

An Examination of the Factors Influencing the Level of Consideration for Activity-based Costing

John A. Brierley

Management School, University of Sheffield, 9 Mappin Street,
Sheffield, S1 4DT, United Kingdom

Tel: 44-114-222-3431 E-mail: j.a.brierley@sheffield.ac.uk

Abstract

Prior research into the extent to which operating units have considered activity-based costing (ABC) has either examined the extent to which operating units have considered or not considered ABC. This paper uses logistic ordinal regression analysis to examine the impact of the level of competition, product customization, manufacturing overhead costs and operating unit size on the level of consideration for ABC when measured on a three-point ordinal scale ranging from not considered, considering and considered ABC. The results indicate that operating unit size is related positively to the level of consideration for ABC. This implies that the availability of financial, labour, computing and time resources should mean that it is more likely for operating units to be considering or have considered ABC.

Keywords: Activity-based costing (ABC), Consideration for ABC, Ordinal regression

1. Introduction

In recent years there has been a significant amount of research into the factors which have influenced whether operating units have adopted activity-based costing (ABC). However, this research has been somewhat fragmented because of the different ways in which it has defined the extent to which operating units have or have not adopted ABC (see Brown et al., 2004). This is illustrated below, which shows the different definitions of ABC adoption in research conducted in manufacturing industry. (Note 1)

- (1) Using ABC verses not using ABC (Groot, 1999; Joshi, 1998).
- (2) Adopted ABC verses not adopted ABC (Malmi, 1996).
- (3) Using ABC verses considered and rejected, currently considering and not considered ABC (Schoute, 2004).
- (4) Using ABC versus assessed and rejected, currently assessing and not considered ABC (Clarke et al., 1999).
- (5) Implemented after having adopted ABC verses not implemented after having adopted ABC (Gosselin, 1997).
- (6) Adopted ABC verses rejected ABC after having adopted ABC as an idea (Booth & Giacobbe, 1998).
- (7) Using or implementing ABC verses not using or not implementing ABC (Schoute, 2004).
- (8) Using ABC or activity-based management (ABM), or currently implementing ABC verses not using ABC or ABM, or not currently implementing ABC (Malmi, 1999).
- (9) Using, implementing, approved for implementing, or implemented and abandoned ABC verses considered then rejected, considering or not considered ABC (Krumwiede, 1998).
- (10) Using, implementing or intending to implement ABC verses not using, not implementing or not intending to implement ABC (Al-Omiri & Drury, 2007).
- (11) Implemented, currently implementing or wanted to implement ABC verses did not want to adopt or have not decided about ABC (Bjørnenak, 1997).

The problem with this research is that it may have adopted a narrow approach to ABC usage by assuming that operating units that have adopted ABC are distinct from operating units that have not adopted it. For example, research that has compared operating units that have adopted or are using ABC with those that have not adopted or are not using ABC, assume that each of these two groups are homogeneous. However, this may not be the case. Krumwiede (1998) points out that firms that reject ABC after having considered it usually have higher quality information systems than other non-adopters who have not considered ABC. In this case, firms that have rejected ABC may have similar characteristics to those that have adopted ABC, rather than those that have not considered it. Similarly, Krumwiede (1998) argues that firms that adopt ABC and subsequently abandon it, tend to have high quality information systems, which again may lead to them having similar characteristics to ABC adopters rather

than non-adopters. Thus, operating units that are categorized as not using ABC may not be a homogeneous group, which may affect any interpretation of the differences between operating units that have adopted and have not adopted ABC. Furthermore, operating units that have adopted ABC may be similar to operating units that have rejected it, because they have both considered it, which may distinguish them from operating units that are currently considering ABC (and, hence, have not made a decision about whether or not to adopt it) and those that have not considered it.

Only Booth & Giacobbe (1998), Brown et al. (2004) and Krumwiede (1998) have examined the issue of consideration for ABC. (Note 2) Booth & Giacobbe (1998) compared operating units with an interest in ABC (or those who were at least willing to consider it) to those that had not considered ABC. Brown et al. (2004) compared operating units that had shown an interest in ABC by either currently considering it or having considered it with those that had not considered it. The problem with this approach, however, is that it assumes that operating units with an interest in ABC are a homogeneous group. This may not be the case, however, because there may be differences between those that are currently considering and those that have considered ABC. Given that operating units' consideration for ABC can be divided between those that have not considered ABC, are considering ABC and have considered ABC, operating units that are considering ABC are in the process of moving from the not considered category to the considered category. These operating units may retain the characteristics of those that have not considered ABC until they have completed their considerations and/or they may have characteristics that are similar to those that have considered ABC.

