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The impact of firm characteristics on management accounting practices: A UK-based empirical analysis

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ABSTRACT

There has been sustained interest in explaining why firms adopt different management accounting practices. This paper applies contingency theory to respond empirically to calls by Gerdin (2005), Tillema (2005) and Chenhall (2007) to increase understanding of factors that explain management accounting sophistication.

We examine the impact of a range of potentially contingent variables on a broad set of management accounting practices in a sample of companies selected from the UK's largest industry sector. The variables relate to external characteristics, organisational characteristics, and manufacturing or processing characteristics. The method differs from prior studies in not testing association between contingency factors and a single, or a limited number of, accounting practice(s) but in looking for relationships with aggregate levels of sophistication based on the emphasis that respondents place on 38 practices and techniques. Furthermore, the 10 contingency factors considered in this study include two constructs (product perishability and customer power) not previously explored.

The results, derived from a large scale questionnaire survey, indicate that differences in management accounting sophistication are significantly explained by environmental uncertainty, customer power, decentralisation, size, AMT, TQM and JIT. The data confirms that customer power should be considered as an added external variable in the contingency theory paradigm. Expectations of relationships between competitive strategy, processing system complexity and

product perishability, and management accounting sophistication were not, however, supported by the data.

The improved understanding of the relationships between 10 contingency factors and management accounting techniques employed contributes to the further development of an integrated contingency framework explaining variations in the investment in management accounting.

1. Introduction

Over the last three decades a number of innovative management accounting techniques have been developed across a range of industries. Notable contributions include activity-based techniques, strategic management accounting and the balanced scorecard. Many scholars[1] argue that the 'new' techniques have affected the whole process of management accounting (planning, controlling, decision-making, and communication) and have shifted its focus from a 'simple' or 'naive' role of cost determination and financial control, to a 'sophisticated' role of creating value through improved deployment of resources. For example, Ittner and Larcker (2001) argue that "companies increasingly are integrating various [innovative] practices using a comprehensive 'value-based management' … framework" (p. 350). It has been argued that these 'new' accounting techniques have been designed to support modern technologies and new management processes, such as total quality management and just-in-time production systems, and the search for a competitive advantage to meet the challenge of global competition. As firms adapt to these technological and management developments, they must design a management accounting system congruent with the new requirements (Gerdin, 2005). However, Tillema (2005) reports that many organisations have not adopted the 'advanced' techniques. She explains that "the appropriateness of using sophisticated techniques may depend on the circumstances in which these techniques are being used (and this) … gives rise to the need to adopt a contingency theory perspective " (p. 102)

The contingency theory literature indicates that factors such as technology and environment affect the design and functioning of organisations (Covaleski, Dirsmith and Samuel, 1996). Its central theme is that there is no unique best structure to all organisations under all circumstances; instead each organisational structure is a response to a set of contingencies. A company's accounting system is a significant element of its organisational structure and the particular features of an appropriate system will depend upon the circumstances that the company faces (Otley, 1980). The literature shows that important characteristics (contingencies) affecting organisational structure include size, environmental uncertainty, production technology, corporate strategy and market environment (Otley, 1995; Covaleski et al., 1996; Mitchell, 2002; Reid and Smith, 2000).

In this paper, we follow this tradition arguing that management accounting systems evolve partly in response to the firm-specific and environmental contingencies confronted by individual firms. Our central aim is to determine which characteristics are helpful in explaining the variation

[1] For example, Otley (1995), Kaplan and Atkinson (1998), Hoque and Mia (2001), Fullerton and McWatters (2002), or Haldma and Laats (2002).

between firms adopting different levels of advancement of management accounting techniques and practices. In particular, we empirically investigate whether 'sophistication' levels of management accounting practices (MAPs) are significantly influenced by firm characteristics. In this context, and to be consistent with previous use of the concept (e.g. Chenhall and Morris, 1986; Tillema, 2005; Guilding et al, 2005), *sophistication* refers to the capability of a management accounting system to provide a broad spectrum of information relevant for planning, controlling, and decision-making all in the aim of creating or enhancing value. In an innovation to previous research we locate the sophistication of firms' management accounting practices by reference to four levels derived from the IFAC (1998) Statement on *Management Accounting Concepts*. Our paper further contributes to the tradition of contingency theory research by, unusually, considering a broad range (38) of management accounting techniques rather than concentrating on narrow issues such as activity based costing, and by incorporating a number of contingent variables rather than considering, for instance, simply strategy, decentralisation, or environmental uncertainty. Furthermore (in contrast to a high proportion of empirical contingency studies) the research is prosecuted on a large sample of UK companies - the sample size and the respondents' location convey greater British relevance than previous smaller studies or those based on data from other countries.

Three categories of firm characteristics are examined in this study. These are: external characteristics (environmental uncertainty, customers' power); organisational characteristics (competitive strategy, structure, size); and processing characteristics (system complexity, extent of implementation of advanced manufacturing technology, implementation of total quality management techniques, implementation of just-in-time techniques, and product perishability). Figure 1 depicts these variables and their potential relationships with the sophistication of individual companies' management accounting practices.

The paper is a response to recent calls by Gerdin (2005), Tillema (2005) and Chenhall (2007) for additional research "to increase our understanding of the organisational and environmental factors that explain [management accounting systems] MAS sophistication." (Tillema, 2005, pp. 123-4). Section 2 provides an overview of the relevant literatures and develops the hypotheses. This is followed by details of the research design and data collection. The survey findings are then presented and discussed. The final section contains a summary and the conclusion.

2. Theoretical framework and development of hypotheses

2.1. Management accounting development model

IFAC (1998) provides a framework explaining the development of management accounting in terms of a four stage 'evolution'[2] model. The primary focus of the first stage of evolution, (associated with developments prior to 1950) was 'cost determination and financial control'. Management accounting in this stage is seen to be concerned primarily with internal matters, especially production capacity. In the first half of the 20th century the use of budgeting and cost accounting practices was prevalent. However, the dissemination of cost information tended to be slight, and its use for management decision-making poorly exploited (Ashton et al., 1995).

[2] We acknowledge that the term evolution can, in some contexts, carry an implication of progress when in fact all that is being observed may (just) be change.

The focus of management accounting in its second stage of evolution, in the 1950s and 1960s, shifted to the provision of information for planning and control purposes. Accordingly, management accounting is described by IFAC as "a management activity, but in a staff role" (para 19). It involved staff support to line management through the use of technologies such as decision analysis and responsibility accounting. Management controls were oriented towards manufacturing and internal administration rather than strategic and environmental considerations. Management accounting, as part of a management control system, tended to be reactive, identifying problems and actions only when deviations from the business plan took place (Ashton et al., 1995 and Langfield-Smith, 1997).

In IFAC's third stage of management accounting evolution, the focus shifted towards "reduction of waste in resources used in business processes" (IFAC, 1998, para 7). This shift is partly attributed to the world recession in the 1970s following the oil price shock and the increased global competition in the early 1980s. Increased competition was accompanied and underpinned by rapid technological development which affected many aspects of the industrial sector. The use, for example, of robotics and computer-controlled processes improved quality and, in many cases, reduced costs. Also developments in computers markedly changed the nature and amount of data which could be accessed by managers. Thus the design, maintenance and interpretation of information systems became of considerable importance in effective management (Ashton et al., 1995). The challenge for management accountants, as the primary providers of this information, is to ensure through the use of process analysis and cost management techniques that appropriate information is available to support managers and employees at all levels.

In the 1990s world-wide industry continued to face considerable uncertainty and unprecedented advances in manufacturing and information-processing technologies (Ashton et al., 1995). For example the development of the world-wide web and associated technologies led to the appearance of e-commerce. This further increased and emphasised the challenge of global competition. The focus of management accounting in its fourth stage of evolution shifted to the generation or creation of value through the effective use of resources. This is to be achieved through the "use of technologies which examine the drivers of customer value, shareholder value, and organizational innovation" (IFAC, 1998, para 7).

It should be pointed out that the four stages are not mutually exclusive; each one successively encompasses the concepts of the previous stage, and incorporates additional ones that arose out of a new set of conditions. However, a critical difference between Stage 2 and Stages 3 and 4 is the change of focus away from information provision and towards resource management, in the form of waste reduction (Stage 3) and value creation (Stage 4). The use of resources (including information) to create value is seen to be an integral part of the management process in contemporary organizations. We argue that this, principally chronological, model provides an appropriate framework to classify the sophistication[3] of management accounting systems that exist across the population of contemporary organisations. We interpret the four stages of management accounting development as four levels of sophistication of MAS. The first stage represents a lack of sophistication and the fourth stage is the highest level of sophistication.

[3] The construct of 'sophistication' in the context of management accounting was promoted by Chenhall and Morris (1986). Their model was based on dimensions of scope, aggregation, timeliness and information content. Subsequent interpretations (e.g. Tillema 2005, p.5) have largely focused on scope.

Accordingly, *sophistication* refers to the capability of an organisation's management accounting system to provide a broad spectrum of information relevant for planning, controlling, and decision-making all in the aim of creating or enhancing value.

We recognise that there is some lack of clarity in the IFAC (1998) statement as to whether the model is focused on concepts or practices. For instance, although the statement is entitled *Management Accounting Concepts*, para 19 describes "the way in which management accounting as a field of activity is positioned within organizations"; it seems that those who drafted the statement view concepts merely as derivatives of practices. Another caveat, recognized by the statement, is that the scope, role, and organizational positioning of management accounting inevitably differs across organizations, cultures and countries. This problem is compounded, unless one believes that concepts are in vogue at the same time throughout the world, by the identification in the Statement, of evolutionary stages with dates in history. An attempt is made to clarify this by referring to "leading edge practice internationally" (para 3), presumably (in this context) meaning leading edge conceptual practice. Nevertheless, despite its limitations the framework provides an interesting view of history and a useful set of parameters[4].

2.2. Food and drinks industry

The UK food and drinks sector provides the sectoral context for this research. Given that we were particularly interested in firm-specific contingent factors it was appropriate to restrict ourselves to one important sector. Within the UK, and many other countries, food and drinks is the largest industry sector. Its turnover in 2003 was about £68 billion representing 15% of total manufacturing. The industry employs some 500,000 people or 13% of the whole UK manufacturing workforce. Mann et al. (1999b) indicated that, from primary producers to manufacturers and retailers, it provided employment for over three million people and accounted for 9% of gross domestic product. A total contribution of £20 billion 'gross value added' is made to the UK economy[5].

Despite its significance little attention was paid to the performance of the industry until 1996 when the 'Food and Drinks Industry Benchmarking and Self-Assessment Initiative' was launched. This aimed to improve the competitiveness of the UK food and drinks industry by increasing the awareness and use of practical business improvement techniques (Mann et al., 1999a). The self-assessment programme of the initiative sought to encourage and enable companies to assess their management systems and business performance against a European Business Excellence Model (Mann and Adebanjo, 1997). The self-assessment was carried out by means of a questionnaire comprising 85 questions. By reference to 50 responses a major finding was that only 18% of the food and drinks companies were developing their management systems along the lines of business excellence. It was stated that most companies were applying traditional methods of management, were not learning from the experiences of best-in-practice companies, and not applying a systematic approach to achieving business improvement. This was considered to be causing low financial returns right across the industry.

