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A survey of factors influencing the choice of product costing systems in UK organizations

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Abstract

This paper reports on the findings of a postal questionnaire that examines the extent to which potential contextual factors influence the characteristics of product costing systems. Prior research has mostly used the adoption or non-adoption of ABC systems to capture the characteristics of product costing systems. This research has generally been inconclusive and has been unable to establish strong links between ABC adoption and those contextual factors that have been identified in the literature that are conducive to the adoption of ABC systems. Instead of using only the adoption or non-adoption of ABC systems as a measure of product cost system design this research uses four different proxy measures of cost system sophistication to capture the characteristics of the product costing systems. This allows for a more robust test of the relations among the predictor variables and cost system sophistication. Results indicate that higher levels of cost system sophistication are positively associated with the importance of cost information, extent of use of other innovative management accounting techniques, intensity of the competitive environment, size, extent of the use of JIT/lean production techniques and the type of business sector. No association was found between the level of cost system sophistication and cost structure, product diversity and quality of information technology.

Keywords: Product costing; Activity-based costing; Direct costing; Absorption costing; Cost system sophistication; Contingent factors; Cost pools; Cost drivers

1. Introduction

To explain the diversity of management accounting practices researchers have adopted contingency theory to demonstrate how specific aspects of an accounting system are associated with various contextual variables. A considerable amount of contingency-based research has been undertaken relating to management accounting control systems (Chenhall, 2003). Little attention, however, has been given to identifying the factors that explain the content of product costing systems. This is surprising considering the vast amount of publicity given to developing more sophisticated product costing systems (Cooper, 1988a; Cooper, 1988b; Cooper and Kaplan, 1992; Kaplan and Cooper, 1998). The need to improve the sophistication of product costing systems has been driven by changes in manufacturing technology, global competition, information costs and customers' demands for greater product diversity. These changes prompted criticisms of the ability of traditional management accounting systems to report sufficiently accurate product costs and ABC systems were promoted as the solution to overcome the distortions in the product costs reported by traditional costing systems (Cooper, 1988b; Kaplan, 1994).

The survey evidence suggests that the ABC adoption rate has been fairly low, being approximately 15% of the companies surveyed by UK studies (Innes et al., 2000; Drury and Tayles, 2000). This low rate of adoption has prompted several writers to question the usefulness of ABC in generating more accurate product costs (Noreen, 1991; Datar and Gupta, 1994; Yahya-Zadeh, 1997; Maher and Marais, 1998) and the costly design, implementation and operation of such systems (Cobb et al., 1992). Research has only been recently undertaken into examining the contingencies influencing the nature of product costing systems. Virtually all of this research has concentrated on the factors influencing the adoption or non-adoption of ABC systems. This research has generally been inconclusive and has been unable to establish strong links between the adoption of ABC and those contextual factors that have been identified in the literature that are conducive to the adoption of ABC systems. Two possible reasons may account for this situation. First, there may be no relations between the constructs of interest and thus any significant findings may have been spurious and not reproducible. Second, the methods adopted by previous research may have fatal flaws relating to poor measures, measurement error, bias etc. The lack of consistent findings from previous research suggests that there is a need for continuing empirical research on this topic.

Besides using the measure adopted by previous research (i.e. the adoption or non-adoption of ABC systems) this study also uses alternative proxy measures for identifying the characteristics of product costing systems. The paper examines the extent to which different contextual factors influence the choice of product costing systems using these alternative proxy measures. Thus, the distinguishing feature of the research is that provides the potential for testing the robustness of the contextual factors based on using different proxy measures to identify the characteristics of product costing systems.

The paper consists of nine sections. The next section considers how the characteristics of product costing systems can be classified in terms of their level of sophistication. Section 3 summarizes the previous studies relating to this research and the following section provides a justification for the further research. The research hypotheses are presented in Section 5 and the research design and methods used to measure the variables tested in the research are presented in Sections 6 and 7. Section 8 presents the research findings and the final section contains a discussion of the limitations of the research and the potential for future areas of research.

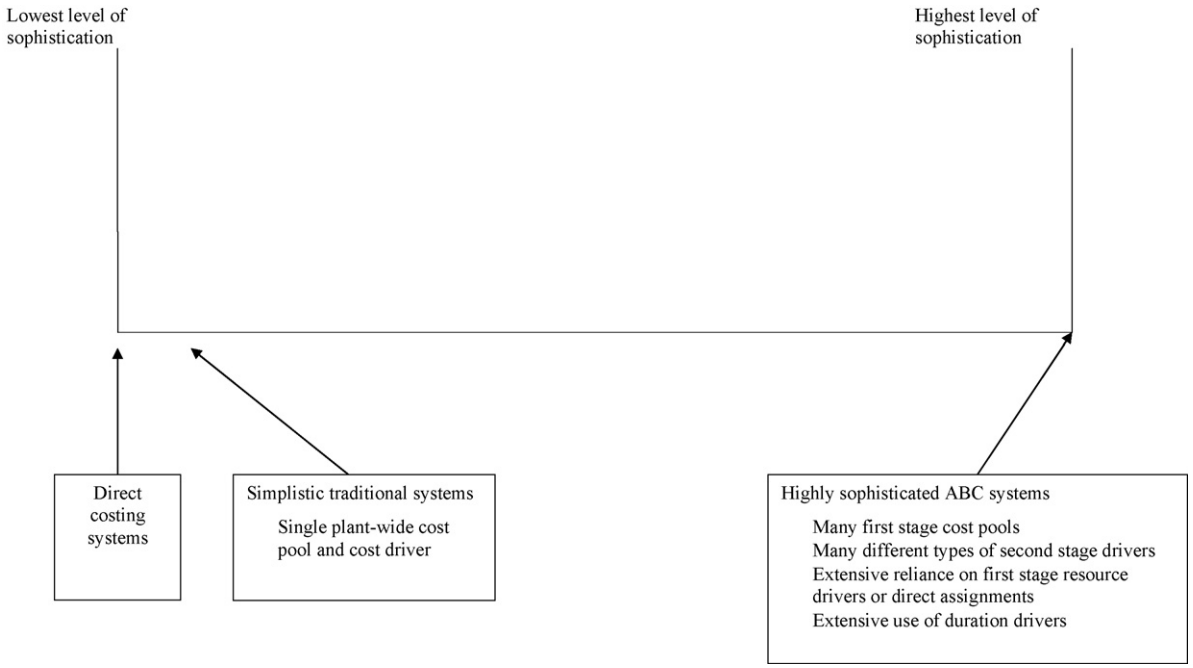

Fig. 1. Dimensions determining the varying levels of cost system sophistication.

2. Classifying product costing systems by their level of sophistication

Product costing system design choices can be viewed as varying along four dimensions: the number of cost pools, the number of different types of cost drivers used in the second stage of the two-stage overhead assignment process, the types of second stage drivers used and the extent to which direct assignments or resource drivers are used in the first stage of the allocation process. Costing systems are classified according to their level of sophistication based on where they fit on a continuum representing the four dimensions for assigning indirect costs.[1] Fig. 1 presents the model we use to classify product costing systems by their level of sophistication.[2]

The most simplistic system is a direct costing system and this is located on the extreme left of the continuum shown in Fig. 1. Moving along the continuum represents different sophistication levels in terms of assigning indirect costs to cost objects. Towards the extreme left are the simplistic systems (e.g. single plant-wide cost pools). Higher levels of sophistication are assumed to be associated with increasing the number of cost pools based on the premise that creating a greater number of cost pools enables the costing system to better capture the variability in cost pool resource consumption by products/services. The second dimension influencing the level of sophistication relates to the number of different types of

[1] Both simplistic and sophisticated costing systems can accurately assign direct costs to cost objects. Cost assignment merely involves the implementation of data processing systems to identify and record the resources consumed by products. The choice of costing system design choices therefore generally applies to the assignment of indirect costs.