To the author's knowledge, only Krumwiede (1998) has empirically examined the issue of consideration of ABC by looking at the impact of a variety of factors on operating units that had not considered ABC, were considering ABC and had considered and adopted ABC. From the perspective of consideration, this research is incomplete, however, because it does not examine operating units that had considered and rejected ABC. This is an important omission because not all operating units that have considered ABC will adopt it, and by implication, not all those that are currently considering ABC will adopt it. Hence, research into the consideration of ABC should include operating units that have not considered ABC, are considering ABC and have considered ABC (including those that have adopted and rejected it).

Another issue from prior research into ABC usage relates to the data analysis procedures. Some of the research described above has used univariate statistical methods, such as chi-square tests, Mann Whitney tests or t-tests to compare ABC adopters and non-adopters, however defined, over a variety of constructs (Booth & Giacobbe, 1998; Groot, 1999; Joshi, 1998; Malmi, 1996, 1999). Other researchers have overcome the limitations of using only univariate statistical methods by using more powerful multivariate statistical methods, such as binary logistic regression analysis or discriminant analysis to consider the impact of a variety of factors on the extent to which operating units have adopted ABC relative to those that have not adopted ABC, however defined (Al-Omiri & Drury, 2007; Bjørnenak, 1997; Brown et al., 2004; Booth & Gosselin, 1998; Schoute, 2004)).

One disadvantage with multivariate binary logistic regression is that the dependent variable in the regression runs is binary coded, meaning that it is restricted to two data points, and, consequently, this can limit the depth of the analysis. Furthermore, if ordinal coded constructs are collapsed into a binary coded construct, then important data may be lost in the analysis. This problem can be overcome by using ordinal logistic regression (hereafter ordinal regression), which is a logistic regression method that can be applied when a dependent construct is coded on an ordinal scale consisting of three or more points. Unlike binary logistic regression, which considers the log odds of an individual event occurring, ordinal regression considers the log odds of an event occurring and all other events that can be ordered before it. In addition, ordinal regression overcomes the problem of trying to apply ordinary least squares (OLS) regression analysis to a dependent construct coded on an ordinal scale, because one of the assumptions of OLS regression is that the dependent construct should be coded on at least an interval scale, with equal intervals between the points on the scale. Furthermore, ordinal regression has the advantage of not requiring a constant variance in the residuals.

In relation to ABC, operating units can have three levels of consideration for ABC, which can be coded on an ordinal scale. At the lowest level are operating units that have not considered ABC, at the next level are operating units that are considering ABC and at the highest level are those that have considered ABC, regardless of whether or not they have accepted it. To the author's knowledge, only Krumwiede (1998) has applied ordinal regression to ABC research. However, as mentioned above the latter point on the consideration scale adopted in his research excludes operating units that have considered, but rejected ABC. Given the above, the objective of this paper is to use ordinal regression analysis to develop and test a model of the influences of the level of competition, product customization, manufacturing overhead costs and operating unit size on the level of consideration that operating units give to ABC, including those that have considered and rejected ABC.

The remainder of the paper is organized into four further sections. Section two proposes four hypotheses relating to the influence of the four factors referred to above on the level of consideration for ABC. Section three describes how the research data was obtained from a questionnaire survey of British management accountants working in manufacturing operating units and how it was analysed using ordinal regression. Section four reports the results of the ordinal regression analysis. Section five concludes the research, identifies some of its limitations and the opportunities for future research.

2. Research hypotheses

Based upon the results of prior ABC research, four constructs are examined as possible influences on the level of consideration for ABC and the possible influence of each of these constructs is discussed below and this results in a research hypothesis for each construct.

