production capacity and should be able to generate greater sales; higher sales and

greater efficiency should both contribute to a strong positive relationship between profit and size.

There have been several studies of the relationship between size and financial performance. Hall and Weiss (1967) and Marcus (1969) found positive relationship between size and performance. Montgomery (1979) also argues that it is the significance of economies of scale which leads to better performance in the larger firms. However, these findings are in conflict with those produced by Whittington (1971) and Child (1974) in their studies of UK firms. Child (1974) reports no relationship at all between size and performance, and both Whittington and Child reveal that there are differences in technology and cost performance among industries that directly influence performance. Empirical research on the relationship between firm performance and capital budgeting selection techniques also found that firm size is positively associated with performance (Klammer, 1973; Kim, 1982; and Pike, 1984).

Capital intensity can be interpreted as equivalent to what contingency theories refer to as technology. Technology determines the manner in which an organisation transform inputs to outputs. One important aspect of technology that influences organisational productivity is the level of mechanisation. A highly mechanised technology means greater fixed investment in capital. Investments in capital assets per employee are expected to result in more efficient utilisation of inputs to outputs and thus reduced costs. The net effect should be to increase profit and profitability. Pike's study (1984) shows that capital intensity was positively

associated with performance. Similarly Weiner and Mahoney (1981) found that technology was highly associated with the rate of return.

Studies on the influence of risk on performance have yielded conflicting results. Armour and Teece (1978) reported a negative relationship between return on equity and the variance in return on equity. Bowman (1984) also found negative association between risk and returns. In their research, Fiegenbaum and Thomas (1986) found no association between the systematic risk of a firm's stock returns - commonly known as beta - and returns measured using accounting data. In contrast, Fiegenbaum and Thomas (1988), and Jegers (1991) found positive association between variance in returns and average returns for firms whose return were above the median in their industry and negative association for below-median performers. In their study of capital budgeting techniques, Klammer (1973), Kim (1982), and Pike (1984) reported that there was positive relationship between risk and firm performance.

The firms financial leverage also has an impact on the firm performance. Firm leverage represents the proportion of financing obtained via debt relative to equity financing (issuing stock). A firm's debt-to-equity ratio affects a company's ability to borrow and the cost of borrowing. Profit is expected to be negatively associated with capital structure strategy because increasing debt creates a fixed financial obligation, interest. Grant and Jammie (1988) reported high leverage to be associated with low profitability. Weiner and Mahoney's (1981) study also found that capital structure strategy was inversely related to both profitability and stock prices.

The effect of firm characteristics on the application of management accounting techniques have been discussed in detail in the previous section. A number of studies have discovered that firm size is directly related to the application of management accounting techniques (More and Reichert, 1983; Kim and Farragher, 1981; McNally and Eng, 1980; Patterson, 1989; and Freeman and Hobbes, 1991). Capital intensity and risk also have been reported to be directly associated with the application of management accounting techniques (Neal, 1970; Petry, 1975; Kim and Farragher, 1981).

The effect of the application of management accounting techniques on firm performance has been reported in the previous studies. A number of studies have been undertaken to relate long range planning with performance. Fulmer and Rue (1973), for example, examined the planning activities of three categories of U.S. firms: (1) durables, (2) services, and (3) non-durables, and related the planning effort to financial success. The results indicate that in the durable good industry formal long range planners outperformed non-planners. However, in the service industry group the opposite relationship was observed, the non-planners performed better than the sophisticated planners. Ronald Kudla (1980) surveyed the Fortune 500 companies and classified respondents into three long range planning groups. He hypothesised that a firm engaged in sophisticated planning efforts would earn above average returns for its shareholders, while unsophisticated planning firms would not. He did not find any statistically significant differences in the returns of the planning and the non-planning firms. Two studies have been undertaken which specifically focus on the banking industry. Woods and LaForge (1979) studied 92

banks which were classified three categories according to the completeness and sophistication of their long range planning activities. The results indicate that U.S. commercial banks which engaged in comprehensive long range planning outperformed the less comprehensive planners. Sapp and Seiler's (1981) study of 302 U.S. commercial banks also found that long range planning efforts were significantly related to three measures of financial performance: deposit growth rate, loan yield, and capital to risk asset ratio.

In the area of capital budgeting, a number of studies have been undertaken in the past to relate the capital budgeting selection techniques with performance, but the results have not been consistent. Kim (1975, 1982) found positive relationship between degree of sophistication of the budgeting process and firm performance. In contrast, other studies conducted by Klammer (1973), Pike (1984), Haka et al. (1985), and Ho (1992) found negative relationship between the adoption of sophisticated selection techniques and firm performance. Instead of studying specific techniques such as long range planning and capital budgeting techniques, McNally and Eng (1980) and also Moore and Reichert (1989) attempted to investigate the relationship between various techniques and firm performance. McNally and Eng (1980) studied the relationship between the usage of thirteen cost and management accounting techniques and five financial performance measures. Significant differences between the mean scores for 'users' and 'non-users' were observed on at least one financial performance measure for eight of the thirteen cost and management accounting techniques being studied. This study also identified three techniques for which the 'users' and 'non-users'

consistently had statistically different score for variety of financial measures. These are budget report, capital expenditure decision making, and long range planning. Moore and Reichert (1989) also studied the association between nine analytical techniques and firm performance which is measured by its return on investment (ROI). They found that the firm's use of personal computer and financial leverage were highly correlated with performance, while their use of security portfolio models, internal rate of return capital budgeting techniques, and inventory models had only marginal influence on performance.

Summary

The first part of this chapter provides the result of empirical research findings of the application of management accounting techniques in practice. In the area of capital budgeting, previous research has suggested that the usage of sophisticated investment procedures has increased over time. The sophistication includes discounted cash flows (DCF), risk adjusted discount rate, sensitivity and probability analysis. Some studies also attempt to determine whether there is any relationship between the use of sophisticated selection technique and firm performance. The evidence shows that the research findings have produced mixed result. Christy (1966) and Klammer (1973) found that there is no relationship between firm performance and the use of sophisticated capital budgeting techniques. In contrast Kim (1975, 1982) found that there is a positive relationship between degree of sophistication of the capital budgeting process and firm performance. In the area of operations research techniques, previous studies observed that critical path scheduling, linear programming and inventory models

were widely accepted in practice. Chiu (1973) found that traditional management accounting techniques such as operating budget, capital budgeting, cost-volume-profit analysis and standard costing were widely accepted in Taiwanese medium and large manufacturing firms.

The second part of this chapter presents the empirical findings concerning the relationship between firm characteristics and application of management accounting techniques. A number of studies have tested the relationship between the use of management accounting techniques and the size of the firm. In the area of capital budgeting Schall (1978) and Kim and Farragher (1981) found that there is tendency for larger firms to use more sophisticated techniques. For New Zealand firms, MacNally and Eng (1980) and also Patterson (1989) found positive association between firm size and the use of sophisticated techniques. Freeman and Hobbes (1991) also found a significant correlation between firm size and the sophistication of capital budgeting techniques in the Australian firms. In the area of operations research techniques, surveys by Vatter (1967), Radnor and Neal (1973), and Gaither (1975) found that size and extent of operations research techniques use are positively related. Other than size, capital intensity and risk are reported to be related with the firm's choice of management accounting techniques. Kim and Farragher (1981) observed that larger capital intensive firms are more likely to employ sophisticated capital budgeting practice than smaller low capital intensive firms. In term of risk, they found that lower risk firms appear to make greater use of sophisticated techniques than higher risk firms. Kim and Farragher' findings (1981) is consistent with Radnor and Neal's study (1970).

Radnor and Neal detected that capital intensive industries tended to utilise operations research techniques to a greater extent than labour intensive industries.

The last part of this chapter investigates the selected empirical studies on the contingency theory of management accounting for developing a model of this study. From the study of literature, there are two types of contingent variables that may influence firm performance and the application of management accounting techniques. Those variables are firm environment and firm characteristics. The effect of the environment on management accounting design is reported by Piper (1978), Daft and MacIntosh (1978), Hopwood (1972), and Otley (1978). There is also considerable research which suggest that environment influences company performance. Previous research also has been discussed that firm characteristics is important determinants of organisation performance. The purpose of the review of literature was to provide background for the research design and analysis of research findings of this study.

CHAPTER III

METHODOLOGY AND RESEARCH DESIGN

In this chapter the research methodology employed to achieve the objectives of the study is presented. First, a description of the study is given, then operational measures of the variables and population, sampling frame and data collection method are discussed. Second, hypotheses for the study are formulated and statistical tests employed in this study examined.

Description of the Study

This study was designed to determine the relationship between certain contextual variables of firm characteristics and the application of advanced management accounting techniques. It also explores how firm performance is affected by contextual variables and the application of advanced management accounting techniques. The two primary study objectives were 1) determination of positive relationship between the application of advanced management accounting techniques and the company's performance and 2) analysis of the effect of contextual variables of firm characteristics size, age, type of industry, capital intensity, risk, leverage and type of ownership on the application of advanced management accounting techniques. A secondary objective of the study was to provide information on the nature of advanced management accounting techniques employed by Australian public listed companies.

Definition and Operational Measure of the Variables

Dependent variable

Previous studies that have considered organisational performance can be classified into two groups. The first group measures performance based on subjective criteria (Hayes, 1977; Merchant, 1981; Kenis, 1979 and Govindarajan, 1984). The subjective approach requires that the subjects, their peers or superiors make a subjective rating on a single or group of performance measure. The second group measures performance based on objective criteria which rely on standard financial measures and ratio such as earning per share, return on investment, and growth in sales (Child, 1974; Haka, 1987; Mak, 1989; Moores and Duncan, 1989).

Moores and Stuart (1985) noted that subjective measures of performance have the advantage that they can be applied to all types of organisations. However, they suffer from serious problems of validity and reliability. Objective measures also suffer from the same limitation, but when dealing with commercial organisation they can be replicated, unobtrusively obtained, and have been shown to correlate with subjective measures. Therefore, in the absence of a reliable and valid set of measures based on sound organisational theories, objective measures will provide the most acceptable approximation of performance measures.

Based on this argument, this study uses an adjusted operating rate of return for measuring company performance. The rate of return is calculated by dividing the operating income by the operating assets at year end. To be comparable for each company, operating income must be adjusted by the differences in the

application of accounting principles and procedures, and the differences in the method of financing investments. Therefore, an adjusted operating income is defined as income before taxes, financial expenses and depreciation. This adjusted operating rate of return is calculated from the financial statements of the companies surveyed for the period of six years (1987 - 1992).

Independent Variables

There are two types of independent variables. Those are application of advanced management accounting techniques and contextual variables of firm characteristics.

Advanced Management Accounting Techniques

The term advanced management accounting techniques in this study includes three groups of techniques. The first group consists of those techniques that the frequency of its application depends on company's activities. These techniques can be applied many times or not at all within one year. Included in these techniques are decision tree analysis, relevant cost analysis, capital budgeting, linear programming, net-work analysis, inventory control models, just in time inventory and sensitivity analysis.

The second group comprises those techniques that the frequency of its application is periodical or at regular interval. These techniques can be applied monthly, quarterly, semi-annually, and annually. These techniques include variance analysis, break-even analysis, contribution reporting, inventory turnover analysis, account receivable turnover analysis, aging of account receivable, gross profit analysis and other financial ratio analysis.

The third group consists of those techniques that the frequency of its application is continuous for one year and these techniques can be either used or not used. These techniques include responsibility accounting, transfer pricing, standard costing, activity based costing, operating budget, flexible budget, appropriation budget, performance budget and fixed budget.

It is not an easy task to measure how the frequency of advanced management accounting techniques are being applied in practice. Previous studies (e.g., Chiu, 1973; MacNally and Eng, 1992) used a scoring system that is based solely on a dichotomous yes-no measure. No attempt has been made to establish a score for how “intensively” a company uses a specific technique. In order to get some indication of the company’s intensity in applying advanced management accounting techniques, the scoring system employed in this study considers more than the number of techniques that have been adopted. In addition to the dichotomous yes-no measure, two other indices of Likert scale are considered.

The first index is applied to the first group of management accounting techniques. This index Likert score is based on the respondent’s assessments of how intensively each of the selected advanced management accounting techniques is being used in the firm. There are five possible responses Never Used, Seldom Used, Sometime Used, Usually Used and Always Used. If the response is never used, it will be given score 0, seldom used 1, sometimes used 2, usually used 3, and always used 4.

The second index is applied to the second group of management accounting techniques. This group comprises techniques that can be applied monthly,

quarterly, semi-annually, annually, and not used at all. There will be five possible responses. If the techniques applied monthly it will be given score 4, quarterly score 3, semi-annually score 2, annually score 1, and not used will be given score 0. The third group of management accounting techniques consists of techniques that the frequency of its application is continuous for one year, so there are only two possible answer yes or no. If the answer is yes it will be given score 1 and if the answer no, the score is 0.

In the testing of the study's hypotheses, the extent of use of advanced management accounting techniques in a given firm is operationally defined as the sum of the respective scores of each technique adopted, as reported by its chief-accounting officer, with a possible range of 0 to 73 points.

Firm Characteristics

Firm's characteristics used as independent variables are size, age, type of industry, capital intensity, risk, type of ownership, and firm's leverage. The following definitions are used for these firm's characteristics: (1) size is measured by the average operating assets of the firm for six year periods, 1987-1992. The larger the absolute dollar amount of the average assets, the greater a firm's size; (2) age is measured from the year it is incorporated; (3) type of industry is classified into two categories, manufacturing and non-manufacturing; (4) capital intensity is measured by the yearly depreciation expenses divided by the yearly operating assets for each of the six years, 1987-1992, the larger this ratio, the higher the capital intensity of the firm; (5) risk is measured by the standard deviation of the firm's adjusted operating rate of return for the six years period,

1987-1992; the larger the standard deviation, the riskier the firm; (6) type of ownership is classified into two categories -- public domestic firm and public foreign firm; (7) leverage is measured by the ratio between total debts and equities for the six years period, 1987-1992, the larger the ratio, the higher firm's leverage. For testing the hypotheses two through eight, variable size is grouped into large firms and small/medium firms based on median value. If the operating assets are above the median it will be classified as a large firm and vice versa. Age also grouped into two, whether an old firm or a new firm. If it is below the median, it will be treated as a new firm and if it is above the median it will be treated as an old firm. Capital intensity, risk and leverage are grouped into high and low based on median value. If it is above the median, it is considered as high and if it is below the median it is considered as low.

Information Sources

The primary sources of data collection was a mail questionnaire. The study questionnaire was designed to accomplish two objectives: (1) to determine the extent of use of selected advanced management accounting techniques in Australia, and (2) to collect information necessary to test empirically a certain number of theoretical hypotheses. The questionnaire is given in appendix A. It contains two series of questions. The first series requests general information as well as characteristic contextual variables of the company. The second series inquires about the extent to which the company employs advanced management accounting techniques. In this series three groups of advanced management

accounting techniques are listed. For each group of techniques, a list of questions is asked regarding the extent to which the company applies these techniques.

Other sources of information came from library research and firms' annual reports. The purpose of the library research was to obtain an in depth understanding of advanced management accounting techniques to be included in the questionnaire. Data collected from the firm's annual report are used to measure variables firm's performance, size, capital intensity, risk and leverage. These variables were measured as average for the periods of six years (1987-1992).

Population, Sampling Frame and Data Collection Method

The population of interest in this study was large public listed firms in Australia. While it would be ideal to make general inferences about the relationship between the application of advanced management accounting techniques and firm's performance, several characteristics of this study precluded the feasibility of sampling the entire public listed companies population. First, the design of the data collection instrument assumes that respondent firms were large enough to apply many different management accounting techniques. Second, the study examined variables which typically have more dramatic affect on larger firms such as risk, leverage, capital intensity. Therefore, it seemed reasonable to test that portion of the general target population where a relationship between contextual variables of firm characteristics, application of advanced management accounting techniques and firm's performance was to surface.

The sampling frame of the population tested was the Top 500 Australian companies listed in the Australian Financial Review Listed Company Handbook (1992) which represents approximately the Top 500 companies ranked by market capitalisation in 1992. The total market capitalisation of these companies represents approximately 97% of the total market capitalisation of the main board of the Australian Stock Exchange. The entire frame or population was included in the survey. The mode of data collection was a mail questionnaire sent to the chief accounting officer of each of the Top 500 companies. The intended recipient of the questionnaire for most firms was the company chief accounting officer. An initial pilot study of one hundred (100) questionnaires was sent to determine the feasibility of the questionnaire and to gauge interest in the study objectives. A response rate of 29 percent indicated an existing interest from the population.

Hypotheses Development

As indicated earlier the primary study objective was to determine the relationship between the application of advanced management accounting techniques and firm's performance and also analysis of the effect of contextual variables of firm characteristics on the application of advanced management accounting techniques. Thus, the first hypothesis tested the existence of a relationship between the application of advanced management accounting techniques and firm performance.

Hypothesis one:

H01: There is no significant relationship between application of advanced management accounting techniques and company performance.

H1₁: There is significant relationship between application of advanced management accounting techniques and company performance.

Hypothesis two to eight, which analysed the effect of firm characteristics on the application of advanced management accounting techniques, were developed based on the underlying premises that management accounting techniques used in a company are expected to be a function of the characteristics of the company. The classification of companies by some of their characteristics may reflect underlying differences in technology, financing, planning horizon, product and management structure. These differences may be a catalyst for companies to adopt and use specific management accounting techniques.

Company Size

A number of studies have tested the relationship between the use of more sophisticated quantitative techniques and the size of a company. The size of company was generally found to be positively related to the application of management accounting techniques. More and Reichert (1983) analysed the association between 23 financial management techniques and company size. The results indicated that out of 23, 11 techniques appear to be directly related to company size.

In the area of capital budgeting, Schall et al., (1978) found that there was a slight tendency for larger firms to use more advanced techniques. Similar findings have been reported by Kim and Farragher (1981). For New Zealand companies McNally and Eng (1980) and Patterson (1989) found positive association between company size and the use of advanced quantitative techniques. By analysing

Australian firms, Freeman and Hobbes (1991) also discovered that there was a significant correlation between company size and sophistication of capital budgeting techniques.

In the area of operations research techniques, the surveys by Vatter (1967), Radnor and Neal (1973), and Gaither (1975) suggest that size and extent of operations research techniques use are positively related. Of firms responding to Vatter's survey, the 30 firms with revenues over \$ 1 billion reported 100 percent use. In Gaither's survey the five largest firms measured by number of employees (over 5000) reported 100 percent use. Radnor and Neal found operations research activity in 104 of 108 firms with annual revenue in excess of \$ 500 million. It may be the case that application of advanced management accounting techniques becomes necessary as a result of increasing size and greater spans of control. Therefore, hypothesis 2 is as follow:

H02: There is no significant difference in the application of advanced management accounting techniques between large companies and other companies.

H12: Advanced management accounting techniques are applied more extensively in large companies than in other companies.

Company Age

The general case for expecting company age to be positively associated with the extent of application of management accounting techniques has rarely been addressed in the literature. We have not found empirical studies which attempt to observe the application of management accounting techniques of old

firms (more than 30 years in operation) as compared with new firms. It can be argued that old firms are likely to be better established, to have more experience and to recognise more varieties of management accounting techniques than newer firms. Hence it is hypothesised that:

H03: There is no significant difference in the extent of application of advanced management accounting techniques between old companies and new companies.

H13: Advanced management accounting techniques are applied more extensively in older companies than in newer companies.

Type of Ownership and Industry

In this study organisations are classified into four overlapping categories. The distinction is between public domestic companies and public foreign companies and between manufacturing and non-manufacturing companies. This study seeks to extend the previous studies by attempting to discern whether there are any difference in the application of advanced management accounting techniques between public domestic and public foreign companies, and between manufacturing and non-manufacturing companies.

It may be hypothesised that public foreign companies and manufacturing companies are more frequent users of management accounting techniques than public domestic companies and non-manufacturing companies because of the significant differences that exist between them with regard to goals, expectations and legal constraints. It is therefore important to test empirically whether there are

any significant differences in the extent of application of advanced management accounting techniques between these two type of companies. Therefore, hypothesis 4 and 7 are formulated as follow:

H04: There is no significant difference in the application of advanced management accounting techniques between manufacturing and non-manufacturing companies.

H14: Advanced management accounting techniques are applied more extensively in manufacturing companies than in non-manufacturing companies.

H07: There is no significant difference in the application of advanced management accounting techniques between public domestic companies and public foreign companies.

H17: Advanced management accounting techniques are applied more extensively in public foreign companies than in public domestic companies.

Capital Intensity

Capital intensity can be interpreted as equivalent to what contextual theories refer to as technology. Indeed some empirical studies of the contextual theory of management accounting measure technology in terms of “the degree of automation of the production process” (Merchant, 1984). Different types of production methods have long been recognised as influencing the design of internal accounting systems (Otley 1980). Perrow (1967) conceptualised such production technologies in term of whether they are routine or non-routine. The former are capital intensive whereas the latter are labour intensive. Capital

intensity is measured in this study by the yearly depreciation expenses divided by the yearly operating assets.

Study of management's choice of accounting methods also indicated that the choice of accounting practice is influenced by whether a firm is capital intensive or labour intensive. Hagerman and Zmijewski (1981) found that the degree of capital intensity affects choice of accounting methods. A firm with a high degree of capital intensity reports artificially higher income than do labour intensive firms because they are matching past cost of depreciation with current earning. Therefore, there is a tendency the firm would be apt to choose income decreasing accounting methods to reduce this inequity. Therefore, hypothesis 5 is as follow:

H05: There is no significant difference in the application of advanced management accounting techniques between companies that have high capital intensity and low capital intensity.

H15: Advanced management accounting techniques are applied more extensively in companies that have high capital intensity than companies that have low capital intensity.

Risk and Leverage

There are also a number of studies which indicated that management's choice of accounting methods may be influenced by a firm's capital structure as well as firm's risk. However, studies which try to observe the association between firm's risk and leverage with the extent of application of advanced management accounting techniques, are rare in the literature. Dhaliwal (1980) found that the

level of leverage affects the method of accounting for oil and gas explorations costs. He hypothesised that firms with high degrees of leverage would oppose accounting principles which reduced income. The explanation is that as firms incur increased levels of debt, a twofold effect may occur. First additional borrowing may command a higher interest rate. Second, greater income is needed to offset interest cost. Hence, it can be argued that as a firm increase debt, it may attempt to reduce the effects on the debt/equity ratio via income-increasing accounting methods.

Hagerman and Zmijewski (1979) stated that firms with high systematic risk might elect accounting principles which reduced reported earning. Accounting profits consist of a normal return of capital plus (minus) abnormal profits (losses) with the normal return of capital affected by the firm's risk. They contended that firms with higher systematic risk have higher rates of return and, therefore, appear to make excessive profits. Further, firms with periodic high earnings appear to earn abnormal profits, subjecting the firms to political costs. Therefore, to reduce their reported earnings, these firms would opt for accounting methods which postpone income to later years. Using a logical extension of this study, it may be expected that firm's risk and leverage will influence the application of advanced management accounting techniques. Therefore it is hypothesised that:

H06: There is no significant difference in the application of advanced management accounting techniques between high risk companies and low risk companies.

H16: Advanced management accounting techniques are applied more extensively in high risk companies than in low risk companies.

H0g: There is no significant difference in the application of advanced management accounting techniques between high leverage companies and low leverage companies.

H1g: Advanced management accounting techniques are applied more extensively in high leverage companies than in low leverage companies.

Statistical Method for Data Analysis

Mann-Whitney U Test

Hypotheses two through eight will be tested by nonparametric test, namely Mann-Whitney U test (M-W U test). Nonparametric tests are appropriate for data in nominal or ordinal scale. As has been discussed earlier, the application of advanced management accounting techniques is measured on a five point Likert scale for accounting techniques group one and two. This scoring system is ordinal in nature. An ordinal or ranking scale is a scale of measurement in which the object of a set are rank-ordered on the basis of operationally defined characteristics. Therefore, the derived measure of the extent of application of advanced management accounting techniques does not achieve measurement characteristics normally associated with parametric statistical techniques. Based on this argument, this study adopted a nonparametric test, namely M-W U test as the most appropriate manner in which to test the study's hypothesis.

Mann-Whitney U test is basically used to test whether two independent groups have the same distribution. Suppose two groups of companies, X and Y. The null hypothesis, H0, may be that X and Y have the same distribution. The

alternative hypothesis, H_1 , may be accepted if the probability that a score (the frequency of application of advanced management accounting techniques) from group X is larger than the score from group Y is greater than one-half. That is, if x is one observation (score) from group X, and y is one observation (score) from Y, then the alternative hypothesis, H_1 , is that $p(x > y) > 1/2$. If the evidence supports H_1 , this implies that the “frequency of application of advanced management accounting techniques” of group X is higher than group Y (Siegel, 1988).

Multiple Logistic Regression

Hypothesis one, which concerns to the relationship between application of advanced management accounting techniques and company's performance, will be tested by using multiple logistics regression model. One of the more common techniques used to analyse the hypothesis which concerns the relationship between application of management accounting techniques and company's performance is ordinary least squares (OLS). Use of this technique requires four assumptions:

1. linearity between the dependent and independent variables,
2. normal distribution in the error terms,
3. homoscedasticity of the error terms, and
4. independence of the error terms.

However, the dependent variable in this study, firm performance, is a discrete variable. The use of a discrete dependent variable makes the OLS technique inapplicable because it violates two of the above assumptions; there is nonlinearity

between the dependent variable and independent variable, and the error terms are heteroscedastic. Therefore, some alternative statistical technique must be employed.

The choice of an appropriate statistical techniques is dependent upon the data specification. For this study, the choice of techniques was based on the derivation of the dependent variable (firm's performance) which is measured by its adjusted rate of return. A discrete, ordinal measure for the dependent variable was chosen. This led to the selection of multiple logistic regression as the statistical techniques to be used.

The dependent variable represents a measure of the relative financial performance of the subject firm. The performance of a specific firm can be gauged by comparing its performance to the average performance of the sample firms. Thus, the relative performance variable for this study become ($ROR_{\text{firm}} - ROR_{\text{average}}$). The difference between firm and average sample firm performance enables one to classify individual firms as above average performers (Above) if the difference is positive and below average performers (Below) if the difference is negative.

In the statistical model employed in this study, the relative performance measure is specified as dichotomous dependent variable: Above = 1; Below = 0. Given the categorical form of the dependent variable, a constrained version of the linear probability model logistic regression is appropriate. Logistics regression interprets the right hand side of the regression equation as a probability restricted to value 0 and 1. The logistics regression model of this study takes the form:

Prob (Above)

$$\text{Log} \frac{\text{Prob (Above)}}{1 - \text{Prob (Above)}} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k$$

or

$$\text{Logit P} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k$$

Where “Above” represents the above average performance category. The X’s represents the application of advanced management accounting techniques and firm’s characteristics variables such as size, age, type of industry, capital intensity, risk, type of ownership and firm’s leverage. The b’s represent the logistic regression coefficients. This logistic model is estimated using nonlinear maximum likelihood estimation techniques. The objective is to estimate the regression parameters that maximise the probability or likelihood of observing the data sample. That is, the logistic model determines the probability that a specific firm with a given set of behavioural and attitudinal attributes will fall into one performance category or the other.