[2] The model represents an extension of the method adopted by Abernethy et al. (2001) to evaluate the level of cost system sophistication.

second stage cost drivers that are used. Using a greater variety of cost drivers that are the significant determinants of costs enables cause-and-effect drivers to be established for each cost pool that more accurately measure the resources consumed by cost objects.

The level of cost system sophistication in respect of the third dimension relates to the extent to which transaction or duration drivers are used in the second stage of the allocation process (Kaplan and Cooper, 1998). Transaction drivers are less sophisticated since they assume that the same quantity of resources is required each time an activity is performed. In contrast, duration drivers are more sophisticated since they represent measures based on the amount of time required to perform an activity. Finally, higher levels of sophistication are also achieved by relying more extensively in the first stage of the allocation process on directly assigning costs to each cost pool or using cause-and-effect first stage drivers (i.e. resource drivers).

Costing systems with many cost pools and different types of cost drivers that rely extensively on using direct first stage assignments or resource drivers and second stage duration drivers (e.g. sophisticated ABC systems) would be located at the extreme right of the continuum. Locating costing systems at intermediate and other points along the continuum is more problematic. Generally costing systems that have both a greater number of cost pools and different types of cost drivers can be classified as more sophisticated than those with both fewer pools and types of drivers.[3] Problems arise, however, in determining the order of the location of costing systems along the continuum when comparing systems that have a greater number of cost pools with those that have fewer cost pools but a greater number and variety of second stage drivers.

In summary, the above discussion has identified four dimensions that can be used as a guide for determining the sophistication of product costing systems. Unfortunately, they are not homogenous and cannot be combined. It is thus only possible to rank costing systems as being more sophisticated than others only when the former exceeds the latter in terms all of the four above determinants of sophistication. Alternatively, the sophistication of costing systems can be classified by broad categories such as direct and absorption costing systems or ABC and non-ABC systems. The disadvantage of such categorizations is that they entail only two very broad categories.[4]

Information relating to the above four dimensions is unlikely to be reliably obtainable from postal questionnaire surveys. Only information relating to the number of first stage cost pools and the number of different types of second stage drivers is likely to be reliably obtainable. However, these two determinants do represent the dominant factors in determining the classification of product costing systems (Kaplan and Cooper, 1998). Therefore, to measure the level of cost system sophistication large scale surveys must rely on using either single proxy measures (e.g. the number of cost pools and/or different types of second stage drivers) or broad dichotomous categories, such as ABC adopters or non-adopters, to identify where costing systems are located on the cost system continuum.

The optimal cost system is different for different organizations and is dependent on various contextual factors (Cooper, 1988a). Thus, this research seeks to empirically identify where cost systems are broadly

[3] This is based on the assumption that use of first stage cost drivers and duration/transaction drivers are held constant or have little impact.

[4] For example, the direct costing category incorporates very simplistic systems at the extreme left of the continuum whereas the absorption costing category incorporates a broad range of costing systems varying from simplistic to highly sophisticated. Similarly, if the ABC adoption and non-adoption categories are used the latter category includes levels of cost system sophistication ranging from very simplistic to moderate levels of sophistication.

located along the sophistication continuum shown in Fig. 1 and identify the contextual factors that influence their location along this continuum based on the following proxy measures:

- Number of first stage drivers.
- Number of different types of second stage cost drivers.
- ABC or traditional costing systems.
- Direct or absorption costing systems.

3. Previous studies

The key concept in contingency based research has been the concept of fit whereby contextual factors and aspects of an accounting system must somehow fit together for an organization to be effective. Drazin and Van de Ven (1985) identify two forms of fit relating to structural contingency theory—the selection and interaction approaches. The former examines the relationship between contextual factors and organization structure without examining whether this context-structure relationship affects performance. In contrast, the interaction approach seeks to explain variations in organizational performance from the interaction of organizational structure and context. Thus, only certain designs are expected to give high performance in a given context, and departures from such designs are expected to give lower performance. Given that organizations are assumed to have varying degrees of fit the task of the researcher is to show that a higher degree of fit between context and structure is associated with higher performance.

In terms of management accounting control systems research the vast majority of studies have adopted the selection approach to fit (Chenhall, 2003; Luft and Shields, 2003) whereby characteristics of the accounting system represent the dependent variable. Accounting researchers have justified the selection approach based on the assumption that rational managers are unlikely to use accounting systems that do not assist in enhancing performance (Chenhall, 2003).[5] Where the interaction approach to fit has been adopted, with a measure of organizational performance as the dependent variable, outcome measures such as satisfaction or usefulness of the management control system have been widely used as proxy measures of desired organizational performance.

The literature review relating to product costing contingency research indicated that virtually all of the research has concentrated on contextual factors influencing the adoption or non-adoption of ABC systems. Seven survey-based studies published in the major journals were identified (Bjornenak, 1997; Gosselin, 1997; Krumwiede, 1998; Malmi, 1999; Clarke et al., 1999; Hoque, 2000 and Cagwin and Bouwman, 2002). The first six studies adopted the selection approach to fit and the latter adopted the interaction approach. The most widely used contextual variable has been product diversity, being included in four of the six studies that have adopted the selection approach. The impact of cost structure and size has been examined in three of the six studies. Other variables that have been examined by only one or two of the above studies include the level of competition, quality of information technology, the extent of advanced technologies/practices and competitive strategy. Only one variable (size) has consistently been identified as a significant variable. Product diversity was identified as a significant variable in two of the four studies and cost structure was not a significant variable at the 5% level in the three studies that examined this

[5] Chenhall (2003) also indicates that an alternative view is that managers adopt accounting systems for institutional and political reasons that may be inconsistent with economic reasons.

variable. The interaction study by Cagwin and Bouwman (2002) reported a positive association between the interactions of ABC with business complexity and the use of other initiatives employed concurrently with ABC (e.g. JIT, TQM, BPR etc.) and improvements in return on investment.

The literature review identified only two studies that sought to classify product cost systems by characteristics other than by the discrete alternatives of traditional and ABC systems. The first by Abernethy et al. (2001) adopted an interactive approach to fit. Based on case study research they classified product costing systems by their level of sophistication using data collected from five divisions within two firms in Australia. Four divisions had a low level of sophistication but there was a reasonable level of satisfaction with the information provided by the costing systems at three of the four divisions. The authors attributed this to the 'fit' between the levels of sophistication of the costing system and the contextual factors of cost structure and product diversity. All three divisions had low product diversity and low overhead costs. In the fourth division overhead costs and product diversity were high. Management was dissatisfied with the costing system and the authors attributed this to the lack of 'fit' between the contextual factors and the existing costing system.

The fifth division operated a sophisticated traditional costing system. The users were very satisfied with the costing system. Product diversity was high but this was facilitated by investment in advanced manufacturing technology (AMT) resulting in overhead costs being mainly associated with investment in AMT, which represented facility-sustaining costs. In these circumstances the authors argued that there was little justification for sophisticated ABC systems because the batch-related and product sustaining costs associated with product diversity were low thus reducing the need for incorporating a variety of non-volume-based drivers.

The second study that adopted a broader perspective to classify costing systems was a survey undertaken by Drury and Tayles (2005). A measure of cost system complexity represented the dependent variable. An 8-point scale was used to obtain information relating to the number of cost pools and different types of cost drivers. The two scales were aggregated to subjectively determine a measure of cost system complexity.[6] The contextual variables, derived mostly from single questions, were incorporated into a multiple regression model with the dependent variable being the measure of cost system complexity. Four variables were statistically significant – product diversity, degree of customization, size and corporate sector (the financial and service sectors had significantly higher levels of cost system complexity compared with companies operating in the manufacturing sector).