2.1 Competition

Prior research has identified a positive relationship between the level of competition in the marketplace and the use of management accounting systems (Khandwalla, 1972; Mia & Clarke, 1999). In relation to product costing, it has been suggested that when there is a high level of competition, then firms should implement ABC (Cooper, 1988; Kaplan & Cooper, 1998). If firms do not implement ABC, then a competitor or competitors may take advantage of errors arising from inaccurate product costs (Cooper, 1988). Consequently, it would be expected that an operating unit facing a high level of competition would have considered or at the very least be considering ABC. Booth & Giacobbe (1998) found there was no significant difference between firms who were interested and not interested in ABC as an idea and whether they were price takers or price makers in the market. Given that, in theory, a higher level of competition would be expected to lead to the adoption of ABC, then, by implication, operating units would have considered ABC and others may be considering it. Hence:

H₁: The level of competition is related positively to the extent to which operating units have considered ABC.

2.2 Product customization

Customized products are produced in non-repetitive manufacturing processes, which means that it is not possible to derive standard costs (Drury & Tayles, 2005). Kaplan & Cooper (1998) suggest that ABC systems should be used to enhance the accuracy of customized product costs. Thus, a company producing customized products would be expected to have considered ABC or at least to be considering it. Hence:

H₂: The level of product customization is related positively to the extent to which operating units have considered ABC.

2.3 Manufacturing overhead costs

When higher levels of overhead costs are incurred to produce products, it is argued that there is a greater need to use product costing systems to capture those costs in product costs (Bjørnenak, 1997). When overhead costs (excluding facility-level costs) make up a high proportion of total product costs, Kaplan & Cooper (1998) consider that ABC should be used. In research into the consideration for ABC, Brown et al. (2004) did not observe a significant effect for overhead costs to value added costs on operating units that were considering or had considered ABC versus those that had not considered it. In contrast, Booth & Giacobbe (1998) found that operating units with a higher percentage of overhead costs to value added costs in operating units had shown an interest in ABC. Operating units with a higher percentage of manufacturing overhead costs to total manufacturing overhead costs would be expected to be more likely to have considered or to be considering ABC. Hence:

H₃: The percentage of manufacturing overhead costs to total manufacturing costs is related positively to the extent to which operating units have considered ABC.

2.4 Operating unit size

Krumwiede (1998) pointed out that the reasons for the significant size effect in prior ABC adoption research are unclear. It may be that as larger operating units are likely to have access to more resources, have more contacts and communication channels (Bjørnenak, 1997), and they are able to invest in and, by implication, to have considered ABC. Brown et al. (2004) suggested that larger firms are able to spread the costs of implementation across several products. In empirical research, Brown et al. (2004) found that the number of employees was positively related to whether operating units were considering or had considered ABC. Similarly, Booth & Giacobbe (1998) found that the annual sales revenue of operating units was positively related to whether operating units had an interest in ABC. When using ordinal regression, Krumwiede (1998) found that annual sales revenue had a positive effect on whether operating units had considered and adopted ABC. However, it did not have a significant effect on whether operating units were considering, or had considered and adopted ABC. Given the significant size effects in prior research into

the consideration for ABC, this research assumes that larger operating units are more likely to be considering or to have considered ABC. Hence:

H₄: Operating unit size is related positively to the extent to which operating units have considered ABC.

3. Research method

3.1 Research questionnaire

Questionnaire subjects were obtained initially from a list of 854 members of the Chartered Institute of Management Accountants in Great Britain who were working in British manufacturing industry and had the job title of cost, management or manufacturing accountant. An initial letter was posted to all potential subjects outlining the objectives of the research and informing them that they would receive a questionnaire in two weeks time. Accompanying each questionnaire was a covering letter, which assured subjects of the confidentiality of their responses, and a stamped-addressed envelope. Non-respondents to the questionnaire were posted a follow-up letter two weeks later, and a further follow-up letter, questionnaire and stamped-addressed envelope were posted to non-respondents two weeks after that. After identifying potential subjects who worked in the same operating unit, potential subjects who had left their operating unit, operating units that had closed down, and subjects whose work did not involve manufacturing or product costing, the total potential subjects employed in independent operating units declined to 673. A total of 280 usable questionnaires were received (effective response rate = 41.6 percent) and, of these, 274 respondents indicated that they used product costs in decision making. (Note 3)

The existence of non-response bias was tested by Mann-Whitney tests to compare respondents who had returned the questionnaire prior to the first reminder being sent out ($n = 116$) and those who returned the questionnaire after the second reminder had been sent out ($n = 40$). This did not reveal any significant differences between these two types of respondent on any of the five research constructs ($p > 0.05$). (Note 4) Hence, non-response bias may not be a problem.