Testing for the Significance of the Model

In multiple linear regression, the hypothesis that the regression equation did not provide any information about the dependent variable is tested by examining the ratio of the variation associated with the regression equation compared to the residual variation about the regression plane. When the resulting value F was large, it can be concluded that the regression equation “explained” some variance in the dependent variable.

The likelihood ratio test serves a role analogous to this F test for testing the overall fit of a logistic regression (Stanton and Bryan, 1990). To construct the test statistic for the likelihood ratio test, first compute the likelihood of obtaining the observation if the independent variables had no effect on whether or not the dependent variable was “above” or “below” average performers. In this case $b_1 = b_2 = b_3 = \dots = b_k = 0$, and the regression model reduces to $\text{Logit } P = b_0$ and b_0 is the mean outcome, or proportion of above average performers. When the information in the independent variables included, the likelihood L of obtaining the set of observations increases. The question is: does the increase in the likelihood obtained by adding the independent variables significantly contribute to the ability to predict the dependent variables?

This question can be answered by comparing the likelihood of obtaining the observations if the full model holds L with the likelihood of obtaining the observations if the independent variables had no effect on the outcome (the intercept-only model) L_0 by computing the test statistic:

$$G_0^2 = 2 \ln \frac{L}{L_0} = 2 (\ln L - \ln L_0)$$

If the pattern of observed outcomes is more likely to have occurred when the independent variables affect the outcome than when they do not, G_0^2 will be a large number. On the other hand, if the independent variables do not influence the outcome (i.e., the value of the dependent variable), then the likelihood of

obtaining the observations given the information in the independent variables will be the same as that contained in the mean response b_0 and G_0^2 will be zero.

Because of sampling variation, G_0^2 will vary if the null hypothesis of no effect of the independent variables is true, just as the values of F varied in multiple linear regression. Therefore, it needs to compare the observed value of the G_0^2 test statistics with an appropriate sampling distribution. It has been shown that the likelihood ratio test statistic approximately follows a χ^2 distribution with $k-1$ degree of freedom, with the quality of this approximation improving as the sample size grows. A large value of the likelihood ratio test statistic (or corresponding small p value) indicates that the independent variables significantly improve the ability to predict the outcome, the dependent variable.

Testing the Individual Coefficients

To test whether the coefficients associated with each independent variables are significantly different from zero, this study used Wald test (analogous to the t test in multiple linear regression). The Wald test is obtained by comparing the maximum likelihood estimate of the slope parameter, b_1 , to an estimate of its standard error. The resulting ratio, under the hypothesis that $b_1 = 0$, will follow a standard normal distribution. Walt test can be stated as follow:

$$W = \frac{b_1}{SE(b_1)}$$

A second approach to testing whether or not the independent variables X_j improve the predictability of the regression equation is a form of the likelihood

ratio test just described. Let L_{-j} be the likelihood associated with the regression model containing all the independent variables except X_j ,

$$\text{Logit } P = b_0 + b_1X_1 + \dots + b_{j-1}X_{j-1} + b_{j+1}X_{j+1} + \dots + b_kX_k$$

and let L be the likelihood associated with the full regression equation. Testing whether adding the independent variable X_j significantly improves the predictive ability of the equation is carried out by computing the test statistic

$$G_j^2 = 2 \ln \frac{L}{L_{-j}} = 2 (\ln L - \ln L_{-j})$$

This test statistic is compared with the critical values of the χ^2 distribution with 1 degree of freedom. This test is also sometimes called the improvement chi-squares which is analogous to the incremental F test in linear regression. All statistical tests in this study are run using computers software statistical packaged SPSS.

Summary

This chapter described the research methodology used to accomplish the study’s objectives. The primary sources of data came from a mail questionnaire and secondary data were gathered from library research and company annual reports. A questionnaires was mailed to each of 500 Top Australian public listed companies. Eight hypothesis were developed to be tested. The multiple logistic regression was selected as the appropriate test to be used in testing the hypothesis one concerning the relationship between application of advanced management accounting techniques and firm’s performance. Nonparametric test namely Mann-Whitney U test was selected to be used in testing hypotheses two through eight.

The sampling procedure, the definition and operational measures of the variables were also discussed. The following chapter will be devoted to analysis of results of the questionnaire and to discuss the profile of the respondents.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

This chapter reports the results of the mail questionnaires on the application of advanced management accounting techniques by respondents. The first section presents the results of a pilot study and the full scale study, including testing of nonresponse bias. The second section describes the profile of the respondents, and the third section presents the results that is the of application of management accounting techniques by respondents. Part of the reason was to examine what type of management techniques widely are accepted and less accepted in practice.

The Pilot Study

An initial pilot of 100 questionnaires were sent to the respondents. The objectives of the pilot study were twofold. First, to determine the feasibility of the questionnaire and interest in the study objective. Second, to test the questionnaire to ensure that the questions were clear to the recipients. A questionnaire was mailed to the participants of the pilot study which were randomly drawn from the Top 500 Australian companies listed in the Australian Financial Review Listed Company Handbook (1992). The questionnaire included a cover letter describing the purpose of the study (see Appendix A). Pilot participants were asked not only to complete the questionnaire, but they were also asked to comment on the clarity of the questions and to follow further discussion regarding the questionnaire.

The pilot study proved to be successful in terms of testing of the questionnaire as well as testing of response rate. Some minor revisions were suggested by participants in the pilot. Most of the participants asked to revise the questionnaire series B part b regarding the application of management accounting techniques type II. The response scale on these accounting techniques were simplified to only 5 points scale instead of monthly scale. Further suggestion from the respondents was that each management accounting technique needs to be explained further by giving its definition.

A response rate of 28 percent indicated an existing interest in the population and produced an estimate of the rate of return as well as the distribution of responses that could be expected from an expanded mailing. Table 3 displays the distribution of the respondents of pilot study by activity sector.

TABLE 3
DISTRIBUTION OF RESPONDENTS OF PILOT STUDY
BY ACTIVITY SECTOR

Activity Sector	No of Firms	%
Agriculture, forestry, fishing, hunting	3	11
Mining	1	4
Manufacturing	12	42
Electricity, gas and water	-	-
Wholesale and retail trade	5	18
Transport, storage and communication	2	7
Finance, property and business services	5	18
Community services	-	-
Recreation, personal	-	-
Totals	28	100

Full Scale Study

After evaluating the results of the pilot study, a revised questionnaire was mailed to all Top 500 Australian companies listed in the Australian Financial Review Listed Company Handbook. The questionnaires were mailed on September 15, 1993 to chief-accountant officers of all Top 500 Australian listed companies. Included in the questionnaire were a cover letter by the researcher which explained the purpose of the study and a self-addressed envelope. After four weeks, a follow up letter was sent to the companies that did not return the questionnaire. Copies of all material sent as part of the full scale study are contained in Appendix B. The results of the mailing are presented in Table 4. Out of 500 questionnaires sent, 101 usable responses were received from the first mailing , or 20 percent responded. Another 26 usable responses were received after the follow up letter. Total usable responses were 127 which is accounted for 25 percent response rate. The response rate in the full scale study was slightly lower than the pilot study (25 percent versus 28 percent). This response rate compare favourable to the similar survey in Australia by Lilleyman (1984) which accounted for 26.4 percent response rate.

TABLE 4
FULL SCALE STUDY RESPONSE DATA

Item	No of firms	%
Number of questionnaires sent	500	100.00
Usable responses:		
To initial letter	101	20.20
To follow up letter	26	5.20
Total usable responses	127	25.40

Test for Nonresponse Bias

A major problem that might appear in collecting data through mailing of questionnaires is not receiving a response from everyone in the sample.

Nonresponse bias would be present if responders were not representative of the total population. Unless the responses are adequate, any conclusions drawn from such a sample would not be valid since the sample would not be representative of the population. Some sources of nonresponse are considered beyond the control of the researcher such as the nature of the potential respondents, the auspices of the research, and the ability to respond. However, the researcher can have some influence on the response rate by considering his limited control over the survey's sponsorship, population, subject matter and implementation.

To increase the response rate the sample of this study consisted of chief-accountant officer of the companies. Thus, the questionnaire was addressed to a very select group who would recognise the importance of the study. An appropriately designed cover letter is essential in this study. The first paragraph of the letter identified the researcher and the purpose of the study. The second paragraph stressed the importance of the subject's response by indicating that his name was chosen as a respondent who can provide information useful for the study. In addition, responses will be held in strict confidence and will be published in the form of statistical summaries which will make the identification of the company impossible.

In order to catch the attention and to motivate the respondent, care was taken to personalise the correspondence. This was achieved by typing each letter on University of Wollongong letterhead. Each letter was addressed to the chief-accountant officer of the firm and was personally signed. A pre-addressed return envelope was included. In order to increase response rate, Dillman (1978) suggests a follow up program, which consists of sending follow up postcards and reminder letters at regular interval. But he emphasises that each step should be subject to a cost and benefit analysis. Due to the high cost of postage, the full scale study was conducted with only one follow up letter four weeks after the initial mailing of the questionnaire.

All of these efforts were aimed at improving not only the quality of the data collected but also the response rate obtained. A poor response rate constitutes a critical failing in that it may result in conclusions which are not representative of the population under study. Moser (1971) stated that while responses to mail surveys as low as 10 percent are not unknown, a response rate which does not rise above 20 percent may result in survey results of little, if any, value. In view of the low response rate of 25.40 percent, nonresponse bias will be tested in this study.

To test the possible presence of nonresponse bias, a test was constructed identical to one suggested by Oppenheim (1973). Oppenheim suggested two methods of testing to find out whether nonresponse bias is presence. First, by comparing respondents with non respondents on the original sampling list (in terms of geographical location, sex, type of qualification, and so on). Second, by comparing early respondents with late respondents (in term of their answers to the

questionnaire). This study adopted the second method which assumed that respondents who respond in later waves are assumed to have responded because of the increase stimulus, and they are expected to look more like the nonrespondents than those in earlier waves.

This test was accomplished by comparing mean response score of each type of management accounting techniques applied for the first 101 early returned questionnaires with the last 26 late returned questionnaires. A series of t-test were then run to determine whether there was a significant difference for each pair of means response score. For each case the hypothesis can be stated as:

$H_0: U_1 = U_2$

$H_0: U_1 \neq U_2$

The test run was a two-tailed t-test which tests the null hypothesis that there is no difference in the means response score for each type of management accounting technique applied of the two groups respondents. The results of these tests are shown in Table 5.

TABLE 5
SUMMARY OF T-TEST FOR NON-RESPONSE BIAS

Accounting Techniques	Early Response=E Late Response=L	N	Means Score	T-value	Prob	Reject The Null
Type I	E	101	11.8812	-0.9800	0.3360	No
	L	26	13.2308			
Type II	E	101	21.1188	-1.4200	0.1620	No
	L	26	23.5000			
Type III	E	101	4.4158	-1.6900	0.0970	No
	L	26	5.0385			

* Significant at the 0.05 confidence level

As indicated by Table 5, for each type of management accounting technique there was no significant difference between means response score of early responses and late responses. The observed probability were 0.3360, 0.1620 and 0.0970 for type I, type II and type III accounting techniques. All these observed probabilities were above the significant level of 0.05. The results indicate a lack of a material nonresponse bias.

Profile of the Respondents

Out of 500 questionnaires mailed to chief-accountant officer, 127 usable questionnaires returned. Table 6 displays the distribution of the respondents by activity sector. The main activity of respondents are manufacturing, mining and finance companies. Manufacturing and mining companies accounted more than one-half of total respondents that is 32.28 percent and 29.92 percent of total respondents. Finance, property and business services companies contribute 17.32 percent of total respondents. The remaining activity sectors each contributed less than 10 percent of total respondents. This results is consistent with the pilot study except for the mining companies. In the pilot study, only one mining company returned the questionnaire.

TABLE 6
DISTRIBUTION OF RESPONDENTS BY ACTIVITY SECTOR

Activity Sector	No of Firms	%
Agriculture,forestry and fishing	4	3.15
Mining	38	29.92
Manufacturing	41	32.28
Wholesale and retail trade	10	7.87
Transport, storage and communication	5	3.94
Finance, property and business services	22	17.32
Recreation, personal and other services	7	5.52
Totals	127	100.00

In terms of ownership, the respondents are classified into two categories, domestic firms and foreign firms. The types of ownership is reflected in the different legal and political factors. These factors, such as political ideology, system of government, specific laws concerning control of organisations may have a significant impact on the application of management accounting techniques.

Table 7 shows the distribution of respondents by type of ownership.

TABLE 7
DISTRIBUTION OF RESPONDENTS BY TYPE OF OWNERSHIP

Type of Ownership	No of Firms	%
Domestic Firms	114	89.76
Foreign Firms	13	10.24
Totals	127	100.00

Table 7 above shows that the majority of respondents are controlled by domestic firms and only 10 percent are controlled by foreign firms.

It could be reasoned that old firms are more likely to be better established, to have more experience than the new firms. When respondents are classified by years in business operation, it indicates that nearly one-half of the respondents have been in business operation for more than 30 years.

TABLE 8
DISTRIBUTION OF RESPONDENTS BY AGE
(YEARS IN BUSINESS)

Years in Business Operation	No of Firms	%
< = 10 years	39	30.71
11 - 20 years	12	9.45
21 - 30 years	16	12.60
more than 30 years	60	47.24
Totals	127	100.00

About one-third of respondents stated that they have been in business for less than 10 years and 22 percent of respondents have been in business between 10 to 30 years (see Table 8).

Cross-Classification of the Respondents

To aid in the interpretation of the study’s results, the responses received are cross-classified as shown in Tables 9, 10 and 11. Table 9 displays the cross-classification between type of ownership and activity sector. The respondents of domestic firms is dominated by the firms who engage in mining and manufacturing activity. These two types of firm accounted more than one-third of total respondents of domestic firms. For respondents of foreign firms, more than one-half come from the manufacturing sector.

TABLE 9
CROSS CLASSIFICATION OF RESPONDENTS
BY TYPE OF OWNERSHIP AND ACTIVITY SECTOR

Activity sector	Type of ownership	Domestic Firms		Foreign Firms	
		No of firms	%	No of firms	%
Agriculture, forestry and fishing		3	2.63	1	7.69
Mining		35	30.70	3	23.08
Manufacturing		34	29.82	7	53.85
Wholesale and retail trade		9	7.90	1	7.69
Transport, storage and communication		5	4.39	-	-
Finance, property and business services		21	18.42	1	7.69
Recreation, personal and other services		7	6.14	-	-
Totals		114	100.00	13	100.00

About 18.42 percent of domestic firms engage in finance and property sector and followed by wholesale and retail sector, recreation and personal sector, transport

and storage, and agriculture, forestry. The percentage are 7.90 percent, 6.14 percent, 4.39 percent and 2.63 percent respectively.

When respondents are cross-classified by years in business operation and type of ownership, it indicates that nearly one-half of domestic firms have been in business more than 30 years. This figure is even higher for the foreign firms which accounted more than two-thirds of firms have been in business for more than 30 years (see Table 10). Almost one-third or 33.33 percent of domestic firms have been in business for less than 10 years, while 15.39 percent of foreign firms have been in business less than 10 years. Domestic firms who are in business between 11-20 years and 21-30 years represent by 10.53 percent and 12.29 percent respectively.

TABLE 10
CROSS CLASSIFICATION OF RESPONDENTS
BY TYPE OF OWNERSHIP AND AGE

Type of ownership Years in business	Domestic Firms		Foreign Firms	
	No of firms	%	No of firms	%
< = 10 years	38	33.33	2	15.39
11 - 20 years	12	10.53	-	-
21 - 30 years	14	12.29	1	7.69
more than 30 years	50	43.85	10	76.92
Totals	114	100.00	13	100.00

Table 11 shows cross-classification of respondents in term of years in business and their activity sector. The respondents who have been in business more than 30 years mainly come from manufacturing and mining companies which accounted for 45 percent and 16.67 percent respectively. For the other years in business categories, again manufacturing and mining sectors contribute a higher

percentage. For category in business less than 10 years, 30 percent is represented by mining firms and 25 percent is represented by manufacturing firms.

TABLE 11
CROSS CLASSIFICATION OF RESPONDENTS
BY AGE AND ACTIVITY SECTOR

Activity Sector	Years in business		< = 10 yrs		11 - 20yrs		21 - 30yrs		> 30 yrs	
	# firms	%	# firms	%	# firms	%	# firms	%	# firm	%
Agriculture, forestry and fishing	1	2.50	-	-	1	6.67	2	3.33		
Mining	12	30.00	8	66.67	8	53.33	10	16.67		
Manufacturing	10	25.00	2	16.67	2	13.33	27	45.00		
Wholesale and retail trade	1	2.50	-	-	1	6.67	8	13.33		
Transport, storage and comm.	-	-	1	8.33	1	6.67	3	5.00		
Finance, property and services	11	27.50	-	-	2	13.33	9	15.00		
Recreation, personal and other	5	12.50	1	8.33	-	-	1	1.67		
Totals	40	100.00	12	100.00	15	100.00	60	100.00		

Finance and property firms also contribute 27.50 percent, second after mining firms. For categories years in business 11 - 20 years as well as 21 - 30 years, once again mining firms contribute more than one-half of the respondents from that categories. That are 66.67 percent for 11 - 20 years category and 53.33 percent for 21 - 30 years category.

Management Accounting Practice

This section is mainly devoted to the application of advanced management accounting techniques in Australian listed companies. The results is based on questionnaires mailed to the chief-accountant officer of the firms. As discussed in chapter 3, there are 25 management accounting techniques asked in the questionnaire. These 25 accounting techniques are classified into three different types of techniques. The first type of these techniques is mainly known as

operational research techniques. This type of technique can be applied many times or not at all within one year. To capture the extent usage of this type I techniques by the respondents, a simple adoption/non-adoption dichotomy may be an unsatisfactory measure. Instead of asking yes or no to the respondents, five points Likert scale used in this study. The scale consists of five alternative responses, never used, seldom used, sometimes used, usually used, and always used. If the management accounting techniques never used by the firms, it will be given score 0, seldom used 1, sometimes used 2, usually used 3, and always used 4. Type I advanced management accounting techniques consists 8 techniques. Those are decision tree analysis, relevant costs analysis, capital budgeting, linear programming, net-work analysis/PERT, inventory control models, just in time inventory, and sensitivity analysis. For each respondent the maximum total score of application type I techniques is 32 which means the respondent always used these 8 management accounting techniques and minimum score of 0 is expected if the respondents never used these 8 techniques.

Similar five points scale also used to measure the application of advanced management accounting techniques type II. Type II techniques are those techniques that are used at regular intervals. Therefore, these techniques can be applied monthly, quarterly, semi annually, annually, and not used at all. There are 8 techniques included in the type II techniques and are mainly ratio analysis. Those are variance analysis, break-even analysis, contribution reporting, inventory turnover analysis, account receivable turnover, aging account receivable, gross profit analysis and other ratio analysis. If respondent applied the accounting

techniques monthly which means frequently applied in one year, it will be given score 4, quarterly score 3, semi annually score 2, annually score 1 , and not used at all in one year will be given score 0. Hence, total maximum score is 32 and minimum score 0 for each respondent.

The third type of advanced management accounting techniques comprises techniques where the frequency of application is continuous for one year.

Therefore, there are only two possible answers either used or not used. There are 9 techniques included in this type III techniques which consists of responsibility accounting, transfer pricing, standard costing, activity based costing, operation budget, flexible budget, appropriation budget, performance budget and fixed budget.

The chief-accountant officers responses to the application of advanced management accounting techniques is shown in Table 12. An examination of the utilisation rate of type I management accounting techniques showed that capital budgeting, sensitivity analysis and relevant cost analysis were the most frequent used techniques. More than one-half of the respondents claimed to always use capital budgeting techniques and 21.26 percent of respondents usually used this techniques. More than 75 percent of the respondents claimed that they sometimes, usually and always used sensitivity analysis techniques. Relevant cost analysis has been used by 70 percent of the respondents with 26.77 percent and 22.05 percent of respondents said that they usually used and always used of this technique. Operation research techniques seemed less popular for the respondents. Decision tree analysis was never used by 67.72 percent of respondents and this was

TABLE 12
THE EXTENT OF MANAGEMENT ACCOUNTING TECHNIQUES
% USED BY RESPONDENTS

Techniques Type I	Never Used	Seldom Used	Sometimes Used	Usually Used	Always Used	Total
Decision tree analysis	67.72	14.17	13.39	3.94	0.78	100
Relevant cost analysis	30.71	4.72	15.75	26.77	22.05	100
Capital budgeting	12.60	0.79	7.87	21.26	57.48	100
Linear programming	65.35	20.47	10.24	3.94	-	100
Net-work analysis/PERT	62.99	14.17	16.54	4.72	1.58	100
Inventory control models	43.31	7.09	11.02	12.60	25.98	100
Just in time inventory	56.69	8.66	8.66	12.60	13.39	100
Sensitivity analysis	19.69	3.94	23.62	25.98	26.77	100
Techniques Type II	Not Used	Monthly	Quarterly	Semi Annually	Annually	Total
Variance analysis	7.87	85.04	3.94	0.79	2.36	100
Break-even analysis	44.88	22.05	8.66	7.87	16.54	100
Contribution reporting	20.47	69.29	3.94	0.79	5.51	100
Inventory turnover	40.17	45.67	4.72	4.72	4.72	100
Acc. receivable turnover	39.37	57.48	-	0.79	2.36	100
Aging of acc. receivable	29.13	67.72	0.79	-	2.36	100
Gross profit analysis	12.60	77.95	3.15	3.94	2.36	100
Other financial ratio	12.60	66.93	7.87	6.30	6.30	100
Techniques Type III	Not Used	Used	Total			
Responsibility accounting	27.56	72.44	100			
Transfer pricing	60.63	39.37	100			
Standard costing	54.33	45.67	100			
Activity based costing	66.93	33.07	100			
Operating budget	3.94	96.06	100			
Flexible budget	62.99	37.01	100			
Appropriation budget	77.95	22.05	100			
Performance budget	48.82	51.18	100			
Fixed budget	42.52	57.48	100			

followed by linear programming which accounted for 65.35 percent never used and net-work analysis/PERT was never used by 62.99 percent of respondents. Other techniques such as inventory control models have been used by almost than one-half of respondents and more than 25 percent of respondents claimed to always used this technique. New techniques such as just in time inventory have been used by nearly one-half of respondents with 11.02 percent, 12.60 percent and 13.99 percent of respondents said that they sometimes used, usually used and always used this techniques.

The results of the extent usage of operation research techniques in this study is consistent with the findings of the previous studies conducted by Lonnstedt (1973), Gaither (1975), Green et al., (1977) and Kwong (1986). On the study of 12 listed companies known to be using operation research techniques, Lonnstedt found that 37 percent of respondents used net-work analysis. This was followed by linear programming which only used by 16 percent of respondents. Green et al., (1977) also found similar results. In the study of the extent of usage of quantitative techniques in production/operations management in large US corporation, Green et al., observed that 25 percent of respondents were frequent use of net-work analysis, linear programming and inventory models. Studies in the developing countries conducted by Kwong (1986) also found the same results compared to the studies in developed countries. Kwong surveyed 106 firms in Singapore and 212 firms in Malaysia. The Malaysian survey found that 55 out of 198 responding firms were using some form of operation research techniques. The degree of use of techniques indicates that inventory models and linear

programming were being adopted by about a quarter of the user firms. Net-work analysis/PERT was only used by 18 users firms. The Singapore results were lower compared to Malaysian results. Inventory models were used only by nine firms and linear programming was used by only three users firms. A recent survey conducted by Lam (1993) confirmed previous findings as well as the current findings. Lam surveyed all the companies listed on the Hongkong Stock Exchange. The result shows that a number of operations research techniques, which have been in the literature for many years, are virtually unused by the respondents companies. Net-work analysis/PERT and linear programming had been used by 14 percent of the responding firms. The other two techniques, inventory models and decision tree analysis, had been used by 18 percent and 6 percent of the respondents respectively.

There is a belief held by academics that management accounting techniques developed in the academic literature are actually used in practice. However, textbooks do not give evidence that support this belief. The research findings in this study regarding the application of management accounting techniques type I shows that four of the eight techniques gained wide acceptance in practice. Capital budgeting, sensitivity analysis, relevant cost analysis, and inventory control models were reported to be actually used in practice by 87.4 percent (111 firms), 80.31 percent (102 firms), 69.29 percent (88 firms) and 56.69 percent (72 firms) of the respondents, respectively. Other techniques such as decision tree analysis, linear programming, net-work analysis/PERT and Just in

time inventory received minor acceptance in practice which accounted for less than 40 percent of respondents claimed being used of these techniques.

Examining advanced management accounting techniques type II used by respondents reveals that four techniques have been used by more than three-quarters of the respondents. Those techniques are variance analysis, contribution reporting, gross profit analysis, and other financial ratio analysis. Other techniques such as break-even analysis, inventory turnover analysis, account receivable turnover analysis, and aging account receivable have been used by more than one-half of respondents.

The frequency of using the techniques shows that 85.04 percent of respondents use variance analysis at least monthly. This followed by contribution reporting, aging account receivable, gross profit analysis, and other financial ratio techniques which have been used at least monthly by more than 65 percent of respondents. Break-even analysis have been used evenly across the categories, 22.05 percent respondents used this techniques monthly, 8.66 percent respondents claimed used break-even techniques at least quarterly, 7.87 percent respondents used semi-annually and about 16.54 percent respondents said that they used break-even analysis annually. It is interesting to note that popular techniques according to textbooks such as break-even analysis had not been used widely in practice. This study finding shows that 63.22 percent of respondents claimed had used break-even analysis. Lam (1983) reported low usage of this technique which was only used by 22 percent of the responding firms

The application of management accounting techniques type III have been categorised into whether the techniques “is” or “is not” used by respondents. Table 12 shows that operating budget was the most popular techniques used, being adopted by almost all respondents which accounted for 96.06 percent of respondents. This was followed by responsibility accounting, fixed budget, and performance budget. Responsibility accounting has been adopted by 72.44 percent of respondents . Fixed budget and performance budget have been adopted by 57.48 percent and 51.18 percent of respondents respectively. In contrast, appropriation budget was a less popular techniques, used by 22.05 percent of respondents and followed by activity based costing, flexible budget and transfer pricing. An interesting to note that new techniques such as activity based costing is now being adopted in Australia and is used by 33.07 percent of respondents.

In the area of budgets, the findings of this study was also supported by previous studies. Imhoff (1978) discovered from his surveyed of 53 publicly-traded companies included in NYSE and AMEX that 73 percent of the firms surveyed used budget as significant factor in the evaluation of performance. He also found that 81 percent of those firms which used budget as a performance measure did use flexible budget. Ntow (1991) also confirmed the present study results. In comparing budgetary control systems between American and Japanese manufacturing firms, Ntow found that most of the firms used types of budgets such as static budgets, flexible budgets, standard budgets, contingency budgets and simulated budgets.