4. The need for further studies

Previous studies have used different measures for both the dependent and independent variables. Where the adoption or non-adoption of ABC systems has been used as the dependent variable the terms 'adoption' and 'non-adoption' have been subject to different interpretations with some studies defining adoption as actual ABC implementation and others defining it as actual implementation or a desire to implement it. The studies have also generally allowed the respondents to self-specify whether their organization operate an ABC system despite the fact that there is also some disagreement as to whether systems described by survey respondents as ABC are really ABC systems (Dugdale and Jones, 1997; Innes and Mitchell,

[6] Each point on the 8-point scale represented class intervals specifying a range relating to the number of cost pools and different types of cost drivers for the product costing system.

1997). Inconsistent measures have also been used for measuring the independent variables. Most of the studies have used measures derived from a single question for obtaining non-factual data rather than using composite scores derived from multiple questions (Foster and Swenson, 1997).

Apart from the studies by Gosselin and Krumwiede, the ABC studies based on a selection approach to fit have used bivariate statistics to examine whether the difference between adopters and non-adopters were statistically significant. Where the contextual variables are related to each other there is a danger that spurious relationships may be reported. There is a need for tests to be undertaken using higher powered multiple and logistic regression statistical tests that express the unique contribution of each variable by systematically controlling for the impact of other variables in the model.

This research therefore seeks to remedy the above deficiencies. In particular, prior research has adopted a much too simplistic approach to product cost system design. Instead of using only the adoption or non-adoption of ABC systems as a measure of product cost system design this research uses four different measures of cost system sophistication to capture the attributes of the product costing systems. This allows for a more robust test of the relations among the predictor variables and cost system sophistication.

5. Research hypotheses

A literature review was undertaken to identify the potential contextual factors that may influence the level of sophistication of product costing systems. The following contextual factors are examined:

1. Importance of cost information
2. Product diversity
3. Cost structure
4. Intensity of the competitive environment
5. Size of the organization
6. The quality of information technology
7. Extent of the use of innovative management accounting techniques
8. Extent of use of lean production techniques (including JIT techniques)
9. Business sector

5.1. Importance of cost information

Even if sophisticated cost systems could substantially reduce product cost distortions it is unlikely to be helpful unless a firm can actually utilise better cost information in its decision-making process (Cagwin and Bouwman, 2002). Firms mainly relying on cost information for inventory valuation/profit measurement rather than decision-making purposes may rely on less accurate cost information derived from simplistic costing systems (Kaplan and Cooper, 1998). According to Anderson (1995) and Estrin et al. (1994) the differing needs by organizations for accurate cost data for strategic decisions and cost reduction may affect ABC adoption. Factors affecting the decision usefulness of cost information include the firm's use of cost data in pricing decisions, cost reduction efforts and the need for special cost studies. The following hypothesis is therefore tested:

Hypothesis 1 (H1). There is a positive relationship between the importance of cost information and the level of cost system sophistication.

5.2. Product diversity

Product diversity leads to a higher potential for cost distortion and applies when products consume activity resources in different proportions. Greater product diversity requires more sophisticated costing systems to capture the variation in resource consumption by different products. Cooper (1988b) and Estrin et al. (1994) point out that product diversity includes support, process and volume diversity. Support diversity refers to varying support given to each product by various support departments whereas process diversity refers to differences in consumption among all identifiable activities relating to product design, manufacture, and distribution. Volume diversity occurs when products are manufactured in different batch sizes thus affecting how batch level costs should be assigned to products. The more complex the production process the more complex the costing system that is required to model it (Malmi, 1999). Product diversity determines production process complexity resulting in more activities being required to manufacture them. Thus, to measure the resource consumption of different products in a complex setting, sophisticated costing systems are required. Based on the above discussion the following hypothesis is formulated:

Hypothesis 2 (H2). There is a positive association between higher levels of product diversity and the level of cost system sophistication.

5.3. Cost structure

A review of European surveys relating to cost structures of manufacturing companies by Brierley et al. (2001) indicated that direct material costs tend to be higher than indirect costs. They conclude that if indirect costs make up a relative small proportion of total costs in some industries it may not be worthwhile investing in sophisticated accounting methods to allocate indirect costs. Kaplan and Cooper (1998) advocate that firms with high indirect costs should assign these costs using sophisticated systems, since unsophisticated systems are likely to report distorted costs. Conversely, where the proportion of indirect costs is low, direct costing may be appropriate or, if indirect costs are assigned to cost objects, unsophisticated traditional costing systems may not result in the reporting of seriously distorted costs. Thus, the following hypothesis is tested:

Hypothesis 3 (H3). There is a positive association with the proportion of indirect costs within an organization's cost structure and the level of cost system sophistication.

5.4. Intensity of the competitive environment

Studies by Libby and Waterhouse (1996) and Simons (1990) suggest that companies facing intensely competitive market environments tend to employ relatively more sophisticated management accounting systems. These views are also consistent with Khandwalla's (1972) finding of a positive relationship between sophisticated management controls and competition intensity. Bruns and Kaplan (1987) identify competition as the most important external factor for stimulating managers to consider redesigning their costing systems. Cooper (1988b) has also argued that organizations facing fierce competition should implement ABC.

Companies facing intensive competition also have a greater impetus to find ways to differentiate their products and services from those provided by competitors (Guilding and McManus, 2002). This requirement frequently results in a greater number of product and service lines. In addition, it results in differentiation sought through increased customization of products and services in order to meet specific customer desires. In these circumstances companies require sophisticated costing systems to measure accurately the costs of increased variety and customization. They will then be able to ascertain whether the strategy adopted results in the revenues generated exceeding the higher costs associated with the increase in variety and customization. Companies facing relatively intensive market conditions are also likely to have products and services with low profit margins due to pressure to match or under-cut prices charged by competing firms. Thus, there is a greater need for accurate cost systems since there is a danger that inaccurate systems may significantly overcost or undercost products/services to such an extent that they result in incorrect decisions. For example, undercosting may lead to incorrectly continuing with low margin products which are really loss making. Conversely, overcosting may mistakenly result in the discontinuation of reported loss making products or services, which are really generating low profit margins. Thus, organizations facing intense competition have a greater need for accurate cost information. Based on the above discussion the following hypothesis is tested:

Hypothesis 4 (H4). There is a positive association between the intensity of competition and the level of cost system sophistication.

5.5. Size of the organization

Size has been found to be an important factor influencing the adoption of more complex administration systems (Moores and Chenhall, 1994). Previous studies have also noted a positive relationship between company size and the adoption of ABC systems (Innes and Mitchell, 1995; Bjornenak, 1997; Malmi, 1999). A possible reason for this is that larger organizations have relatively greater access to resources to experiment with the introduction of more sophisticated accounting systems. Therefore, the following hypothesis is tested:

Hypothesis 5 (H5). There is a positive relationship between the size of the organization and the level of cost system sophistication.

5.6. The quality of information technology

The chosen level of cost system sophistication should be made on costs versus benefits criteria. Sophisticated costing systems become more beneficial as the cost of data collection and processing is reduced (Cooper, 1988b). The level of information technology can thus play an important role in influencing cost system design. For example, the measurement cost associated with using additional cost drivers depends on whether the data required by that driver is already available or has to be specifically determined. Organizations with high quality information systems can provide detailed data that is easy to access relating to the cost driver information that is needed by more sophisticated costing systems. In general, companies with shared databases that track the detailed operational data needed for resource and activity analysis have an easier time implementing and maintaining ABC (Reeve, 1995; Anderson, 1995). Therefore, the following hypothesis is tested:

Hypothesis 6 (H6). There is a positive relationship between the quality of an organization's information technology and the level of cost system sophistication.