[4] For further detail concerning the operationalisation of the IFAC framework, see Abdel-Kader and Luther (2006).
[5] Food and Drink Federation, http://www.fdf.org.uk/industrystats.aspx, accessed on 20 June 2004.

Also, it was suggested that the food industry needed to be more progressive and more willing to learn and apply new methods (Mann et al. 1999b). In particular, it was held that companies require leaders who develop policies and strategies that really address the needs of the customer and utilise the full potential of their employees. There may be benefits from monitoring performance against policies and strategies using a performance measurement system incorporating all the financial and non-financial aspects that are critical to an organisation's success. The reported view was that these should include measures of customer satisfaction, employee satisfaction and impact on society; only by doing this would long-term financial success be achieved. The research reported in this paper can be seen as extension to the above as it seeks to identify the level of sophistication of management accounting practices which are an important part of companies' management control systems.

2.3. Contingency theory perspective

Although the findings from contingency theory studies have not always been consistent and the approach is limited in terms of its ability to capture patterns and dynamics, nevertheless over the last 30 years the contingency theory has provided a convenient, theoretical framework for numerous studies of organisational structure and behaviour (Chenhall, 2003 and 2007). "The continuous stream of empirical articles signals the importance and vitality of this research area" (Gerdin and Greve, 2004, p.303). The extensive research has led to a series of review articles providing an overall picture of the contingency theory's contribution to accounting in general and management accounting in particular (Chapman, 1997). Gerdin and Greve (2004) in their review provide a classificatory framework for mapping different forms of contingency fit. They argue that researchers should relate their empirical contingency based studies to those using similar sets of contingencies. Although their focus was principally on management accounting's interaction with strategy it can equally be applied to other types of contingent studies**.** Chenhall (2003) reviews empirical contingency-based research developed since 1980s. His extensive review concludes that "to maintain the relevance of MCS [management control systems] contingency-based research, scholars will need to focus their attention on contemporary dimensions of MCS, context and organisational and social outcomes" (p. 161). In this study we look at contemporary dimensions of MAPs and the context within which they operate**.** Three groups of firms' characteristics (external, organisational and processing) are examined as contextual contingent factors that could affect the design of management accounting systems.

2.4. Development of hypotheses

In this sub-section, in order to locate our work within the context of the extant body of knowledge, we briefly[6] review studies that have relevance to the approach and variables adopted and then develop ten hypotheses to be examined in this study.

2.4.1. Uncertainty and degree of centralisation

Perceived environmental uncertainty (PEU) and structure of the firm were early contingent factors examined for their effect on the design of management accounting systems (MAS). For

[6] This paper aims to mobilise contingency theory rather than provide an in-depth critique of its assumptions or limitations.

example, Gordon and Narayanan (1984) explored the relationships among organisations' PEU, their structures and their information systems (the extent to which there is emphasis upon information that is external, non-financial and *ex ante*). They found that greater PEU is associated with organic organisational structures and that both uncertainty and organic structure were associated with higher importance attached to external, non-financial and *ex ante* type information. However, the relationship between organisational structure and information characteristics was not significant when environmental uncertainty was controlled for. Their results suggested that "as decision makers perceive greater environmental uncertainty, they tend to seek external, non-financial and *ex ante* information in addition to other types of information." (Gordon and Narayanan, 1984, p.42). Similar results were found by Chenhall and Morris (1986). Gul and Chia (1994) explain that when PEU is low, management is able to make relatively accurate predictions about the market, while when PEU is high management may require additional information to cope with complexities of the environment.

However, care must be exercised when interpreting results that examine the effect of external environment on the design of MAS because of the use of different measures of the environment construct. Gordon and Narayanan (1984) used a measure of uncertainty that captures the intensity of competition, the dynamism and unpredictability of the external environment. But in Chenhall and Morris (1986) the measure reflects a lack of information on environmental factors, inability to assign probabilities on how the environment will affect success or failure, and knowledge of the outcome of decisions if they proved to incorrect.

In other studies the interaction effects of PEU and decentralisation on MAS (Gul and Chia, 1994), of decentralisation and MAS on managerial performance (Chia, 1995) and of task uncertainty and MAS on managerial performance (Chong, 1996) were examined. This stream of research suggests that when an organisation is confronted by high uncertainty a decentralised structure is required – and consequently a more sophisticated management accounting system. More sophisticated reports from MAS can help to reduce uncertainty and improve managerial decision making (Chong and Chong, 1997). These established research findings lead us to include the extent of environmental uncertainty and the extent of centralisation as potentially influential contingent variables in a multivariate contingency model. We examine these relationships through hypotheses H1 and H2:

H1: Firms perceiving a higher degree of environmental uncertainty adopt more sophisticated MAPs than firms that perceive lower environmental uncertainty.

H2: Firms characterised as decentralised adopt more sophisticated MAPs than firms characterised as centralised.

2.4.2. Size

Organisational size is an important factor that is reported to affect both structure and other control arrangements. Larger organisations have resources to adopt more sophisticated MAPs than smaller organisations. Otley (1995), for example, reported evidence of the impact of size on control techniques in studies of the role of management accounting systems following merger or takeover. Also, Haldma and Lääts (2002) argue that the sophistication level of cost accounting and budgeting systems tends to increase in the line with a firm's size. Moving from naive to more sophisticated MAPs requires resources and specialists only affordable by large organisations. Accordingly we test the following hypothesis:

H3: Large firms adopt more sophisticated MAPs than small firms.

2.4.3. Operational complexity, technology, total quality management and just-in-time

Dean and Snell (1996, p.459) reported that "for 30 years following World War II, the manufacturing function was virtually ignored by top management, and consigned to backwaters of day-to-day operations." To improve the manufacturing performance, contain costs with rising labour rates, and to gain competitive advantage enormous changes have occurred in Western manufacturing. Advanced manufacturing technology (AMT), total quality management (TQM) and just-in-time (JIT) are the most notable innovations in manufacturing during the last few decades. Kaplan and Atkinson (1998) contrast the new manufacturing paradigm with the stable environment of mass production of standardized products that prevailed through most of the twentieth century. The changes require management accounting systems to be designed to support, not restrict, the drive for excellence. In the new environment, many companies found that their traditional cost accounting measures were inhibiting the introduction of innovative processes and technologies. For example, measures of profitability and of individual worker efficiency and machine utilization encouraged the production of items in advance of when they are needed. This however conflicted with goals of improved quality and responsiveness to customers, of increased throughput and reductions in defects, waste and working capital. Measurement systems have had to evolve to support efforts to increase quality and productivity, move to just-in-time and computer-integrated production systems, and help justify investment in new technologies.

Following a call by Young and Selto (1991) for changes in technology to be considered within their organisational context, the contingency research was extended to examine the effect of new management practices such as TQM and JIT on the design of MAS. Chenhall (2003), for example, argues that the search for continuous improvement predicated by TQM programmes requires access to knowledge on world's best practice and systems to encourage innovation. "Appropriate control systems should be open and informal, include broad scope information, benchmarking, and performance measures that indicate links between strategy and operations such as balanced scorecards and strategic integrative controls" (Chenhall, 2003, p. 141). Empirical results support this argument; for instance Fullerton and McWatters (2002) provide evidence that the use of non-traditional performance measures is related to the degree of JIT practices implemented. Further, Haldma and Lääts (2002) examined the influence of the external environment, technology and organisational aspects on the change of management accounting systems within Estonian companies. Their results indicate firstly, that environmental aspects such as increasing competition, change of the market structure have affected the MAS. Secondly, that the use of AMT is associated with tightening global competition and increasing fixed costs. And thirdly, that MAS change is influenced by organisational aspects such as the need for more detailed divisional performance information, changes in managerial practices, advances in information technology, the organisational structure and dissatisfaction with the existing performance measurement system. Similarly, Chenhall (1997) examined the effect of the interaction between TQM and manufacturing performance measures on organisational performance. The results revealed an association between TQM and performance that was stronger where manufacturing performance measures were used as part of managerial evaluation.

Hypotheses H4–H7 are stated to examine the relationships between management accounting sophistication and the complexity of processing systems, AMT, TQM and JIT.

H4: Firms with complex processing systems adopt more sophisticated MAPs.
H5: Firms with advanced manufacturing technology (AMT) adopt more sophisticated MAPs.
H6: Firms with total quality management (TQM) adopt more sophisticated MAPs.
H7: Firms with a just-in-time (JIT) system adopt more sophisticated MAPs.

2.4.4. Strategy

Considerable attention has been paid to incorporating strategy as a contingent factor of the MAS design (e.g. Langfield-Smith, 1997 and Gerdin and Greve, 2004). Three generic taxonomies have been employed in studying the strategy-MAS relationship: Miles and Snow's (1978) prospectors/analysts/defenders model, Gupta and Govindarajan's (1984) build/hold/harvest model, and Porter's (1980) product differentiation/cost-leadership classification. Arguably these taxonomies are not significantly different and can be reconciled with prospectors/builders/product differentiators at one end of a continuum and defenders/harvesters/cost-leaders at the other end.

The literature (e.g. Langfield-Smith, 1997 and Chenhall, 2003) suggests that certain types of MAS will be more suited to particular strategies. Empirical evidence indicates that strategies of defend/harvest/cost-leadership do not require sophisticated information systems while those of prospect/build/product differentiate do (Langfield-Smith, 1997 and Chenhall, 2003). Abernethy and Guthrie (1994) found that sophisticated MAS has a more positive effect on performance in firms that adopt a prospector strategy than in firms that adopt a defender strategy.