Management Accounting Practice and Activity Sector

Table 13A was prepared to examine whether there is any difference in the extent usage of management accounting techniques between manufacturing firms and non-manufacturing firms. As can be seen in Table 13A, for management

TABLE 13A
THE EXTENT OF MANAGEMENT ACCOUNTING TECHNIQUES
% USED BY RESPONDENTS ACCORDING TO THE ACTIVITY SECTOR

Techniques Type I	Never Used		Seldom Used		Sometimes Used		Usually Used		Always Used	
	M	NM	M	NM	M	NM	M	NM	M	NM
Decision tree analysis	63.41	69.77	17.07	12.79	12.20	13.95	4.88	3.49	2.44	-
Relevant cost analysis	34.15	29.07	-	6.98	19.51	13.95	26.83	26.74	19.51	23.26
Capital budgeting	14.63	11.63	-	1.16	9.76	6.98	21.95	20.93	53.66	59.30
Linear programming	65.85	65.12	24.39	18.61	9.76	10.46	-	5.81	-	-
Net-work analysis/PERT	70.72	59.30	12.20	15.12	12.20	18.61	2.44	5.81	2.44	1.16
Inventory control models	41.46	44.19	2.43	9.30	9.76	11.63	12.20	12.79	34.15	22.09
Just in time inventory	48.78	60.47	14.63	5.81	7.32	9.30	7.32	15.12	21.95	9.30
Sensitivity analysis	21.95	18.61	2.43	4.65	21.95	24.42	34.16	22.09	19.51	30.23

Techniques Type II	Not Used		Monthly		Quarterly		Semi Annually		Annually	
	M	NM	M	NM	M	NM	M	NM	M	NM
Variance analysis	12.20	5.81	82.92	86.05	2.44	4.65	-	1.16	2.44	2.33
Break-even analysis	46.34	44.19	21.95	22.09	7.32	9.30	7.32	8.14	17.07	16.28
Contribution reporting	21.95	19.77	68.29	69.77	2.44	4.65	-	1.16	7.32	4.65
Inventory turnover	43.90	38.37	41.46	47.67	2.44	5.82	7.32	3.49	4.88	4.65
Acc. receivable turnover	39.02	39.54	60.98	55.81	-	-	-	1.16	-	3.49
Aging acc. receivable	31.71	27.91	68.29	67.44	-	1.16	-	-	-	3.49
Gross profit analysis	12.20	12.78	75.60	79.07	2.44	3.49	7.32	2.33	2.44	2.33
Other financial ratio	9.76	13.95	73.16	63.95	4.88	9.30	7.32	5.81	4.88	6.99

Techniques Type III	Not Used		Used	
	M	NM	M	NM
Responsibility acctg.	26.83	27.91	73.17	72.09
Transfer pricing	60.98	60.47	39.02	39.53
Standard costing	60.98	51.16	39.02	48.84
Activity based costing	65.85	67.44	34.15	32.56
Operating budget	4.88	3.49	95.12	96.51
Flexible budget	68.29	60.47	31.71	39.53
Appropriation budget	68.29	82.56	31.71	17.44
Performance budget	48.78	48.84	51.22	51.16
Fixed budget	36.58	45.35	63.42	54.65

M= Manufacturing
NM= Non-manufacturing

accounting techniques type I capital budgeting and sensitivity analysis were widely accepted in practice for both manufacturing and non-manufacturing firms. Capital budgeting was adopted by 85.37 percent of responding manufacturing firms and 88.37 percent of respondents non-manufacturing firms.

Both type of firms reported that they used capital budgeting frequently. More than 50 percent of manufacturing as well as non-manufacturing respondents claimed that they always used this techniques. For the categories of usually used this technique, 21.95 percent manufacturing firms reported that they usually used capital budgeting and 20.93 percent of non-manufacturing firms also usually used this techniques. Sensitivity analysis was applied by 78.05 percent of manufacturing firms and 81.39 percent of non-manufacturing firms. The frequency of applying sensitivity analysis techniques had been spread evenly across the categories. The percentage of manufacturing firms applying sensitivity analysis are 21.95 percent sometimes used, 34.16 percent usually used, and 19.51 percent always used this techniques. In the non-manufacturing sector the percentage of applying sensitivity analysis are 24.42 percent sometimes used, 22.09 percent usually used, and 30.23 percent always used this technique. Operation research techniques were not widely accepted in practice by either sector. About 36 percent of manufacturing firms apply decision tree analysis. Only 29.28 percent use net-work analysis/PERT, and about 34.15 percent employ linear programming. As in the manufacturing sector, decision tree analysis, net-work analysis/PERT and linear programming are the least applied techniques in non-manufacturing firms.

Decision tree analysis is used by 30.23 percent of non-manufacturing firms, net-work analysis/PERT by 40.70 percent, and linear programming by 34.88 percent. Surprisingly, net-work analysis/PERT which is much more suitable in the manufacturing sector had been less accepted in manufacturing firms than in non-manufacturing firms. Inventory control models had been applied by more than one-half of both sectors. They are applied by 58.54 percent of manufacturing firms and 55.81 percent of non-manufacturing firms. Just in time inventory had been adopted more in practice by manufacturing firms than non-manufacturing firms. It is adopted by 51.22 percent of manufacturing firms and only used by 39.53 percent of non-manufacturing firms. This is not surprising since just in time inventory is much more dedicated to manufacturing firms.

In the case of management accounting techniques type II, the most widely accepted techniques by manufacturing firms were other financial ratio analyses, followed by variance analysis, gross profit analysis and contribution reporting. Financial ratio analysis is used by 90.24 percent of manufacturing firms respondents and 73.16 percent claimed they had been used this techniques at least monthly. Variance analysis and gross profit analysis are adopted by 87.80 percent of responding manufacturing firms. Both techniques claimed to be used monthly by about 82.92 percent and 75.60 percent of manufacturing firms respectively. Contribution reporting is applied by 78.05 percent of manufacturing firms and 68.29 percent claimed that they used this technique monthly. These figures are almost the same for non-manufacturing respondents. Variance analysis was the most frequently applied technique being used by 94.19 percent of non-

manufacturing firms. This was followed by gross profit analysis which is being applied by 87.22 percent of non-manufacturing firms, and other financial ratio analysis is adopted by 86.05 percent of non-manufacturing firms.

In the area of management accounting techniques type III, both activity sectors reported that the most widely accepted technique was operating budget. This technique had been applied by 95.12 percent of manufacturing firms and 96.51 percent of non-manufacturing firms. Responsibility accounting also gained wide acceptance by both sectors. It is being used by 73.17 percent of manufacturing firms and 72.09 percent of non-manufacturing firms. Flexible budget and appropriation budget are not popular techniques for either sector. The percentage of manufacturing firms applying flexible budget and appropriation budget is 31.71 percent, while the figure for non-manufacturing firms is 39.53 percent and 17.44 percent respectively. In the case of flexible budget, it is surprising that this technique is received low acceptance in the manufacturing sector. Other budgeting techniques that are performance budget and fixed budget had been applied by more than one-half of responding manufacturing firms as well as non-manufacturing firms. Transfer pricing and standard costing which were expected to be popular techniques among manufacturing firms, in reality have low acceptance. The figure is less than 50 percent of respondents from both sectors claimed to use transfer pricing and standard costing.

The research's findings indicate that conventional management accounting techniques such as capital budgeting, variance analysis, contribution reporting, gross profit analysis, operating budget and responsibility accounting have gained

considerable acceptance and application in Australian public listed manufacturing as well as non-manufacturing companies. Operation techniques such as decision tree analysis, linear programming and net-work analysis/PERT were not popular in Australian public listed manufacturing and non-manufacturing firms. The relatively newer techniques such as just in time inventory and activity based costing have gained growing acceptance in practice.

Management Accounting Practice and Type of Ownership

Table 13B is presented to highlight the effects that type of ownership might have on the adoption of management accounting techniques. In terms of ownership, the respondents were categorised into two type of ownership: domestic controlled firms and foreign controlled firms.

Capital budgeting and sensitivity analysis were the most widely adopted in practice by both types of companies. However, foreign companies tend to apply these techniques more extensively than domestic companies. The percentage applying capital budgeting and sensitivity analysis by foreign firms is 92.31 percent . Fifteen percent of foreign firms claimed that they usually use capital budgeting techniques and 69.23 percent of foreign firms claimed that they always use capital budgeting. For sensitivity analysis, 38.46 percent of foreign firms reported that they sometimes use this technique, 23.01 percent of foreign firms said that they usually use, and 30.77 percent of foreign firms claimed that they always use sensitivity analysis. The percentage of domestic firms who claimed to use capital budgeting and sensitivity analysis is 86.84 percent and 78.95 percent.

TABLE 13B
THE EXTENT OF MANAGEMENT ACCOUNTING TECHNIQUES
% USED BY RESPONDENTS ACCORDING TO THE TYPE OF OWNERSHIP

Techniques Type I	Never Used		Seldom Used		Sometimes Used		Usually Used		Always Used	
	F	D	F	D	F	D	F	D	F	D
Decision tree analysis	38.46	71.05	7.69	14.91	53.85	8.77	-	4.39	-	0.88
Relevant cost analysis	23.08	31.58	7.69	4.39	23.08	14.91	15.39	28.07	30.76	21.05
Capital budgeting	7.69	13.16	-	0.88	7.69	7.90	15.39	21.92	69.23	56.14
Linear programming	38.46	68.42	38.46	18.42	15.39	9.65	7.69	3.51	-	-
Net-work analysis/PERT	53.84	64.04	23.08	13.16	23.08	15.79	-	5.26	-	1.75
Inventory control models	23.08	45.61	-	7.90	23.08	9.65	15.39	12.28	38.45	24.56
Just in time inventory	30.77	59.64	15.39	7.90	-	9.65	38.45	9.65	15.39	13.16
Sensitivity analysis	7.69	21.05	-	4.39	38.46	21.93	23.08	26.31	30.77	26.32

Techniques Type II	Not Used		Monthly		Quarterly		Semi-Annually		Annually	
	F	D	F	D	F	D	F	D	F	D
Variance analysis	7.69	7.90	84.62	85.08	-	4.39	-	0.88	7.69	1.75
Break-even analysis	38.46	45.61	30.77	21.05	-	9.65	7.69	7.90	23.08	15.79
Contribution reporting	15.39	21.05	69.23	69.30	7.69	3.51	-	0.88	7.69	5.26
Inventory turnover	7.69	43.85	76.93	42.11	7.69	4.39	-	5.26	7.69	4.39
Acc. receivable turnover	38.46	39.47	61.54	57.02	-	-	-	0.88	-	2.63
Aging acc. receivable	23.08	29.83	69.23	67.54	-	0.88	-	-	7.69	1.75
Gross profit analysis	-	14.04	92.31	76.31	-	3.51	-	4.39	7.69	1.75
Other financial ratio	7.69	13.16	76.93	65.79	-	8.77	7.69	6.14	7.69	6.14

Techniques Type III	Not Used		Used	
	F	D	F	D
Responsibility acctg.	15.39	28.95	84.61	71.05
Transfer pricing	53.85	61.4	46.15	38.6
Standard costing	38.46	56.14	61.54	43.86
Activity based costing	76.92	65.79	23.08	34.21
Operating budget	-	4.39	100	95.61
Flexible budget	69.23	62.28	30.77	37.72
Appropriation budget	69.23	78.95	30.77	21.05
Performance budget	46.15	49.12	53.85	50.88
Fixed budget	30.77	43.86	69.23	56.14

F= Foreign firms
D= Domestic firms

Fifty-six percent of domestic firms reported to always use capital budgeting and 26.32 percent of domestic firms said to always use sensitivity analysis.

Operation research techniques such as decision tree analysis, linear programming and net-work analysis/PERT were less popular among domestic firms than foreign firms. Decision tree analysis had been applied by 28.95 percent of domestic firms, while the percentage for foreign firms was 61.54 percent. Similar findings also appear for linear programming which was used by 31.58 percent of domestic firms and 61.54 percent of foreign firms. Net-work analysis/PERT is being applied by 35.96 percent of domestic firms and 46.16 percent of foreign firms. In the area of inventory control, both inventory control models and just in time inventory techniques had been applied more extensively by foreign firms than domestic firms. Inventory control models being applied by 76.99 percent of foreign firms and 38.45 percent of domestic firms respondents claimed always use this techniques. In contrast, inventory control models only being applied by 54.39 percent of domestic firms with category of always use this techniques 24.56 percent of responding domestic firms. The percentage of foreign firms applying just in time inventory is 69.23 percent and the frequency of its application were 38.45 percent of foreign firms claimed usually use and 15.39 percent said that they always use this techniques.

On the other hand, just in time inventory had been applied by only 40.36 percent of domestic firms with the frequency of application 9.65 percent usually use and 13.16 percent always use this technique.

In the case of financial ratio techniques, foreign firms and domestic firms did not report any differences in applying financial ratio techniques. Almost all techniques had been applied by more than 60 percent of responding foreign and

domestic firms. More than one-half of respondents claimed that they apply all techniques monthly with the exception of break-even analysis which was applied monthly and annually. In the foreign firms, the most widely accepted techniques in order are gross profit analysis, variance analysis, inventory turnover analysis, and other financial ratio. Meanwhile, the most adopted techniques in the domestic firms are variance analysis, other financial ratio, gross profit analysis and contribution reporting.

There was not much difference in the application of management accounting techniques type III between foreign firms and domestic firms. In the area of budget, three types of budget techniques gained wide acceptance in practice for both types of firms. Those budget techniques are operating budget, fixed budget and performance budget. All responding foreign firms (13 firms) claimed to use operating budget. This was followed by fixed budget which had been used by 69.23 percent of foreign firms and performance budget.

The percentage of domestic firms applying operating budget , fixed budget and performance budget is 95.61 percent, 56.14 percent and 50.88 percent respectively. The other two types of budget that are flexible budget and appropriation budget only received minor acceptance in practice being applied by less than 40 percent of responding foreign and domestic firms. Responsibility accounting also gained wide acceptance in practice. This technique was being applied by 84.61 percent of foreign firms and 71.05 percent of domestic firms. Standard costing had been applied more extensively by foreign firms than domestic

firms. It is being applied by 61.54 percent of foreign firms and 43.86 percent of domestic firms.

The research findings show that capital budgeting and sensitivity analysis were the most widely accepted management accounting techniques type I by both foreign and domestic firms. The frequency of its application mostly claimed to be usually used and always used. In contrast, operation research techniques such as decision tree analysis, linear programming and net-work analysis/PERT only gained minor acceptance in both foreign and domestic firms. Foreign firms applied more extensively inventory control models and just in time inventory than domestic firms. In the area of management accounting techniques type II which is mainly financial ratio analysis, both foreign and domestic firms had applied almost all techniques monthly. Only break-even analysis had been claimed to be used monthly as well as annually. Operating budget, fixed budget and performance budget were the most popular budget techniques applied by both foreign and domestic firms, while flexible budget and appropriation budget only gained minor acceptance in those two types of companies. Foreign firms used slightly more responsibility accounting and standard costing techniques than domestic firms.

Summary

The first section of this chapter provides the results of pilot study and full scale study. The pilot study was conducted to determine feasibility of the questionnaire and interest in the study objective. One hundred questionnaires were sent to the respondents and 28 responses were received or 28 percent a response

rate. This indicates an existing interest in the population. Some minor revision of the questionnaires were suggested by respondents. In the full scale study, a revised questionnaire was sent to all Top 500 Australian companies. Out of 500 questionnaires sent, 101 usable responses were received from the first mailing or 20 percent response rate. Further 26 usable responses were received after the follow up letter. Total usable responses were 127 which accounted for 25 percent response rate. Nonresponse bias was tested by comparing early respondents with late respondents in terms of their answer to the questionnaires. This test was accomplished by comparing mean response score of each type of management accounting techniques applied for the first 101 early returned questionnaires with the last 26 late returned questionnaires. The result shows a lack of a material nonresponse bias.

The second section provides a profile of the respondents. The main activity sector of respondents were manufacturing, mining and finance companies. About 90 percent of respondents were controlled by domestic firms and the remaining were controlled by foreign firms. When respondents were classified by years in business operation, it indicates that nearly one-half of the respondents have been in business for more than 30 years. About one-third have been in business for less than 10 years and about one-fifth have been in business between 10 to 30 years. The respondents of domestic firm were dominated by mining and manufacturing firms, while respondents of foreign firm were dominated by manufacturing firms. Nearly one-half of domestic firms have been in business operation for more than 30 years. This figure is even higher for the foreign firms

which accounted of two-third of firms. The respondents who have been in business for more than 30 years mainly came from manufacturing and mining sector.

The third section presents the results of management accounting practice adopted by the respondents. For the management accounting techniques type I, the most frequent used of techniques were capital budgeting, sensitivity analysis and relevant cost analysis. Operation research techniques seemed less popular with the respondents. A new technique such as just in time inventory had gained acceptance in practice. This technique had been used by nearly one-half of the respondents with category of usually used 12.60 percent and always used 13.99 percent of the respondents. The most popular techniques for management accounting techniques type II were variance analysis, contribution reporting, gross profit analysis, and other financial ratio analysis which had been used by more than three-quarter of the respondents. Break-even analysis which is popular technique according to textbooks had not been used as widely in practice. The study result shows that break-even analysis had been used by 63.22 percent of the respondents.

In the case of management accounting techniques type III, operating budget was the most popular technique, being adopted by almost all respondents which accounted for 96.06 percent. This was followed by responsibility accounting, fixed budget, and performance budget. In contrast, appropriation budget was a less popular technique, followed by activity based costing, flexible budget and transfer pricing. A new technique such as activity based costing is now being adopted in Australia and it was used by 33.07 percent of the respondents. Capital budgeting and sensitivity analysis were widely accepted in practice for both manufacturing

and non-manufacturing firms. In contrast, operations research techniques were not widely accepted in practice by either sector. In the area of management accounting techniques type III, both activity sectors reported that the most widely accepted technique was operating budget, followed by responsibility accounting. Flexible budget and appropriation budget were not popular techniques for either sector.

In terms of ownership, capital budgeting and sensitivity analysis were the most widely adopted in practice by domestic firms as well as foreign firms. However, foreign firms tend to apply these techniques more extensively than domestic firms. Operations research techniques such as decision tree analysis, linear programming and net-work analysis/PERT were less popular among domestic firms than foreign firms. Both inventory control models and just in time inventory had been applied more extensively by foreign firms than domestic firms. In the case of financial ratio analysis, foreign firms and domestic firms did not report any differences. Similar result were also found for management accounting techniques type III that there was no difference in the application of management accounting techniques type III between foreign firms and domestic firms.

CHAPTER V

EVALUATION OF THE STUDY'S HYPOTHESES

This chapter is concerned with the statistical analysis which is applied to test the study's hypotheses. Before presenting the findings, a test of the data collected is given. This test includes test of randomness and internal consistency (reliability test). Since data collected to test the hypotheses came from questionnaires sent to the respondents, it is necessary to run test of these data collected. The first section provides the results of data test and the second section describes the findings of hypothesis testing.

Test of Randomness

Test of randomness basically to examine whether respondents answered the questionnaires randomly or not. Test of randomness is carried out by comparing the observed frequency of response score and the frequency of response score expected if respondents answered randomly. The chi-square test is suitable for analysing the test of randomness. Chi-square can be used to test whether a significant difference exists between an observed number of responses falling in each category and an expected number based upon the null hypothesis. Thus, the chi-square test assesses the degree of correspondence between the observed and expected observation in each category. The null hypothesis is tested by using the following statistic:

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$$

Where: O_i = the observed number of cases in the i th category

E_i = the expected number of cases in the i th category when H_0 is true

k = the number of categories

If the agreement between the observed and expected frequency is close, the differences $(O_i - E_i)$ will be small and, consequently, χ^2 will be small. However, if the divergence is large, the value of χ^2 also will be large. Roughly speaking, the larger the value of χ^2 , the less likely it is that the observed frequency came from the population on which the hypotheses H_0 and the expected frequencies are based (Siegel, 1988). In this case, if the difference is significant then it means that respondents did not answer the questionnaire randomly. In this study, the questionnaire is divided into three types of management accounting techniques, therefore the test of randomness is conducted for each type of management accounting technique.

Table 14 shows the result of test randomness for each of the management accounting techniques data with a significance level 0.05. The results indicate that the observed χ^2 for management accounting techniques type I is 526.54. This figure is higher than the value of chi-square according to table with degree of freedom 7 which shows 14.07. It can be concluded that the frequency of response score from the respondents is significantly different from the frequency of

response score expected. Hence, respondents did not answer the questionnaire randomly.

TABLE 14
SUMMARY OF TEST OF RANDOMNESS

Type of Data		χ^2 Observed	χ^2 Critical	df	Explanation
Accounting	Technique Type I	526.54	14.07	7	No random responses
Accounting Techniques	Type II	157.71	14.07	7	No random responses
Accounting Techniques	Type III	101.87	15.51	8	No random responses

$\alpha = 0.05$
 $df = k - 1$

Similar results for data of management accounting techniques type II also shows that the observed chi-square is 157.71 which is higher than its critical value with level of significance 0.05 and degree of freedom 7 that is 14.07. It means that the frequency of score responses for management accounting techniques type II is significantly different from the frequency of score responses expected, or it can be said that the respondents did not answer the question of application of management accounting techniques type II randomly (see appendix C for the calculation).

In the case of accounting techniques type III, the observed chi-square of these techniques is also higher than its critical value with significance level 0.05 and degree of freedom 8. The observed chi-squares is 101.87 and the critical value is 15.51. Again the results are confirmed that the respondents did not answer randomly for accounting techniques type III. From the findings above, it can be inferred that the respondents did not answer randomly for all the applications of

management accounting techniques. Therefore, all data collected can be accepted and processed further.

Test of Internal Consistency or Reliability Test

Before data can be accepted and processed further, certain condition must be fulfilled and these are concerned with the usage of three different types of measuring instruments in this study. The instrument used must give a reliable measurement which means that the result obtained from the instrument on certain occasion under certain conditions should be reproducible. The result should be the same if it remeasures the same trait under identical conditions on another occasion (Magnusson, 1966). This aspect of the accuracy of measuring instruments is called reliability.

As discussed in previous chapter, the extent use of management accounting techniques is classified into three different techniques. Those are techniques type I, techniques type II and techniques type III. Each type of technique is measured by different instruments. Each instrument was tested for reliability. There are four basic methods to estimate reliability: retest, alternative forms, split -halves, and internal consistency (Carmin and Zeller, 1979). All four methods attempt to determine the proportion of variance in a measurement scale that is systematic. Basically, these methods correlate scores obtained from a scale with scores from some form of replication of the scale. If the correlation is high, most of the variance is of the systematic type, and with some degree of consistency, the measures can be depended upon to yield the same result (Peter, 1979).

The basic difference among the four methods is in what the scale is to be correlated with to compute the reliability coefficient. In test-retest, the identical set of measures is applied to the same subjects at two different times. The two sets of obtained scores are then correlated. In alternative forms, two similar sets of items are applied to the same subjects at two different times. Scale items on one form are designed to be similar to scale items on the other form. The resulting scores from the two administrations of the alternative forms are then correlated. The basic form of internal consistency reliability is split-halves in which item scores obtained from the administration of a scale are split in half and the resulting half scores are correlated. The scale is usually split in terms of odd and even numbered items or on random basis.

The test-retest method involved at least three basic problems. First, different results may be obtained depending on the length of time between measurement and remeasurement. Second, if a change in the phenomena occurs between the first and second administration, there is no way to distinguish between the change and unreliability. Third, the retest correlation is only partly dependent on the correlation between different items in the scale, because a portion of the correlation of sums includes the correlation of each item with itself (Peter, 1979). Similar problem are also found for the split-halves methods. Different results may be obtained depending on how the items are split in half. One approach to overcome this problem is to determine the mean reliability coefficient for all possible ways of splitting a set of items in half. A formula which accomplishes this step is Cronbach's coefficient alpha (1951).

Cronbach’s alpha was used to test the reliability of data in this study. The advantage of using Cronbach’s alpha is that it requires only one administration of the test. Cronbach’s alpha was calculated for each type of management accounting technique by using statistical package program SPSS. Table 15 shows the result of reliability test for each management accounting techniques.

TABLE 15
TEST OF DATA RELIABILITY

Type of Data	Cronbach’s Alpha
Management Accounting Techniques Type I	0.7027
Management Accounting Techniques Type II	0.7927
Management Accounting Techniques Type III	0.5463

The result indicate that Cronbach’s alpha for management accounting techniques type I and II reached 0.7027 and 0.7927 respectively. Meanwhile, Cronbach’s alpha for management accounting techniques type III only reached 0.5463.

Reviewing the results of reliability coefficients reported in table 15 raises the question of whether this result demonstrated satisfactory levels of reliability. Though no hard and fast rules have been offered for evaluating the magnitude of reliability coefficient, Nunnally (1967, p 226) suggests the following guide. In early stage of research, modest reliability in the range of 0.50 to 0.60 will suffice. For basic research, it is argued that increasing reliability beyond 0.80 is unnecessary because at that level correlation are attenuated very little by measurement error. In applied settings, in contrast to basic research, a reliability of 0.90 is the minimum that should be tolerated and a reliability of 0.95 should be considered the desirable standard. Since the present study is still in the early stage

of research, these guidelines suggests that the result of test of reliability demonstrated at least satisfactory level.

Hypotheses Testing

Before presenting the results of hypothesis testing, a brief review is given of the research methodology employed and the key variables involved. As discussed in chapter 3, the extent to which advanced management accounting techniques were applied by respondents was determined by investigating twenty-five specific techniques. These techniques were classified into three types of techniques, namely management accounting techniques type I, type II and type III. These classification were based on the frequency of its application by sample firms. Type I techniques are those that are used at intervals that are not regular. Type II techniques are those that are used at regular intervals such as monthly or annually and type III techniques are either used or not used. A Likert scaling system is employed for each type of technique.

An overall score was computed for each type of technique which gave an indication of the extent of use of management accounting techniques by respondents . In the case of management accounting techniques type I, respondents were asked to rate the extent use of techniques in the following five points scale:

- 0 if the management accounting techniques is never used at all.
- 1 if the management accounting techniques is seldom used.
- 2 if the management accounting techniques is sometimes used.
- 3 if the management accounting techniques is usually used.

4 if the management accounting techniques is always used.

A five points scale also applied for management accounting techniques type II. A score of 0 is given if respondents have not used the accounting techniques, a score of 4 is given if respondents applied the accounting techniques at least monthly, a score of 3 is given for applying the accounting techniques quarterly, a score of 2 if the accounting techniques applied semi-annually, and a score of 1 is given if respondents applied the accounting techniques annually. Accounting techniques type III are either used or not used. A score of 1 is given if it used and a score of 0 if it is not used.

The independent variables are contextual firm characteristics. The contextual firm characteristics variables comprise: size, age, industry, risk, ownership, leverage and capital intensity. The firm characteristics variables are defined as follow: (1) size is measured by the average operating assets of the respondents for the six year period, 1987-1992. The larger the absolute dollar amount of the average assets, the greater a firm's size. (2) age or years in business operation is measured from the year it is incorporated. The longer respondents in business operation, the older is the respondents. (3) type of industry is classified into manufacturing firms and non-manufacturing firms. (4) capital intensity is measured by the yearly depreciation expenses divided by the yearly operating assets for each of the six years in the period, 1987-1992. The larger this ratio, the higher the capital intensity of the firms. (5) risk is measured by the standard deviation of the firm's adjusted operating rate of return for the six year period, 1987-1992. The larger the standard deviation, the riskier the firm. (6) type of

ownership is classified into two categories public listed domestic firm and public listed foreign firm. (7) leverage is measured by the ratio between total debts and equities for the six year period, 1987-1992. The larger the ratio, the higher firm's leverage.