5.7. Extent of the use of innovative management accounting techniques

ABC is often linked to other strategic and business initiatives that are likely to complement and enhance each other, rather than being individually necessary and sufficient for improvement (Cooper and Kaplan, 1991). In particular, studies indicate that improvements in costing systems have been implemented to reconcile management accounting information with other advanced management practices (Anderson, 1995). According to Swenson (1995) linkages with other initiatives provides a ready application for the ABC information. Krumwiede (1998) also reported that firms linked ABC to other improvement initiatives (e.g. target costing, benchmarking of activities and value chain analysis) because of their need for more accurate product/activity costs. Thus, other initiatives may act as catalysts for replacing simplistic costing systems with more sophisticated ones (Innes and Mitchell, 1990). Therefore, the following hypothesis is tested:

Hypothesis 7 (H7). The level of cost system sophistication will be greater in organizations adopting other accounting innovations than the organizations not adopting them.

5.8. Extent of use of lean production techniques (including JIT techniques)

Firms adopting JIT production techniques establish production cells that are dedicated to the manufacturing of a single product or family of similar products. Hence, many of the support activities can be directly traced to the dedicated cells. Therefore, the benefits from implementing sophisticated costing systems may be lower in JIT organizations. Also given that JIT production is oriented towards process and time it is likely to be supported by traditional costing methods that are based on how long the product is in the process

The pursuit of lean production techniques and a JIT philosophy that focuses on eliminating waste or non-value-added activities also motivates firms to derive a better understanding of what is creating the firm's product and support costs and what are the cost drivers. The focus on activity analysis makes the implementation of sophisticated costing techniques based on activity costing and the identification of appropriate cost drivers easier to implement. Based on the conflicting relationship on the impact of lean production techniques the following null hypothesis is formulated:

Hypothesis 8 (H8). There is no relationship between the implementation of lean production techniques and the level of cost system sophistication.

5.9. Business sector

Shields (1997) argues that the design and effectiveness of cost accounting information and systems are conditional on characteristics of industries. The diffusion of innovation literature (Abrahamson, 1991) also implies that organizations within an industry sector may imitate other organizations. Therefore, the imitation process may result in similar accounting systems being adopted within specific business sectors. ABC was initially introduced in manufacturing organizations. Thus, mimicking behaviour suggests

that manufacturing organizations may be more likely to adopt sophisticated costing systems. Kaplan and Cooper (1998), however, suggest that service firms are ideal candidates for ABC, even more than manufacturing firms, because most of their costs are fixed and indirect. In contrast, manufacturing firms can trace important components of costs (i.e. direct costs) to individual products so traditional product costing systems may report reasonably accurate product costs. Both of the above arguments suggest that the level of cost system sophistication may differ between business sectors but it is unclear which sectors would have the more sophisticated systems. The following non-directional hypothesis is therefore formulated:

Hypothesis 9 (H9). The level of cost system sophistication will differ significantly according to the business sector in which an organization operates.

6. Research design and data collection

A postal questionnaire survey was used to gather the data. A random sample consisting of 1000 UK manufacturing/service firm of was chosen from the Financial Analysis Made Easy (FAME) database. Only firms with annual sales exceeding £50 million were selected since the focus was on larger companies that would be likely to have an established management accounting function. The membership database of the Chartered Institute of Management Accountants (CIMA) was used to assist in identifying potential respondents within the selected FAME sample. An attempt was made to match the 1000 firms with the CIMA database. This resulted in the identification of 534 firms where named individuals were identified operating within the management accounting function but the remaining 466 questionnaires were addressed to the Finance Director with the instruction that the questionnaire should be completed by the head of the management accounting function.

A total of 384 questionnaires were returned from the sample of 1,000 companies consisting of 176 completed and usable questionnaires and 208 uncompleted. This yielded a usable response rate of 19.6% based on the method recommended by De Vaus (1990).[7] Details relating to the respondents' business sector and annual sales turnover are presented in Table 2.[8]

Respondents were asked to complete the questionnaire from the perspective of the business unit where they were employed. The justification for this is that the features of costing systems and contextual factors may differ between business units in large companies. For example, one business unit may have low product diversity and low overhead costs thus resulting in a simplistic costing being appropriate. In contrast, another business unit within the same company may engage in different activities and have high product diversity and overhead costs resulting in a more sophisticated costing system being appropriate.[9] It was

[7] The 208 non-respondents consisted of 102 indicating that either the company had ceased to exist or the company no longer employed the respondent and 106 specifying lack of time or it was not company policy to participate in surveys. The usable response rate was derived as follows:
$176/(1000 - 102) = 19.6\%$.
Low response rates appear to be a feature of recent product costing surveys. Ittner et al. (2002) and Cagwin and Bouwman (2002) respectively reported response rates of 11% and 21.2%.

[8] Approximately 80% of the responses were received from the 534 questionnaires mailed to a named CIMA member. Thus the mailing of 466 questionnaires to unnamed individuals had a detrimental impact on the response rate.

[9] The study by Abernethy et al. (see Section 3 of this paper) described how the costing systems differed, in terms of their level of sophistication, between different divisions in the same company. Also, 57% of the respondents to this survey indicated that the costing system was only applicable to the business unit where they were employed.

not possible to undertake non-response bias tests relating to comparing demographic data for respondents and non-respondents as no data were available at the business unit level. Respondents provided details relating to their business units (e.g. annual sales turnover, number of employees, types of business activities undertaken) but this frequently differed from the information contained for the company as a whole in the FAME database. Thus, it was inappropriate to compare respondents demographic data (based on business unit responses) with those of non-respondents (based on the company as a whole recorded in the FAME database).

The initial mailing of the questionnaire resulted in 83 usable responses and the first and second reminders respectively resulted in 46 and 18 usable responses. Thus, after the second reminder stage a total of 147 usable responses were received. The analysis of the respondents indicated that 22 of the responding organizations (15%) were ABC users. Given that the research sought to examine the influence of contextual factors on ABC adoption and sophisticated costing systems it was considered that the aims of the research could not be achieved based on responses from only 22 ABC adopters. [10]

In order to increase the number of respondents using sophisticated costing systems we obtained the assistance of a UK firm of ABC consultants. They agreed to mail the questionnaire to their clients and this process resulted in the receipt of a further 29 responses from ABC adopters. All of the 29 respondents were included in the FAME database[11].

The responses of the 22 ABC adopters obtained from the initial, first and second reminder mailings were compared with the 29 ABC adopters obtained from the ABC consultants for all of the variables used in this research. There were no significant differences in the responses between these two groups of ABC adopters. A non-response bias test, based on the assumption that later respondents more closely resemble non-respondents was undertaken, by comparing the responses of the initial mailing ($N = 83$) with the responses from the reminder mailings ($N = 64$) in respect of all of the dependent and independent variables used in the research.[12] There was no evidence of non-response bias.

7. Measurement of the variables

Objective data were used for size, cost structure and business sector. Size was measured using the annual sales turnover (£ million) for the respondents' business unit. The cost structure of the business unit was measured by indirect costs as a percentage of total costs and the respondents were asked to indicate which of six business sectors applied to their business unit. The other independent variables of interest required the use of perceptive measures and thus multi-question Likert-type seven point scales were used to derive composite scores for each variable. Where possible the measures were based on prior literature. Details specifying the number of questions used and Cronbach's Alpha for the independent variables are shown in Table 1.[13]

[10] The initial analysis of the responses also indicated that only a very small number of respondents would be located within the sophisticated region at the extreme right of the sophistication continuum presented in Fig. 1. Therefore, there was a danger that the statistical analysis would not identify the factors influencing the costing system for such a small number of organizations.