In a more complex study Chenhall and Langfield-Smith (1998) examined how combinations of management techniques and management accounting practices can enhance the performance of organisations with differing strategic priorities. Companies were identified as emphasising product differentiation, low price strategies or a combination of both. They expected that, on one hand, higher performing firms emphasising product differentiation strategies would gain benefits from quality systems, team-based structures and from management accounting techniques of balanced performance measures, employee-based measures, benchmarking and strategic planning techniques. On the other hand, firms that placed a strong emphasis on low price strategies were expected to gain particular benefits from management techniques of improving existing processes and manufacturing system innovation and from the traditional accounting and activity-based techniques. They used cluster analysis to group the companies into clusters with similar strategic priorities, management techniques and management accounting practices. Their results showed that high performing product differentiators are associated with management techniques of quality systems, integrated systems, team-based human resource structures, and management accounting practices incorporating employee-based measures, benchmarking, strategic planning techniques and activity-based techniques. On the other hand, high performing low-cost strategy firms are associated with management techniques of improving existing processes, integrating systems, innovating manufacturing systems, and activity-based management accounting techniques. It is notable that activity based techniques are associated with both differentiation and low cost strategies. However, the authors qualified the generalisability of their results since:

> '…only a limited number of traditional management accounting practices were examined. Also, it is likely that contextual factors such as manufacturing technology (for example, robotics and automation) and product diversity may affect the potential usefulness of traditional management accounting practices. Clearly, the impact … of combining traditional and contemporary management accounting practices could be considered in future research.' (p. 257)

In a subsequent study Chenhall (2003) considers strategy as a means (rather than an element of context) by which managers can influence the nature of external environment, the technologies of the organisation, the structure and the management control system. In this regard Baines and Langfield-Smith (2003) argue that there are no direct relationships linking organisation design, technology and advanced MAPs; the changes in these factors appears to be a response solely to the changes in strategic emphasis. The results indicate also that successful organisations are changing towards differentiation strategies. A competitive strategy based on differentiation leads to an increased use of team-based structures and advanced management accounting practices, and consequently a greater reliance on the management accounting systems through the provision of a range of non-financial performance measures. Competitive strategy has also been examined, by Anderson and Lanen (1999), as a mediating variable on the contingent relationship between external competition and MAPs. They found differences in competitive strategies, and international outlook, to be explanatory factors for differences in MAPs. Three areas were examined: planning and control, performance measurement and evaluation, and cost management. They attributed many changes in MAPs to the differences in the strategy adopted by firms and whether they are domestic or international firms. The following hypothesis is used to test the relationship between strategy and MAPs:

H8: Firms following a differentiation strategy adopt more sophisticated MAPs than firms following a cost-leadership strategy.

2.4.5. Industry specific factors

Many previous contingency studies have collected empirical evidence across a broad range of industry sectors. Issues specifically related to a particular industry are likely to affect the design of management accounting systems. As will be detailed in the next section, our preliminarily fieldwork interviews in the food and drinks industry revealed that there are two partly related factors, which have not been examined in previous research and could potentially have contingent effects on the design of management accounting systems. These contingent factors are related to power exercised by giant customers, such as Tesco, and to the perishability of some products.

For example, as regards customers, one manager commented that:

> '… we have approximately eight customers, five of which we would call our major customers – Tesco, Sainsbury, Somerfield, ASDA, Safeway and then we have another group of large type customers which divide themselves within the smaller supermarket type operations – Waitrose, various co-operative societies, cash and carry's … and then we get down to the small cash and carry operators. So a typical structure, small customer base, high turnover in a few small customers, so we've got a pyramid but it's that way up…'

Similarly, another interviewee explained that:

> '… of our customers 80% comes from Sainsburys, Waitrose and Morrisons … which is very common across our type of business with food. The way the retailers work, is a point you come up against. Its all Sainsbury's label … yes – we don't do anything of our own. Its all retail. In our sector and again if you see in chilled food …'

The effect of the strength of customers' power has been researched in the strategy and economics disciplines[7] but not, to our knowledge, in management accounting. It can be argued that firms facing high levels of customer power are at greater risk and may have more incentive to use sophisticated MAPs to improve their control and decision making processes to help them keep their demanding customers satisfied. Contrariwise such firms may have relatively simple product ranges or rely on an established value chain or on their customers' information systems all of which might imply less emphasis on MAPs. The following hypothesis addresses these arguments:

H9: The level of management accounting sophistication differs between firms according to the strength of customer power that they are confronted by.

Many products within the food and drinks industry have limited useful lives and this adds pressure on all operations. In our preliminarily fieldwork interviews we found out that product perishability has an important influence on the control and decision making information required by managers. For instance at one pasta factory orders come through daily via EDI for despatch within a maximum of 24 hours (Because their powerful customers demand 21 days of shelf life.) But the production and despatch cycle takes 36 hours - careful cooling is important for the bending process of fresh pasta, and for safety and quality - so most of the company's information and control systems have to be real time.

Likewise, at a brewery:

> Cask beer is living so we have a finite amount of time. It will perish within 30 days in an unbroached, unopened format.
>
> *And is that a big issue for the company - the cycle time?*
>
> Well, it must be. It is a churn, so in terms of cash flow, it must have an impact. It certainly has an impact in terms of quality.
>
> *And sometimes you have wastage because you have over-produced?*
>
> Yes, that is why the forecasting is not as clear as it can be. In most dry brands it is not a problem because there is a constant churn.
>
> *But you still have 30 days or something so you probably have got time to make up an order after an order. You don't have to make in advance of orders?*
>
> No - Well, we have to have a buffer stock.
>
> *But if someone phones up and says "Hey we have a special order. We need delivery in 2 weeks time" that could be built in?*
>
> Absolutely – depending on what time of year it is. Because we are very seasonal so there are times in the year when we are at full capacity and times that we are not. What we are trying to do is plan our troughs and peaks.

[7] See for instance Brown (1990), or Christensen and Bower (1996) which explores how the demands of a firm's customers shape the allocation of resources.

A third illustration came from a butter processing factory:

> *Presumably your butter goes in frozen to the supermarkets?*
> No, it is all refrigerated in the supply chain, it's like everything: the end users - the retail outlets - command probably 80% of the shelf-life of the product, so in terms of us handling the product we are basically packing and it is straight away going out or within a few days; we've got very little scope for holding stock.
> *Why? I mean if its frozen, it can go on for years can't it?*
> No, it's not frozen, its refrigerated. It's shipped frozen to keep its integrity but once it arrives in the UK we then start bringing it through the refrigerated supply chain so all of the pack operation is refrigerated and the supply chain distribution is refrigerated.
> *So, what would happen if you froze it – would it deteriorate in some way?*
> No, (but) there's lots of complications with ourselves freezing it from the packaging concept. The consumer can freeze it – on all the instructions it says freezable - but there would be significant costs and complications involved with the packaging to ensure that it remained looking like that at the point of sale. If you freeze it, the packet wrinkles; there's no way that we could market our product like that.
> *So you do have a pressure on keeping your supply chain topped up?*
> Oh yes, and we are aiming for a minimum of 98.5% service level and that's against volume and time.
> *So in general, from an average supermarket, if you get an email through or something and you have to do delivery within three days or something?*
> We do daily deliveries. Take Tesco for instance, the orders go through their distribution network because they have distribution stores before they actually go to the individual supermarkets, so it probably takes a day/night going through one of their stores. Probably within 48 hours of us receiving the order, there's every likelihood that it's going to be in the storeroom by then. So we've got very little scope on site here for holding vast quantities of stock and doing what we wish. We're under extreme pressure to get all the aspects of our production facility/distribution facility/administration facility pro-active.

We find that this potential relationship between product perishability and information systems has not been addressed in the management accounting literature, though it is fully recognised in economics and operations research[8].

Accordingly, we address the following hypothesis:

H10: The level of management accounting sophistication differs between firms according to the perishability of their products.

[8] Examples include Teng et al, (2007), Ramanathan (2006), Nahmias (1982), and Kanchanasuntorn & Techanitisawad (2006).

3. Research design and data collection

3.1. The method

Postal questionnaires were used to collect the empirical data. This facilitated access to a large number of management accountants and production managers. In addition a limited number of face-to-face interviews were carried out. The interviews were used to pilot, and amend, the questionnaire before sending it out and, later, to check the reliability of the survey results and seek further explanation of some of the responses.

Five pilot interviews (three management accountants and two production managers) were undertaken before the questionnaires were sent out. After each interview the questionnaires were modified according to comments received. The questionnaires were also reviewed by seven academics. Another set of six interviews was carried out to follow up issues arising out of the analysis of responses to the survey instrument. These interviewees were with key personnel responsible for the management accounting or production systems in their companies. They were selected from those who had responded to the questionnaires; our interviews aimed to check the reliability of the questionnaire responses and to gain more insights into the survey results.

The information gathered to examine the hypotheses includes company-specific data related to practices of management accounting, data on strategic business unit (SBU) structure and performance, and information related to the products processed by each company. Difficulty was anticipated in obtaining all this information from any one single company employee. Accordingly, two versions of the questionnaire were sent to each sampled company. The first version was addressed to the person leading the management accounting function (MA) while a modified version was to be completed by the production manager (PM).

3.2. The instrument

As stated above, two versions of the questionnaire were used to collect the empirical data. The MA's version was divided into three sections. The first section included questions related to the management accounting practices. Respondents were asked to rate the extent of use and importance of a range of practices or techniques in their SBUs. These 38 practices which represent our initial dependent-variable unit of analysis are detailed in Appendix I. The second section contained questions that measured the perceived environmental uncertainty, degree of centralisation, strategic orientation and the respondent's perception of their SBU's performance. The final section asked for demographic information about the respondent.

The PM's version comprised four sections. The first included questions related to processing factors: complexity of processing system, total quality management, just-in-time and product perishability; also questions related to the extent of concentration of customer base. The second and third sections were similar to those in the MA's questionnaire. The final section included questions concerning the extent of the PM's satisfaction with the firm's management accounting system.

3.3. Sample firms

The questionnaire sample frame was derived from the FAME[9] database. We concentrate on one broad, representative sector, the food and drinks industry, in order to remove irrelevant distractions arising out of variations between industry sectors, (Moores and Yuen, 2001). The sample frame included 658 companies which satisfied the following criteria:

- a 1992 SIC UK industry code of '15' (manufacture of food products and beverages),
- employment of at least 30 people,
- being active and independent companies, and
- having a registered office address in England, Scotland or Wales.

A letter was sent to the company secretary of the 658 companies to obtain the names of the most appropriate persons to complete the questionnaires. Two of the letters were returned by the post office stamped 'addressee has gone away' and six companies asked to be removed from our sample leaving 650 potential responses. We received names of 148 persons responsible for heading the management accounting function and of 85 production managers, or equivalent.

Two versions of the questionnaire were sent to all 650 companies. The questionnaires were addressed to the names that had been obtained or, in cases where they had not been obtained, for the attention of 'The Management Accountant' or 'The Production Manager' respectively. Three weeks later second copies of the questionnaire were sent to all non-respondents. We received 194 responses. Follow-up telephone calls were made to all non-respondents of the companies from which we had received only one completed version; all other non-respondents were sent a third copy of the questionnaire.

At the end of the process a total of 280 questionnaires were returned giving a response rate of 21.5% (280/1300). Of these 31 were blank because of company policy not allowing responses to surveys or because the company was small, had ceased trading, or was in the process of merging. A further five responses were judged invalid because a large portion of the questionnaire was not completed. Hence 245 usable completed questionnaires were used in the analysis giving a net usable response rate of 19.6% which was considered acceptable. Of these usable completed questionnaires 122 were the MA version and 123 the PM version. Forty eight companies completed both versions of the questionnaire.