For testing the hypothesis two through eight, these independent variables are categorised further into: size (large vs small), age (old vs new), capital intensity (high vs low), risk (high vs low), and leverage (high vs low). The categorisation of independent variables are based on its median value. Table 16 shows the descriptive statistic of some independent variables. In terms of size which is measured by the average operating assets, the respondents of this study on average have operating assets about \$ 1,373.654 million.

TABLE 16
DESCRIPTIVE STATISTICS OF SOME INDEPENDENT VARIABLES

Variables	Mean	Median	Maximum	Minimum	Std Dev.
Size (A\$'000)	\$1,373,654	\$108,335	\$86,966,450	\$6,135	\$7,793,750
Age	40 years	28 years	160 years	6 years	37 years
Risk	0.076	0.045	0.643	0.007	0.092
Leverage	1.683	0.935	15.907	0.057	2.833
Capital intensity	0.030	0.026	0.238	0	0.029

The minimum operating assets reported by respondents was \$ 6.135 million and the maximum operating assets reported by respondents was \$ 86,966.450 million. Due to the wide range between minimum and maximum value of respondents' operating assets, size is classified into large and small firms is based on its median

value instead of its mean. Therefore, firm who has an operating assets above its median value is grouped as large firms and firm who has an operating assets below its median is grouped as small firms.

On average the respondents of this study have been in business for 40 years. The shortest period in business reported by respondents was 6 years and the longest period in business was 160 years with standard deviation 37 years. In term of age, the respondents also classified as old and new firms based on median value. Hence, respondents who have been in business more than the median value 28 years are classified as old firms, and those who have been in business less than 28 years are classified as new firms. The highest leverage reported by respondents was 15.907 which means that every \$ 15.907 debt is only backed up by \$ 1.00 equity and the lowest leverage reported was 0.057 which means every \$0.057 debt is backed up by \$1.00 which is very liquid. On average the respondents have leverage about 1.683. Due to the wide range between its maximum value and its minimum value of risk, leverage and capital intensity, these three variables were grouped into high and low risk, leverage and capital intensity based on the median value. If the respondents have risk, leverage and capital intensity value above the median, they are classified as high and vice versa.

To test the study's hypotheses two through eight, the technique of nonparametric statistical analysis, as discussed in chapter 3, is adopted, namely the Mann-Whitney U-test (M-W U test). M-W U test is basically used to test whether two independent groups have the same distribution. Suppose two groups of firms, X and Y have the same distribution with regard to some operationally defined

characteristics, say the extent use of management accounting techniques. The null hypothesis, H_0 , is that X and Y have the same distribution in the extent use of management accounting techniques. The alternative hypothesis, H_1 , may be that group X score is higher than group Y. The alternative hypothesis may be accepted if the probability that a score from group X is larger than the score from group Y is greater than one-half. That is, if x is one observation (score) from group X, and y is one observation (score) from Y, then the alternative hypothesis, H_1 , is that $p(x > y) > 1/2$. If the evidence support H_1 , this implies that the extent use of management accounting techniques of group X is higher than the group Y (Siegel and Castellan, 1988, p 129). In this study, M-W U test is calculated by using statistical package SPSS.

Hypothesis 2

The hypothesis to be tested concerns size and the extent application of management accounting techniques. The null hypothesis (H_{02}) was tested against the alternative hypothesis H_{12} , that advanced management accounting techniques are applied more extensively in large companies than in other companies. Table 17 show the result of hypothesis testing. As shown in table 17, there were statistical difference (at 0.05 significant level) in the application of advanced management accounting techniques type I and type III. The observed probability was 0.0024 for accounting technique type I and 0.0279 for accounting techniques type III. These observed probability were less than 0.05 which means the null hypothesis was rejected and the alternative hypothesis was accepted that advanced management

TABLE 17
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY COMPANY SIZE (OPERATING ASSETS)

Techniques Used	Mean Rank Score		Z	One-tailed P	
	Other Firms	Large Firms			
Techniques Type I :	54.85	73.29	-2.8274	0.0024	*
Decision tree analysis	57.60	70.50	-2.3872	0.0085	*
Relevant cost analysis	61.70	66.33	-0.7322	0.2320	
Capital budgeting	54.15	74.01	-3.4033	0.0004	*
Linear programming	56.05	72.07	-2.9286	0.0017	*
Net-work analysis/PERT	61.87	66.17	-0.7687	0.2211	
Inventory control models	61.59	66.45	-0.7882	0.2153	
Just in time inventory	64.36	63.63	-0.1236	0.4508	
Sensitivity analysis	52.34	75.84	-3.7054	0.0001	*
Techniques Type II :	59.72	68.35	-1.3246	0.0927	**
Variance analysis	64.99	62.99	-0.4938	0.3107	
Break-even analysis	62.85	65.17	-0.3750	0.3539	
Contribution reporting	58.87	69.21	-1.9519	0.0255	*
Inventory turnover analysis	62.70	65.32	-0.4368	0.3312	
Account receivable turnover	61.54	66.50	-0.8775	0.1901	
Aging account receivable	62.24	65.79	-0.6653	0.2529	
Gross profit analysis	59.00	69.08	-2.1311	0.0166	*
Other financial ratio	56.09	72.03	-2.9220	0.0018	*
Techniques Type III :	57.88	70.21	-1.9134	0.0279	*
Responsibility accounting	59.67	68.40	-1.7259	0.0422	*
Transfer pricing	59.84	68.23	-1.5185	0.0645	**
Standard costing	66.75	61.21	-0.9836	0.1627	
Activity based costing	63.84	64.17	-0.0621	0.4753	
Operating budget	64.52	63.48	-0.4724	0.3183	
Flexible budget	59.35	68.72	-1.7153	0.0432	*
Appropriation budget	60.91	67.13	-1.3263	0.0924	**
Performance budget	57.30	70.81	-2.3892	0.0085	*
Fixed budget	64.21	63.79	-0.0760	0.4697	

* Significant at 5% level

** Significant at 10% level

accounting techniques type I and III were applied more extensively in large companies than in other (small and medium) companies. There was also statistical difference at less than 0.10 significant level in the application of advanced management accounting techniques type II. Therefore, advanced management accounting techniques type II are also applied more extensively in large companies than in small and medium companies with the observed probability 0.0927.

In the case of management accounting techniques type I, four out of eight techniques were statistically significant at less than 0.05. Those techniques were decision tree analysis, capital budgeting, linear programming and sensitivity analysis which were applied more extensively by large firms than small and medium firms. For accounting techniques type III the result shows that five out of nine techniques were significant. Responsibility accounting, flexible budget and performance budget were significant at less than 0.05. While transfer pricing and appropriation budget were significant at less than 0.10. This result indicates that responsibility accounting, transfer pricing, flexible budget, appropriation budget and performance budget were applied more extensively in large firms than in small and medium firms. Only three out of eight techniques were significant at less than 0.05 for management accounting techniques type II. These techniques were contribution reporting, gross profit analysis and other financial ratio. There were no significant differences in the other five techniques.

This result should not be surprising, since size can be considered as a measure of the complexity of business operations. As firms grow, more data are required for rationalising and coordinating their activities. The required data is

supplied by the firm's accounting system. It is therefore quite normal to expect that the extent of use of management accounting techniques will be greater in the larger firms than in the small and medium firms. Previous studies also have tested the relationship between the extent of use of accounting techniques and firm's size. More and Reichert (1983) analysed the association between twenty-three financial management techniques and the size of firm which is measured by their total assets. The result indicates that out of twenty-three techniques, eleven techniques appear to be directly related to firm size. Kwandwalla (1977) also observed the relationship between organisation size and the sophistication of control and information system (CIS). A significant relationship between organisation size and the sophistication of CIS was found. He asserted that as large firms tend towards higher differentiation and involvement in a variety of markets and activities, more sophisticated control and information systems are needed. Moores and Stuart (1985) and Lal (1991) adopted the same variables of CIS used by Kwandwalla and examined the relationship between size and CIS. Both studies support the evidence provided by Kwandwalla (1977) who found a positive relationship between firm size and CIS.

Hypothesis 3

The null hypothesis was tested against the alternative hypothesis H13 that advanced management accounting techniques are applied more extensively in old companies than in new companies. The results appear in table 18, and they indicate that there were statistical differences (at less than 0.05 significant level)

in the application of advanced management accounting techniques type I, type II and type III. The observed probability for accounting techniques type I, II and III

TABLE 18
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY COMPANY AGE

Techniques Used	Mean Rank Score		Z	One-tailed P	
	New Firms	Old Firms			
Techniques Type I :	56.87	71.25	-2.2045	0.0138	*
Decision tree analysis	55.72	72.41	-3.0896	0.0010	*
Relevant cost analysis	62.06	65.97	-0.6176	0.2684	
Capital budgeting	63.13	64.89	-0.3023	0.3812	
Linear programming	56.30	71.82	-2.8364	0.0023	*
Net-work analysis/PERT	62.95	65.07	-0.3010	0.3520	
Inventory control models	58.10	70.09	-1.9564	0.0252	*
Just in time inventory	57.89	70.21	-2.1017	0.0178	*
Sensitivity analysis	65.49	62.48	-0.4743	0.3177	
Techniques Type II :	53.70	74.47	-3.1881	0.0007	*
Variance analysis	64.40	63.60	-0.1983	0.4214	
Break-even analysis	59.34	68.73	-1.5204	0.0642	**
Contribution reporting	57.88	70.22	-2.3293	0.0099	*
Inventory turnover analysis	56.23	71.89	-2.6152	0.0045	*
Account receivable turnover	54.57	73.58	-3.3623	0.0004	*
Aging account receivable	55.48	72.66	-3.2261	0.0007	*
Gross profit analysis	58.77	69.31	-2.2277	0.0130	*
Other financial ratio	63.11	64.90	-0.3292	0.3710	
Techniques Type III :	55.53	72.60	-2.6490	0.0041	*
Responsibility accounting	63.64	64.37	-0.1433	0.4431	
Transfer pricing	56.86	71.25	-2.604	0.0046	*
Standard costing	58.81	69.27	-1.8555	0.0318	*
Activity based costing	63.84	64.17	-0.0621	0.4753	
Operating budget	63.52	64.48	-0.4366	0.3312	
Flexible budget	67.29	60.66	-1.2137	0.1125	
Appropriation budget	58.93	69.15	-2.1791	0.0147	*
Performance budget	58.29	69.80	-2.0356	0.0209	*
Fixed budget	56.27	71.85	-2.7846	0.0027	*

* Significant at 5% level

** Significant at 10% level

was 0.0138, 0.0007 and 0.0041 respectively. Since the observed probability is less than 0.05, the null hypothesis was rejected. It can be concluded that advanced management accounting techniques type I, II and III are applied more extensively in old companies than in new companies.

Examining table 18 in detail reveals that out of eight accounting techniques type I, four techniques were significantly different at less than 0.05 confidence level. This finding shows that decision tree analysis, capital budgeting, inventory control models and just in time inventory were applied more extensively in old firms than in new firms. In the case of management accounting techniques type II, six out of eight techniques were found to be significantly different at less than 0.05 level with the exception of one technique significant at less than 0.10 level. Those techniques were break-even analysis, contribution reporting, inventory turnover analysis, account receivable turnover, aging account receivable and gross profit analysis. All of these techniques were applied more extensively by old firms than new firms. For management accounting techniques type III, out of nine techniques, five techniques were found to be significantly different at less than 0.05 level. These techniques were transfer pricing, standard costing, appropriation budget, performance budget and fixed budget which were applied more extensively in old firms than in new firms.

As discussed in chapter 3, even though the association between company age and the extent use of management accounting techniques has rarely been addressed in the literature, it is generally held that the extent of use of management accounting techniques is positively related to the age of firms. This

study has found at the empirical level that advanced management accounting techniques were applied more extensively in old firms than in new firms. The explanation is that old firms are more likely to be better established, to have more experience and to recognise more varieties of management accounting techniques than newer firms. From this result it appears that as firms mature and extend, the control network necessary for management becomes more pervasive. This may be due to either a growing span of control, or to the development of control systems requiring time to come to fruition.

Hypothesis 4

The null hypothesis was tested against the alternative hypothesis H14 that advanced management accounting techniques are applied more extensively in manufacturing companies than in non-manufacturing companies. Table 19 displays the results of hypothesis testing.

As shown in table 19, there were statistical differences at less than 0.05 significance level for all three types of management accounting techniques. The observed probability were 0.0002, 0.0001 and 0.0002 for accounting types I, II and III respectively. These figures were less than 0.05 significance level, which means that the null hypothesis was rejected. Therefore, the advanced management accounting techniques were applied more extensively in manufacturing firms than in non-manufacturing firms.

The significant result for management accounting techniques type I was represented by five out of eight techniques. Those techniques are relevant cost

analysis, capital budgeting, net-work analysis/PERT, inventory control models and just in time inventory which were significantly different at less than 0.05

TABLE 19
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY TYPE OF INDUSTRY

Techniques Used	Mean Rank Score		Z	One-tailed P	
	Non-manufacture	Manufacture			
Techniques Type I :	56.08	80.61	-3.5167	0.0002	*
Decision tree analysis	61.74	68.74	-1.2125	0.1127	
Relevant cost analysis	58.30	75.95	-2.6099	0.0046	*
Capital budgeting	60.30	71.76	-1.8355	0.0332	*
Linear programming	62.01	68.18	-1.0562	0.1455	
Net-work analysis/PERT	57.83	76.94	-3.1947	0.0007	*
Inventory control models	57.00	78.68	-3.2840	0.0005	*
Just in time inventory	55.80	81.20	-4.0522	0.0001	*
Sensitivity analysis	64.99	61.91	-0.4541	0.3249	
Techniques Type II :	52.06	89.05	-5.3090	0.0001	*
Variance analysis	61.05	70.18	-2.1081	0.0175	*
Break-even analysis	58.24	76.07	-2.7006	0.0035	*
Contribution reporting	59.94	72.52	-2.2207	0.0132	*
Inventory turnover analysis	54.28	84.39	-4.7042	0.0001	*
Account receivable turnover	53.10	86.85	-5.5823	0.0001	*
Aging account receivable	56.26	80.24	-4.2119	0.0001	*
Gross profit analysis	61.21	69.85	-1.7092	0.0874	**
Other financial ratio	62.03	68.13	-1.0467	0.1476	
Techniques Type III :	55.97	80.85	-3.6114	0.0002	*
Responsibility accounting	60.83	70.66	-1.8189	0.0345	*
Transfer pricing	56.72	79.27	-3.8143	0.0001	*
Standard costing	53.46	86.11	-5.4176	0.0001	*
Activity based costing	62.94	66.23	-0.5790	0.2813	
Operating budget	62.81	66.50	-1.5690	0.0583	**
Flexible budget	64.87	62.18	-0.4593	0.3230	
Appropriation budget	61.08	70.13	-1.8060	0.0355	*
Performance budget	63.99	64.02	-0.0060	0.4976	
Fixed budget	62.20	67.77	-0.9303	0.3522	

* Significant at 5% level

** Significant at 10% level

confidence level. Hence, these five techniques were applied more extensively by the manufacturing firm respondents than non-manufacturing firm respondents. For management accounting techniques type II, with the exception of other financial ratio, all techniques were significantly different. Those techniques are variance analysis, break-even analysis, contribution reporting, inventory turnover analysis, account receivable turnover, aging account receivable which were significant at less than 0.05 confidence level. Gross profit analysis was significant at less than 0.10 instead of 0.05 significant level. Out of nine management accounting techniques type III, five techniques were found to be significantly different. Responsibility accounting, transfer pricing, standard costing and appropriation budget were significant at less than 0.05, while operating budget was significant at less than 0.10.

The research findings were not surprising. In the case of management accounting technique type I, those five techniques which were significantly different are typical accounting techniques mostly found in manufacturing firms. Similar results were also found for management accounting techniques type III. Techniques such as responsibility accounting, transfer pricing, standard costing and operating budget were primarily developed for the manufacturing sector. Therefore, it is quite reasonable to expect that management accounting techniques were applied more extensively in manufacturing firms than in non-manufacturing firms. It should be remembered that management accounting techniques were earliest developed in the manufacturing sector, and hence the industry wide

acceptance alone could prompt manufacturing firms to apply management accounting techniques without giving formal thought as to their usefulness.

Hypothesis 5

The null hypothesis was tested against the alternative H15 that advanced management accounting techniques are applied more extensively in companies that have high capital intensity than companies that have low capital intensity. The results appear in table 20. Table 20 shows that there were significant differences at less than 0.05 for all type of management accounting techniques. The observed probability for accounting type I, II and III was 0.0016, 0.0297 and 0.0186 respectively. These observed probabilities were less than the significant level of 0.05. Therefore, the null hypothesis was rejected and alternative hypothesis was accepted that advanced management accounting techniques are applied more extensively in companies that have high capital intensity than companies that have low capital intensity.

Looking at individual accounting techniques, the result shows that almost all type I techniques were statistically significant at less than 0.05, except for network analysis/PERT where no difference was indicated. This results suggest that decision tree analysis, relevant cost analysis, capital budgeting, linear programming, inventory control models, just in time inventory, and sensitivity analysis were applied more extensively by high capital intensity firms than low capital intensity firms. In the case of management accounting techniques type II, four out of eight techniques were found to be significantly different. Break-even

TABLE 20
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY COMPANY CAPITAL INTENSITY

Techniques Used	Mean Rank Score		Z	One-tailed P	
	Low CI	High CI			
Techniques Type I :	54.45	73.71	-2.953	0.0016	*
Decision tree analysis	59.38	68.69	-1.7226	0.0425	*
Relevant cost analysis	56.00	72.13	-2.5503	0.0054	*
Capital budgeting	57.12	70.99	-2.3777	0.0087	*
Linear programming	59.09	68.99	-1.8113	0.0351	*
Net-work analysis/PERT	61.60	66.44	-0.8644	0.1937	
Inventory control models	57.95	70.14	-1.9743	0.0242	*
Just in time inventory	58.02	70.08	-2.0587	0.0198	*
Sensitivity analysis	57.62	70.48	-2.0290	0.0213	*
Techniques Type II :	57.91	70.19	-1.8853	0.0297	*
Variance analysis	63.52	64.49	-0.2411	0.4048	
Break-even analysis	57.96	70.13	-1.9719	0.0243	*
Contribution reporting	59.85	68.21	-1.5776	0.0574	**
Inventory turnover analysis	60.25	67.81	-1.2629	0.1033	
Account receivable turnover	59.52	68.55	-1.5962	0.0552	**
Aging account receivable	60.59	67.46	-1.2893	0.0987	**
Gross profit analysis	62.84	65.18	-0.4962	0.3099	
Other financial ratio	63.85	64.15	-0.0549	0.4782	
Techniques Type III :	57.34	70.77	-2.0845	0.0186	*
Responsibility accounting	61.66	66.38	-0.9346	0.1750	
Transfer pricing	63.80	64.20	-0.0712	0.4716	
Standard costing	60.80	67.25	-1.1457	0.1260	
Activity based costing	59.87	68.20	-1.5651	0.0588	**
Operating budget	66.50	61.46	-2.2904	0.0110	*
Flexible budget	62.33	65.70	-0.6169	0.2687	
Appropriation budget	59.92	68.14	-1.7527	0.0399	*
Performance budget	61.27	66.78	-0.9746	0.1649	
Fixed budget	59.25	68.83	-1.7119	0.0435	*

* Significant at 5 % level
** Significant at 10 % level

analysis was significantly different at less than 0.05 and the other three, that are contribution reporting, account receivable turnover and aging account receivable

were significant at less than 0.10. These findings indicate that break-even analysis, contribution reporting, account receivable turnover and aging account receivable were applied more extensively in high capital intensity firms than in low capital intensity firms. Three out of nine techniques of management accounting techniques type III were statistically significantly different at less than 0.05. Those are operating budget, appropriation budget and fixed budget. One technique, activity based costing, was significant at less than 0.10. It means that operating budget, appropriation budget, fixed budget, and activity based costing were applied more extensively in high capital intensity firms than in low capital intensity firms.

Capital intensity can be interpreted as equivalent to what contingency theory refers to as technology. A highly mechanised technology means greater fixed investment in capital. Previous studies also found that capital intensity may influence a firm's choice of management accounting techniques. In their study of capital budgeting practice, Kim and Farragher (1981) found that larger capital intensive firms are more likely to employ sophisticated budgeting techniques than smaller low capital intensity firms. In the area of operations research techniques, Neal's study (1970) and Petry's study (1975) also found similar results to the Farragher's study. Radnor and Neal (1970) detected that capital intensive industries tended to utilise operations research techniques to a greater extent than labour intensive industries. Petry (1975) surveyed the use of multiple measures of project worth. He found that capital intensive industries typically used several alternative methods to measure project worth.

Hypothesis 6

The null hypothesis was tested against the alternative hypothesis H1₆ that advanced management accounting techniques are applied more extensively in high risk companies than in low risk companies. The test results appear in table 21, and they indicate that there was no significant difference between extent use of management accounting techniques type I and the risk of firms. The observed probability was 0.1060 which is above its significant level of 0.10, therefore the null hypothesis can not be rejected. In contrast, management accounting techniques type II with observed probability of 0.0709 was statistically different at less than 0.10 significance level. Management accounting techniques type III were also statistically significant at less than 0.05 level with observed probability 0.0279. The result suggests that the null hypothesis was rejected and alternative hypothesis accepted that advanced management accounting techniques type II and III are applied more extensively in high risk companies than in low risk companies.

Evaluating table 21 in detail reveals that out of eight techniques type I, only two techniques were significantly different at less than 0.05. Those are capital budgeting and linear programming with the observed probability 0.0313 and 0.0323 respectively. Regarding accounting technique type II, two techniques were significantly different at less than 0.10, namely break-even analysis and aging accounts receivable and one technique was significantly different at less than 0.05, that is inventory turnover analysis. For management accounting techniques

type III, two techniques were significantly different. Flexible budget was significantly different at less than 0.05 with observed probability 0.0037 and

TABLE 21
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY COMPANY RISK

Techniques Used	Mean Rank		Z	One-tailed P	
	Score				
	Low Risk	High Risk			
Techniques Type I :	68.04	59.90	-1.2483	0.1060	
Decision tree analysis	63.59	64.41	-0.1516	0.4398	
Relevant cost analysis	67.22	60.73	-1.0261	0.1525	
Capital budgeting	69.39	58.52	-1.8622	0.0313	*
Linear programming	69.02	58.90	-1.8487	0.0323	*
Net-work analysis/PERT	66.50	61.46	-0.9010	0.1838	
Inventory control models	67.74	60.20	-1.2218	0.1109	
Just in time inventory	64.83	63.16	-0.2849	0.3879	
Sensitivity analysis	65.71	62.26	-0.5439	0.2933	
Techniques Type II :	68.75	59.17	-1.4696	0.0709	**
Variance analysis	63.34	64.67	-0.3305	0.3705	
Break-even analysis	68.27	59.66	-1.3954	0.0815	**
Contribution reporting	65.69	62.29	-0.6417	0.2605	
Inventory turnover analysis	70.00	57.90	-2.0206	0.0217	*
Account receivable turnover	66.69	61.27	-0.9583	0.1690	
Aging account receivable	67.41	60.53	-1.2922	0.0982	**
Gross profit analysis	65.01	62.98	-0.4296	0.3338	
Other financial ratio	65.91	62.06	-0.7074	0.2397	
Techniques Type III :	70.12	57.79	-1.9134	0.0279	*
Responsibility accounting	64.63	63.36	-0.2523	0.4004	
Transfer pricing	66.78	61.17	-1.0142	0.1553	
Standard costing	62.78	65.24	-0.4359	0.3315	
Activity based costing	64.83	63.16	-0.3136	0.3769	
Operating budget	63.52	64.48	-0.4366	0.3312	
Flexible budget	71.26	56.63	-2.6782	0.0037	*
Appropriation budget	66.87	61.09	-1.2322	0.109	
Performance budget	68.21	59.72	-1.5009	0.0667	**
Fixed budget	66.20	61.77	-0.7912	0.2144	

* Significant at 5% level

** Significant at 10% level

performance budget was significantly different at less than 0.10 with observed probability 0.0667.

The present study results confirmed previous study by Kim and Farragher (1981). In their study of capital budgeting practice, Kim and Farragher use coefficient of variation of the rate of return on assets as a measure of the firm's risk. Their study failed to show a clear-cut relationship between risk and capital budgeting techniques. In the area of management science techniques which include decision theory, PERT, and goal programming, they found that lower risk companies used management science techniques more than higher risk companies. It can be speculated that management science or operations research techniques may be helpful in reducing the overall riskiness of the company.

Hypothesis 7

The null hypothesis was tested against alternative hypothesis H17 that advanced management accounting techniques are applied more extensively in public listed foreign companies than in public listed domestic companies. Table 22 displays the results of hypothesis testing.

As shown in table 22, the results fail to reject the null hypothesis for management accounting techniques type II and III. The observed probability of accounting techniques type II and III were 0.1339 and 0.1667 respectively. These figures were above its significant level at 0.10, therefore null hypothesis was not rejected that there is no significant difference in the application of advanced

TABLE 22
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY TYPE OF OWNERSHIP

Techniques Used	Mean Rank Score		Z	One-tailed P	
	Domestic	Foreign			
Techniques Type I :	61.50	85.96	-2.2741	0.0115	*
Decision tree analysis	61.61	84.92	-2.6154	0.0045	*
Relevant cost analysis	63.51	68.31	-0.4601	0.3228	
Capital budgeting	63.12	71.69	-0.8903	0.1867	
Linear programming	62.00	81.50	-2.1611	0.0154	*
Net-work analysis/PERT	63.50	68.35	-0.5248	0.2999	
Inventory control models	62.25	79.38	-1.6829	0.0462	*
Just in time inventory	62.01	81.46	-2.0125	0.0221	*
Sensitivity analysis	63.29	70.27	-0.6677	0.2522	
Techniques Type II :	62.78	74.69	-1.1083	0.1339	
Variance analysis	64.05	63.54	-0.0770	0.4694	
Break-even analysis	63.52	68.19	-0.4586	0.3233	
Contribution reporting	63.88	65.04	-0.1323	0.4474	
Inventory turnover analysis	61.37	87.08	-2.6038	0.0046	*
Account receivable turnover	63.79	65.81	-0.2160	0.4145	
Aging account receivable	63.79	65.88	-0.2390	0.4056	
Gross profit analysis	62.93	73.38	-1.3402	0.0901	**
Other financial ratio	63.34	69.81	-0.7191	0.2361	
Techniques Type III :	62.95	73.23	-0.9674	0.1667	
Responsibility accounting	63.12	71.73	-1.0326	0.1509	
Transfer pricing	63.51	68.31	-0.5263	0.2994	
Standard costing	62.85	74.08	-1.2076	0.1136	
Activity based costing	64.72	57.65	-0.8052	0.2104	
Operating budget	63.71	66.50	-0.7674	0.2215	
Flexible budget	64.45	60.04	-0.4898	0.3122	
Appropriation budget	63.37	69.54	-0.7975	0.2126	
Performance budget	63.81	65.69	-0.2021	0.4199	
Fixed budget	63.15	71.46	-0.9010	0.1838	

* Significant at 5 % level
** Significant at 10% level

management accounting techniques type II and III between public listed domestic companies and public listed foreign companies. However, there was significant difference for management accounting techniques type I. The observed probability

was 0.0115 which was below 0.05 significant level. This suggests that alternative hypothesis was accepted that management accounting techniques type I are applied more extensively in public listed foreign firms than in public listed domestic firms.