[11] The firm of consultants were not prepared to provide us with a list of their clients and they insisted on mailing the survey. They were provided with 50 copies of the questionnaire and this process yielded 29 responses.

[12] In addition, the responses from the initial mailing were also compared with the responses from the second reminder ($N = 18$). There was no evidence of non-response bias.

[13] The complete questionnaire is available on request from the corresponding author.

Table 1
Details of the independent variables used in the research[a]

Independent variables	Number of questions used	Cronbach's Alpha
Size	1	Objective measure
Cost structure	1	Objective measure
Business sector	1	Objective measure
Importance of cost information	4	0.62
Quality of information technology	4	0.77
Extent of use of innovative management accounting techniques	7	0.76
Intensity of the competitive environment	4	0.87
Extent of use of lean production techniques	6	0.78
Product diversity		
Volume diversity	2	0.75
Support diversity	2	0.53

[a] *Note*: A complete version of the questionnaire is available from the corresponding author.

The exploratory factor analysis showed a one factor solution for all of the independent variables derived from multiple questions apart from product diversity. Four questions were used to measure product diversity. Two factors emerged from the factor analysis with loadings greater than 0.4 that explained 74% of the variance. Two questions that were concerned with volume diversity loaded on to one factor and the remaining two relating to support diversity loaded on to the other factor. These factors were therefore respectively labeled volume diversity and support diversity. Cronbach's alpha for the latter item (0.53) is marginally below the minimum acceptable level of 0.60 suggested by Hair et al. (1998) but above the minimum of 0.5 suggested by Nunnally (1978).[14]

Four different measures were used as a proxy for the dependent variable for determining the level of cost system sophistication. First, two dichotomous variables were used to measure the level of cost system sophistication. ABC adopters were categorized as sophisticated systems and non-ABC adopters were categorized as non-sophisticated systems. A question, adapted from Krumwiede (1998), was used to identify which of nine different stages towards ABC implementation best described the business unit's current situation and thus identify whether organizations were ABC adopters or non-adopters.[15] The second measure for the dependent variable focused on the number of cost pools (centres) used in the first stage of the two-stage allocation process and the third measure used the number of different types of second stage cost drivers. Respondents were requested to insert the number of cost centers/cost pools that were used in the first stage of the two-stage allocation process to assign indirect costs to products or services. Information for the third measure was derived from a question that requested the respondents to insert how many different types of overhead allocation bases were used in the second stage of the two-

[14] Taking into account that Cronbach's alpha is sensitive to the number of items, and that alpha provides conservative results for scales with a few items, it was decided to use a composite score for support diversity. This is consistent with Hair et al.'s assertion that as Cronbach's alpha has a positive relationship with the number of items within the scale. Thus, researchers can rely on less stringent reliability measurements for scales consisting of a few items.

[15] The following are examples of the different stages included in the question—ABC has not been seriously considered (stage 1), ABC has been considered but not approved (stage 2) and ABC has been implemented and is generally accepted (stage 9)

Table 2
Information relating to the respondents' business sector and annual sales turnover

	Number of Cases (*N*)	Percentage (%)
Business sector		
Manufacturing	91	52
Financial and commercial	22	12
Retail	9	5
Service	40	23
Conglomerate	0	0
Other	14	8
	176	100
Annual sales turnover		
Less than £ 25 m[a]	6	3
£26-£50 m[a]	19	11
£51-£75 m	19	11
£76-£100 m	30	17
£101-£200 m	26	15
£201-£300 m	30	17
Over £300 m	46	26
Total	176	100

[a] *Note*: Because the respondents were asked to complete the questionnaire from the perspective of the business units where they were employed the annual sales revenues for some of the business units shown in Table 2 is below the minimum sales turnover of £50 million used to select the sample from the FAME database. As indicated in Section 6 the annual sales turnover in the FAME database was recorded at the group level.

stage allocation process.[16] Finally, the fourth measure compared the results with the dependent variable being categorized by dichotomous variables represented by direct costing and absorption costing systems. To ascertain whether absorption or direct costing systems were used respondents were asked to indicate whether or not their costing systems assigned indirect costs to products or services.

8. Research findings

The descriptive statistics relating to the research findings are presented in Tables 2–6. Table 2 indicates that 52% of the respondents were employed in the manufacturing sector and the remainder in the non-manufacturing sector.[17] An analysis of total costs by business sectors is presented in Table 3. This table indicates that the average direct and indirect costs for all organizations were respectively 69% and 31%. Manufacturing units have a significantly larger percentage of direct costs (75%) and financial and

[16] Detailed examples were provided for the questions relating to the number of cost pools and different types of overhead allocation bases in order to ensure that the respondents fully understood what information was required.

[17] The non-manufacturing sector accounts for more than 48% of UK gross domestic product and the lower proportion of non-manufacturing organizations included in this survey is likely to be attributed to the fact that the sample omitted organizations whose objectives were not profit making. Most of the organizations (e.g. municipal authorities and public sector organizations) within this category are likely to operate in the service (non-manufacturing) sector.

Table 3
Average cost structure as a percentage of total costs analysed by business sectors

	Manufacturing	Financial and commercial	Service	Retail and other	Total
Direct materials	52.2				
Direct labour	14.0				
Direct non-manufacturing costs	8.7				
Indirect manufacturing costs	10.3				
Indirect non-manufacturing costs	14.8				
Total direct costs—mean/(standard deviation)	74.9 (13.9)	49.0 (23.9)	68.1 (25.6)	66.4 (18.5)	69.1 (19.1)
Total indirect costs—mean/(standard deviation)	25.1 (13.9)	51.0 (23.9)	31.9 (25.6)	33.6 (18.5)	30.9 (19.1)
N	87	20	39	20	166

Table 4
Analysis of costing systems by business sectors

Business sector	% ABC adoption	% Traditional absorption costing	% Direct costing systems	% No formal costing system	*N* (%)
Manufacturing	20	52	21	7	91 (52%)
Financial and commercial	68	9	9	14	22 (12%)
Retail and other	22	26	35	17	23 (13%)
Service	33	17	28	22	40 (23%)
Total (%)	29	35	23	13	100%
Total (*N*)	51	62	40	23	176

commercial organizations have a significantly higher proportion of indirect costs (51%).[18] Tables 4 and 5 provide an analysis of the types of costing systems used by business sectors and sales turnover. Both tables indicate that the following types of costing systems were used:

- Traditional absorption costing systems (35%; $N=62$).
- ABC systems (29%; $N=51$). [19]
- Direct costing systems (23%; $N=40$).
- No formal costing systems (13%; $N=23$).

Table 4 indicates that 68% of the organizations within the financial and commercial sector compared with 20% in the manufacturing sector have implemented ABC systems. Table 5 indicates that 53% of the smallest firms (annual sales of less than £100 million) have either no formal costing systems or

[18] A *t*-test was performed comparing the differences between the responses for the percentage of indirect costs for financial and commercial organizations ($N=20$) and the remaining organizations ($N=146$). The results were significant at the one per cent level (two-tailed) level of confidence. In addition, the *t*-test was also performed to examine the differences in the responses for the cost structures between the manufacturing ($N=87$) and the non-manufacturing ($N=79$) organizations. The results were also significant at the one per cent level (two-tailed) of confidence.

[19] The adoption rate of 29% is likely to represent an over estimate of ABC usage because of the inclusion of 29 ABC adopters derived from the firm of ABC consultants (see Section 6 for an explanation). Care should therefore be taken in generalising the findings relating to ABC adoption rates. The adoption rate (without including the responses from the ABC consultants) was 15% and is likely to represent a more reliable estimate of ABC adoption.