In order to assess the possibility of non-response bias, comparisons between the sample frame and the responding companies using t-tests on company size were conducted. No significant difference was found. Further, the answers to the main questions in the questionnaire from respondents who replied without the follow-up telephone calls were compared with the answers from those who replied only after the follow-up telephone calls. Again there was no significant difference between these two groups of answers. Accordingly, it can be concluded that non-response bias is unlikely to be a threat to the conclusions based on the responses received.

[9] Financial Analysis Made Easy

3.4. The measurement of contingent variables

This study examines relationships between management accounting sophistication and ten contingent variables. (The measurement of MAPs sophistication, the dependent variable, is explained in Section 4.1) As to the contingent variables, two constructs, which represent customers' power and product perishability, are innovations that have been developed out of this project's preliminary fieldwork interviews. The other eight were adopted from previously validated instruments. Table 1 summarises the origin of each construct and the measurement of each contingent variable together with their descriptive statistics.

The reliability of the multiple items scales was estimated using Cronbach's alpha for internal consistency of the ten constructs. As can be seen from Table 1, the alpha for each item is above the minimum acceptable level of 0.50 (Nunnally, 1978) confirming that they can be considered as reliable measures for this study. However, the alpha for customers' power is the lowest suggesting that care needs to be exercised in this regard especially as it is the first time that this construct is being used.

Three contingent variables – perceived environmental uncertainty, decentralisation and competitive strategy – were surveyed in both the MA and PM versions. The non-parametric Mann-Whitney test was run to examine whether the two responses are significantly different. The test revealed no significant difference between the two responses for the three variables with p-values of 0.12, 0.20 and 0.96 for perceived environmental uncertainty, decentralisation and competitive strategy respectively. Accordingly, for these variables, an average of the MA and PM responses was used in the analysis. The measures of customers' power, processing system complexity, AMT, TQM, JIT and product perishability were derived from the questionnaires sent to production managers while size was derived from published sources.

4. Survey findings

4.1. Classification of responding companies

In order to examine the hypotheses responding firms were categorised into four groups according to the sophistication level of their management accounting practices. As stated earlier we adopt the IFAC's management accounting development model with four stages of sophistication as follows:
Stage 1 – cost determination and financial control (CDFC)
Stage 2 – information for management planning and control (IPC)
Stage 3 – reduction of waste in business resources (RWR)
Stage 4 – creation of value through effective resource use (VC).
These IFAC stages were operationalised by classifying[10] each of 38 management accounting practices into one of four levels of sophistication relating to each of IFAC's four stages. The classification is shown in Appendix I.

[10] The internal consistency of MAPs included in each sophistication level was confirmed by means of Cronbach's alpha. The results are shown in Appendix II and it can be seen that according to Nunnally (1978) the alpha for each level is at an acceptable level of reliability.

The questionnaires asked respondents to rate both the frequency of use and the importance of 38 MAPs and an 'emphasis' score was calculated for each responding firm. Then, the emphasis scores for the MAPs that had been attached to each IFAC stage were used to classify individual firms into groups using cluster analysis[11]. That is, for each firm, an average (composite) score was calculated for the set of MAPs related to each IFAC stage: CDFC, IPC, RWR and VC. These four scores were used to cluster each of 113 firms[12], into four groups A, B, C and D. As a result of clustering procedures, 30 firms were categorised in Cluster A, 21 in Cluster B, 47 in Cluster C and 15 in Cluster D. The mean scores of variables within each cluster are presented in Table 2, with *F*-tests for each clustering variable. To validate the cluster analysis, we performed multiple discriminant analysis on the four sets of composite MAPs (CDFC, IPC, RWR and VC) and the classification derived from cluster analysis. This indicated that the four variables played significant roles in correctly classifying 95.5% of the firms into their respective groups. More specifically, 95.2%, 93.5%, 100% and 93.3% of companies were correctly classified into clusters A, B, C and D. Thus, the cluster solution was regarded valid.

Having established the validity of the cluster analysis, the next step involved labelling the clusters. This was done by matching the clusters to a related level of sophistication (Level 1, Level 2 etc.). According to IFAC's theoretical model of management accounting evolution, firms in Level 1 place more emphasis on CDFC (cost determination and financial control) practices and less emphasis on the practices in other sets (i.e. those relating to IPC, RWR and CV). Firms in Level 2 place emphasis on practices on both CDFC (cost determination and financial control) and on IPC (provision of information for management planning and control) and less emphasis on practices on the other two sets (RWR and CV). Firms in Level 3 emphasise CDFC (cost determination and financial control), IPC (provision of information for management planning and control) and RWR (reduction of waste in business resources) but not the fourth set CV (Creation of value through effective resources use). Finally, firms in Level 4 emphasise all four sets of practices.

An inspection of the mean scores of CDFC, IPC, RWR and CV in Table 2 provides bases for preliminary labelling of the empirically derived clusters of sample firms. Mean scores of firms in Cluster B are the lowest for all sets (CDFC, IPC, RWR and CV) – this suggests that Cluster B represents Level 1 of MAPs sophistication. Firms in Cluster C have higher mean scores for all of CDFC, IPC, RWR and CV than those of Cluster B; thus Cluster C can represent Level 2 of MAPs sophistication.

[11] Cluster analysis is a statistical technique which classifies a large set of objects (people, firms, etc.) into distinct subgroups based on predictor variables. If the cluster analysis is successful it should produce homogenous groups with respect to the group's scores on the predictor variables (Coolidge, 2000, p.267). The hierarchical agglomerate approach was adopted because it generates non-overlapping clusters (Norusis, 1994, p. 85). The distance between each two sub-groups was measured using Ward's method. This is commonly used to form clusters based on the squared Euclidean distance measure. First, the means for all predictor variables are calculated. Then, for each case, the squared Euclidean distance to the cluster means is calculated. These distances are summed for all of the cases. At each step, the two clusters that merge are those that result in the smallest increase in the overall sum of the squared within-cluster distances (Norusis, 1994, p. 98).

[12] Of the 122 companies for which a response was received from the management accountant, 9 were excluded because of missing at least two variables.

Clusters A and Cluster D have higher mean scores for all sets of CDFC, IPC, RWR and CV than those of Clusters B and C. Also, mean scores of CV in both Clusters C and D are higher than those of RWR. Because the mean scores of all four sets of CDFC, IPC, RWR and CV in Cluster D are higher than those in Cluster A, we have considered that Cluster D best represents Level 4. Thus, Cluster A represents Level 3.

It can be seen from Table 2 that 21 firms (19%) are in Level 1, 47 firms (41%) are in Level 2, 30 firms (27%) in Level 3 and 15 firms (13%) in Level 4 of management accounting sophistication. About 40% of firms have management accounting systems in either Level 3 or Level 4. We can conclude that management accounting systems in many firms of the UK food and drinks industry are moving from the simple, or naïve, role of cost determination and financial control towards a more sophisticated role in the creation of value through effective resource use.

In pursuit of testing the hypotheses and research questions, the characteristics of each group of firms merit further investigation. This is done by testing whether or not there are differences among the four groups of companies in relation to each firm's characteristics. The non-parametric Kruskal-Wallis one-way ANOVA test was used[13]. The results are considered by category below.

4.2. External characteristics (hypotheses H1 and H9)

Perceived Environmental Uncertainty (PEU). Many researchers have investigated the relationship between perceived environmental uncertainty[14] and some specific characteristics of management accounting. Hypothesis H1 states that firms perceiving a higher degree of environmental uncertainty adopt more sophisticated MAPs than firms that perceive lower environmental uncertainty. This hypothesis was tested using Kruskal-Wallis one way ANOVA. The results are shown in Panel A of Table 3. It can be seen that, based upon the mean ranks, there is a significant difference among firms in the four groups in relation to PEU. The Kruskal-Wallis test does not, however, make comparisons between individual pairings of company groups. Thus the critical difference has been calculated, for each pair of clusters, and compared with the absolute difference of the pairing to identify which pairs show significant differences[15]. The results show that there are significant differences between Level 1 firms and both Level 3 and Level 4 firms and between Level 2 and both Level 3 and Level 4. This can be explained as being caused by companies adding to the less sophisticated MAPs (Level 1 or Level 2 e.g. budgeting and product profitability analyses) some more sophisticated MAPs (Level 3 or Level 4

[13] In the computation of the Kruskal-Wallis test, for a specific variable, all scores of all groups are ranked in a single series. The lowest score is replaced by rank 1, the next lowest score is replaced by rank 2 and the largest score is replaced by rank N (the total number of independent respondents in all the groups). The sum of ranks in each group is then calculated and divided by the total number of respondents within each group to obtain the average rank. The Kruskal-Wallis test assesses the differences between the average ranks to determine whether they are significant or not. (Gibbons, 1993 and Siegel & Castellan, 1988).

[14] The approach of using uncertainty as subjectively perceived by decision makers is advocated by Gordon and Naryanan (1984). "The driving force behind decisions related to organization structure and information characteristics seems to be the key *individuals' perception of uncertainty in the environment*" (p.42, emphasis added).

[15] The difference is considered significant when the absolute difference between each pair of company groups is not less than the critical difference of that pair. See Siegel and Castellan (1988, pp.213-4) for more detail.

e.g. sensitivity analyses and value chain analyses) when they perceive high environmental uncertainty. Accordingly, H1 was supported and confirms earlier studies of Gordon and Naryanan (1984), Chenhall and Morris (1986), Gul and Chia (1994) and (Chong and Chong, 1997).

Customer power. In our preliminary fieldwork interviews we found out that customer power is an important variable affecting many aspects of the operations of companies which have to depend on few customers such as the large supermarket chains. To our knowledge no previous study has investigated the effect of customers' power on the sophistication level of MAPs. Hypothesis 9 addresses the extent to which customer power explains variation in the sophistication level of MAPs. On balance we expected (from the discussion with interviewees) that companies facing strong customer power might use more sophisticated MAPs to improve their decision making process and control and help them keep their demanding customers satisfied.

The results of the Kruskal-Wallis test shown in Panel A of Table 3 indicate that there is indeed a significant difference between the four groups of companies in relation to customers' power. The significant differences are between Level 1 and both Level 3 and Level 4, and between Level 2 and both Level 3 and Level 4. This leads us to conclude that companies add more sophisticated management accounting practices to the relatively naive Level 1 and Level 2 MAPs as their power relative to their customers diminishes.

4.3 Organisational characteristics (hypotheses H2, H3 and H8)

Firm structure – decentralisation. Chenhall and Morris (1986) define decentralisation as the degree of autonomy delegated to managers. It gives business unit managers greater responsibility over planning and control activities and greater access to information not available to 'the centre'. For decentralised companies to succeed, they need to design a management accounting system that provides relevant information to support managers in their planning, controlling and decision-making. Hypothesis H2 states that firms characterised as decentralised adopt more sophisticated MAPs than firms characterised as centralised.