Out of eight techniques of type I, four techniques were significantly different at less than 0.05 significance level. These techniques include decision tree analysis, linear programming, inventory control models and just in time inventory. Meanwhile, only two techniques of type II were significantly different. Inventory control models was significant at less than 0.05 significant level and gross profit analysis was significant at less than 0.10. In the case of inventory turnover analysis, the result is consistent with inventory control models included in management accounting technique type I. For management accounting techniques type III, all techniques were insignificant which suggest that there is no difference in the application of management accounting techniques type III between domestic firms and foreign firms.

At the theoretical level, there is no reason to expect that type of ownership to influence the extent of application of management accounting techniques. Since both types of firm are public listed companies, they are indeed surrounded by uncertainties, and to cope with these uncertainties more and better data are needed which is supplied by the management accounting system. In terms of management accounting techniques type II and III the results show that there is no difference between domestic and foreign firms in applying the management accounting techniques. However, the present study also shows that the management

accounting techniques type I are applied more extensively in foreign firms than in domestic firms.

Hypothesis 8

The null hypothesis was tested against the alternative hypothesis H18 that advanced management accounting techniques are applied more extensively in high leverage companies than in low leverage companies. The test results appear in table 23, and indicate there was no significant difference between the extent use of management accounting techniques type I and the firm leverage. The observed probability was 0.1452 which is above the significance level of 0.10. Hence, the null hypothesis can not be rejected. In contrast, management accounting techniques type II and III were significantly different. The observed probability for accounting techniques type II was 0.0266 which was significant at less than 0.05 and the observed probability for technique type III was 0.0830 which was significant at less than 0.10. These results suggest that management accounting techniques type II and III were applied more extensively in high leverage firms than in low leverage firms.

All accounting techniques type I were not significantly different and this test fails to reject null hypothesis. Out of eight type II techniques, four techniques were found to have a significant difference. Contribution reporting and accounts receivable turnover were significant at less than 0.05 with the observed probability 0.0158 and 0.0174 respectively. Break-even analysis and aging account receivable were significant at less than 0.10 level with observed probability 0.0584 and

TABLE 23
MANN-WHITNEY U TEST COMPARISON OF MANAGEMENT
ACCOUNTING
TECHNIQUES BY COMPANY LEVERAGE

Techniques Used	Mean Rank Score		Z	One-tailed P	
	Low Leverage	High Leverage			
Techniques Type I :	60.52	67.42	-1.0576	0.1452	
Decision tree analysis	63.14	64.84	-0.3148	0.3765	
Relevant cost analysis	61.10	66.86	-0.9115	0.1810	
Capital budgeting	66.08	61.95	-0.7071	0.2398	
Linear programming	64.76	63.25	-0.2764	0.3911	
Net-work analysis/PERT	60.74	67.21	-1.1573	0.1236	
Inventory control models	62.05	65.92	-0.6275	0.2652	
Just in time inventory	61.16	66.80	-0.9621	0.1680	
Sensitivity analysis	60.61	67.34	-1.0605	0.1445	
Techniques Type II :	57.65	70.25	-1.9337	0.0266	*
Variance analysis	63.46	64.53	-0.2644	0.3958	
Break-even analysis	59.12	68.80	-1.5688	0.0584	**
Contribution reporting	58.25	69.66	-2.1510	0.0158	*
Inventory turnover analysis	63.55	64.45	-0.1500	0.4404	
Account receivable turnover	57.98	69.92	-2.1115	0.0174	*
Aging account receivable	60.21	67.73	-1.4105	0.0792	**
Gross profit analysis	61.43	66.53	-1.0789	0.1403	
Other financial ratio	62.32	65.66	-0.6121	0.2703	
Techniques Type III :	59.50	68.43	-1.3856	0.0830	**
Responsibility accounting	63.36	64.63	-0.2523	0.4004	
Transfer pricing	57.14	70.75	-2.4615	0.0069	*
Standard costing	62.21	65.76	-0.6287	0.2648	
Activity based costing	61.14	66.81	-1.0651	0.1434	
Operating budget	63.48	64.52	-0.4724	0.3183	
Flexible budget	63.68	64.31	-0.1153	0.4541	
Appropriation budget	63.10	64.88	-0.3794	0.3522	
Performance budget	61.74	66.23	-0.7936	0.2137	
Fixed budget	62.78	65.20	-0.4336	0.3323	

* Significant at 5% level

** Significant at 10% level

0.0792 respectively. For accounting technique type III, only transfer pricing was highly significant difference at less than 0.05 level.

Firm leverage represents the proportion of financing obtained via debt relative to equity financing. Firm leverage affects a firm's ability to borrow and the cost of borrowing. Hence, additional borrowing may command a high interest rate. As a result greater income is needed to offset interest cost. Therefore, it can be argued that as a firm increases debt, it may attempt to reduce the effects on the leverage ratio by choosing certain accounting techniques which will increase income. The management accounting techniques type II and III mainly have direct effect on the generating income of the firm.

Hypothesis 1

As noted in chapter 3, a logistic multiple regression was selected to test the first hypothesis that there is no significant relationship between application of advanced management accounting techniques and the company's performance. Prior to applying the logistic regression analysis, it is necessary to present regression diagnostics for identifying influential data points.

Regression Diagnostics for Logistic Regression

As in linear regression models fit by least squares, it is desirable to assess the adequacy of a fitted linear logit model by examining the data for outliers and influential points. Examining these diagnostics can point to specific shortcomings in the way the regression model is formulated and can help in developing a form

of regression model which better describes the data and leads to a more accurate hypothesis test. In this study two types of techniques were used to determine the data for outliers , namely standardised residual, and Cook's distance.

Actually the raw residuals can be used to locate outliers, however there are no a priori cutoff value to define a "large" residual. The most direct way to deal with this problem is to normalise the residuals by the standard error of the estimate to obtain standardised residuals. If the sample size is large, these residuals will approximately follow normal distribution. Therefore, points with standardised residuals exceeding about 2 should be examined for potential problems. Cook's distance is a statistic which directly assesses the actual influence of a data point on the regression equation by computing how much the regression coefficients change when the point is deleted. Some people consider point with Cook's distance statistic exceeding 1 to be worth further investigation and points with values exceeding 4 to be potentially serious outliers.

Data gathered from 127 usable responses and data collected from secondary resources were investigated for outliers and influential points using both techniques mentioned above. The result shows that 10 cases were considered as outliers since their standardised residual and their Cook's distance statistics were above 3 and 4 respectively. Therefore, these 10 usable responses were deleted and were not used for further analysis. The logistic regression model was run using 117 cases rather than 127 cases

The Results of Testing Hypothesis 1

The SPSS statistical package was used to run the logistic regression model based on 117 sample respondents. Four models of logistic regression were obtained which could explain the relationship between application of advanced management accounting techniques and company's performance. Table 24 reports the results of regressing the dichotomous dependent variable against the set of independent variables. The four models were significant at 0.01 level of significant with the likelihood ratio ranged from 56.569 to 60.796, and the Chi-squares ranged from 85.220 to 89.447.

From running many different models, three models were obtained that are model 1, model 2 and model 3. The three models show that extent use of advanced management accounting techniques is significant at the 5% level in model 1 and model 2, and in model 3 at the 10% level. Surprisingly, all three models had negative coefficients of parameters which is contrary to what it is expected. This means that *ceteris parabis*, the extent use of advanced management accounting techniques, significantly reduces the probability of the firms to perform above its average performance of the sample firms. Similar result were found for variable size which were significant at the 5% level of significance for the three models and all have negative coefficients parameter. *Ceteris parabis*, size, significantly reduces the firms ability to perform above average performance of the sample firms. However, significant interaction were found between extent of use of advanced management accounting techniques and firm size for all three models, making any separation of size effect from extent use of management accounting

techniques problematic. This interaction variable described that *ceteris parabis*, large firms that applied advanced management accounting techniques extensively significantly increases the probability that the firm will perform above average performance of the sample firms. Variables age, type of industry, capital intensity and leverage do not appear to be important determinants of the firm performance in all three models, but the interaction between capital intensity and extent of use of management accounting techniques was significant at the 5% level for all three models. It can be concluded that highly capital intensive firms that applied management accounting techniques extensively significantly increases the probability the firm will perform above average performance of the sample firms. Risk variable is shown to be important determinant of firm performance. In all three models, risk is significant at the 5% level of significance and sign on the parameter were expected to be positive. This means high risk firm significantly increases the probability the firm will perform above average performance of the sample firms, other things held equal. Type of ownership also seemed to be important determinant of the firm performance. Variable type of ownership is significant at the 5% level of significance in all three models with negative sign of coefficients of parameter. The interpretation of this variable is that other things being equal, foreign firm significantly reduces the probability the firm will perform above average performance of the sample firms.

TABLE 24
LOGISTIC REGRESSION ESTIMATE - PROBABILITY OF ABOVE AVERAGE PERFORMANCE VERSUS BELOW AVERAGE PERFORMANCE
DEPENDENT VARIABLE = PERFORMANCE (RATE OF RETURN)

Variables	Model 1			Model 2			Model 3			Model 4		
	Coef.	Wald stat.	Coef.	Wald stat.	Coef.	Wald stat.	Coef.	Wald stat.	Coef.	Wald stat.	Coef.	Wald stat.
Intercept	-1.2937	0.6172	-0.7187	0.2382	-1.5405	0.9607	-0.6244	0.4125	-0.6244	0.4125	-0.6244	0.4125
Accounting Technique (X1)	-0.1077	4.2666*	-0.1153	5.0426*	-0.0968	3.5535**	-0.1034	7.6188*	-0.1034	7.6188*	-0.1034	7.6188*
Size (X2)	-8.1770	5.5346*	-6.6902	4.4156*	-7.9432	4.9796*	-6.7612	5.5358*	-6.7612	5.5358*	-6.7612	5.5358*
Age (X3)	-0.0020	0.0390	-0.0019	0.0302	0.0411	1.2074			0.0411	1.2074		
Industry (X4)	0.7568	0.6430	0.7411	0.6251	0.8799	0.8471			0.8799	0.8471		
Capital Intensity (X5)	2.8552	0.0015	2.3231	0.0011	-35.4100	0.2634			-35.4100	0.2634		
Risk (X6)	23.6622	6.7420*	21.4421	6.4369*	22.5106	6.9797*			22.5106	6.9797*		
Type of Ownership (X7)	-5.5867	5.5160*	-5.1207	5.3681*	-5.5600	5.1551*			-5.5600	5.1551*		
Leverage (X8)	0.9257	1.5080	0.2158	1.5417	0.2242	1.7365			0.2242	1.7365		
Interaction X1 and X2	0.1897	5.3820*	0.1515	3.5200*	0.1800	4.1131*			0.1800	4.1131*		
Interaction X1 and X3					-0.0012	1.5913			-0.0012	1.5913		
Interaction X1 and X5	6.5800	5.8693*	6.1859	5.8241*	7.8834	7.2671*			7.8834	7.2671*		
Interaction X1 and X8	-0.0199	0.9050										
Likelihood Ratio (-2 Log L)	57.585		58.430		56.569		60.796		56.569		60.796	
Chi-Squares (X2)	88.431		87.586		89.447		85.220		89.447		85.220	
Significance (p)	0.0001*		0.0001*		0.0001*		0.0001*		0.0001*		0.0001*	
Classification Accuracy												
% correct - Above	91.25%		90.00%		90.00%		91.25%		90.00%		91.25%	
% correct - Below	78.38%		75.68%		78.38%		72.97%		78.38%		72.97%	
% correct - Total	87.18%		85.47%		86.32%		85.47%		86.32%		85.47%	
n	117		117		117		117		117		117	

* Significant at 5 % level

** Significant at 10 % level

Based on the three models, model 4 was developed which incorporated only those significant variables found in the three models. Compared to the previous three models, model 4 reached the highest likelihood ratio 60.796 with the goodness fit test significant at 1 % level of significant. The extent of use of management accounting techniques, firm size and the interaction of these two variables were found to be significant at 5 % level. Due to the interaction effects, the extent of use of management accounting technique variable alone can not be used to interpret the relationship between application of management accounting techniques and firm performance. By looking at the interaction variable, it can be concluded that large firm that applied management accounting techniques extensively significantly increase the probability the firm will perform above average performance of the sample firms. Variable of management accounting techniques also interact with the capital intensity which means that highly capital intensive firms that applied management accounting techniques extensively significantly increase the probability that the firm will reach performance above the average performance of the sample firms. Other controlling variables risk and type of ownership were also found to be significant at 5 % level. High risk firms significantly increase the probability the firm will reach performance above the average performance of the sample firms, while foreign firm significantly reduces the probability the firm will reach performance above the average performance of the sample firms.

From the parameter estimates and the original data set, logistic regression printout from SPSS package also provides a table of correct and incorrect

classification and the figure is shown at the bottom of table 24. Model 1 was able to classify correctly 87.18 percent of all firms in the data set. For example, model 1 was more successful in correctly classifying the above average performer firms (91.25%) than below average performer firms (78.38%). The overall success rate of all the models was over 85 percent. Model 4 was able to classify correctly 85.47 percent of all firms in the data set and the model was more successful in correctly classifying the above average performer firms (91.25%) than below average performer firms (72.97%).

Summary

In this chapter, the results of study's hypotheses testing were presented. A test of randomness and reliability was performed on data collected from the respondents. Test of randomness examined whether respondents answered the questionnaires randomly or not. The results show that for each type of accounting technique, respondents did not answer the questionnaires randomly. Reliability test of data was accomplished by calculating the Cronbach's alpha for each type of accounting technique. The Cronbach's alpha for accounting techniques type I and II reached 0.7027 and 0.7927 respectively. However, Cronbach's alpha for accounting technique type III only reached 0.5463. Since the present study is still in the early stages of research, the result of reliability test demonstrated satisfactory level.

A nonparametric statistical test namely Mann-Whitney U test was selected to test the hypotheses two through eight. When respondents were classified in

terms of size, the result of hypothesis two shows that advanced management accounting techniques were applied more extensively in large companies than in other (small and medium) companies. Accounting techniques type I and III were significant at less than 0.05 level, while accounting technique type II was significant at less than 0.10. Four out of eight techniques type I were statistically significant at less than 0.05. Those techniques were decision tree analysis, capital budgeting, linear programming and sensitivity analysis. Three out of nine techniques type III were significant at less than 0.05. Those are responsibility accounting, flexible budget and performance budget, while two other techniques, transfer pricing and appropriation budget were significant at less than 0.10. Only three out of eight techniques type II were significant at less than 0.05, namely contribution reporting, gross profit analysis and other financial ratio.

When respondents were categorised in term of its age (years in business operation), the result shows that all type of techniques I, II and III were significant at less than 0.05 which suggest that advanced management accounting techniques were applied more extensively in old firms than in new firms. Examining individual techniques reveals that four techniques type I, decision tree analysis, capital budgeting, inventory control models and just in time inventory were significant at 0.05. Six out of eight techniques type II were found to be significant at less than 0.05 with the exception of one technique significant at less than 0.10. Those techniques were break-even analysis, contribution reporting, inventory turnover, account receivable turnover, aging account receivable and gross profit analysis. For accounting technique type III, five out of nine techniques were found

to be significant at less than 0.05. These technique were transfer pricing, standard costing, appropriation budget, performance budget and fixed budget.

When respondents were categorised into manufacturing and non-manufacturing firms, the result of hypothesis four shows that advanced management accounting techniques type I, II and III were applied more extensively in manufacturing firms than in non-manufacturing firms. Those techniques type I which were significant at less than 0.05 were relevant cost analysis, capital budgeting, net-work analysis/PERT, inventory control models and just in time inventory. With the exception of other financial ratio, all techniques type II were significant. Five techniques type III were found to be significant. Those techniques were responsibility accounting, transfer pricing, standard costing, appropriation budget and operating budget.

When respondents were categorised into high capital intensive firms and low capital intensive firms, the result of hypothesis five shows that all advanced management accounting techniques type I, II and III were significant at less than 0.05. This suggest that advanced management accounting techniques were applied more extensively in high capital intensive firms than in low capital intensive firms. Almost all techniques type I were significant at less than 0.05. In the case of accounting techniques type II, break-even analysis was significant at less than 0.05 and the other three techniques, that are contribution reporting, account receivable turnover and aging account receivable were significant at less than 0.10. Three techniques type III were significant at less than 0.05. Those techniques were operating budget, appropriation budget and fixed budget.

In term of firm's risk, the result of hypothesis six indicates that there was no significant difference between the extent use of management accounting techniques type I and the firm's risk. However, management accounting techniques type II and III were applied more extensively in high risk firms than in low risk firms. Two techniques type II were significant at less than 0.10, namely break-even analysis and aging accounts receivable and one technique was significant at less than 0.05, that is inventory turnover analysis. For accounting technique type III, flexible budget was significant at less than 0.05 and performance budget was significant at less than 0.10.

When respondents were classified in term of ownership, the result of hypothesis seven shows that null hypothesis failed to be rejected for accounting techniques type II and III, which means that there is no significant difference in the application of advanced management accounting techniques type II and III between public listed domestic firms and public listed foreign firms. However, there was significant difference at less than 0.05 for management accounting techniques type I. This suggests that advanced management accounting technique type I was applied more extensively in public listed foreign firms than in public listed domestic firms. Out of eight techniques type I, four techniques were significant at less than 0.05. Those were decision tree analysis, linear programming, inventory control models and just in time inventory.

In term of firm's leverage, the result of hypothesis eight indicates that there was no significant difference between the extent use of management accounting techniques type I and the firm's leverage. However, there were significant

difference for management accounting techniques type II and III. Four techniques type II were found to be significant. Those were contribution reporting, account receivable turnover, break-even analysis and aging account receivable. For technique type III, only transfer pricing which was highly significant at less than 0.05.

A logistic multiple regression was selected to test the first hypothesis. To assess the adequacy of a fitted logit model, a test of data outliers and influential points were conducted. Out of 127 cases (usable responses), 10 cases were considered outliers and it was dropped for further analysis. Therefore, the logistic regression models was run using 117 cases rather than 127 cases. Four models of logistic regression were obtained which were significant at 0.0001 level with the likelihood ratio ranged from 56.569 to 60.796. From the first three models, it was found that management accounting techniques, size, risk, type of ownership, interaction between management accounting techniques and size, and interaction between management accounting techniques and capital intensity were significantly different.

Model four was obtained by running all these significant variables and the result shows that the model was significant at 0.0001 with likelihood ratio 60.796. Management accounting techniques and size were significant at 0.05, but surprisingly these two variables had negative coefficient of parameters which is contrary to what it is expected. Risk and type of ownership were also found to be significant at 0.05. Since there was significant interaction between management accounting techniques and size, making any separation of size effect from the

management accounting techniques problematic. It can be concluded that the extent of use of management accounting techniques, the larger of the firms, and foreign firms will reduce the probability of the firms reaching performance above average performance of the sample firms. Larger firm risk will increase the probability of the firms reaching performance above average performance of the sample firms. The interaction variables can be interpreted that large firms and high capital intensive firms that applied advanced management accounting techniques extensively will increase the probability the firms will reach performance above average performance of the sample firms.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The major purposes of this study were twofold: (1) determination of positive relationship between the application of advanced management accounting techniques and the company's performance, and (2) an analysis of the effect of contextual variables of firm characteristics such as organisation size, age, type of industry, capital intensity, risk, leverage, and type of ownership on the application of advanced management accounting techniques. A secondary purpose of the study was to provide information on the nature of advanced management accounting techniques employed by Australian public listed companies.

A literature review was conducted in order to gain a better understanding of management accounting practices in general and to become familiar with the development and current state of empirical research of management accounting practice. Eight hypothesis were formulated to accomplish the study purpose. The first hypothesis is concerned with the relationship between the application of advanced management accounting techniques, firm contextual characteristics and the firm performance. Hypothesis two to eight are designed to answer the second major purpose of the study, that is to analyse the effect of contextual variables of firm characteristics on the application of management accounting techniques. A questionnaire was developed to gather data to test the eight hypothesis.

The conclusions of this study are based on the literature review and the statistical analysis of the data obtained through use of questionnaire, with emphasis

on the latter. In addition to the conclusions, this chapter contains a section on the limitations of study and suggestions for further research.

Summary

In chapter II, the developments and current state of empirical research of management accounting practice were examined. The first part of this chapter reviews the findings of the survey of the application of management accounting techniques. In the area of capital budgeting, previous surveys that have been conducted in Australia, United Kingdom, and United States suggest that the use of sophisticated investment procedures have increased overtime. The sophistication includes discounted cash flows, risk adjusted discount rate, sensitivity, and probability analysis. Some studies also attempted to determine whether there was any relationship between the use of sophisticated selection techniques and firm performance. These studies were based on the theory that a firm should perform better if it employs sophisticated techniques than if it uses naive techniques.

The research findings have produced mixed result. The studies conducted by Christy (1966) , Klammer (1973) , and Pike (1984) show that there was no significant relationship between firm performance and the use of sophisticated capital budgeting techniques. In contrast Kim (1975, 1982) found a positive relationship between degree of sophistication of the capital budgeting process and firm performance. In the area of operations research techniques, previous studies found that operations research techniques such as network planning, simulation, linear programming, and inventory models were not widely accepted in practice.

Traditional management accounting techniques such as operating budget, capital budgeting, break-even analysis, and standard costing had been widely accepted in practice in Taiwanese medium and large manufacturing firms (Chiu, 1973). In the case of budgeting control systems, studies conducted by Imhoff (1978), Lyall (1990), and Ntow (1991) showed that many different types of budgets such as static budget, flexible budget, standard budget, contingency budget, and simulated budget have been used in practice.

The second part of Chapter II relates to studies on the relationship between firm characteristics and application of management accounting techniques. A number of studies tested the relationship between the use of management accounting techniques and firm characteristics. More and Reichert (1983) analysed the association between 23 financial management techniques and organisation size. The result indicate that out of the 23 techniques, 11 techniques appear to be directly related to firm size. Those techniques are sales forecasting models, cash and inventory management models, statistical credit scoring models, internal rate of return, financial modeling and simulation, optimal transportation modelling, linear programming, goal programming, and PERT. In the area of capital budgeting, Schall (1978) and Kim and Farragher (1981) found that there is tendency for larger firms to use more sophisticated techniques. New Zealand studies conducted by McNally and Eng (1980) and Patterson (1989) also found a positive association between firm size and the use of quantitative sophisticated techniques. Similar findings are also reported in Australia by Freeman and Hobbes (1991).

In the area of operations research techniques, surveys by Vatter (1967), Radnor and Neal (1973), and Gaither (1975) suggest that size and extent of operations research techniques use are positively related. In addition to organisation size, capital intensity and risk also have an effect on the application of management accounting techniques. In their study of capital budgeting techniques, Kim and Farragher (1981) observed that larger capital intensive firms are more likely to employ sophisticated capital budgeting practice than smaller low capital intensive firms. In term of risk the results show that lower risk firms used science techniques such as decision tree, PERT, linear programming and goal programming than higher risk firms. From this result it can be inferred that management science techniques may be helpful in reducing the overall riskiness of the firm. Kim and Farragher's finding is consistent with Radnor and Neal's study (1970) and Petry's study (1975). These two studies detected that capital intensive firms tend to utilise operations research techniques to a greater extent than labor intensive firms.

The last part of Chapter II is concerned with developing the model to test the relationship between firm contextual characteristics, application of management accounting techniques and firm performance. Based upon previous studies on contingency theory it can be constructed to show how the firm environment and firm characteristics influence the application of management accounting techniques and firm performance.

Chapter III provides methodology and research design of the study. The term advanced management accounting techniques in this study includes 25

techniques which were grouped further into three groups. The first group consists of decision tree analysis, relevant cost analysis, capital budgeting, linear programming, net-work analysis, inventory control models, just in time inventory, and sensitivity analysis. These techniques are basically operations research techniques and can be applied many times or not at all within one year. The second group comprises techniques where the frequency of application is periodical or at regular intervals and mainly are analysis of ratios. These techniques include variance analysis, break-even analysis, contribution reporting, inventory turnover analysis, account receivable turnover analysis, aging of account receivable, gross profit analysis, and other financial ratio analysis. The third group consists of management control techniques and the frequency of its application is continuous for one year. Included in these techniques is responsibility accounting, transfer pricing, standard costing, activity based costing, operating budget, flexible budget, appropriation budget, performance budget, and fixed budget.

To measure the firm's intensity in applying management accounting techniques, indices of Likert scale was employed. Variables of firm contextual characteristics consists of organisation size, age, type of industry, capital intensity, risk, type of ownership, and firm's leverage. Firm performance was measured using an adjusted operating rate of return. The primary sources of data collection was a mail questionnaire. Other sources of information came from library research and firm's annual reports. The population of interest in this study was large public listed firms in Australia. The sampling frame of the population tested was the Top

500 Australian companies listed in the Australian Financial Review Listed Handbook. The intended recipient of the questionnaire was the firm chief-accountant officer. An initial pilot study of 100 questionnaires were sent to determine feasibility of the questionnaire and interest in the study objectives.

To accomplish the study objectives, eight hypotheses were proposed and tested. The first hypothesis tested the existence of a relationship between the application of advanced management accounting techniques and firm performance. Hypotheses two through eight tested the effect of firm contextual characteristics on the application of advanced management accounting techniques. Two types of statistical analyses were adopted to test the hypotheses. Hypothesis one is tested by using multiple logistic regression model. Hypotheses two through eight are tested by nonparametric statistical test namely, Mann-Whitney U Test.

Chapter IV presents the result of the mailing questionnaires. A pilot study of 100 questionnaires were sent to the respondents which were randomly drawn from the Top 500 Australian companies listed in the Australian Financial Review Listed Company Handbook. A response rate of 28 percent indicated an existing interest in the research. After evaluating the results of the pilot study, a revised questionnaire was mailed to all Top 500 Australian listed companies on September 15, 1993. Out of 500 questionnaires sent, 101 usable responses were received from the first mailing, or 20.20 percent response rate. Another 26 usable responses were received after the follow up letter. Total usable responses were 127 which is accounted for 25 percent response rate.

Test for nonresponse bias was conducted to test whether 127 usable responses were representative of the population. The test was conducted by comparing early respondents with the late respondents in terms of their answers to the questionnaire as suggested by Oppenheim (1973). This test is accomplished by comparing mean response scores of each type of management accounting techniques applied for the first 101 early returned questionnaires with the last 26 late return questionnaires. The result shows that for each type of management accounting techniques there was no significant difference between means response scores of early responses and late responses. It indicates a lack of a material nonresponse bias.