Table 5
Analysis of costing systems by annual sales turnover

Annual sales revenue (£ million)	% ABC adoption ($N=51$)	% Traditional absorption costing ($N=62$)	% Direct costing systems ($N=40$)	% No formal costing system ($N=23$)	N (%) ($N=176$)
< £100 m	12	35	30	23	74 (42%)
£100 m–£300 m	39	34	23	4	56 (32%)
Over £300 m	43	37	11	9	46 (26%)
Total (%)	29	35	23	13	176
Mean (£ million)	995	309	188	105	
Standard deviation (£ million)	2,093	471	327	90	

Table 6
Cross tabulation table (cost pools by cost drivers)

	Number of cost drivers							
	1	2	3	4	5	6	7-10	Over 10
	N %[a]	N %	N %	N %	N %	N %	N %	N %
1 cost pool (N = 5)	5 (4.5)							
2-3 cost pools (N = 5)	2 (1.8)	1 (0.9)	2 (1.8)					
4-5 cost pools (N = 7)	5 (4.5)	1 (0.9)		1 (0.9)				
6-10 cost pools (N = 19)	7 (6.2)	4 (3.6)	3 (2.7)	4 (3.6)	1 (0.9)			
11-20 cost pools (N = 20)	3 (2.7)	2 (1.8)	4 (3.6)	3 (2.7)	4 (3.6)	2 (1.8)	2 (1.8)	
21-30 cost pools (N = 19)	4 (3.6)	1 (0.9)	2 (1.8)	2 (1.8)	2 (1.8)		7 (6.3)	1 (0.9)
31-50 cost pools (N = 27)	2 (1.8)	2 (1.8)	4 (3.6)	2 (1.8)	3 (2.7)	1 (0.9)	9 (8)	4 (3.6)
Over 50 cost pools (N = 10)	2 (1.8)				3 (2.7)	1 (0.9)	1 (0.9)	3 (2.7)
Total (N = 112)	30 (27)	11 (10)	15 (13)	12 (11)	13 (12)	4 (4)	19 (17)	8 (7)

[a]*Note*: The numbers in the parentheses relate to the number of individual observations (N) expressed as a percentage of the total number of observations.

operate only direct costing systems. The corresponding percentage for the largest companies (annual sales exceeding £300 million) is 20%. Table 5 also indicates that 43% of the largest firms compared with 12% of the smallest firms had adopted ABC systems.

Table 6 presents a cross tabulation table and frequency distributions for the number of cost pools and the different types of second stage cost drivers in respect of 112 of the 113 respondents that operated absorption costing systems. The shaded area in the lower right hand corner represents the more sophisticated costing systems in terms of the number of cost pools and different types of drivers and those towards the top left hand corner the least sophisticated systems. Of the 50 companies that are located in the shaded area 45 out of the 46 companies currently using ABC were located in this area.[20] In addition, the number of cost pools and different types of cost drivers was significantly higher for ABC users compared with non-users (p-value using the t-test < .01, two-tailed). Therefore, the analysis suggests that those respondents that claim that their organizations have implemented ABC 'really' are ABC adopters.

[20] Of the 51 companies that had adopted ABC 46 were currently using ABC and 5 were in the process of implementing it.

In order to test the hypotheses specified in Section 5 the following model was applied in respect of the four different measures of the dependent variable:

$$Y = b_1 + b_2\text{COSTIMP} + b_3\text{SUPDIV} + b_4\text{VOLDIV} + b_5\text{INDCOST} + b_6\text{COMPET} + b_7\text{SIZE} + b_8\text{ITQUAL} + b_9\text{INOVMAT} + b_{10}\text{SERV} + b_{11}\text{FIN} + b_{12}\text{RETAIL} + e$$

where Y: level of cost system sophistication using the four measures described at the end of Section 7 to measure the dependent variable; COSTIMP: importance of cost information; SUPDIV: support diversity; VOLDIV: volume diversity; INDCOST: indirect costs as a percentage of total costs; COMPET: intensity of the competitive environment; SIZE: size measured by annual sales turnover logarithmically adjusted for the observed non-linearity; ITQUAL: quality of information technology; INOVMAT: extent of the use of innovative management accounting techniques; SERV: service sector, dummy variable set equal to 1 if company is in service sector, otherwise zero; FIN: finance sector, dummy variable set equal to 1 if company is in finance sector, otherwise zero; RETAIL: retail sector, dummy variable set equal to 1 if company is in retail sector, otherwise zero.

The variable 'the extent of lean production techniques (including JIT techniques)' is excluded from the above regression equation since this variable is only applicable to manufacturing organizations.[21] The first of the four measures of the dependent variable classifies the dependent variable in terms of the dichotomous variable of ABC adoption and non-adoption. Therefore, logistic regression is used and the applied to the 153 companies that had established formal costing systems as shown in Table 4. The above model contains 11 independent variables (including 3 dummy variables).[22]

Table 7 presents the results of the logistic regression. The final two columns of the table present the collinearity statistics. It can be seen the variance inflation factors well below the generally accepted critical threshold of 10 (an indication of high levels of multicollinearity) and the tolerances are above 0.2 (tolerances below 0.2 represent a more conservative estimate that multicollinearity may be a problem). Table 8 also presents a correlation matrix for the independent variables. None of the correlation coefficients are high thus suggesting that multicollinearity is not an issue. Table 7 indicates that the following variables are statistically significant:

Importance of cost information ($p < .01$).
Intensity of the competitive environment ($p < .01$).
Size measured by annual sales turnover ($p < .01$).
Extent of the use of innovative management accounting techniques ($p < .01$).
Finance sector; dummy variable ($p < .01$).
Service sector; dummy variable ($p < .05$).

A positive sign for the logistic regression coefficient indicates that the variable is positively related to ABC adoption whereas a negative sign indicates that as the variable increases, an organization is less

[21] The results relating to this variable are reported later in this section.

[22] Green (1991) proposed a general rule of thumb for determining the minimum sample size to test the R^2 and significance tests on the regression coefficients. He suggested that the minimum sample should be greater than $50 + 8k$ for the former and greater than $104 + k$ for the latter, where k is equal to the number of independent variables. Therefore, the sample of 153 respondents exceeds the minimum requirements specified by Green for applying regression models.

Table 7
Logistic regression analysis with the dichotomous variable ABC/non-ABC as the dependent variable ($N = 153$)

	Expected sign	*B* (Logistic coefficient)	Standard error	*p*-values[a]	Exp. B	Collinearity statistics tolerance	VIF
Volume diversity	+	−.032	.177	.427	.968	.756	1.322
Support diversity	+	−.244.	.190	.100	.783	.870	1.150
Intensity of the competitive environment	+	.479	.229	.002	1.620	.695	1.439
Quality of information technology	+	−.234	.194	.114	.791	.800	1.250
Importance of cost information	+	1.272	.359	.000	3.569	.781	1.281
Extent of use of innovative management accounting practices	+	.556	.226	.007	1.744	.794	1.259
Size (Annual sales in £ million)	+	.854	.250	.000	2.350	.785	1.274
Cost structure (% of indirect costs)	+	−.013	.014	.172	.987	.805	1.242
Financial sector dummy variable	Non-directional	2.864	.886	.001	17.529	.638	1.567
Retail and other sector dummy variable	Non-directional	.555	.727	.223	1.743	.787	1.271
Service sector dummy variable	Non-directional	1.239	.625	.047	3.452	.860	1.163
Intercept	−9.182	2.408	2.466	.000			
Chi-square			.000				
Cox and Snell R square			.371				
Hosmer and Lemeshow goodness of fit			.574				
Nagelkerke *R* square			.515				
Per cent correctly classified			83%				

[a] *Note*: *p*-values are two-tailed for the dummy variables and one-tailed for the remaining variables.

likely to adopt ABC.[23] All of the significant variables listed above are in the direction predicted. The Chi-square statistic shown in Table 7 is comparable to the overall *F*-test in multiple regression. The model is statistically significant at the .000 level. The Hosmer and Lemeshow goodness of fit value (.574) measures the correspondence of the actual and predicted values of the dependent variable. This statistic tests the hypothesis that the observed data are significantly different from the predicted values. Thus, a non-significant statistic indicates that the model does not differ significantly from the observed data (Hair et al., 1998).[24] Nagelkerke R^2 (.515) attempts to quantify the proportion of explained "variation" in the logistic regression model. It is similar in intent to the R^2 in a linear regression model (Norusis, 2000).