The results of Kruskal-Wallis test shown in Panel B of Table 3 indicate a significant difference between the four groups of firms in their relation to decentralisation. More detailed comparisons between pairs of firm clusters reveal significant differences between firms in Level 1 and firms in Level 2, 3 and 4. Also, a significant difference exists between firms in Level 2 and Level 4 and between those in Level 3 and Level 4. These pairwise comparisons suggest that companies with more delegated managerial structures may need more sophisticated MAPs to provide managers with enhanced relevant information for the planning, controlling and decision making for which they are responsible. Hypothesis H2 is thus supported. This result confirms the positive relationship between decentralisation and sophisticated MAS found out by Chia (1995).

Size. As stated earlier, a firm's size is an important factor that affects both structure and other control arrangements. Hypothesis H3 states that large firms adopt more sophisticated MAPs than small firms. The results of Kruskal-Wallis tests indicate a significant difference between the four groups of firms in relation to their size. Further, pairwise comparisons reveal a significant

difference between each pair of groups of firms with the exception of Level 3 companies when compared with companies in Level 4. Overall, the result confirms the expectation that more sophisticated MAPs are likely to be implemented by larger companies (e.g. Otley, 1995 and Haldma and Lääts, 2002).

Competitive strategy. Two alternative competitive strategies are considered in this research - cost-leadership and differentiation. Firms adopting a cost-leadership strategy aim to provide products with the lowest possible cost relative to their competitors. Those adopting a differentiation strategy focus on creating distinctive features, customer service, brand image or performance. Hypothesis H8 states that firms following a differentiation strategy adopt more sophisticated MAPs than firms following a cost-leadership strategy. Using our dataset the Kruskal-Wallis test shows no significant difference between the four groups of firms in relation to their competitive strategies (see Panel B of Table 3). Our result therefore does not support hypothesis H8.

The results are interesting. Conventional wisdom (see, for example, Govindarajan (1986)) argues that a successful differentiator will seek approaches that lead to a price premium greater than the differentiating cost. Considering that there are numerous ways of achieving and maintaining uniqueness in the marketplace, a differentiator will require a relatively large information-processing capacity to deal with the many available options. In contrast, a strategy of cost leadership implies tight control systems. For a cost leadership strategy to be successful, managers must direct their attention to the internal aspects of their SBUs - primarily to the production and engineering functions. This logic is based on the premise that the tactical options available to a differentiator are greater than those available in the case of a cost leadership strategy. Thus, information processing requirements will be greater in the case of SBUs following a differentiation strategy.

Likewise Drury and Tayles (2000) argue *a priori* that companies following a differentiation strategy need a sophisticated cost system that accurately measures the costs of product and volume diversity arising from following such a strategy. Without a sophisticated system companies run the risk of not being able to determine whether the higher revenue generated from their products or services exceeds the extra costs associated with differentiation. They used measures of product diversity as a proxy for a differentiation strategy. They could not, however, find evidence to suggest that competitive strategy influenced the sophistication of costing system. Our result therefore confirms Drury and Tayles' (2000) finding.

4.4 Processing characteristics (hypotheses H4–H7 and H10)

'Manufacturing' is not a word usually applied to the production of food and drink. However, the actual activities encompassed within the term 'manufacturing' are very broad and many of them are similar to the activities of processing and producing food and drink; the main differences relate not so much to activity as to underlying material - organic, as opposed to metal or chemical. One *caveat*, based on Heasman and Henson's (1997) view that the food sector is relatively 'over-regulated', is that the firms in this sample may contain unrepresentatively high adoption of total quality management and advanced manufacturing techniques.

Complexity of processing system. Complexity can be measured by the diversity of product lines, processes and volume. Hypothesis H4 states that firms with complex processing systems adopt more sophisticated MAPs. However, the results of Kruskal-Wallis one-way ANOVA in Panel C of Table 3 do not support this hypothesis. We found no significant difference of complexity among the four MAP sophistication levels. This result contradicts Krumwiede (1998) who found that complexity is positively correlated with the decision to implement ABC – an indicative of a sophisticated management accounting system.

Advanced manufacturing technology (AMT). One of earliest contingent variables to be associated with the design of management accounting systems was the type of manufacturing technology. For example, a positive association was found between the degree of automation in the manufacturing process and the formality of budget systems used (Otley, 1995). Hoque and Mia (2001) argue that traditional performance measures are narrow in focus, historical in nature and in many cases incomplete. Organisations that adopt AMT need a multidimensional performance (financial and non-financial) measurement system to provide managers with continuous signals as to what is most important in their day-to-day activities and where efforts must be directed.

Hypothesis H5 states that firms with advanced manufacturing technology adopt adopt more sophisticated MAPs. The results of Kruskal-Wallis test in Panel C of Table 3 show a significant difference among the four groups of firms in relation to the extent of their AMT. More specifically, pairwise comparisons reveal that a significant difference exists between each pair of firm groups (with the exception of Level 1 firms when compared with Level 2 firms, and Level 3 compared with Level 4 firms). This result suggests that sophisticated MAPs are more likely to be implemented by firms with AMT. Thus, hypothesis H5 is supported by our data.

Total quality management. Hypothesis H6 states firms with TQM adopt more sophisticated MAPs. The results of Kruskal-Wallis test in Panel C of Table 3 are consistent with those relating to AMT, i.e. a significant difference is found between firms in Level 4 and firms in Levels 1 and 2 and between firms in Level 3 and those in Levels 1 and 2. There is no significant difference between firms in Level 1 and firms in Level 2 or between firms in Levels 3 and 4. This suggests that while mere 'lip-service' to quality has little effect, an identifiable commitment to implementing TQM is associated with enhanced MAPs. Thus hypothesis H6 is supported by the data.

Just in time. Hypothesis H7 states that firms with a JIT system adopt more sophisticated MAPs. Again, the JIT results are similar to those results concerning AMT and TQM. There are significant differences between firms in Level 1 and companies in Levels 3 and 4 and between firms in Level 2 and firms in Levels 3 and 4. Taken overall, the results reported in Panel C of Table 3 lead us to conclude, in agreement with Abdel-Maksoud et al. (2005), that relatively sophisticated MAPs exist in firms which have made significant investment in AMT, TQM and JIT.

Product perishability. Hypothesis H10 addresses the extent to which product perishability explains variation in the sophistication level of MAPs. On balance, our expectation based on the preliminarily fieldwork interviews was that more sophisticated MAPs would be implemented in

firms with a perception that product perishability dictates the way business is run. However, the results of Kruskal-Wallis test does not support this expectation; there were no significant differences among the four groups of companies in this regard.

5. Summary and conclusion

In this paper we have examined the effect of 10 aspects of firms' internal and external characteristics on individual firms' management accounting practices. In particular, we have sought to ascertain the extent to which characteristics relating to a firm's external environment, its organisational strategy, structure and size, and the nature of its production processes, explain the sophistication level of its management accounting. The literature, albeit from more narrowly drawn and largely non-UK studies, together with our preliminary fieldwork led us to expect that variation in management accounting sophistication (a composite based on the emphasis on 38 individual accounting practices) would partly be explained by identified potentially influential firm-characteristics (contingent variables).

In order to provide a theoretical framework for modelling the sophistication of management accounting practices we operationalised the IFAC statement of management accounting evolution. In this framework the sophistication of management accounting increases when more recently developed MAPs are emphasised by the firm. We first categorised each MAP into one of four levels based on the IFAC stages. Then we developed an emphasis score for each category of MAPs in each firm and this score was used to cluster the responding firms into four groups. Each group represents a level of management accounting sophistication. Finally, we examined the differences between these four groups of firms in terms of the 10 contingent variables to find out which of these characteristics differentiate adopters from non-adaptors of sophisticated MAPs.

The results (summarised in Table 4) show that differences in management accounting sophistication are significantly explained by environmental uncertainty (hypothesis H1), customer power (H9), decentralisation (H2), size (H3), AMT (H5), TQM (H6) and JIT (H7). Furthermore, from the mean ranks in Table 3 we can conclude that, for these variables, the direction of the significant relationships confirms the *a priori* expectations. On the other hand, our expectations of significant relationships between competitive strategy (H8), processing system complexity (H4) and product perishability (H10) and management accounting sophistication were not supported by the data.

The finding that firms facing relatively high environmental uncertainty place greater emphasis on their management accounting information confirms earlier, non industry-specific, studies that have looked at individual techniques. We extend this by finding that management accounting is more highly evolved in companies facing powerful customers. Customer power is particularly relevant to food and drinks processors because of the concentration of the food and drink retail sector. Producers dominated by their supermarket chain customers appear to find it necessary to invest in advanced management accounting.

Turning to organisational characteristics, we surveyed the relationship between alternative strategies of product differentiation and cost leadership on management accounting. Various authors have argued persuasively that differentiators require more sophisticated management

accounting. However, in common with Drury and Tayles (2000) we found no evidence that competitive strategy had any influence. A second potentially influential organisational factor that was investigated was the extent of firms' decentralisation and delegation. We anticipated that more delegated managerial structures may need more sophisticated MAPs to provide managers with enhanced relevant information for the planning, controlling and decision making for which they are responsible. This expectation was strongly endorsed by the statistics. Management accounting practices are subject to economies of scale, and investment in sophisticated systems was expected to be more readily justified in large businesses. Again, this expectation was upheld.

Our final category of characteristics relates to companies' processing technologies. Prior research has shown that relationships may exist between the application of new manufacturing technologies and the sophistication of management accounting practices. From the data we conclude that more sophisticated MAPs exist in companies which have made significant investment in processing automation, in TQM and in JIT. We did not however find that either processing complexity or product perishability influenced the level of advancement of management accounting.

The improved understanding, that this paper offers, of the relationships between 10 contingency factors and management accounting techniques employed, contributes to the further development of an integrated contingency framework explaining variations in the sophistication of MAPs (Tillema, 2005). Overall, the results of this study have showed that sophisticated management accounting practices are emphasised in firms that have the following characteristics:

- a highly uncertain environment,
- powerful customers,
- a decentralised structure,
- relatively large size, and those which
- employ AMT, TQM and JIT.

In reflecting upon the findings we recognise that specific research limitations might reduce their generalisability. By focusing on four levels of sophistication or advancement, as opposed to individual management accounting practices, we have unavoidably sacrificed the ability to make more detailed prescriptions. We also acknowledge the unsuitability of contingency theory for exploring nuanced and dynamic processes relating to the adoption of accounting techniques and, of course, the well rehearsed limitations of data from postal questionnaires.

Cross-sectional surveys are subject to criticism for lacking specificity (Ittner and Larcker, 2001). We maintain that this concern has been mitigated by including, along with each item in the questionnaire, a brief description of each management accounting practice or technique thereby reducing possible misunderstandings of terms. This study also differed from previous cross-sectional surveys by targeting both a management accountant and a production manager in each firm, thereby enhancing the appropriateness of the respondents.