Profile of The Respondents

The main activity sector of respondents were manufacturing, mining , and finance companies. About 90 percent of respondents were controlled by domestic firms and the remaining were controlled by foreign firms. When respondents were classified by years in business operation, nearly one-half of the respondents have been in business for more than 30 years. About one-third have been business for less than 10 years and about one-fifth have been in business between 10 to 30 years. The respondents of domestic firms was dominated by mining and manufacturing firms, while respondents of foreign firms was dominated by manufacturing firms. Nearly one-half of responding domestic firms have been in business operation for more than 30 years. This figure is even higher for the responding foreign firms which is accounted of two-third of firms. The

respondents who have in business for more than 30 years mainly came from manufacturing and mining sector.

Conclusions

Management Accounting Practice

An examination of the utilisation rate of type I management accounting techniques showed that capital budgeting, sensitivity analysis, and relevant cost analysis were the most frequently used techniques. Operations research techniques seemed less popular for the respondents. More than 60 percent of respondents claimed never used decision tree analysis, linear programming, and net-work analysis/PERT. Inventory control models has been used by more than one-half of the respondents. It is surprising to note that new management accounting techniques such as just in time inventory had gained popularity. Nearly one-half of respondents had used this technique. The result of the extent usage of operations research techniques in this study is consistent with the findings of previous studies conducted by Lonnstedt (1973), Gaither (1975), Green et al., (1977), and Kwong (1986). These researchers also found low usage of operations research techniques.

In the case of management accounting techniques type II, it is noted that four techniques have been widely used in practice by the respondents. Those techniques are variance analysis, contribution reporting, gross profit analysis, and other financial ratio analysis which were used by more than three-quarters of the respondents. Other techniques such as break-even analysis, inventory turnover analysis, account receivable turnover analysis, and aging of account receivable

also widely accepted in practice, and were used by more than one-half of respondents. These type II management accounting techniques were mainly applied by respondents at least monthly.

In terms of management control techniques which is mainly management accounting techniques type III, operating budget was the most widely used technique. This techniques was being adopted by 96.06 percent of the respondents. This was followed by responsibility accounting, fixed budget, and performance budget. In contrast, appropriation budget was a less popular technique, used by one-fifth of the respondents and followed by activity based costing, flexible budget and transfer pricing. A new technique such as activity based costing shows growing acceptance in Australia. This technique is now being adopted by more than 33.07 percent of the respondents.

In the area of budgets, the findings of this study confirmed previous studies conducted by Imhoff (1978) and Ntow (1991). Imhoff found that 81 percent of firms which used budget as a performance measure did use flexible budget. Our findings show that flexible budget has been used by 37.01 percent of the respondents. In comparing budgetary control systems between American and Japanese manufacturing firms, Ntow (1991) found that most of the firms used types of budgets such as static budget, flexible budget, standard budget, contingency budget, and simulated budget.

Management Accounting Practice and Activity Sector

When respondents are classified into manufacturing and non-manufacturing firms the results show that capital budgeting and sensitivity analysis were widely accepted in practice by both manufacturing and non-manufacturing firms.

Operations research techniques were not widely accepted in practice by either sector. Inventory control models had been applied by more than one-half of each sector. Just in time inventory had been more adopted in practice by manufacturing firms than non- manufacturing firms. This result is not so surprising since just in time inventory is basically used for production processes.

In the case of management accounting techniques type II, there is no difference between manufacturing and non-manufacturing firms. The most widely accepted techniques by both sector were other financial ratio analysis, followed by variance analysis, gross profit analysis, and contribution reporting. For management accounting techniques type III, both activity sectors reported that the most widely accepted technique was operating budget which had been applied by more than 95 percent of both sectors. Responsibility accounting also gained wide acceptance by both sectors. It is being used by more than 72 percent of manufacturing as well as non-manufacturing firms. In the case of flexible budget, it is surprising that this technique received less acceptance in manufacturing sector.

When respondents were categorised into domestic firms and foreign firms, the results show that capital budgeting and sensitivity analysis were most widely adopted in practice by both types of firms. However, foreign firms tend to apply

these techniques more extensively than domestic firms. Operations research techniques such as decision tree analysis, linear programming and network analysis/PERT were less popular among domestic firms than foreign firms. Similar findings were made for inventory control models and just in time inventory. These techniques have been applied more extensively by foreign firms than domestic firms.

In the case of management accounting techniques type II, foreign firms and domestic firms did not report any differences in applying the techniques. Almost all techniques had been applied by more than 60 percent of responding foreign and domestic firms. Similar results were found for the management accounting techniques type III there was no difference between foreign firms and domestic firms in applying the techniques.

Hypothesis Testing

Hypothesis One Stated:

There is no significant relationship between application of advanced management accounting techniques and the company's performance. This hypothesis was tested by building multiple logistic regression models. Four models of logistic regression were obtained which could explain the relationship between application of advanced management accounting techniques and the company's performance. The four models were significant at 0.01 and the likelihood ratio ranged from 56.569 to 60.796, and the chi-squares ranged from 85.220 to 89.447. The first three models show that variable extent use of management accounting

techniques, size, risk, type of ownership, interaction between size and management accounting techniques, and interaction between management accounting techniques and capital intensity were significant at 5% and 10% significance level. Surprisingly, all three models had negative coefficients of parameters for management accounting techniques and size which is contrary to what it was expected.

This result can be interpreted that *ceteris parabis*, the extent of use of advanced management accounting techniques significantly reduces the probability the firm will perform above average performance of the sample firms. Size also significantly reduces the firms ability to perform above average performance of the sample firms. Variables risk and type of ownership had positive coefficient parameters which means that, high risk firms and foreign firms are significantly more likely to perform above average performance of the sample firms. Variables of age, type of industry, capital intensity, and firm leverage do not appear to be important determinants of the firm performance. The interaction variables provide evidence that any separation of size and capital intensity effect from the extent use of management accounting techniques is problematic. These interaction variables could explain the negative effect of size and extent use of management accounting techniques on firm performance. Therefore, these two variables can not be interpreted individually. Looking at the interaction variables it can be said that large firms that applied advanced management accounting techniques extensively significantly increases the probability the firm will perform above average performance of the sample firms. It is also true high capital intensive firms that

applied advanced management accounting techniques extensively increased the probability the firm will perform above average performance of the sample firms.

Based on these three models, the fourth model was run using only those significant variables. The result is still consistent with the first three models. The fourth models is considered as the best models to explain the first hypothesis.

Hypothesis two stated:

There is no significant difference in the application of advanced management accounting techniques between large companies and other (small/medium) companies. For management accounting techniques type I and III, the Mann-Whitney U test rejected the null hypothesis at the 5 percent level of significant. Consequently, the alternative hypothesis was accepted, that is, management accounting techniques type I and III were applied more extensively in large companies than in small and medium companies. There was also statistical difference at less than 0.10 significance level in the application of management accounting techniques type II. This also suggests that management accounting techniques type II was applied more extensively in large companies than in small and medium companies.

This findings may, in part, be explained by the fact that organisational size can be considered as a measure of the complexity of business operations. As firms grow, more data are required for rationalising and coordinating their activities. The required data is supplied by the firm's accounting system. Therefore, it is

quite normal to expect the extent of use of management accounting techniques to be greater in larger firms than in small and medium firms.

Hypothesis three stated:

There is no significant difference in the extent of application of advanced management accounting techniques between old companies and new companies. The Mann-Whitney U test rejected the null hypothesis at the 5 percent level of significance for all three types of management accounting techniques. Thus, it can be said that advanced management accounting techniques type I, II and III are applied more extensively in old companies than in new companies. This result can be explained by suggesting that old firms are more likely to be better established, to have more experienced and to recognise more varieties of management accounting techniques than newer firms. From this result it also appears that as firms mature and extend, the control network necessary for management become more pervasive. This may due to either a growing span of control, or to the development of control systems requiring time to come to fruition.

Hypothesis four stated:

There is no difference in the application of advanced management accounting techniques between manufacturing and non-manufacturing companies. The result shows that there were statistical differences at less than 0.05 significant level for all three types of management accounting techniques. Therefore, the advanced management accounting techniques were applied more extensively in

manufacturing firms than in non-manufacturing firms. The research findings was not surprising since management accounting techniques included in this study are mostly found in the manufacturing sector. Furthermore, it should be remembered that management accounting techniques were earliest developed in the manufacturing sector. Therefore, it is reasonable to expect that management accounting techniques were applied more extensively in manufacturing firms than in non-manufacturing firms.

Hypothesis five stated:

There is no significant difference in the application of advanced management accounting techniques between companies that have high capital intensity and low capital intensity. The result shows that there were significant differences at less than 0.05 significant level for all type of management accounting techniques. This means that null hypothesis was rejected and the alternative hypothesis was accepted that advanced management accounting techniques are applied more extensively in high capital intensive firms than in low capital intensive firms.

Capital intensity can be interpreted as equivalent to what contingency theory refers to as technology. Technology determines how organisations transform inputs into outputs. A highly mechanised technology means greater fixed investment in capital. Thus the level of mechanisation also reflects differing firm capabilities across manufacturing firms. The study finding is consistent with previous research. Kim and Farragher (1981) reported that studies which have

considered the capital intensity of the firm are more likely to employ sophisticated accounting techniques. Hagerman and Zmijewski (1979) also observed that the degree of capital intensity affects the choice of accounting methods.

Hypothesis six stated:

There is no significant difference in the application of advanced management accounting techniques between high risk companies and low risk companies. The Mann-Whitney U test rejected the null hypothesis for management accounting techniques type II and III at the 0.05 and 0.10 level of significance respectively. This result suggests that advanced management accounting techniques type II and III are applied more extensively in high risk companies than in low risk companies. For management accounting technique type I, there was no difference in the application of these techniques between high risk companies and low risk companies.

Hypothesis seven stated:

There is no significant difference in the application of advanced management accounting techniques between public listed domestic companies and public listed foreign companies. The result fail to reject the null hypothesis for management accounting techniques type II and III. However, there was significant difference for management accounting techniques type I. This means that the alternative hypothesis was accepted that management accounting techniques type I was applied more extensively in foreign companies than in domestic companies.

At a theoretical level, there is no reason to expect type of ownership to influence the extent use of management accounting techniques. Both types of firms are public listed companies and they are indeed surrounded by uncertainties. To cope with these uncertainties more and better data are needed which is supplied by the management accounting system.

Hypothesis eight stated:

There is no significant difference in the application of advanced management accounting techniques between high leverage companies and low leverage companies. The test result shows there was no significant difference between the extent use of management accounting techniques type I and firm leverage. In the case of management accounting techniques type II and III, the null hypothesis is rejected and alternative hypothesis is accepted that advanced management accounting techniques type II and III were applied more extensively in high leverage companies than in low leverage companies.

The probable explanation of this finding is that as firms incur increased levels of debt, a twofold effect may occur. First additional borrowing may command a higher interest rate. Second, greater income is needed to offset interest cost. Therefore, it can be argued that as a firm increases debt, it may attempt to reduce the effects on the debt/equity ratio by choosing certain accounting techniques which will increase its income. Accounting techniques included in the management accounting techniques type II and III have direct effect on generating income for the firms.

Limitations of the Study

The use of questionnaires to gather data in this study carries certain inherent limitations. Since the response rate only reached 25 %, the question arises as to whether the responses obtained are representative of the population. An attempt was made in the study to address the effect of this limitation by testing of nonresponse bias and none was detected.

The use of a questionnaire also introduces the possibility that the respondents may place a different interpretation on the questions than did the researchers. Efforts were made to overcome this limitation by including the definition for each of the management accounting techniques in the questionnaire. In addition, a pilot study was conducted to test the questionnaire.

There are some advanced management accounting techniques which are not included in this study and the frequency of application of advanced management accounting techniques may actually be influenced by variables other than those considered in this study. Therefore, conclusions can be made only with respect to the management accounting techniques and other variables included in the study.

Suggestion for Further Research

This study was broad in scope and exploratory in nature. As such, it touched on many aspects of management accounting techniques, but did not provide an in depth analysis of any aspect. In this study, the extent of use of management accounting techniques is measured by the frequency of the techniques applied within one year, there is no attempt to measure the quality of its

application. Thus, one possible research study is to conduct similar study that focuses on the quality of application of management accounting techniques.

From the results of study, it appears that there was an observed increase in the use of some techniques as companies mature. It may be useful to speculate on whether the increase is the result of maturity, or whether it is related to the timing of the introduction of technology to support these techniques. It is suggested for further research to use a longitudinal study matching age and the introduction of the techniques with the early availability of common technology to support the techniques.

From the results of the logistic regression model, only three variables and two interaction variables show significant differences. Furthermore, the relative performance of the firms in this study is measured by comparing the individual firm performance with the average performance of the sample firms. It is suggested for further research to include more variables other than used in this study. Since the respondents came from many different sectors, it is suggested to use standard industry performance instead of using average performance of the sample firms.

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APPENDIX A
PILOT STUDY QUESTIONNAIRE

Wollongong, April 15, 1993

The Chief Accounting Officer

Dear Sir/Madam,

I am working on a doctoral degree in the Department of Accountancy in the Faculty of Commerce, the University of Wollongong, Australia. My thesis topic involves the relationship between application of advanced management accounting techniques and company performance. In order to gather information that will provide insight into this relationship, I am conducting a survey of advanced management accounting techniques used by Australian public listed companies. The application of advanced management accounting techniques play a significant role in allocating the economic resources of the company. Therefore it is important to determine their impact on the company performance. This survey also seeks other variables that may influence the company performance.

Your company has been selected as one that can provide useful information for this study. I would appreciate it if you would complete and return to me the enclosed questionnaire. Your cooperation is extremely important and it will be a real contribution to the success of this study. Your answers to this questionnaire will be held in strict confidence and will be published in the form of statistical summaries which will make the identification of any specific company impossible.

I am including a stamped envelope for your convenience in returning the questionnaire and thank you for your help.

Sincerely,

Imam Ghozali

RESEARCH QUESTIONNAIRE

This questionnaire contains two series of question. Series A requests general information of your company. In series B three (3) types of management accounting techniques are listed. For each type of the techniques , a list of questions regarding the extent to which your company employed these techniques is provided.

SERIES A

Instruction: Please check one or fill the appropriate response to the following questions.

I. GENERAL INFORMATION

- a. Please give the following details of your company (optional).
 Company Name: _____
 Address : _____
- b. Is control of your company:
 - () domestic?
 - () foreign?
- c. What year your company commence business? _____
- d. What is the activity sector of your company?
 - () Agriculture, forestry, fishing, hunting
 - () Mining
 - () Manufacturing
 - () Electricity, gas and water
 - () Wholesale and retail trade
 - () Transport, storage and communication
 - () Finance, property and business services
 - () Community services
 - () Recreation, personal and other services

- e. Size of your company
 - Number of employees (1991-1992) _____
 - Sales (1991-1992) _____

Based on the indicators above, how would you classify the size of your company? (check one)

- () Medium
- () Large

SERIES B

II. RESEARCH QUESTIONS

The questionnaire in this section seeks to determine the extent to which your company is using the management accounting techniques listed below and the year in which those techniques were being adopted for the first time.

a. Management Accounting Techniques: Type I

Instruction: Please check the frequency of any and all of the following techniques that are used in your company and indicate the year it's adoption for the first time.

	Never Used	Seldom Used	Sometimes Used	Usually Used	Always Used	Year Adopted
Decision tree analysis	()	()	()	()	()	_____
Relevant cost analysis	()	()	()	()	()	_____
Capital budgeting	()	()	()	()	()	_____
Linear programming	()	()	()	()	()	_____
Net-work analysis/PERT	()	()	()	()	()	_____
Inventory control models	()	()	()	()	()	_____
Just in time inventory	()	()	()	()	()	_____
Sensitivity analysis	()	()	()	()	()	_____

b. Management Accounting Techniques: Type II

Instruction: Please indicate the frequency of any and all of the following techniques that are used in your company by circling the appropriate number on the scale and also indicate the year of it's adoption.

- 1 = monthly
- 2 = 2 months
- 3 = 3 months
- 4 = 4 months
- 5 = 5 months
- 6 = 6 months
- 7 = 7 months
- 9 = 9 months
- 10 = 10 months
- 11 = 11 months
- 12 = 12 months

	Monthly Scale	Year Adopted
Variance analysis	1 2 3 4 5 6 7 8 9 10 11 12	_____
Break-even analysis	1 2 3 4 5 6 7 8 9 10 11 12	_____
Contribution reporting	1 2 3 4 5 6 7 8 9 10 11 12	_____
Inventory turnover analysis	1 2 3 4 5 6 7 8 9 10 11 12	_____
Account receivable turnover	1 2 3 4 5 6 7 8 9 10 11 12	_____
Aging of account receivable	1 2 3 4 5 6 7 8 9 10 11 12	_____
Gross profit analysis	1 2 3 4 5 6 7 8 9 10 11 12	_____
Other financial ratio analysis	1 2 3 4 5 6 7 8 9 10 11 12	_____

c. Management Accounting Techniques: Type III

Instruction : Please check whether your company uses or does not use any and all of the following techniques. If yes, indicate the year of it's adoption for the first time.

	No	Yes	Year Adopted
Responsibility accounting	()	()	_____
Transfer pricing	()	()	_____
Standard Costing	()	()	_____
Activity based costing	()	()	_____
Operating budget	()	()	_____
Flexible budget	()	()	_____
Appropriation budget	()	()	_____
Performance budget	()	()	_____
Fixed budget	()	()	_____

Would you be prepared for further discussion on the subject by telephone or at your office? Yes () No ()

If (yes) please indicate office and telephone number for contact.

Would you please comment the clarity of the question?

THANK YOU FOR YOUR HELP

APPENDIX B
FULL SCALE STUDY QUESTIONNAIRE

Wollongong, September 15, 1993

The Chief Accounting Officer

Dear Sir/Madam,

I am working on a doctoral degree in the Department of Accountancy in the Faculty of Commerce, the University of Wollongong, Australia. My thesis topic involves the relationship between application of advanced management accounting techniques and company performance. In order to gather information that will provide insight into this relationship, I am conducting a survey of advanced management accounting techniques used by Australian public listed companies. The application of advanced management accounting techniques play a significant role in allocating the economic resources of the company. Therefore it is important to determine their impact on the company performance. This survey also seeks other variables that may influence the company performance.

Your company has been selected as one that can provide useful information for this study. I would appreciate it if you would complete and return to me the enclosed questionnaire. Your cooperation is extremely important and it will be a real contribution to the success of this study. Your answers to this questionnaire will be held in strict confidence and will be published in the form of statistical summaries which will make the identification of any specific company impossible.

I am including an addressed envelope for your convenience in returning the questionnaire and thank you for your help.

Sincerely,

Imam Ghozali

RESEARCH QUESTIONNAIRE

This questionnaire contains two series of question. Series A requests general information of your company. In series B three (3) types of management accounting techniques are listed. For each type of the techniques , a list of questions is asked regarding the extent to which your company employs these techniques.

SERIES A

Instruction: Please check one or fill the appropriate response to the following questions.

GENERAL INFORMATION

- a. Please give the following details of your company (optional).

Company Name:

Address :

- b. Is control of your company:

() domestic?

() foreign?

- c. What year did your company commence business? 19_____

- d. What is the activity sector of your company?

() Agriculture, forestry, fishing, hunting

() Mining

() Manufacturing

() Electricity, gas and water

() Wholesale and retail trade

() Transport, storage and communication

() Finance, property and business services

() Community services

() Recreation, personal and other services

- e. Size of your company

Number of employees (1991-1992) _____

Sales (1991-1992) \$million_____

Based on the indicators above, how would you classify the size of your company? (check one)

() Medium

() Large

SERIES B
RESEARCH QUESTIONS

The questionnaire in this section seeks to determine the extent to which your company is using the management accounting techniques listed below and the year in which those techniques were being adopted for the first time.

a. Management Accounting Techniques: Type I

Instruction: Please check the frequency of any and all of the following techniques that are used in your company and indicate the year it's adoption for the first time.

	Never	Seldom	Sometimes	Usually	Always	Year
	Used	Used	Used	Used	Used	Adopted
Decision tree analysis	()	()	()	()	()	_____
Relevant cost analysis	()	()	()	()	()	_____
Capital budgeting	()	()	()	()	()	_____
Linear programming	()	()	()	()	()	_____
Net-work analysis/PERT	()	()	()	()	()	_____
Inventory control models	()	()	()	()	()	_____
Just in time inventory	()	()	()	()	()	_____
Sensitivity analysis	()	()	()	()	()	_____

b. Management Accounting Techniques: Type II

Instruction: Please check the frequency of any and all of the following techniques that are used in your company and indicate the year of it's adoption for the first time.

	Not	Monthly	Quarterly	Semi	Annually	Year
	Used			annually		Adopted
Variance analysis	()	()	()	()	()	_____
Break-even analysis	()	()	()	()	()	_____
Contribution reporting	()	()	()	()	()	_____
Inventory turnover analysis	()	()	()	()	()	_____
Account receivable turnover	()	()	()	()	()	_____
Aging account receivable	()	()	()	()	()	_____
Gross profit analysis	()	()	()	()	()	_____
Other financial ratio analysis	()	()	()	()	()	_____

c. Management Accounting Techniques: Type III

Instruction : Please check whether your company uses or does not use any and all of the following techniques. If yes, indicate the year of it's adoption for the first time.

	No	Yes	Year Adopted
Responsibility accounting	()	()	_____
Transfer pricing	()	()	_____
Standard Costing	()	()	_____
Activity based costing	()	()	_____
Operating budget	()	()	_____
Flexible budget	()	()	_____
Appropriation budget	()	()	_____
Performance budget	()	()	_____
Fixed budget	()	()	_____

Would you be prepared for further discussion on the subject by telephone or at your office? Yes () No ()

If (yes) please indicate office and telephone number for contact. (0)

Thank you for your valuable time in completing this questionnaire. Your information will assist in identifying the type and frequency of use of various management accounting techniques in Australian companies.

Please return the completed questionnaire in the envelope supplied, to:

Mr. Imam Ghozali
Department of Accountancy
University of Wollongong
Northfields Avenue
Wollongong NSW 2522

Definition of Management Accounting Techniques Type I:

Decision tree analysis: involves a schematic analysis of a multiperiod or sequential decision-making problem under risk.

Relevant cost analysis: an analysis of all cost that will change between the alternative course of action being considered.

Capital Budgeting: the process of choosing projects by considering the present value of cashflow and deciding how to raise the fund required by the project.

Linear programming: a mathematical tool for finding profit-maximising (or cost-minimising) combination of products to produce when there are linear constraints on the resources available.

Net-work analysis/PERT: a system under which an activity such as factory production is organised and controlled on the basis of the sequenced time periods required for each operating step.

Inventory control models: the process of planning, monitoring and efficiently managing inventory by using mathematical models (eg. EOQ, MRP I and MRP II).

Just in time inventory: system of managing inventory for manufacturing where each component is purchased or manufactured just before it is used or sold.

Sensitivity analysis: is the study of how the outcome of a decision-making process changes as one or more of the assumptions change.

Definition of Management Accounting Techniques Type II:

Variance analysis: the investigation of the causes of variances in a standard costing system.

Break-even analysis: a method to investigate the relationship among cost, volume, and profit to determine the volume at which we break-even in an operation.

Contribution reporting: a method of preparing income statement that separates variable costs from fixed costs in order to emphasise the importance of cost behaviour patterns for purpose of planning and control.

Inventory turnover analysis: number of times the average inventory sold per years.

Account receivable turnover: represents the average length of time that the firm must wait after making a sale before receiving cash. Also called the average collection period.

Aging of account receivable: an analysis of the elements of individual account receivable according to the time elapsed after the dates of billing or due dates.

Gross profit analysis: a quantitative expression of proximate causes of change from one year to another in the elements of the gross profit.

Other financial ratio: other ratio between balance sheet items and financial statement items.

Definition of Management Accounting Techniques Type III:

Responsibility accounting: an accounting system by considering various units as separate entities, or profit centres, giving management of each units responsibility for the units revenues and expenses.

Transfer pricing: the amounts charged by one segment of an organisation for product or service that it supplies to another segment of the same organisation.

Standard costing: a product costing and cost-control system in which standard costs of direct material, direct labor, and overhead are applied to work in process.

Activity based costing: a product or service costing method that assigns costs to the cost objective using a variety of cost drivers usually called activities.

Operating budget: budget of the income statement together with supporting schedules.

Flexible budget: budget that projects receipt and expenditures as a function of activity levels.

Appropriation budget: a budget of certain types of expenditures in a business that are planned and controlled on the basis of define appropriations for specific time periods.

Performance budget: a budget that shows the difference between actual results and expected performance planned in a budget.

Fixed budget: a budget that provides for specified amounts of expenditures and receipts that do not vary with activity levels. Sometimes called a “static budget”.

APPENDIX C **NONREPONSE BIAS TEST RESULT**

SPSS/PC + The Statistical Package for IBM PC

10/3/94

This program is run by Mr. Imam Ghozali

TRANSLATE FROM 'c:\thesis\lotus\ttestx1.wk1' /FIELDNAMES.

Data written to the active file.
5 variables and 127 cases written.
5 of 603 storage units used.

Page 1	SPSS/PC +	10/3/94
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This procedure was completed at 20:11:03

Page 2	SPSS/PC +	10/3/94
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T-Test /Group Response (0,1) /Variable x1.

Page 3	SPSS/PC +	10/3/94
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Independent samples of RESPONSE

Group 1: RESPONSE EQ .0 Group 2: RESPONSE EQ 1.0

t-test for: X1 (Accounting Techniques Type I)

		Number of Cases	Mean	Standard Deviation	Standard Error			
Group 1		101	11.8812	6.055	.603			
Group 2		26	13.2308	6.352	1.246			
Pooled Variance Estimate					Separate Variance Estimate			
F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	
1.10	.713	-1.00	125	.318	-.98	37.55	.336	

SPSS/PC+ The Statistical Package for IBM PC

10/3/94

This program is run by Mr. Imam Ghozali

TRANSLATE FROM 'c:\thesis\lotus\ttests1.wk1' /FIELDNAMES.

Data written to the active file.

5 variables and 127 cases written.

5 of 603 storage units used.

Page 1 SPSS/PC+ 10/3/94

This procedure was completed at 20:42:08
T-Test /Groups Response (0,1) /Variables s1.

Page 2 SPSS/PC+ 10/3/94

Independent samples of RESPONSE

Group 1: RESPONSE EQ .0 Group 2: RESPONSE EQ 1.0

t-test for: S1 (Accounting Techniques Type II)

	Number of Cases	Mean	Standard Deviation	Standard Error
Group 1	101	21.1188	8.619	.858
Group 2	26	23.5000	7.328	1.437

Pooled Variance Estimate					Separate Variance Estimate		
F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.38	.355	-1.29	125	.199	-1.42	44.56	.162

APPENDIX D

TEST OF RANDOMNESS

1. Test of randomness for type I management accounting techniques answering score

a. Hypothesis.

H0 : The frequency distribution of type I management accounting techniques score is fit with its theoritical distribution.