3.2 The ordinal regression model

The ordinal regression model for a dependent construct defined as the level of consideration of ABC is:

$$\ln(\theta_{j=1,2}) = \alpha_{j=1,2} - \beta_1 \text{COMP} - \beta_2 \text{CUST} - \beta_3 \text{MANUO/D} - \beta_4 \text{SIZE} + e$$

Where:

$\ln(\theta_{j=1,2})$ = The link function that connects the independent constructs of the linear model. In this case, it is the natural logarithm of $\theta_{j=1,2}$, where j is the number of link functions. Here, there are two link functions, that is $j = k - 1$, where:

k = number of points on the ordinal scale, in this case a three point scale.

$\theta_{j=1,2}$ = The odds of an event occurring defined as $p_k / (1 - p_k)$ where:

p_k = the cumulative probability of an event or events occurring, and

$1 - p_k$ = the probability of that event or events not occurring.

In this case:

$$\theta_1 = \frac{p(\text{not considered ABC})}{p(\text{considering or considered ABC})}$$

$$\theta_2 = \frac{p(\text{not considered or considering ABC})}{p(\text{considered ABC})}$$

$\alpha_{j=1,2}$ = A constant term for each of the link functions.

β_{1-4} = The ordinal regression coefficients.

COMP = The level of competition.

CUST = The level of product customization.

MANUO/D = Percentage of manufacturing overhead costs to total manufacturing costs.

SIZE = The operating unit size, measured by SALES = Annual sales revenue or EMPLOYEES = Number of employees.

e = Residual error term.

Given that there are two size measures, there are two versions of each logit function depending upon whether size is measured by the annual sales revenue or the number of employees.

3.3 Construct measurement

Respondents were asked to answer the questionnaire from the perspective of the operating unit in which they worked. Operating units' experience of ABC was obtained from a single question with responses of currently using ABC; intending to use ABC; currently investigating using ABC; intending to investigate using ABC; rejected ABC, but established a system of activity analysis or cost driver analysis; implemented ABC and subsequently abandoned it; investigated using ABC and rejected it; rejected ABC, but never investigated its possible use; never considered ABC and other. For the purposes of the ordinal regression analysis, respondents were classified as having never considered ABC (code = 1), respondents who were currently investigating or intending to investigate using ABC were regarded

as considering ABC (code = 2), and all other respondents were regarded as having considered ABC (code = 3). The respondents who gave the response of other were omitted from subsequent analysis, because they did not indicate their level of consideration for ABC.

The level of competition was measured by two questions developed by the researcher. The first question covered the current general level of competition for the major products produced by the operating unit with responses on five-point Likert scale ranging from 1 = Very intense to 5 = Very slack. The second question requested information about the expected level of competition over the next two years for the major products produced by the operating unit, with responses ranging from 1 = Very high and 5 = Very low. For the purpose of data analysis the scores on these two questions were reverse scored and initially summed and divided by 2 to provide a measure of the general level of competition on a nine-point scale from a low score of 1 to a high score of 5. Similarly, product customization was measured by two questions developed by the researcher. From these two questions, respondents had to identify the range of products produced by their operating unit on a five-point Likert type scale. For the first question responses ranged from 1 = Virtually all customized products, to 5 = Virtually all standardized products. For the second question responses ranged from 1 = At least 95% of products produced are unique and produced to satisfy individual customer's orders, to 5 = At least 95% of products are identical products produced in large quantities. The responses to both questions were initially reverse scored for data analysis and summed and divided by 2 to give a low score of 1 to a high score of 5.

The percentage share of manufacturing overhead costs to total manufacturing costs was obtained from responses to a question that required details about the operating unit cost structure. From this it was possible to derive the percentage of manufacturing overhead costs to total manufacturing costs (i.e., the sum of direct material costs, direct labour costs and manufacturing overhead costs). Operating unit size was measured in two different ways. Respondents were asked to indicate the approximate annual sales revenue of their operating unit in the last financial year and the approximate number of employees in their operating unit.