The contribution of the paper derives from its exploration of factors, other than industry sector, that may explain differences in the sophistication of management accounting in UK production companies. Such contingency studies have two-fold relevance; first, they are interesting from

what Tillema (2005, p.102) describes as 'the purely scientific point of view", and secondly they can provide organisations with practical information about the accounting practices that others, in similar circumstances, have adopted. The twenty year period since the mid 1980s has been notable for the high profile of novel management accounting techniques and, as Roslender (1995) observes, accountants and managers may have difficulty deciding which of the numerous novel techniques to embrace.

In this study, to normalise for inter-sectoral influences, we concentrated on the very large but under-researched UK food and drinks industry. While we have not formally ascertained the extent to which the sector is representative of other British industry we nevertheless believe that our large sample empirical findings have broad relevance and contribute to the understanding of the determinants of companies' management accounting activity. Our method differs from prior studies in not testing association between contingency factors and a single, or a limited number of, accounting practice(s) but in looking for relationships with aggregate levels of sophistication based on the emphasis that respondents place on 38 practices and techniques. This overcomes the concern articulated by Chenhall (2003, p. 131) that examination of a specific element of management control systems in isolation, without linking it to other elements, can lead to 'serious model underspecification.'

The use of the non-parametric Kruskal-Wallis test in this study (unlike the more traditional use of regression analysis in most contingency theory studies) and the categorisation, using cluster analysis, of firms into four groups according to their level of MAP sophistication allowed us to identify the point at which each contingent variable leads to a change in the level of MAP sophistication. For example, the results in Table 3 show no significant difference regarding perceived environmental uncertainty faced by firms at Levels 1 and 2 of MAP sophistication, but that a significant difference does exist between Level 1 firms and those at Level 3. This might lead one to expect that further sophistication (exhibited by Level 4 firms relative to those at Level 3) would be associated with even greater uncertainty but this is not borne out by the data. The implication is that while it may be rational for firms to invest in enhanced management accounting such as probability analysis, computer simulation and 'what if analysis' in their decision making process, in response to moderate uncertainty it is not necessarily appropriate to adopt 'value creation' (Level 4) practices in even more uncertain situations. Likewise similar conclusions, about the distinction between Levels 2 and 3 – but non-distinction between Levels 3 and 4 – can be extended to five[16] of the six other significant contingent variables – in fact all except 'decentralisation'. This discontinuity between the responsiveness of 'waste reducing' practices and 'value creating' practices invites speculation that the latter are not so much evolutionary developments 'pulled through' by a range of established intrinsic contingent variables but more concepts that have been more actively 'pushed through' by consultants and other agents of change. Exploration of this theme is beyond the scope of this paper but presents an opportunity for future research.

Importantly, the 10 contingency factors considered in this study include two constructs (product perishability and customer power) not previously explored. We submit that the 'grounding' of this questionnaire-focused study in fieldwork visits to a sample of research targets has enhanced

[16] Size, customer power, JIT, AMT and TQM.

the outcomes by allowing identification of new potential variables and by allowing useful contextualisation of the statistical findings. The quantitative results confirm that customer power should be added to the contingency theory paradigm as an external variable in certain circumstances. As an innovation the relationship between customer power and management accounting sophistication certainly merits further in-depth investigation. The potential explanatory usefulness of 'product perishability' has, however, not been supported by the data. Nevertheless it remains an avenue that could be investigated more thoroughly.

The large size of the sample and the location of the respondents make the findings particularly apposite to an understanding of management accounting in British production companies. We believe that there is potential for further fruitful work mobilising the concept of levels of sophistication and also submit that industry specific studies, combining both fieldwork and large sample data, can prove helpful in identifying new relevant contingent factors such as customer power.

REFERENCES

Abdel-Kader, M. and Luther, R.G., (2006), IFAC's conception of the evolution of management accounting, Advances in Management Accounting, Vol. 15, pp. 237-256

Abdel-Maksoud, A., Dugdale, D. and Luther, R.G., (2005), Non-financial performance measurement in manufacturing companies, British Accounting Review, Vol. 37, pp. 262 - 297

Abernethy, M. and Guthrie, C. (194), An empirical assessment of the "fit" between strategy and management information system design, Accounting and Finance, Vol. 34, No. 2, pp. 49-66.

Anderson, S. and Lanen, W. (1999), Economic transition, strategy and the evolution of management accounting practices: the case of India, Accounting, Organizations and Society, Vol. 24, pp. 379-412.

Ashton, D., Hopper, T. and Scapens, R. (1995), The changing nature of issues in management accounting, in Ashton, D., Hopper, T. and Scapens, R. (eds), *Issues in Management Accounting*, Prentice Hall, Hertfordshire.

Baines, A. and Langfield-Smith, K. (2003), Antecedents to Management Accounting Change: A structural Equation Approach, Accounting, Organization and Society, Vol. 28, pp. 675-698.

Brown, D. (1990), Quality of service supports customers' power requirements, Transmission & Distribution, September, pp. 44-52.

Chapman, C. (1997), Reflections on a contingent view of accounting, Accounting, Organizations and Society, Vol. 22, No. 2, pp. 189-205.

Chen, S. (1995), An empirical examination of capital budgeting techniques: impact of investment types and firm characteristics, The Engineering Economist, Vol. 40, No. 2, Winter, pp. 145-170.

Chenhall, R. (1997), Reliance on manufacturing performance measures, total quality management and organizational performance, Management Accounting Research, vol. 8, pp. 187-206.

Chenhall, R. (2003), Management control systems design within its organizational context: findings from contingency-based research and directions for the future, Accounting, Organization and Society, Vol. 28, pp. 127-68.

Chenhall, R. (2007), Theorizing contingencies in management control systems research, In Chapman, C., Hopwood, A. and Shields, M. (editors), Handbook of Management Accounting Research, Elsevier.

Chenhall, R. and Langfield-Smith, K. (1998), The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a system approach, Accounting, Organization and Society, Vol. 23, No. 3, pp. 243-264.

Chenhall, R. and Morris, D. (1986), The impact of structure, environment, and inter-dependence on the perceived usefulness of management accounting systems, The Accounting Review, Vol. LXI, No. 1, January, pp. 16-35.

Chia, Yew Ming (1995), Decentralization, management accounting systems (MAS) information characteristics and their interaction effects on managerial performance: a Singapore study, Journal of Business Finance and Accounting, Vol. 22, No. 6, September, pp. 811-830.

Chong, V. (1996), Management accounting systems, task uncertainty and managerial performance: a research note, Accounting, Organization and Society, Vol. 21, No. 5, pp. 415-421.

Chong, V. and Chong, K. (1997), Strategic choices, environmental uncertainty and SBU performance: a note on the intervening role of management accounting systems, Accounting and Business Research, Vol. 27, No. 4, pp. 268-276.

Christensen, C. and Bower, J. (1996), Customer Power, Strategic Investment, and the Failure of Leading Firms, Strategic Management Journal, Vol. 17, No. 3, pp. 197-218.

Coolidge, F. (2000), Statistics: a gentle introduction, SAGE Publications, London.

Covaleski, M., Dirsmith, M.and Samuel, S. (1996), Managerial accounting research: the contributions of organizational and sociological theories, Journal of Management Accounting Research, Vol. 8, pp. 1-35.

Dean, J W (Jr), Snell, S.t A. (1996), The strategic use of integrated manufacturing: an empirical examination, Strategic Management Journal, Vol. 17, No. 6; pp. 459-480.

Drury, C. and tayles, M. (2000), Cost system design and profitability analysis in UK companies, CIMA, London.

Food and Drink Federation, http://www.fdf.org.uk/industrystats.aspx, accessed on 20 June 2004.

Fullerton, R. and McWatters, C. (2002), The role of performance measures and incentive systems in relations to the degree of JIT implementation, Accounting, Organizations and Society, Vol. 27, pp. 711-735.

Gerdin, J. (2005), Management accounting system design in manufacturing departments: an empirical investigation using a multiple contingencies approach, Accounting, Organization and Society, Vol. 30, pp. 99 – 126.

Gerdin, J. and Greve, J. (2004), Forms of contingency fit in management accounting research – a critical review, Accounting, Organization and Society, Vol. 29, pp. 303– 26.

Gibbons, J. (1993), Nonparametric Statistics: An Introduction, Sage Publications, London.

Gordon, L. and Narayanan, V. (1984), Management accounting systems, perceived environmental uncertainty and organization structure: an empirical investigation, Accounting, Organization and Society, Vol. 9, No. 1, pp. 33-47.

Govindarajan, V. (1986), Decentralization, strategy, and effectiveness of strategic business units in multibusiness organizations, Academy of Management, Vol. 11, No. 4; pp. 844-56.

Govindarajan, V. (1988), Decentralization, strategy, and effectiveness of strategic business units in multibusiness organizations, Academy of Management Review, Vol. 11, No. 4, pp. 8440-856.

Govindarajan, V. and Fisher, J. (1990), Strategy, control systems, and resource sharing: effects on business-unit performance, Academy of Management Journal, Vol. 33, No. 2, pp. 259-285.
Guilding, C., Drury, C., and Tayles, M., (2005), An empirical investigation of the importance of cost-plus pricing, Managerial Auditing Journal, Vol. 20, No. 2, pp.125-137
Gul, F. and Chia, Y. (1994), The effect of management accounting systems, perceived environmental uncertainty and decentralization on managerial performance: a test of three-way interaction, Accounting, Organization and Society, Vol. 19, No. 4/5, pp. 413-426.
Gupta, A. and Govindarajan, V. (1984), Business unit strategy, managerial characteristics, and business unit effectiveness at strategy implementation, Academy of Management Journal, Vol. 27, No. 1, pp. 25-41.
Haldma, T. and Lääts, K. (2002), Contingencies influencing the management accounting practices of Estonian manufacturing companies, Management Accounting Research, Vol. 13, pp. 379-400.
Heasman, M and Henson, S. (1997), Costs of compliance with food regulation in the UK: the response of food and drink manufacturers, British Food Journal, Vol. 99, No. 5, pp. 181- 7.
Hoque, Z. and Mia, L. (2001), Market competition, computer-aided manufacturing and use of multiple performance measures: an empirical study, British Accounting Review, Vol. 33, pp.23-45.
International Federation of Accountants (IFAC), (1998), International Management Accounting Practice Statement: Management Accounting Concepts, New York
Ittner, C. and Larcker, D. (1998), Innovations in performance measurement: trends and research implications, Journal of Management Accounting Research, Vol. 10, pp. 205-238.
Ittner, C. and Larcker, D. (2001), Assessing empirical research in managerial accounting: a value-based management perspective, Journal of Accounting and Economics, Vol. 32, pp. 349-410.
Kanchanasuntorn, K. and Techanitisawad, A. (2006), An Approach Periodic Model for Fixed-life Perishable Products in a Two-echelon Inventory-Distribution System, International Journal of Production Economics, Vol. 100, pp. 101-15.
Kaplan, R. and Atkinson, A. (1998), Advanced Management Accounting, 3rd Ed., Pearson Education.
Krumwiede, K. (1998), The implementation stages of activity-based costing and the impact of contextual and organizational factors, Journal of Management Accounting Research, Vol. 10, pp. 239-77.
Langfield-Smith, K. (1997), Management control systems and strategy: a critical review**,** Accounting, Organizations and Society, Vol. 22, pp. 207-232.
Mann, R. and Adebanjo, O. (1997), Business Excellence in the Food and Drinks Industry: Practical ways to Improve Performance, FT Retail & Consumer Publishing, London.
Mann, R., Adebanjo, O. and Kehoe, D. (1999a), An Assessment of Management Systems and Business Performance in the UK Food and Drinks Industry, British Food Journal, Vol. 101, No. 1, pp. 5-21.
Mann, R., Adebanjo, O. and Kehoe, D. (1999b), Best Practices in the UK Food and Drinks Industry, British Food Journal, Vol. 101, No. 3, pp. 184-99.
Miles, R. and Snow, C. (1978), Organizational strategy, structure and process, McGraw-Hill, New York.
Mitchell, F. (2002), Research and practice in management accounting: improving integration and communication, The European Accounting Review, Vol. 11, No. 2, pp. 277 – 289.