H1 : The frequency distribution of type I management accounting techniques score is not fit with its theoretical distribution.

b. Testing criteria

H0 is accepted if $\chi^2 < 14.07$

H0 is rejected if $\chi^2 > 14.07$

c. Calculation of χ^2

$$\chi^2 = \frac{(O_i - E_i)^2}{E_i}$$

$$\chi^2 = \frac{(71-193)^2}{193} + \frac{(260-193)^2}{193} + \frac{(394-193)^2}{193} + \frac{(67-193)^2}{193} + \frac{(86-193)^2}{193} +$$

$$\frac{(217-193)^2}{193} + \frac{(149-193)^2}{193} + \frac{(300-193)^2}{193}$$

$$= 526.54$$

d. Conclusion

χ^2 observed is greater than its χ^2 table that is $526.54 > 14.07$ with degree of freedom 7 and level of significant 0.05. Therefore the null hypothesis is rejected which means that frequency distribution of type I management accounting techniques score is not fit with its theoretical distribution.

2. Test of randomness for type II management accounting techniques answering score

a. Hypothesis.

H0 : The frequency distribution of type II management accounting techniques score is fit with its theoritical distribution.

H1 : The frequency distribution of type II management accounting techniques score is not fit with its theoretical distribution.

b. Testing criteria

H0 is accepted if $\chi^2 < 14.07$

H0 is rejected if $\chi^2 > 14.07$

c. Calculation of χ^2

$$\chi^2 = \frac{(O_i - E_i)^2}{E_i}$$

$$\begin{aligned}\chi^2 &= \frac{(452-343)^2}{343} + \frac{(186-343)^2}{343} + \frac{(376-343)^2}{343} + \frac{(268-343)^2}{343} + \frac{(297-343)^2}{343} \\ &\quad + \frac{(350-343)^2}{343} + \frac{(421-343)^2}{343} + \frac{(394-343)^2}{343} \\ &= 157.71\end{aligned}$$

d. Conclusion

χ^2 observed is greater than its χ^2 table that is $157.71 > 14.07$ with degree of freedom 7 and level of significant 0.05. Therefore the null hypothesis is rejected which means that frequency distribution of type II management accounting techniques score is not fit with its theoretical distribution.

3. Test of randomness for type III management accounting techniques answering score

a. Hypothesis.

H0 : The frequency distribution of type III management accounting techniques score is fit with its theoretical distribution.

H1 : The frequency distribution of type III management accounting techniques score is not fit with its theoretical distribution.

b. Testing criteria

H0 is accepted if $\chi^2 < 15.51$

H0 is rejected if $\chi^2 > 15.51$

c. Calculation of χ^2

$$\chi^2 = \frac{(O_i - E_i)^2}{E_i}$$

$$\begin{aligned} \chi^2 = & \frac{(92-64.11)^2}{64.11} + \frac{(50-64.11)^2}{64.11} + \frac{(58-64.11)^2}{64.11} + \frac{(42-64.11)^2}{64.11} + \frac{(122-64.11)^2}{64.11} + \\ & \frac{(47-64.11)^2}{64.11} + \frac{(28-64.11)^2}{64.11} + \frac{(65-64.11)^2}{64.11} + \frac{(73-64.11)^2}{64.11} \\ = & 101.87 \end{aligned}$$

d. Conclusion

χ^2 observed is greater than its χ^2 table that is $101.87 > 15.51$ with degree of freedom 8 and level of significant 0.05. Therefore the null hypothesis is rejected which means that frequency distribution of type III management accounting techniques score is not fit with its theoretical distribution.

APPENDIX E
Frequency Score of The Application of Advanced Management
Accounting Techniques Type I, II and III

Management Accounting Tecniques Type I

Company #	X1	X2	X3	X4	X5	X6	X7	X8	Total
1	1	3	3	0	0	3	4	3	17
2	0	0	4	3	0	0	0	4	11
3	0	0	2	1	3	0	0	3	9
4	0	0	4	0	3	3	0	3	13
5	0	4	4	0	3	2	3	4	20
6	1	3	4	1	0	0	0	4	13
7	0	3	4	0	0	4	3	2	16
8	1	2	4	0	0	1	0	3	11
9	4	0	4	0	0	0	0	4	12
10	0	3	4	0	2	3	0	2	14
11	0	2	2	0	0	0	1	2	7
12	2	4	3	1	0	4	0	4	18
13	0	2	4	1	0	4	4	2	17
14	0	0	3	0	0	0	0	3	6
15	2	2	4	2	0	2	0	4	16
16	0	3	3	1	2	0	0	3	12
17	0	0	3	0	0	0	0	2	5
18	0	4	2	0	0	0	0	0	6
19	0	2	0	0	0	2	0	0	4
20	0	0	0	0	0	0	0	3	3
21	0	4	4	0	0	4	3	2	17
22	2	0	4	0	0	2	3	2	13
23	2	4	4	2	2	3	3	2	22
24	0	0	4	1	0	4	0	4	13
25	0	3	3	0	0	0	0	1	7
26	0	2	1	0	0	0	0	2	5
27	0	0	0	0	1	0	0	1	2
28	0	4	4	2	0	4	4	0	18
29	0	1	4	3	2	3	3	3	19
30	2	3	4	1	1	2	4	3	20
31	0	3	0	0	0	0	0	3	6
32	0	3	4	0	0	0	0	4	11
33	0	4	3	0	0	0	4	0	11
34	0	0	4	0	0	0	0	4	8
35	1	3	3	1	1	4	3	3	19
36	0	0	2	0	0	0	0	0	2
37	3	4	4	0	2	3	2	4	22
38	1	3	4	0	2	4	4	3	21

39	0	2	0	0	0	0	0	0	2
40	0	0	3	0	2	4	0	3	12
41	0	3	4	1	1	1	1	4	15
42	0	0	0	0	0	0	0	0	0
43	0	0	4	0	0	0	0	0	4
44	0	0	0	0	0	0	0	0	0
45	2	3	4	0	0	0	3	3	15
46	3	2	4	0	0	2	0	4	15
47	0	4	3	0	1	3	0	2	13
48	0	0	2	0	2	0	0	1	5
49	0	3	4	0	0	4	3	2	16
50	0	3	2	3	0	4	0	4	16
51	1	4	4	0	1	0	4	4	18
52	1	4	4	0	0	0	0	4	13
53	1	2	4	2	2	4	4	4	23
54	2	3	2	0	2	2	3	3	17
55	0	4	4	0	1	1	3	0	13
56	0	0	4	0	0	3	0	3	10
57	0	1	4	0	0	4	2	4	15
58	1	4	2	2	4	4	4	2	23
59	0	4	4	0	0	0	0	4	12
60	1	0	4	1	2	4	1	4	17
61	1	3	4	1	1	4	1	3	18
62	0	0	0	0	0	0	0	0	0
63	2	3	3	3	3	1	0	3	18
64	1	2	3	0	2	4	3	3	18
65	0	3	4	0	0	2	0	3	12
66	0	3	0	0	0	0	1	0	4
67	0	0	0	0	0	4	2	3	9
68	0	0	4	0	0	0	0	2	6
69	0	0	0	0	0	0	0	0	0
70	0	2	4	2	3	0	0	3	14
71	0	1	4	1	2	4	2	4	18
72	0	0	3	0	2	1	3	0	9
73	0	4	4	1	1	2	0	3	15
74	3	3	4	1	0	0	0	3	14
75	0	3	3	0	0	0	0	0	6
76	0	0	3	0	1	1	0	2	7
77	0	4	4	0	0	0	0	2	10
78	0	2	4	0	0	3	2	2	13
79	2	4	4	2	0	4	3	4	23
80	1	2	3	1	2	3	0	3	15
81	0	1	2	0	0	2	1	3	9
82	1	4	4	2	2	3	3	2	21
83	0	3	4	0	0	0	0	3	10

84	0	0	4	0	0	0	0	2	6
85	0	4	4	0	0	0	0	3	11
86	2	3	3	0	0	0	0	0	8
87	2	3	4	2	1	1	1	1	15
88	2	2	3	1	1	4	4	4	21
89	1	3	3	0	1	3	0	4	15
90	0	0	0	0	0	0	0	0	0
91	0	4	4	0	0	4	0	4	16
92	0	4	4	0	0	3	4	2	17
93	0	3	4	1	2	4	4	1	19
94	0	0	0	0	0	0	0	0	0
95	0	3	3	0	2	0	0	3	11
96	0	3	4	0	0	0	0	0	7
97	0	0	4	0	0	4	0	0	8
98	0	2	4	0	0	0	0	2	8
99	0	0	3	0	0	0	0	0	3
100	0	2	2	2	0	0	0	0	6
101	3	0	4	3	3	3	3	4	23
102	0	2	0	0	0	2	2	2	8
103	2	4	4	1	0	4	1	4	20
104	0	3	4	0	2	4	2	2	17
105	0	0	4	1	0	2	0	3	10
106	0	0	3	0	0	0	0	3	6
107	0	4	4	0	0	4	4	4	20
108	2	2	4	1	0	3	1	2	15
109	0	0	4	1	0	0	4	2	11
110	0	3	4	1	0	0	0	2	10
111	0	3	3	0	2	4	1	4	17
112	0	0	3	0	0	0	0	4	7
113	0	4	4	0	0	0	0	2	10
114	0	0	4	2	2	4	4	4	20
115	0	0	0	0	0	0	0	0	0
116	2	2	4	2	0	4	2	4	20
117	0	0	0	0	0	0	4	2	6
118	0	4	4	0	0	2	0	2	12
119	0	4	3	0	4	0	0	0	11
120	0	0	4	0	0	3	2	0	9
121	2	4	4	1	1	4	4	4	24
122	0	4	4	1	0	4	1	4	18
123	1	3	3	1	1	1	0	3	13
124	3	1	4	0	1	0	0	3	12
125	2	2	4	2	0	2	0	2	14
126	1	3	3	0	1	4	2	2	16
127	1	1	4	1	1	1	2	4	15
Total (real	71	260	394	67	86	217	149	300	1544

distribution)								
Theoretical distribution	193	193	193	193	193	193	193	193

- X1 = Decision tree analysis

X2 = Relevant cost analysis

X3 = Capital budgeting

X4 = Linear programming
- X5 = Net-work analysis/PERT

X6 = Inventory control models

X7 = Just in time inventory

X8 = Sensitivity analysis

Management Accounting Technique Type II

Company #	S1	S2	S3	S4	S5	S6	S7	S8	Total
1	4	4	0	0	0	4	4	4	20
2	4	3	4	3	4	4	4	4	30
3	4	3	4	0	0	0	4	4	19
4	4	4	4	4	4	4	4	4	32
5	4	4	4	3	4	3	4	3	29
6	4	1	4	0	0	0	4	4	17
7	4	0	4	4	0	4	4	4	24
8	4	0	4	0	0	0	4	4	16
9	0	0	4	0	0	0	4	4	12
10	4	4	4	4	4	4	4	4	32
11	4	0	0	4	4	4	4	4	24
12	4	4	4	3	0	1	4	0	20
13	0	0	0	4	4	4	4	4	20
14	0	0	0	0	0	0	4	4	8
15	4	1	4	0	4	4	4	4	25
16	4	4	4	0	0	4	4	4	24
17	4	0	0	0	0	0	4	4	12
18	4	0	4	0	0	0	4	1	13
19	4	1	4	4	4	4	4	4	29
20	4	0	3	0	0	4	4	1	16
21	4	3	4	4	4	4	4	4	31
22	4	0	4	4	4	4	4	4	28
23	4	4	4	4	4	4	4	4	32
24	4	1	4	4	0	4	4	4	25
25	1	0	1	0	0	1	0	1	4
26	2	2	1	2	4	4	1	1	17
27	4	0	0	0	0	0	4	4	12
28	4	0	4	0	4	4	4	4	24
29	4	0	4	4	4	4	4	4	28
30	0	4	4	4	4	4	4	4	28
31	4	0	4	0	0	0	4	4	16

32	4	0	4	0	0	0	4	4	16
33	4	0	4	0	4	4	4	4	24
34	0	0	0	0	0	4	4	0	8
35	4	3	4	4	4	4	4	4	31
36	3	0	0	0	0	0	0	0	3
37	4	4	4	4	4	4	4	4	32
38	4	0	4	4	4	4	4	3	27
39	3	0	4	4	4	4	4	3	26
40	4	4	2	4	4	4	4	4	30
41	4	0	4	0	0	0	3	2	13
42	4	0	4	0	0	4	4	4	20
43	4	0	4	4	4	0	0	4	20
44	4	0	0	3	0	4	4	0	15
45	4	4	4	4	4	4	4	4	32
46	0	1	0	2	4	4	2	4	17
47	4	0	4	1	1	4	4	1	19
48	0	1	4	2	4	4	0	2	17
49	4	3	0	4	4	4	4	4	27
50	4	0	4	4	4	4	4	2	26
51	4	4	4	4	4	4	4	4	32
52	4	3	0	0	0	0	3	3	13
53	4	4	4	4	4	4	4	4	32
54	4	3	4	4	4	4	4	4	31
55	4	0	4	4	4	4	4	0	24
56	4	4	4	0	0	0	4	4	20
57	4	1	1	4	4	4	4	3	25
58	4	4	4	4	4	4	4	2	30
59	4	1	4	1	4	4	4	4	26
60	4	1	4	4	4	4	4	4	29
61	4	2	4	4	4	4	2	4	28
62	4	0	0	0	0	0	4	4	12
63	4	0	4	4	4	4	4	4	28
64	4	0	4	4	4	4	4	4	28
65	0	1	1	1	4	4	2	4	17
66	4	3	4	3	4	4	4	3	29
67	4	2	4	4	4	4	4	4	30
68	3	0	3	0	0	0	0	0	6
69	4	2	4	0	4	4	4	4	26
70	4	0	4	0	4	4	4	4	24
71	4	0	4	4	0	0	0	4	16
72	4	1	4	0	4	4	4	4	25
73	4	2	3	4	4	4	4	2	27
74	4	0	4	0	0	0	4	4	16
75	4	0	4	0	0	0	4	0	12
76	4	3	4	0	0	0	2	2	15

122	4	4	4	4	4	4	4	4	32
123	4	0	4	0	0	0	4	4	16
124	4	0	4	2	2	4	4	4	24
125	0	1	4	4	0	0	4	4	17
126	4	1	4	4	4	4	4	4	29
127	4	0	4	4	4	4	0	4	24
Total (real distribution)	452	186	376	268	297	350	421	394	2744
Theoretical distribution	343	343	343	343	343	343	343	343	

- S1 = Variance analysis

S2 = Break-even analysis

S3 = Contribution reporting

S4 = Inventory turnover analysis
- S5 = Account receivable turnover

S6 = Aging of account receivable

S7 = Gross profit analysis

S8 = Other financial ratio analysis

Management Accounting Techniques Type III

Company #	P1	P2	P3	P4	P5	P6	P7	P8	P9	Total
1	1	0	0	0	1	0	1	1	1	5
2	1	1	1	0	1	0	0	1	1	6
3	1	1	0	1	1	0	0	1	1	6
4	1	1	1	0	1	0	0	0	1	5
5	1	0	1	1	1	0	0	1	0	5
6	1	0	0	0	1	0	0	1	1	4
7	1	0	0	0	1	0	0	1	1	4
8	0	0	0	0	1	1	0	1	0	3
9	1	0	0	0	1	0	0	0	0	2
10	1	0	1	0	1	0	0	0	1	4
11	1	0	0	0	1	0	0	0	0	2
12	1	0	1	0	1	0	0	0	1	4
13	0	1	0	1	1	0	1	1	1	6
14	0	0	0	0	1	1	0	1	1	4
15	1	1	1	1	1	0	0	1	1	7
16	1	1	0	1	1	1	0	0	0	5
17	0	0	0	0	1	1	0	0	1	3
18	0	0	1	0	0	0	0	0	1	2
19	0	0	1	0	1	0	0	0	1	3
20	0	0	0	0	1	1	0	0	1	3
21	1	0	1	0	1	0	0	0	0	3
22	1	1	1	0	1	0	1	0	1	6
23	1	0	1	1	1	1	1	1	1	8
24	1	0	0	0	1	0	0	0	1	3

25	1	0	0	0	1	1	0	0	0	3
26	0	1	1	0	1	1	0	0	0	4
27	1	0	0	1	1	0	0	0	1	4
28	1	0	0	1	1	0	0	1	1	5
29	1	1	1	1	1	0	0	1	0	6
30	1	1	0	1	1	1	1	1	1	8
31	0	0	0	0	0	0	0	1	0	1
32	1	1	0	1	1	0	0	0	1	5
33	0	1	1	0	1	0	0	0	1	4
34	0	0	0	0	1	0	0	0	0	1
35	1	1	1	0	1	0	0	0	1	5
36	0	0	0	0	1	0	0	0	0	1
37	1	1	1	0	1	1	0	0	0	5
38	1	0	0	1	1	0	0	1	1	5
39	1	0	0	0	1	1	0	0	0	3
40	1	1	1	0	1	1	0	0	0	5
41	1	0	0	1	1	1	0	1	0	5
42	1	0	1	0	1	0	0	1	1	5
43	0	0	1	0	1	0	0	0	1	3
44	0	0	0	0	1	0	0	0	0	1
45	1	0	1	0	1	0	0	1	0	4
46	1	0	0	1	1	0	0	0	1	4
47	1	1	1	0	1	1	0	0	1	6
48	1	1	0	0	1	0	1	1	1	6
49	1	0	1	0	1	0	0	0	0	3
50	1	0	0	1	1	0	0	1	0	4
51	1	0	0	1	1	1	1	1	1	7
52	1	0	0	1	1	1	0	0	0	4
53	1	1	1	1	1	1	1	1	1	9
54	1	1	1	1	1	1	1	1	1	9
55	0	0	0	0	1	0	0	1	1	3
56	1	0	0	0	1	1	1	1	0	5
57	0	1	0	1	1	0	0	1	1	5
58	1	0	1	1	1	0	1	1	1	7
59	0	0	1	0	1	0	0	0	0	2
60	1	1	1	1	1	0	1	1	1	8
61	1	0	1	1	1	1	1	1	1	8
62	0	0	0	0	1	0	0	0	1	2
63	1	0	1	0	1	1	0	1	1	6
64	1	1	1	0	1	0	0	0	0	4
65	1	1	0	1	1	1	0	1	0	6
66	1	1	0	0	1	0	0	0	1	4
67	1	0	1	1	1	0	1	0	1	6
68	1	1	0	0	0	1	0	0	0	3
69	1	0	0	0	1	0	0	0	0	2

70	0	0	0	0	1	1	0	0	1	3
71	1	0	0	1	1	1	0	1	0	5
72	1	1	1	1	1	0	1	0	0	6
73	1	1	1	0	1	1	0	0	1	6
74	1	1	0	0	1	1	0	1	1	6
75	0	1	0	0	1	0	0	1	0	3
76	1	0	0	0	1	0	0	0	1	3
77	0	0	1	0	1	0	0	1	0	3
78	0	1	1	1	1	0	0	1	1	6
79	0	1	1	1	1	0	0	0	1	5
80	1	0	0	0	1	0	0	0	0	2
81	0	0	1	0	1	0	0	0	1	3
82	1	1	1	1	1	1	0	1	1	8
83	1	0	0	0	1	1	1	1	1	6
84	0	0	0	1	1	0	0	0	0	2
85	1	1	1	0	1	1	0	0	0	5
86	1	1	0	0	1	0	0	0	1	4
87	1	1	1	1	1	1	1	1	1	9
88	0	0	0	0	1	1	0	0	1	3
89	1	0	1	1	1	0	0	1	0	5
90	0	0	1	0	1	0	0	1	0	3
91	1	0	0	0	0	1	0	0	0	2
92	1	1	0	0	1	0	0	1	1	5
93	1	0	1	0	1	1	0	1	0	5
94	1	0	1	0	0	0	0	0	1	3
95	1	0	0	0	1	0	0	0	0	2
96	1	0	0	1	1	0	0	0	0	3
97	1	1	0	0	1	0	1	1	0	5
98	1	1	0	0	1	0	0	0	0	3
99	0	0	1	0	1	0	0	0	1	3
100	1	0	1	0	1	1	1	1	1	7
101	1	0	0	0	1	0	1	1	1	5
102	1	1	0	0	1	0	0	1	1	5
103	1	1	0	1	1	0	1	1	1	7
104	1	1	1	1	1	0	0	0	0	5
105	1	0	0	1	1	1	1	1	0	6
106	1	0	0	0	1	1	0	0	0	3
107	1	1	1	0	1	1	0	1	1	7
108	1	0	1	1	1	1	1	1	1	8
109	1	1	0	0	1	0	0	0	1	4
110	0	0	0	0	1	1	0	0	0	2
111	0	0	1	1	1	1	0	1	1	6
112	0	0	0	0	1	0	0	1	0	2
113	0	0	0	0	1	1	0	0	0	2
114	1	0	0	1	1	1	0	1	1	6

115	0	0	0	0	1	0	0	0	1	2
116	1	1	1	0	1	0	1	1	0	6
117	0	0	1	0	1	0	0	0	0	2
118	0	0	0	0	1	0	0	1	0	2
119	1	0	1	0	1	0	1	1	0	5
120	1	0	1	0	1	0	1	0	1	5
121	1	1	1	0	1	1	0	1	0	6
122	1	0	1	1	1	1	0	1	1	7
123	1	1	0	1	1	0	0	1	1	6
124	1	1	0	0	1	1	0	1	0	5
125	1	1	0	0	1	0	1	1	1	6
126	1	1	1	0	1	0	0	1	1	6
127	1	1	1	0	1	1	1	1	1	8
Total (real distribution)	92	50	58	42	122	47	28	65	73	577
Theoretical distribution	64.11	64.11	64.11	64.11	64.11	64.11	64.11	64.11	64.11	

P1 = Responsibility accounting
P2 = Transfer pricing
P3 = Standard costing
P4 = Activity based costing

P6 = Flexible budget
P7 = Appropriation budget
P8 = Performance budget
P9 = Fixed budget

APPENDIX F

CLASSIFICATION OF DATA COLLECTED FROM ONE HUNDRED AND TWENTY SEVEN FIRMS

Company #	Y	X1	X2	X3	X4	X5	X6	X7	X8	ROR
1	1	42	229740	67	0	0.06481	0.05059	0	0.77909	61.48689
2	1	47	424012	111	1	0.01650	0.03251	0	0.92669	50.35009
3	1	34	5970236	56	0	0.00215	0.04099	0	15.32419	50.73947
4	0	50	12992	8	1	0.03833	0.11206	0	0.09871	18.98368
5	0	54	15353	7	1	0.00160	0.14761	0	0.11674	11.68817
6	1	34	777210	40	0	0.03113	0.02061	0	0.65628	50.79033
7	0	44	59887	98	0	0.02851	0.08591	1	0.87859	28.49416
8	0	30	33831	8	0	0.02162	0.26216	0	2.91391	29.98369
9	1	26	616334	15	0	0.04626	0.02127	0	1.02336	56.85637
10	1	50	30611	67	1	0.04949	0.01198	0	1.22336	62.48427
11	0	33	138207	6	1	0.01230	0.05833	1	0.65945	43.51696
12	1	42	96128	106	0	0.10978	0.16867	1	1.93272	59.07757
13	0	43	86966450	75	1	0.00114	0.01543	0	15.55071	36.64162
14	1	18	122419	24	0	0.02152	0.02775	0	0.36023	56.00104
15	0	48	22967	103	0	0.01594	0.07984	0	0.06445	39.05761
16	0	41	3541495	7	0	0.00189	0.04112	0	14.96992	49.22719
17	0	20	806483	120	0	0.00257	0.02728	0	8.70780	46.71511
18	0	21	50564	23	0	0.02945	0.16482	0	0.40807	45.17395
19	0	36	62282	74	1	0.00474	0.04362	0	0.69593	32.99734
20	0	22	25209	8	0	0.01309	0.06382	0	1.78243	48.24417
21	1	51	27041	8	1	0.02978	0.05224	0	1.22232	58.87525
22	0	47	235991	53	1	0.05003	0.03396	1	1.96029	47.09098

Company #	Y	X1	X2	X3	X4	X5	X6	X7	X8	ROR
23	1	62	5599141	30	1	0.02783	0.03380	1	0.74887	62.38679
24	1	41	505498	8	0	0.00777	0.02361	0	0.45420	55.51416
25	0	14	108335	8	0	0.00022	0.02172	0	0.22514	49.48613
26	1	26	20364	113	0	0.04565	0.06794	0	0.98200	71.4267
27	0	18	9311	8	0	0.00043	0.12755	0	0.36529	34.01766
28	1	47	616977	160	0	0.05090	0.05493	0	1.46904	55.36652
29	1	53	1682603	93	1	0.03422	0.04537	1	1.98114	63.91637
30	1	56	4976175	79	0	0.04027	0.01181	0	1.28574	70.37926
31	0	23	128435	6	0	0.02807	0.00805	0	0.05682	49.34047
32	1	32	2322400	88	0	0.04167	0.07785	0	1.20119	61.6237
33	0	39	42182	34	1	0.03894	0.07693	0	1.13973	49.9477
34	1	17	118466	28	0	0.04261	0.12360	0	0.66055	82.34785
35	0	55	65553	8	0	0.00409	0.02806	0	0.06069	31.26861
36	0	6	18172	6	0	0.00000	0.09413	0	0.19146	30.15571
37	0	59	5314200	138	1	0.02560	0.05209	0	1.06563	49.97019
38	1	53	124053	15	0	0.04425	0.11707	0	0.61429	81.2624
39	1	31	31630	24	0	0.01312	0.08025	0	0.11737	55.42197
40	0	47	52527	19	0	0.03644	0.04697	0	1.58660	43.56134
41	0	33	63978	10	0	0.05782	0.22981	0	1.03957	48.40314
42	0	25	14810	6	0	0.00298	0.04889	0	2.99833	40.48256
43	0	27	21382	23	0	0.00049	0.11069	0	0.42451	31.56106
44	0	16	31347	37	0	0.01969	0.01795	0	0.63404	36.14155
45	1	51	24970	65	0	0.01591	0.05217	1	0.45544	58.11312
46	1	36	895139	12	0	0.01816	0.03032	0	0.75900	57.11089
47	0	38	26456	8	1	0.00771	0.03581	0	0.30856	34.26949
48	0	28	90212	82	1	0.03698	0.08162	0	1.53952	35.03928
49	0	46	90260	7	1	0.02571	0.07858	0	1.51335	18.82872

Company #	Y	X1	X2	X3	X4	X5	X6	X7	X8	ROR
50	0	46	2575232	42	0	0.00514	0.07125	0	5.24376	41.45719
51	1	57	92254	27	0	0.04417	0.02171	0	1.56252	54.41587
52	1	30	26047	6	0	0.03406	0.14369	0	0.30624	60.27469
53	0	64	10330262	20	1	0.01241	0.08324	0	2.65688	43.60443
54	0	57	78201	38	1	0.02403	0.06965	0	1.32815	43.88186
55	1	40	87194	90	1	0.02947	0.01995	0	0.93510	71.57178
56	0	35	156355	11	0	0.00729	0.01538	0	0.31922	47.61647
57	1	45	72149	11	0	0.04104	0.02132	0	1.70888	53.94508
58	1	60	97572	36	1	0.04648	0.03818	0	1.09294	63.59646
59	0	40	404352	6	0	0.00665	0.19110	0	0.49117	21.48417
60	1	54	2313050	65	1	0.04378	0.06690	1	1.07789	57.70557
61	1	54	412232	78	1	0.04632	0.02731	0	1.26616	56.73084
62	1	14	12842	10	0	0.01700	0.64329	1	1.24466	64.46689
63	0	52	898902	61	0	0.00469	0.02383	0	0.23301	46.21701
64	0	50	53893	113	1	0.01928	0.04908	0	2.77757	42.01987
65	1	35	370787	8	0	0.02038	0.03003	0	0.38716	50.63654
66	0	37	32760	135	1	0.03409	0.03337	0	0.99390	48.42312
67	0	45	71628	77	0	0.02786	0.02923	0	0.86011	46.77351
68	1	15	671826	43	0	0.06402	0.02116	0	2.44334	58.18579
69	0	28	31706	37	0	0.03967	0.06941	0	2.07531	30.50814
70	1	41	191950	30	0	0.03443	0.02022	0	2.27107	53.38978
71	0	39	108235	6	0	0.00000	0.03860	0	0.56625	44.54824
72	1	40	9011	12	1	0.00574	0.08825	0	0.73081	63.8414
73	1	48	692962	77	1	0.03610	0.04006	1	1.01453	56.70335
74	1	36	2276600	6	0	0.00287	0.31888	0	15.90677	86.22864
75	0	21	484456	6	0	0.01807	0.04066	0	1.50177	44.63173
76	1	25	290936	21	0	0.01005	0.04626	0	1.17530	59.7772