[23] Exp B shown in the final column of Table 7 is an indicator of the change in odds resulting from a unit change in the indicator. Values greater than 1 indicate that as the predictor increases, the odds of the outcome occurring increase; conversely, a value less than one indicates that as the predictor increases, the odds of the outcome occurring decrease. This is consistent with the signs of the regression coefficients.

[24] In other words, if the *p*-value is large, the model fits the data well, whereas a *p*-value that is smaller than alpha indicates a lack of fit.

Table 8
Spearman correlation matrix for the independent variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Volume diversity	1.000	.092	.302**	.045	.156	.031	.222**	.159*	.175*	.072	−.128	−.163*
2. Support diversity		1.000	−.031	−.185*	−.024	−.022	.148*	.165*	−.166*	−.172*	−.017	.076
3. Intensity of the competitive environment			1.000	.078	.319**	.047	−.168*	.041	.010	.250**	−.171*	−.072
4. Quality of information technology				1.000	.253*	.184*	−.172*	−.098	.131	−.190	.022	−.024
5. Extent of use of lean production techniques (including JIT)					1.000	.222*	.176	.056	.034	.159	−.170	.013
6. Extent of use of innovative management accounting techniques						1.000	.142	.016	−.032	.160*	−.077	−.025
7. Size (Annual sales turnover)							1.000	.127	−.080	.244**	−.056	−.051
8. Average % indirect costs								1.000	−.170*	.245**	.065	−.043
9. Manufacturing sector dummy variable									1.000	−.391**	−.401**	−.561**
10. Financial sector dummy variable										1.000	−.147	−.205**
11. Retail sector dummy variable											1.000	−.210**
12. Service sector dummy variable												1.000

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 9
Multiple regression analysis with the number of cost pools as the dependent variable ($N = 153$)

	Unstandardized coefficients		Standardized coefficients	t	Significance (p-value)
	B	Standard error	Beta		
(Constant)	−1.215	12.096		−.100	.920
Volume diversity	.700	1.040	.057	.673	.251
Support diversity	.253	1.037	.019	.244	.404
Intensity of the competitive environment	4.399	1.322	.292	3.327	.001
Quality of information technology	−.690	1.189	−.048	−.581	.281
Importance of cost information	3.221	1.578	.169	2.041	.021
Extent of use of innovative management accounting practices	1.417	1.363	.085	1.040	.150
Size (annual sales in £ million)	4.159	1.201	.286	3.463	.001
Cost structure (% of indirect costs)	−.012	.081	−.012	−.147	.442
Financial sector dummy variable	11.154	5.157	.198	2.163	.032
Retail and other dummy variable	−4.524	4.644	−.080	−.974	.332
Service sector dummy variable	1.366	3.646	.030	.375	.708

R square, .24; adjusted R square, .19; F, 4.123; significance ($p = 0.000$).
Note: p-values are two-tailed for the dummy variables and one-tailed for the remaining variables.

The final entry in Table 7 indicates that the model correctly classified 83% of the respondents as ABC adopters or non-adopters.[25]

The second and third measures classify the level of cost system sophistication in terms of the number of cost pools and different types of cost drivers being the dependent variables.[26] Both of these dependent variables were measured on an interval scale so multiple regression was used. The results of the multiple regression analysis are presented in Table 9 for the number of cost pools and Table 10 for the number of different types of cost drivers. Reference to these tables indicates that the following variables were significant for both dependent variables:

- Importance of cost information ($p < .05$ for number of cost pools and $p < .01$ for number of different types of cost drivers).
- Intensity of the competitive environment ($p < .01$ for both dependent variables).
- Size ($p < .01$ for both dependent variables).
- Financial sector ($p < .05$ for both dependent variables).

[25] It should also be noted that the differences in the responses for ABC adopters and non-adopters were also examined based on bivariate analysis using either the Mann–Whitney or t-tests. The results were identical to those reported for logistic regression in terms of the same variables being significant or non-significant for both tests. The above analysis compared ABC adopters ($N = 51$) with non-adopters that operate formal reporting systems ($N = 102$). Thus, those organizations not operating a formal costing system ($n = 23$) were excluded from the analysis. The latter group were, however, also incorporated in a separate logistic regression analysis within the non-ABC adopters category (N = 102 + 23) but there were no differences in the outcomes in terms of the significant and non-significant variables.

[26] The number of cost pools and cost drivers were coded as zero for organizations operating a direct costing system.

Table 10
Multiple regression analysis with the number of different cost drivers as the dependent variable ($N = 153$)

	Unstandardized Coefficients		Standardized Coefficients	t	Significance (p-value)
	B	Std. Error	Beta		
(Constant)	−1.005	2.445		−.411	.682
Volume diversity	−.118	.210	−.047	−.564	.287
Support diversity	−.159	.210	−.058	−.758	.225
Intensity of the competitive environment	.684	.267	.220	2.558	.006
Quality of information technology	−.307	.240	−.103	−1.277	.102
Importance of cost information	1.039	.319	.265	3.256	.001
Extent of use of innovative management accounting practices	.374	.276	.109	1.358	.088
Size (annual sales in £ million)	.931	.243	.311	3.836	.000
Cost structure (% of indirect costs)	.006	.016	.031	.387	.350
Financial sector dummy variable	2.102	1.043	.181	2.016	.046
Retail and other dummy variable	.564	.939	.049	.601	.549
Service sector dummy variable	.043	.737	.005	.059	.953

R square, .27; adjusted R square, .22; F, 4.805; significance (p-value = 0.000).
Note: p-values are two-tailed for the dummy variables and one-tailed for the remaining variables.

The overall model was significant for both models (F ratio p-value = .000) with respective adjusted R^2 of .19 (cost pools) and .22 (cost drivers).[27]

Table 4 indicates that 40 organizations operated a direct costing system compared with 113 that operated an absorption costing system The fourth measure of cost system sophistication therefore used these two dichotomous variables in a logistic regression model. The model correctly classified 78% by the two categories but only the importance of cost information and size were significant (both at the 1% level).[28]

Hypothesis 8 relating to lean production techniques (including JIT techniques) only applied to manufacturing organizations ($N = 91$). Because the sample size failed to meet the criteria relating to the minimum size for multivariate analysis specified by Green (1991) non-parametric bivariate statistics were used to test H8. The ABC adopters had a significantly higher level of usage of JT/lean production techniques compared with non-ABC adopters ($p < .01$ two-tailed). The mean composite scores for the 7-point variable for ABC adopters and non-adopters were respectively 4.98 (S.D. = 0.96) and 4.01 (S.D. = 1.05). There was no significant correlation between the number of cost pools and JIT/lean production techniques at the 5% level but at the 10% level (two-tailed) the correlation was significant ($r = .18$, $p = .09$).[29]

[27] The model was also applied to all of the respondents thus including the 23 organizations that did not operate a formal costing system. This group was coded zero for the number of cost pools and drivers. The results were identical to those obtained when the analysis was restricted to only those organizations operating a formal costing system ($N = 153$).

[28] The differences in the responses between the two groups were also examined based on bivariate analysis using either the Mann–Whitney or t-tests. The results were identical to those reported for logistic regression in terms of the same variables being significant or non-significant for both tests.