Moores, K. and Yuen, S. (2001), Management Accounting Systems and Organizational Configuration: A Life-cycle Perspective, Accounting, Organization and Society, Vol. 26, pp. 351-389.

Norusis, M. (1994), SPSS Professional Statistical 6.1, SPSS Inc., Chicago.

Nahmias, S. (1982), "Perishable Inventory Theory: A Review" *Operations Research*, Vol.30, No.4, pp. 680-708

Nunnally, J. (1978), Psychometric theory, 2nd edition, McGraw-Hill, New York.

Otley, D. (1995), Management control, organisational design and accounting information systems, In Ashton, D., Hopper, T. and Scapens, R. (eds.), Issues in Management Accounting, Prentice Hall, London, pp. 45-63.

Otley, D. (1980), The contingency theory of management accounting: achievement and prognosis. Accounting Organizations and Society, Vol. 4, pp. 413–428.

Porter, M. (1980), Competitive strategy, The Free Press, New York.

Ramanathan, R. (2006), "Stocking and discounting decisions for perishable commodities using expected profit approach", International Journal of Retail & Distribution Management; Volume: 34 Issue: 2, pp. 172-84.

Reid, G. and Smith, J. (2000), The impact of contingencies on management accounting system development, Management Accounting Research, Vol. 11, pp. 427-50.

Roslender, R. (1995), Accounting for strategic positioning: responding to the crisis in management accounting, British Journal of Management, Vol. 6, No.1, pp. 45-57

Siegel, S., and Castellan, N., (1988), Nonparametric Statistics for the Behavioral Sciences, 2nd edition, McGraw-Hill Book Co., New York.

Sim, K. and Killough, L. (1998), The performance effects of complementarities between manufacturing practices and management accounting systems, Journal of Management Accounting Research, Vol. 10, pp. 325–346.

Snell, S. and Dean, J (Jr) (1992), Integrated Manufacturing and Human Resource Management: A Human Capital Perspective, Academy of Management Journal, Vol. 35, No. 3, pp. 467-504.

Teng, J., Ouyang, L. and Chen L. (2007), A Comparison between two pricing and lot-sizing models with partial backlogging and deteriorated items, International Journal of Production Economics, Vol. 105, pp. 190-230.

Tillema, S. (2005), Towards an integrated contingency framework for MAS sophistication: case studies on the scope of accounting instruments in Dutch power and gas companies, Management Accounting Research, Vol. 16, pp. 101-29.

Young, S. and Selto, F. (1991), New manufacturing practices and cost management: a review of the literature and directions for future research, Journal of Accounting Literature, Vol. 10, pp. 265–298.

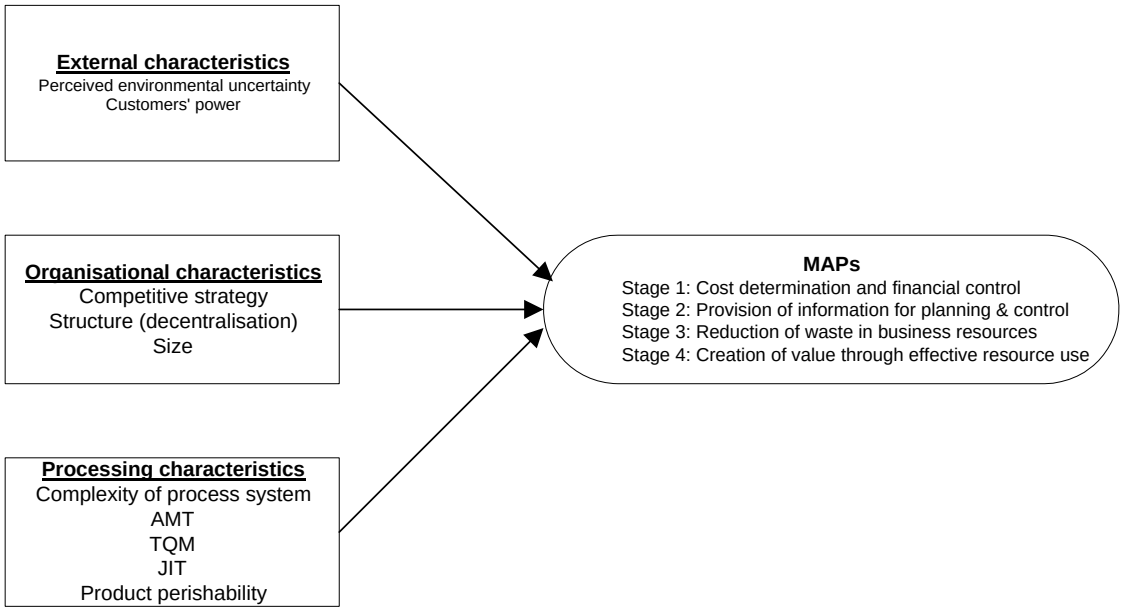

Figure 1 – Firm Characteristics and their relationships with Management Accounting Practices

Table 1 – Contingent Variables Constructs and Descriptive Statistics

Variable	Source of construct	Construct description
Perceived Environmental Uncertainty (PEU)	Miles and Snow (1978)	• Consists of 13 questions to indicate, on seven-point Likert-type scale, the predictability of firms' external environments including suppliers, competitors, customers and governmental/European Union regulatory agencies. • An average of a respondent's scores was used as a measure for PEU, where the low end of the scale indicates a low PEU and the high end indicates high PEU. **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 120 4.03 0.84 1.00 5.85 .78
Firm Structure – Decentralisation.	Gordon and Narayanan (1984).	• Consists of five questions to indicate, on a seven-point Likert-type scale, the degree of authority delegated by the chief executives of their firms to make decisions related to development of new products, the hiring and firing of managerial personnel, selection of large new investments, pricing of new products and significant price changes, and budget setting. • An average of a respondent's scores was used as a measure for decentralisation. The low end of the measure indicates a no delegation at all while the high end indicates complete delegation. **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 117 3.63 1.37 1.00 6.80 .81
Size	N/A (Published data)	• Measured in terms of each firm's total assets. • Obtained from the FAME database and was converted to the natural logarithm. The effect of logarithmic adjustment is to dilute the extreme variability in size and achieve a more normal distribution (Govindarajan, 1988). **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 114 27.5 77.67 0.50 750 n.a.

Variable	Source of construct	Construct description
Complexity of Processing System (CPS).	Krumwiede (1998)	• Consists of three questions to measure, on a seven-point scale, the product line diversity, similarities in the products' design and production, and the existence of major differences between volumes across products and batch sizes. • An average of a respondent's scores was used as a measure for the CPS. The low end of the measure indicates a low CPS while the high end indicates a high CPS. **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 120 4.31 1.17 1.00 7.00 .69
Advanced Manufacturing Technology (AMT).	Dean and Snell (1996)	• Consists of 14 questions to indicate, on a seven-point Likert-type scale, the extent of AMT application including manufacturing resource planning (MRP II), computer-aided design (CAD), numerical control (NC), computer numerical control (CNC), flexible manufacturing systems (FMS), robotics, automated materials handling, computer-aided test/inspection and computer-aided process planning and in terms of integration of manufacturing processes using computers. • An average of a respondent's scores was used as a measure of AMT adoption. The low end of the measure indicates a low adoption of AMT while the high end indicates a high level. **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 121 2.57 1.09 1.00 6.00 .84

Variable	Source of construct	Construct description
Total Quality Management (TQM).	Snell and Dean (1992) as modified by Sim and Killough (1998)	• Consists of seven questions*. Six of the questions were anchored by a seven-point Likert- scale. The seventh question was the percent of the plant's employees having quality as a major responsibility. The percentage reported was divided by 14.3 in order to convert the percent to a scale of 1-7. The questions were related to time devoted to quality improvement, time spent working with suppliers to improve their quality, time and cost spent in preventive maintenance to improve quality, time and cost spent in quality related training, proportion of the plant's major manufacturing processes under statistical quality control and how respondents describe their current approach to ensuring quality control (range from built-in to post production inspection). • An average of a respondent's scores was used as a measure for the extent of TQM. The low end of the measure indicates a low level of TQM while the high end indicates a high level of TQM. **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 120 4.03 1.03 1.67 5.94 .70
Just in Time (JIT).	Snell and Dean (1992) as modified by Sim and Killough (1998)	• Consists of nine questions to rate the degree of JIT adoption on a seven-point Likert-type scale. The questions were related to the frequency of inward deliveries, amount of buffer stock, number of suppliers, number of total components in bill of material, length of product runs, to what extent are product pulled through by specific customer order, how much attention is devoted to minimising set-up time, how closely are predetermined preventive maintenance plans adhered to and how much time is spent in improving the satiability of the production schedule by re-engineering the plant. • An average of a respondent's scores was used as a measure for the JIT adoption. The low end of the measure indicates a low adoption of JIT and *vice versa.* **N** **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 121 4.20 0.62 2.67 6.00 .63

Variable	Source of construct	Construct description
Competitive Strategy	Govindarajan and Fisher (1990)	• Respondents were asked to indicate the percentage of their business unit's total sales accounted for by products representing use of either cost-leadership or differentiation. • The overall cost-leadership was assigned a value of -1 and a differentiation strategy was assigned a value of +1. Then the percentage breakdown a respondent provided for each item was used to construct a weighted-average strategy measure for the SBU.
		N **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 93 0.18 0.52 -1.00 1.00 n.a.
Customers' Power	This project's preliminary fieldwork	• Consists of four questions to indicate percentage of sales value from the three largest customers, percentage of sales value sold under their own brand, how difficult it would be to find alternative business if a customer changed to a different supplier, and how much scope firms had to alter contracts with their customers. • An average of a respondent's scores was used as a composite measure of customer power faced by companies. where the low end of the scale indicates weak customers' power and the high end indicates strong customers' power.
		N **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 120 4.20 1.04 1.18 7.00 .60
Product Perishability.	The preliminary fieldwork	• A one-item construct measured by asking respondents to rate the extent of the effect of product perishability in running their business.
		N **Mean** **Std. dev.** **Min.** **Max.** **Alpha** 120 4.62 2.08 1.00 7.00 n.a.