Company #	Y	X1	X2	X3	X4	X5	X6	X7	X8	ROR
77	1	33	24331	8	0	0.03266	0.19120	0	0.56100	53.88673
78	1	43	82089	39	1	0.05376	0.01663	0	0.68881	75.85061
79	1	60	2468769	110	1	0.04289	0.02627	0	1.22686	58.6978
80	1	41	88017	15	0	0.11101	0.05884	0	0.22852	56.34634
81	1	32	24080	55	0	0.02030	0.01971	0	0.88562	73.68817
82	1	61	3888945	93	1	0.02628	0.04373	0	2.09222	55.11878
83	1	45	466234	20	0	0.05755	0.01635	0	0.90428	57.10485
84	0	16	95789	8	0	0.09611	0.39458	0	1.46055	22.77687
85	1	41	1779775	6	1	0.05092	0.08740	0	1.08004	50.9249
86	0	17	40246	7	1	0.01646	0.04614	0	0.48771	13.33522
87	0	49	36916	33	0	0.01745	0.04544	0	0.06024	44.19715
88	1	30	687265	33	0	0.06831	0.10966	1	0.77789	60.48795
89	0	50	76899	6	1	0.02911	0.07884	0	1.25164	39.51805
90	1	35	129409	36	0	0.01147	0.02232	0	7.40301	54.49232
91	1	31	957552	6	0	0.04073	0.02769	0	0.85180	58.01627
92	0	52	70035	13	0	0.02090	0.09895	0	1.47793	47.22268
93	1	50	121457	33	1	0.04433	0.01069	0	0.50432	56.5034
94	1	11	22389	30	0	0.08787	0.07456	0	5.77665	60.72926
95	0	20	197837	7	0	0.00081	0.01472	0	2.08286	36.12734
96	0	14	15540	24	0	0.01180	0.10601	0	0.34873	33.62935
97	1	41	47621	83	0	0.02245	0.02188	0	1.59965	61.25276
98	1	39	166772	82	1	0.02447	0.01324	0	0.61590	56.5059
99	0	10	6135	12	0	0.01130	0.39133	0	0.07615	5.56659
100	1	33	33405	10	0	0.05861	0.30059	0	0.24622	57.77986
101	1	56	2787833	39	0	0.04513	0.06945	0	1.44521	54.82128
102	0	39	30572	6	0	0.00935	0.00655	0	3.02602	45.27677
103	1	51	30702	32	0	0.03856	0.10137	0	1.52410	50.08795

Company #	Y	X1	X2	X3	X4	X5	X6	X7	X8	ROR
104	1	52	158382	6	0	0.01094	0.02710	0	0.12771	55.27964
105	1	40	95472	10	0	0.04782	0.05082	0	0.20731	73.71958
106	0	13	159138	28	0	0.00055	0.00696	0	0.09950	41.80795
107	0	55	359139	97	0	0.01993	0.01665	0	1.88822	49.02607
108	1	54	213592	48	0	0.03108	0.01404	0	0.84780	71.61863
109	0	24	57964	25	0	0.06946	0.15796	0	0.48268	43.2123
110	1	27	31377	21	0	0.01361	0.03307	0	0.34892	52.46272
111	0	55	17298	6	0	0.05414	0.27628	0	1.58893	28.1714
112	0	29	2540017	118	0	0.00708	0.35741	0	1.51554	25.34356
113	0	16	26697	78	1	0.03655	0.03921	0	0.21642	49.36786
114	0	37	88043	6	0	0.01132	0.04240	0	0.81454	31.68579
115	1	13	38005	108	0	0.02361	0.05242	0	0.27013	61.04672
116	1	58	765009	47	1	0.03425	0.02857	0	0.83917	57.6106
117	1	20	30821	7	0	0.00035	0.10133	0	2.52490	81.98131
118	0	38	243863	38	0	0.01429	0.03937	0	6.51326	34.99891
119	1	40	118103	8	0	0.02261	0.03691	0	3.25462	51.20699
120	1	44	157917	78	1	0.02430	0.01833	0	0.50821	70.32462
121	1	62	444858	93	1	0.04087	0.04396	1	0.36375	50.70499
122	1	57	788881	9	1	0.03591	0.02188	0	1.26341	65.261
123	1	35	3357150	60	0	0.05073	0.02332	0	0.45249	55.39771
124	0	41	1419647	34	0	0.00000	0.00659	0	0.13170	46.95247
125	1	37	129368	33	0	0.23759	0.15582	1	0.20931	52.56789
126	1	51	1162860	71	1	0.02964	0.06822	0	1.13469	51.86967
127	1	47	1570464	21	1	0.02769	0.02342	0	1.15021	53.98159

Y = Adjusted rate of return (1 = above average, 0 = below average) ROR= Adjusted rate of return
X1 = Total score of management accounting techniques

- X2 = Operating assets (in \$ million)
- X3 = Firm age (years)
- X4 = Type of industry (1 = manufacture, 0 = non-manufacture)
- X5 = Firm capital intensity
- X6 = Firm risk
- X7 = Type of ownership (1 = foreign firm, 0 = domestic firm)
- X8 = Firm leverage

APPENDIX G
RESULT OF RELIABILITY TEST

Reliability Test of Management Accounting Techniques Type I

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RELIABILITY /VARIABLES X1 TO X8

/SCALE (MAT1)= X1 TO X8

/STATISTICS COVARIANCES

CORRELATIONS.

METHOD 2 (COVARIANCE MATRIX) WILL BE USED FOR THIS
ANALYSIS

***** 1064 BYTES OF SPACE REQUIRED FOR RELIABILITY *****

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TEST OF RELIABILITY MANAGEMENT ACCOUNTING TECHNIQUES
TYPE I

RUN BY IMAM GHOZALI

RELIABILITY ANALYSIS - SCALE (SCORE MAT 1)

1. X1 DECISION TREE ANALYSIS
2. X2 RELEVANT COST ANALYSIS
3. X3 CAPITAL BUDGETING
4. X4 LINEAR PROGRAMMING
5. X5 NET-WORK ANALYSIS/PERT
6. X6 INVENTORY CONTROL MODELS
7. X7 JUST IN TIME INVENTORY
8. X8 SENSITIVITY ANALYSIS

COVARIANCE MATRIX

	X1	X2	X3	X4	X5
X1	.8516				
X2	.2353	2.4422			
X3	.3391	.6618	1.8228		
X4	.1764	.1585	.2575	.6488	
X5	.0603	.1990	.1627	.2157	.9901

RELIABILITY ANALYSIS - SCALE (SCORE MAT 1)

COVARIANCE MATRIX

	X1	X2	X3	X4	X5
X6	.2092	.6420	.7309	.3901	.4138
X7	.1855	.6119	.4211	.2256	.3380
X8	.4626	.3399	.8674	.3001	.2058

	X6	X7	X8
X6	2.9159		
X7	1.3332	2.3346	
X8	.8372	.2311	2.0424

RELIABILITY ANALYSIS - SCALE (SCORE MAT 1)

CORRELATION MATRIX

	X1	X2	X3	X4	X5
X1	1.0000				
X2	.1631	1.0000			
X3	.2722	.3137	1.0000		
X4	.2372	.1260	.2368	1.0000	
X5	.0657	.1280	.1211	.2691	1.0000
X6	.1328	.2406	.3170	.2836	.2435
X7	.1316	.2563	.2041	.1833	.2223
X8	.3507	.1522	.4496	.2607	.1448

	X6	X7	X8
X6	1.0000		
X7	.5110	1.0000	

RELIABILITY ANALYSIS - SCALE (SCORE MAT 1)

CORRELATION MATRIX

	X6	X7	X8
X8	.3431	.1058	1.0000

OF CASES = 127.0

RELIABILITY COEFFICIENTS 8 ITEMS

ALPHA = .7027 STANDARDIZED ITEM ALPHA = .7061

Reliability Test of Management Accounting Techniques Type II

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TEST OF RELIABILITY MANAGEMENT ACCOUNTING TECHNIQUES
TYPE II
RUN BY IMAM GHOZALI

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RELIABILITY /VARIABLES S1 TO S8
/SCALE (SCOREMAT2)= S1 TO S8
/STATISTICS COVARIANCES CORRELATIONS
```

METHOD 2 (COVARIANCE MATRIX) WILL BE USED FOR THIS ANALYSIS

***** 1064 BYTES OF SPACE REQUIRED FOR RELIABILITY *****

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RELIABILITY ANALYSIS - SCALE (SCOREMAT)

- | | | |
|----|----|--------------------------------|
| 1. | S1 | VARIANCE ANALYSIS |
| 2. | S2 | BREAK-EVEN ANALYSIS |
| 3. | S3 | CONTRIBUTION REPORTING |
| 4. | S4 | INVENTORY TURNOVER ANALYSIS |
| 5. | S5 | ACCOUNT RECEIVABLE TURN OVER |
| 6. | S6 | AGING ACCOUNT RECEIVABLE |
| 7. | S7 | GROSS PROFIT ANALYSIS |
| 8. | S8 | OTHER FINANCIAL RATIO ANALYSIS |

COVARIANCE MATRIX

	S1	S2	S3	S4	S5
S1	1.3596				
S2	.1430	2.6634			
S3	.4587	.6613	2.7842		
S4	.1363	.9246	.9568	3.5433	
S5	.0949	1.0399	1.3468	2.3195	3.8130

COVARIANCE MATRIX					
	S1	S2	S3	S4	S5
S6	.1296	1.0191	1.0935	1.8605	2.7500
S7	.3146	.5589	.9569	.6555	.8608
S8	.2042	.4679	.7263	.8378	.9651
	S6	S7	S8		
S6	3.3606				
S7	1.1807	1.9635			
S8	.8030	.9993	2.1244		

CORRELATION MATRIX					
	S1	S2	S3	S4	S5
S1	1.0000				
S2	.0751	1.0000			
S3	.2358	.2428	1.0000		
S4	.0621	.3010	.3046	1.0000	
S5	.0417	.3263	.4133	.6310	1.0000
S6	.0606	.3406	.3575	.5391	.7682
S7	.1925	.2444	.4093	.2485	.3146
S8	.1202	.1967	.2986	.3054	.3391
	S6	S7	S8		
S6	1.0000				
S7	.4596	1.0000			

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RELIABILITY ANALYSIS - SCALE (SCORE MAT2)

CORRELATION MATRIX

	S6	S7	S8
S8	.3005	.4893	1.0000

OF CASES = 127.0

RELIABILITY COEFFICIENTS 8 ITEMS

ALPHA = .7927 STANDARDIZED ITEM ALPHA = .7806

Reliability Test of Management Accounting Techniques Type III

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TEST OF RELIABILITY MANAGEMENT ACCOUNTING TECHNIQUES TYPE III

RUN BY IMAM GHOZALI

RELIABILITY /VARIABLES P1 TO P9
/SCALE (SCOREMAT3)= P1 TO P9
/STATISTICS COVARIANCES
CORRELATIONS.

METHOD 2 (COVARIANCE MATRIX) WILL BE USED FOR THIS ANALYSIS

***** 1304 BYTES OF SPACE REQUIRED FOR RELIABILITY *****

RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

- 1. P1 RESPONSIBILITY ACCOUNTING
- 2. P2 TRANSFER PRICING
- 3. P3 STANDARD COSTING
- 4. P4 ACTIVITY BASED COSTING
- 5. P5 OPERATING BUDGET
- 6. P6 FLEXIBLE BUDGET
- 7. P7 APPROPRIATION BUDGET
- 8. P8 PERFORMANCE BUDGET
- 9. P9 FIXED BUDGET

RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

COVARIANCE MATRIX

	P1	P2	P3	P4	P5
P1	.2012				
P2	.0538	.2406			
P3	.0157	.0410	.2501		
P4	.0442	.0275	.0065	.2231	
P5	.0049	.0077	.0022	.0131	.0381
P6	.0234	.0039	-.0037	.0195	-.0012
P7	.0533	.0236	.0255	.0456	.0087
P8	.0390	.0271	.0025	.0754	.0124
P9	.0089	.0338	.0291	.0306	.0069

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RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

COVARIANCE MATRIX

	P6	P7	P8	P9
P6	.2350			
P7	.0209	.1732		
P8	.0313	.0767	.2518	
P9	-.0160	.0469	.0368	.2463

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RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

CORRELATION MATRIX

	P1	P2	P3	P4	P5
P1	1.0000				
P2	.2445	1.0000			
P3	.0702	.1671	1.0000		
P4	.2088	.1187	.0275	1.0000	
P5	.0564	.0803	.0230	.1423	1.0000
P6	.1078	.0166	-.0152	.0852	-.0125
P7	.2855	.1157	.1225	.2317	.1077
P8	.1732	.1099	.0100	.3182	.1263
P9	.0399	.1389	.1171	.1306	.0716

RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

CORRELATION MATRIX

	P6	P7	P8	P9
P6	1.0000			
P7	.1038	1.0000		
P8	.1287	.3674	1.0000	
P9	-.0665	.2269	.1478	1.0000

OF CASES = 127.0

RELIABILITY ANALYSIS - SCALE (SCORE MAT3)

RELIABILITY COEFFICIENTS 9 ITEMS

ALPHA = .5463 STANDARDIZED ITEM ALPHA = .5515

APPENDIX H
RESULT OF MULTIPLE LOGISTIC REGRESSION MODELS

Logistic Regression Model 1

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This program is run by Mr Imam Ghozali

TRANSLATE FROM 'b:logit1.wk1' /FIELDNAMES.

Data written to the active file.
20 variables and 117 cases written.
20 of 603 storage units used.

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This procedure was completed at 12:21:33
LOGISTIC REGRESSION /VARIABLES Y WITH X1 X2 X3 X4 X5 X6 X7 X8
X1X2 X1X5 X1X8
/METHOD ENTER

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Total number of cases: 117 (Unweighted)
Number of selected cases: 117
Number of unselected cases: 0

Number of selected cases: 117
Number rejected because of missing data: 0
Number of cases included in the analysis: 117

Dependent Variable Encoding:

Original Value	Internal Value
.0	0
1.0	1

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 146.01651

* Constant is included in the model.

	Chi-Square	df	Significance
-2 Log Likelihood	57.585	105	1.0000
Model Chi-Square	88.431	11	.0000
Improvement	88.431	11	.0000
Goodness of Fit	51.510	105	1.0000

Classification Table for Y

		Predicted		Percent Correct
		.0	1.0	
Observed		0	1	

.0	0	29	8	78.38%
1.0	1	7	73	91.25%

		Overall		87.18%

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----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
X1	-.1077	.0521	4.2666	1	.0389	-.1246	.8979
X2	-8.1770	3.4758	5.5346	1	.0186	-.1556	.0003
X3	-.0020	.0103	.0390	1	.8434	.0000	.9980
X4	.7568	.9438	.6430	1	.4226	.0000	2.1314
X5	2.8552	72.5223	.0015	1	.9686	.0000	17.3779
X6	23.6622	9.1130	6.7420	1	.0094	.1802	1.89E+10
X7	-5.5867	2.3787	5.5160	1	.0188	-.1552	.0037
X8	.9257	.7538	1.5080	1	.2194	.0000	2.5237
X1X2	.1897	.0818	5.3820	1	.0203	.1522	1.2089
X1X5	6.5800	2.7160	5.8693	1	.0154	.1628	720.5631
X1X8	-.0199	.0209	.9050	1	.3415	.0000	.9803
Constant	-1.2937	1.6467	.6172	1	.4321		

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Correlation Matrix:

	Constant	X1	X2	X3	X4	X5	X6
Constant	1.00000	-.69083	.32214	.03236	.03148	-.66794	-.44027
X1	-.69083	1.00000	.19498	-.07691	-.15727	.60110	-.19347
X2	.32214	.19498	1.00000	-.08096	.08674	-.19444	-.72340
X3	.03236	-.07691	-.08096	1.00000	-.20507	.03052	-.11088
X4	.03148	-.15727	.08674	-.20507	1.00000	-.05867	.04348
X5	-.66794	.60110	-.19444	.03052	-.05867	1.00000	.16114
X6	-.44027	-.19347	-.72340	-.11088	.04348	.16114	1.00000
X7	.10052	.30230	.45604	-.00463	-.08304	.16789	-.45129
X8	-.47256	.10196	-.56480	-.12258	.05023	.07229	.46011
X1X2	-.32166	-.19259	-.99884	.07908	-.08802	.19222	.71991
X1X5	.38004	-.73981	-.25244	-.16397	.08646	-.79180	.30991
X1X8	.45709	-.16065	.52318	.09687	-.01617	-.06578	-.41203

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	X7	X8	X1X2	X1X5	X1X8	
Constant	.10052	-.47256	-.32166	.38004	.45709	
X1	.30230	.10196	-.19259	-.73981	-.16065	
X2	.45604	-.56480	-.99884	-.25244	.52318	
X3	-.00463	-.12258	.07908	-.16397	.09687	
X4	-.08304	.05023	-.08802	.08646	-.01617	
X5	.16789	.07229	.19222	-.79180	-.06578	
X6	-.45129	.46011	.71991	.30991	-.41203	
X7	1.0000	-.30873	-.45500	-.49848	.28086	
X8	-.30873	1.00000	.56996	.23775	-.97377	
X1X2	-.45500	.56996	1.00000	.25267	-.53122	
X1X5	-.49848	.23775	.25267	1.00000	-.20224	
X1X8	.28086	-.97377	-.53122	-.20224	1.00000	

Logistic Regression Model 2

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This program is run by Mr Imam Ghozali

LOGISTIC REGRESSION /VARIABLES Y WITH X1 X2 X3 X4 X5 X6 X7 X8
X1X2 X1X5
/METHOD ENTER

Page 1	SPSS/PC+	10/3/94
Total number of cases: 117 (Unweighted)		
Number of selected cases: 117		
Number of unselected cases: 0		
Number of selected cases: 117		
Number rejected because of missing data: 0		
Number of cases included in the analysis: 117		

Dependent Variable Encoding:

Original Value	Internal Value
.0	0
1.0	1

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----- Variables in the Equation -----							
Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
X1	-.1153	.0513	5.0426	1	.0247	-.1444	.8911
X2	-6.6902	3.1838	4.4156	1	.0356	-.1286	.0012
X3	-.0019	.0107	.0302	1	.8619	.0000	.9981
X4	.7411	.9374	.6251	1	.4292	.0000	2.0983
X5	2.3231	69.1829	.0011	1	.9732	.0000	10.2077
X6	21.4421	8.4514	6.4369	1	.0112	.1743	2.05E+09
X7	-5.1207	2.2101	5.3681	1	.0205	-.1519	.0060
X8	.2158	.1738	1.5417	1	.2144	.0000	1.2408
X1X2	.1515	.0807	3.5200	1	.0606	.1020	1.1635
X1X5	6.1859	2.5632	5.8241	1	.0158	.1618	485.8512
Constant	-.7187	1.4726	.2382	1	.6255		

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Correlation Matrix:							
	Constant	X1	X2	X3	X4	X5	X6
Constant	1.00000	-.71587	.07974	.04254	.03988	-.69530	-.34198
X1	-.71587	1.00000	.31872	-.08507	-.15510	.58527	-.23918
X2	.07974	.31872	1.00000	-.07521	.09613	-.23476	-.61720
X3	.04254	-.08507	-.07521	1.00000	-.18508	-.00867	-.16867
X4	.03988	-.15510	.09613	-.18508	1.00000	-.04933	.03990
X5	-.69530	.58527	-.23476	-.00867	-.04933	1.00000	.18106
X6	-.34198	-.23918	-.61720	-.16867	.03990	.18106	1.00000
X7	-.00939	.35133	.38153	-.00556	-.07805	.17183	-.39898
X8	-.09600	-.23392	-.06734	-.02475	.13395	-.06790	.21954
X1X2	-.03512	-.32083	-.98214	.07448	-.08593	.22340	.54777
X1X5	.49461	-.76732	-.12807	-.15173	.06931	-.80621	.25686

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	X7	X8	X1X2	X1X5	
Constant	-.00939	-.09600	-.03512	.49461	
X1	.35133	-.23392	-.32083	-.76732	
X2	.38153	-.06734	-.98214	-.12807	
X3	-.00556	-.02475	.07448	-.15173	
X4	-.07805	.13395	-.08593	.06931	
X5	.17183	-.06790	.22340	-.80621	
X6	-.39898	.21954	.54777	.25686	
X7	1.00000	-.13689	-.35426	-.47216	
X8	-.13689	1.00000	-.01866	.24214	
X1X2	-.35426	-.01866	1.00000	.10175	
X1X5	-.47216	.24214	.10175	1.00000	

Logistic Regression Model 3

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This program is run by Mr. Imam Ghozali

LOGISTIC REGRESSION /VARIABLES Y WITH X1 X2 X3 X4 X5 X6 X7 X8
X1X2 X1X3 X1X5
/METHOD

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Total number of cases: 117 (Unweighted)
Number of selected cases: 117
Number of unselected cases: 0

Number of selected cases: 117
Number rejected because of missing data: 0
Number of cases included in the analysis: 117

Dependent Variable Encoding:

Original Value	Internal Value
.0	0
1.0	1

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 146.01651

* Constant is included in the model.

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	Chi-Square	df	Significance
-2 Log Likelihood	56.569	105	1.0000
Model Chi-Square	89.447	11	.0000
Improvement	89.447	11	.0000
Goodness of Fit	50.408	105	1.0000

Classification Table for Y

		Predicted		Percent Correct
		.0	1.0	
Observed		0	1	
.0	0	29	8	78.38%
1.0	1	8	72	90.00%
Overall				86.32%

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
X1	-.0968	.0514	3.5535	1	.0594	-.1031	.9077
X2	-7.9432	3.5596	4.9796	1	.0256	-.1428	.0004
X3	.0411	.0374	1.2074	1	.2718	.0000	1.0419
X4	.8799	.9560	.8471	1	.3574	.0000	2.4106
X5	-35.4100	68.9972	.2634	1	.6078	.0000	.0000
X6	22.5106	8.5206	6.9797	1	.0082	.1847	5.97E+09
X7	-5.5600	2.4488	5.1551	1	.0232	-.1470	.0038
X8	.2242	.1701	1.7365	1	.1876	.0000	1.2513
X1X2	.1800	.0887	4.1131	1	.0426	.1203	1.1972
X1X3	-.0012	.0010	1.5913	1	.2071	.0000	.9988
X1X5	7.8834	2.9244	7.2671	1	.0070	.1899	2652.982
Constant	-1.5405	1.5717	.9607	1	.3270		

	Constant	X1	X2	X3	X4	X5	X6
Constant	1.00000	-.70256	.23554	-.40529	-.00238	-.40194	-.38055
X1	-.70256	1.00000	.21446	.18111	-.17285	.43244	-.22474
X2	.23554	.21446	1.00000	-.47905	.01618	-.09677	-.60769
X3	-.40529	.18111	-.47905	1.00000	.04726	-.24893	.16142
X4	-.00238	-.17285	.01618	.04726	1.00000	-.12220	.07740
X5	-.40194	.43244	-.09677	-.24893	-.12220	1.00000	.06143
X6	-.38055	-.22474	-.60769	.16142	.07740	.06143	1.00000
X7	.08767	.29673	.40429	-.20420	-.13001	.23421	-.42047
X8	-.12507	-.22370	-.11287	-.02751	.15253	-.09431	.28547
X1X2	-.18660	-.22432	-.98397	.45437	-.00841	.10389	.54116
X1X3	.42941	-.20863	.43933	-.95038	-.11970	.31934	-.20439
X1X5	.15185	-.54494	-.25270	.33054	.17350	-.82719	.35144

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	X7	X8	X1X2	X1X3	X1X5	
Constant	.08767	-.12507	-.18660	.42941	.15185	
X1	.29673	-.22370	-.22432	-.20863	-.54494	
X2	.40429	-.11287	-.98397	.43933	-.25270	
X3	-.20420	-.02751	.45437	-.95038	.33054	
X4	-.13001	.15253	-.00841	-.11970	.17350	
X5	.23421	-.09431	.10389	.31934	-.82719	
X6	-.42047	.28547	.54116	-.20439	.35144	
X7	1.00000	-.16595	-.37747	.21725	-.50441	
X8	-.16595	1.00000	.03443	-.02154	.27711	
X1X2	-.37747	.03443	1.00000	-.41160	.21388	
X1X3	.21725	-.02154	-.41160	1.00000	-.43638	
X1X5	-.50441	.27711	.21388	-.43638	1.00000	

Logistic Regression Model 4

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This program is run by Mr. Imam Ghozali

LOGISTIC REGRESSION /VARIABLES Y WITH X1 X2 X6 X7 X1X2 X1X5
/METHOD ENTER

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Total number of cases: 117 (Unweighted)
Number of selected cases: 117
Number of unselected cases: 0

Number of selected cases: 117
Number rejected because of missing data: 0
Number of cases included in the analysis: 117

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
X1	-.1034	.0375	7.6188	1	.0058	-.1962	.9018
X2	-6.7612	2.8737	5.5358	1	.0186	-.1556	.0012
X6	21.7257	7.5022	8.3863	1	.0038	.2091	2.72E+09
X7	-5.0151	2.0101	6.2244	1	.0126	-.1701	.0066
X1X2	.1570	.0674	5.4176	1	.0199	.1530	1.1700
X1X5	5.9583	1.3725	18.8461	1	.0000	.3397	386.9375
Constant	-.6244	.9722	.4125	1	.5207		

Correlation Matrix:

	Constant	X1	X2	X6	X7	X1X2	X1X5
Constant	1.00000	-.56819	-.06353	-.21364	.16533	.06754	-.11176
X1	-.56819	1.00000	.56409	-.52277	.30979	-.56685	-.68462
X2	-.06353	.56409	1.00000	-.74672	.47275	-.99829	-.62923
X6	-.21364	-.52277	-.74672	1.00000	-.48022	.74041	.69832
X7	.16533	.30979	.47275	-.48022	1.00000	-.47097	-.62816
X1X2	.06754	-.56685	-.99829	.74041	-.47097	1.00000	.62710
X1X5	-.11176	-.68462	-.62923	.69832	-.62816	.62710	1.00000