[29] A comparison between absorption and direct costing users indicated that there were no significant differences in the responses relating to the usage of JIT/lean production techniques.

It is also apparent from Table 4 that 23 organizations did not operate a formal costing system. Given the small number of firms not having formal costing systems it was considered inappropriate to use logistic regression. However, the differences in the scores between the two groups were examined using either Mann–Whitney or the *t*-tests for each of the selected contextual variables. The statistical output indicated that firms operating formal costing systems had significantly greater levels of support diversity, volume diversity, annual sales and proportion of indirect costs and also attached greater importance to cost information ($p < .05$).

9. Discussion and conclusion

Prior research has provided inconsistent findings relating to factors influencing the nature of product costing systems. Weak measures have been used for both the dependent and the independent variables. This study has sought to overcome these weaknesses by using composite scores derived from multiple questions, and where ABC adoption has been used as the dependent variable, evidence has been provided that firms claiming to be ABC adopters are really likely to be ABC adopters. Instead of using only the adoption or non-adoption of ABC systems as a dependent variable this study has used four different measures thus enabling more robust tests of the relations among the predictor variables and the dependent variable. Multiple and logistic regression, rather than bivariate statistical tests, were mostly used to test the hypotheses.

Evidence was presented to support the acceptance of six of the nine hypotheses presented. The importance of cost information and size were significant variables using all of the four dependent variables and the extent of the intensity of competition and the financial sector were significant for three of the methods. The use of other innovative management accounting techniques and the service sector were significant only for distinguishing between ABC and non-ABC adopters. The use of lean production techniques and JIT also had a positive significant influence on the adoption of ABC.[30]

The quality of information technology, product diversity and cost structure were not significant variables for any the four dependent variable measures. The latter two variables, however, were significant in distinguishing between those firms that operated and those that did not operate formal costing systems. In terms of information technology, their reduced costs in recent years have resulted in its widespread availability and adoption by all types of companies. Thus, the quality of information technology may no longer a barrier to implementing more sophisticated costing systems. The lack of significance of product diversity and cost structure for any of the four dependent variable measures is surprising given that both of these variables are often presented in the literature as being the dominant motives for implementing sophisticated costing systems. It is possible that the questionnaire used too simplistic measures that failed to take into account the precise ways that they influence the level of cost system sophistication.

Besides attempting to improve the methods of measuring the variables future research should consider incorporating other important variables that have been omitted from this and other studies but which are likely to influence cost system design. The most notable omitted variables are organizational variables such as top management support, resistance to change by preparers and users of accounting information,

[30] Instead of using three dummy variables for business sector in the regression models, analyses were also undertaken using only one dummy variable for the non-manufacturing sector. The analyses indicated that the non-manufacturing sector was only significant for the 'ABC/non ABC adoption' dependent variable.

lack of relevant employees skills and the lack of a perceived need by senior managers or the management accounting function to develop more sophisticated systems.

Case study research may be a more appropriate research method for examining how organizational factors influence cost system design and also for providing greater insights into how the contextual variables relating to cost structure and product diversity affect the level of cost system sophistication. The case study research by Abernethy et al. (2001) provides some insights as to why the measures of product diversity and cost structure used in this survey may not have captured the complexities relating to their potential impact on cost system design. They found that in one of the organizations studied that high product diversity was accompanied with investment in advanced manufacturing technology (AMT) in order to cope with this diversity. The effect of this investment was to convert the costs associated with offering greater diversity into facility sustaining costs, thus reducing the significance of batch or product sustaining costs. Facility sustaining costs cannot be specifically identified with the individual products. In these circumstances high levels of product diversity may not be associated with more sophisticated costing systems. Conversely, if high product diversity is not accompanied by investment in AMT product diversity will be reflected in high levels of batch-related and product-level costs and sophisticated costing systems have the potential to more accurately measure the consumption of these costs by products. Thus, more appropriate measures of product diversity should attempt to capture specific aspects of diversity that focus on the consumption of batch and product-related activities rather than focusing on product diversity as a whole. Similarly the impact of cost structure on cost system sophistication may be related to the level of batch-related and product-level overhead costs rather than total overhead costs (that incorporate facility-sustaining costs) that was used in this study.

Case studies could be undertaken in different firms that have varying levels of sophistication. Such studies should describe and assess the levels of sophistication drawing off the four dimensions described in Section 2 of this paper and seek to explain the factors determining the differences in the observed levels of sophistication. Case study research thus has the potential to provide a richer insight into explaining why, and under what circumstances, some organizations adopt simplistic systems and others do not. The precise factors identified by case study research could be then tested by means of a mail survey to ascertain whether they are generalizable to a large number of firms.

There is the potential for future product costing contingency research to adopt the interaction approach to fit by incorporating an appropriate outcome measure as the dependent variable. Using measures of organizational performance may prove to be problematic because of the difficulty in extracting the effects of adopting different product costing systems on performance from other events that may be associated with performance. Instead, outcome measures relating to satisfaction or usefulness might be used as proxy measures of desired organizational performance. Thus, future research could seek to identify the extent to which the fit between the contextual factors and the level of cost system sophistication is related to satisfaction with the costing system.[31]

The questionnaire did include a measure of satisfaction relating to the respondents' satisfaction with the accuracy of assigning indirect costs to products/services. The ABC adopters had a significantly higher satisfaction score than the non-adopters ($p < .01$, two-tailed) with 69% of the former and 35% of the latter scoring above the neutral score of 4 on the 7-point scale. There was also a positive significant

[31] If this approach is adopted researchers would need to provide a compelling theory to show how the fit between the contextual factors, cost system sophistication and satisfaction enables managers to take more effective decisions that enhances performance (Chenhall, 2003).

correlation between the number of different types of cost drivers and the satisfaction score ($r = .321$, $p < .01$, two-tailed).[32]

Besides the above limitations the analysis was biased in terms of the including ABC adopters derived from a firm of management consultants.[33] Therefore, the ABC adoption rate and any of the contextual variables associated with ABC are likely to be overstated and thus the findings cannot be generalized in terms of these variables. Instead the findings should be viewed as providing insights into factors influencing the level of cost system sophistication only in the companies that were incorporated in this study. Thus, it may be appropriate to view the findings in a similar manner to case studies in terms of generalizing the findings. Improved generalizability may be obtained by undertaking replication studies based on a larger number of responses. Our research indicates that costing systems and contextual factors differ between business units in large companies. Future research should therefore focus on costing systems at the business unit level but at this level undertaking non-response bias tests may be problematic because of the absence of accessible databases at the business unit level.[34]

Despite the above limitations this study has provided additional insights into areas relating to factors influencing the level of sophistication of product cost accumulation systems and extended the scope of future research. Considerable efforts have been taken to minimise the limitations and remedy the deficiencies of previous studies. It is hoped that this paper will motivate researchers to undertake further research in the areas suggested.

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[32] Given that the measure of satisfaction was derived from a single question it was considered inappropriate to investigate the fit between the contextual factors, cost system sophistication and satisfaction. Nevertheless, the simplistic positive relationships reported above suggest that developing better measures of cost system satisfaction derived from multiple questions may be appropriate as an input for future studies based on an interaction approach to fit.

[33] Analyses were also conducted omitting the 29 responses for the ABC adopters obtained from the management consultants. The findings were the same as those reported in the paper apart from the intensity of competition variable. This variable was reported as being significant at the 1% level when the 29 responses were included. However, when the 29 responses were omitted the variable was significant at the 10% level instead of the 1% level.

[34] A possible solution may be to ask the non-respondents to complete a very short questionnaire relating to demographic factors and compare these factors for respondents and non-respondents.

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