[*] We omitted three questions from the original construct in response to comments, by production managers in the pilot interviews, on the difficulties of understanding the terms used. These three deleted questions are related to the extent of usage of quality function deployment, Taguchi methods and continuous process improvement.

Table 2 – Classification of Responding Firms Using Hierarchical Cluster Analysis

		Clusters*					
		A	**B**	**C**	**D**		
		(*n* = 30)	(*n* = 21)	(*n* = 47)	(*n* = 15)	***F*-test**	***P***
CDFC:	Cost determination & financial control	9.74 (2.11)	5.94 (3.67)	8.29 (2.49)	10.53 (1.88)	12.28	.000
IPC:	Management planning & control	8.87 (1.24)	4.54 (1.96)	6.77 (1.58)	10.14 (1.34)	51.23	.000
RWR:	Reduction of waste in business resources	5.10 (1.27)	2.01 (1.11)	2.83 (1.15)	6.50 (1.22)	63.38	.000
CV:	Creation of value through effective resources use	5.98 (0.99)	3.06 (1.88)	4.36 (1.29)	8.89 (1.14)	65.81	.000
Labels attributed:		**Level 3**	**Level 1**	**Level 2**	**Level 4**		

Values in the table are mean scores of variables within clusters (standard deviation).
*113 firms included in the analysis, 9 companies were not included because of missing at least 2 values.

Table 3 – Results of Kruskal-Wallis one-way ANOVA for MAPs

	Level 1	Level 2	Level 3	Level 4	K-W Statistic (d.f. = 3)
Panel A – External Characteristics					
Perceived Environmental Uncertainty					
Mean Rank	46.79	50.56	66.58	63.53	6.968*
Pairwise Comparisons					
Level 1		3.77	19.79**	16.74*	
		(9.84)	(12.32)	(15.81)	
Level 2			16.02**	12.97**	
			(7.83)	(11.08)	
Level 3				3.05	
				(13.87)	
Customers' Power					
Mean Rank	15.33	16.55	36.32	38.44	26.098**
Pairwise Comparisons					
Level 1		1.22	20.99**	23.11**	
		(9.54)	(12.86)	(15.08)	
Level 2			19.77**	21.89**	
			(8.63)	(10.11)	
Level 3				2.12	
				(13.64)	
Panel B – Organisational Characteristics					
Decentralisation					
Mean Rank	31.45	54.86	61.53	74.20	17.943**
Pairwise Comparisons					
Level 1		23.41**	30.08**	42.75**	
		(6.95)	(11.99)	(16.68)	
Level 2			8.00	11.12**	
			(8.63)	(10.11)	
Level 3				13.85*	
				(12.57)	
Size (total assets)					
Mean Rank	40.76	51.41	64.66	74.67	12.783**
Pairwise Comparisons					
Level 1		10.65**	23.90**	33.91**	
		(9.46)	(11.92)	(16.57)	
Level 2			13.25**	23.26**	
			(8.05)	(11.20)	
Level 3				10.01	
				(14.10)	

	Level 1	Level 2	Level 3	Level 4	K-W Statistic (d.f. = 3)
Competitive strategy					
Mean Rank	41.10	42.72	41.75	50.37	1.435
Panel C – Processing Characteristics					
Complexity of Processing System					
Mean Rank	27.33	24.55	26.32	18.69	1.955
AMT Level					
Mean Rank	17.94	14.73	39.41	35.81	29.452*
Pairwise Comparisons					
Level 1		3.21	21.47**	17.87**	
		(9.54)	(12.86)	(15.08)	
Level 2			24.68**	21.08**	
			(8.63)	(10.11)	
Level 3				3.60	
				(13.64)	
TQM					
Mean Rank	13.44	17.17	38.05	36.63	27.402**
Pairwise Comparisons					
Level 1		3.73	24.61**	23.19**	
		(9.54)	(12.86)	(15.08)	
Level 2			20.88**	19.46**	
			(8.63)	(10.11)	
Level 3				1.42	
				(13.64)	
JIT					
Mean Rank	17.61	14.93	38.45	37.00	28.913**
Pairwise Comparisons					
Level 1		2.68	20.84**	19.39**	
		(9.54)	(12.86)	(15.08)	
Level 2			23.52**	22.07**	
			(8.63)	(10.11)	
Level 3				1.45	
				(13.64)	
Product perishability					
Mean Rank	24.11	24.83	29.00	17.94	2.986

Values of pairwise comparisons represent absolute differences of mean ranks (critical differences).
* $P < .10$; ** $P < .05$.

Table 4 – Summary of relationships between contingent factors and management accounting sophistication

	Significantly positive		Significantly negative	No significant relationship
	at .05	at .10		
External Characteristics:				
Perceived environmental uncertainty		✔		
Customers' power	✔			
Organisational Characteristics:				
Competitive strategy				✔
Decentralisation	✔			
Size (total assets)	✔			
Processing Characteristics:				
Complexity of processing system				✔
AMT	✔			
TQM	✔			
JIT	✔			
Product perishability				✔

Note: The directions of the significant differences shown above are based on the mean ranks for each group reported in Table 3.

APPENDIX I

Classification and Descriptive Statistics of Management Accounting Practices

	Importance[a]		Usage[b]		Emphasis[c]	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Stage 1. Cost Determination and Financial Control (CDFC)						
Using a plant-wide overhead rate	1.61	0.76	2.12	1.42	4.34	4.54
Budgeting for controlling costs	2.66	0.62	4.12	1.05	11.25	4.28
Flexible budgeting	2.05	0.78	2.70	1.40	6.32	4.82
Performance evaluation based on financial measures	2.71	0.59	4.08	1.20	11.43	4.42
Evaluation of major capital investments based on payback period and/or accounting rate of return.	2.32	0.73	3.24	1.32	8.16	4.79
Stage 2. Provision of Information for Management Planning and Control (IPC)						
A separation is made between variable/incremental costs and fixed/non-incremental costs	2.32	0.74	3.30	1.27	8.43	4.73
Using departmental overhead rates	1.67	0.74	2.12	1.30	4.36	4.03
Using regression and/or learning curve techniques	1.17	0.45	1.24	0.61	1.64	1.83
Budgeting for planning	2.68	0.63	4.33	0.91	11.88	4.05
Budgeting with ‘what if analysis’	2.15	0.71	2.88	1.17	6.94	4.26
Budgeting for long-term (strategic) plans.	2.33	0.75	3.05	1.25	7.76	4.45
Performance evaluation based on non-financial measures related to operations	2.16	0.78	2.97	1.40	7.33	4.98
Cost-volume-profit analysis for major products.	2.36	0.72	3.14	1.26	8.17	4.63
Product profitability analysis.	2.69	0.54	3.90	1.07	10.91	4.04
Stock control models	2.16	0.74	2.83	1.26	6.69	4.40
Evaluation of major capital investments based on discounted cash flow method(s)	1.92	0.77	2.32	1.31	5.27	4.47
Long-range forecasting	2.33	0.69	3.17	1.28	8.00	4.64
Stage 3. Reduction of Waste in Business Resources (RWR)						
Activity-based costing	1.57	0.69	1.83	1.14	3.45	3.60
Activity-based budgeting	1.81	0.73	2.34	1.33	4.87	4.24
Cost of quality	1.73	0.70	2.05	1.16	4.18	3.70
Zero-based budgeting	1.54	0.70	1.99	1.28	3.82	4.15

	Importance[a]		Usage[b]		Emphasis[c]	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Performance evaluation based on non-financial measure(s) related to employees	1.75	0.64	2.09	1.13	4.27	3.61
Evaluating the risk of major capital investment projects by using probability analysis or computer simulation.	1.37	0.59	1.48	0.93	2.50	3.06
Performing sensitivity 'what if' analysis when evaluating major capital investment projects.	1.87	0.73	2.38	1.28	5.29	4.38
Stage 4. Creation of Value Creation through Effective Use of Resources (CV)						
Target costing	1.79	0.77	2.36	1.39	5.19	4.71
Performance evaluation based on non-financial measure(s) related to customers	2.32	0.71	3.04	1.33	7.63	4.68
Performance evaluation based on residual income or economic value added	1.43	0.62	1.63	1.03	2.80	3.21
Benchmarking	1.65	0.64	1.97	1.08	3.81	3.26
Customer profitability analysis.	2.53	0.65	3.46	1.27	9.28	4.64
For the evaluation of major capital investments, non-financial aspects are documented and reported.	2.19	0.72	2.94	1.23	7.21	4.44
Calculation and use of cost of capital in discounting cash flow for major capital investment evaluation.	1.75	0.74	2.10	1.21	4.44	4.00
Shareholder value analysis	1.32	0.59	1.50	0.88	2.40	2.81
Industry analysis	1.41	0.61	1.65	1.14	2.89	3.43
Analysis of competitive position	2.19	0.75	2.89	1.19	7.03	4.28
Value chain analysis	1.69	0.79	2.10	1.38	4.51	4.70
Product life cycle analysis	1.46	0.66	1.65	0.93	2.87	2.92
The possibilities of integration with suppliers' and/or customers' value chains	1.68	0.74	2.08	1.17	4.21	3.89
Analysis of competitors' strengths and weaknesses.	2.17	0.69	2.66	1.06	6.23	3.61

[a] Based on 3-point scale (1 = not important, 2 = moderately important, 3 = important).
[b] Based on 5-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often).
[C] The means of the emphases (usage × importance) for each firm - not the product of the mean usage and the mean importance. Surprisingly, perhaps, this would give different figures.
[d] Classification of the 38 MAPs into the four stages was based on judgement, informed by the literature and consultations with colleagues and participants at conferences. The positionings are not unambiguous but their internal consistency was confirmed by the tests reported in Appendix II.

APPENDIX II

Cronbach's alpha tests of internal consistency of MAPs

		Theoretical range		Actual range				
		Min	**Max**	**Min**	**Max**	**Mean**	**Std. dev.**	**Alpha**
CDFC:	Cost determination & financial control	1	15	1.75	15.00	8.467	2.957	.6349
IPC:	Management planning & control	1	15	1.27	12.50	7.366	2.362	.7697
RWR:	Reduction of waste in business resources	1	15	1.00	8.57	3.772	1.941	.6954
CV:	Creation of value through effective resources use	1	15	1.21	11.14	5.137	2.178	.7890