4. Results

The ordinal regression analysis was applied using listwise deletion, which gave a usable sample of 200 respondents. The results of ordinal regression equations including all of the independent constructs, and when operating unit size was measured by either annual sales revenue or number of employees showed that 66.7 percent of the cells between the dependent construct and the independent constructs were empty. This meant that the goodness-of-fit statistics for the ordinal regression equations were unreliable (Norusis, 2005). In order to increase the dependability of the goodness-of-fit statistics in the ordinal regression analysis it was necessary to reduce the number of empty cells between different values of the dependent construct and different values of the independent constructs, and the number of cells with small expected values on the points on the scales of each independent construct. This was achieved by rescaling the independent constructs, and, by a process of trial and error, this led to the scales of the independent constructs being reduced to three-point ordinal scales.

For the competition measure, as no operating units had a score of 1 or 1.5 and only one operating unit had a score of 2, the responses were reduced to a three-point scale with scores of 2, 2.5 and 3 being coded 1, scores of 3.5 and 4 being coded 2, and scores of 4.5 and 5 being coded 3. Unlike the responses to the measure of competition, the responses to the product customization measure were spread more evenly. Hence, the scale was reduced to a three-point scale with scores of 1, 1.5 and 2 being coded 1, scores of 2.5, 3 and 3.5 being coded 2, and scores of 4, 4.5 and 5 being coded 3. (Note 5) The manufacturing overhead cost percentage was reduced to a three-point scale based on up to 12.5 percent = 1, greater than 12.5 percent to 25 percent = 2 and greater than 25 percent = 3. The annual sales revenue measure was coded £0m to £20m = 1, greater than £20m to £100m = 2, and greater than £100m = 3. The number of employees was scored on a similar scale with 0 to 100 employees = 1, 101 to 500 employees = 2 and greater than 500 employees = 3.

The experiences of ABC of these 200 respondents are shown in Table 1. Before testing the research model, a number of preliminary tests were conducted on the data to ensure that the multi-item measures of considering and considered ABC are distinct constructs. Kruskal-Wallis tests examined the differences in responses between the six different responses representing respondents who had considered ABC for each of the independent constructs. The Kruskal-Wallis tests did not reveal any significant differences between the independent constructs. Hence, there were no significant differences between operating units that have adopted ABC and those that have rejected ABC in some way.

Related to the above, Mann-Whitney tests did not reveal any significant differences across the independent measures between operating units that had accepted ABC (that is using and intending to use ABC) (n = 20) and those that had rejected ABC, when defined in the four ways listed in the questionnaire (n = 79). (Note 6). (Note 7) This indicates that operating units that have accepted and those that have rejected ABC were similar for these constructs. The

similarity is that they have both considered ABC. A Mann-Whitney test did not reveal any significant differences across the five independent measures between the two items making up the currently considering ABC construct. This provides evidence that the two measures of currently considering ABC were measuring a single construct. The distribution of responses for the independent constructs in the regression ABC model are shown in Table 2. This shows that operating units faced a high level of competition, had varying levels of product customization and had moderate sizes and manufacturing overhead percentages.

Table 3 shows the Spearman Rank correlation coefficients between the six construct measures, and shows that the only significant correlation with the level of consideration for ABC was for the two size measures ($p < 0.05$). This indicates that these constructs may be related to the level of consideration for ABC in the ordinal regressions. Unsurprisingly, the largest correlation was between the two size measures ($r = 0.679$), but this is of no consequence because these two constructs do not appear in the same ordinal regression equations. The only other significant correlation was between annual sales revenue and manufacturing overhead percentage, and given the low correlations between the independent constructs, multicollinearity is unlikely to be a problem in the ordinal regressions.

The results of the ordinal regressions are shown in Table 4 and reveal that operating unit size, regardless of whether it was measured by annual sales revenue or number of employees was the only construct to significantly influence the level of consideration for ABC. Hence, hypothesis 4 is accepted, but as there were no significant effects for competition, product customization and manufacturing overhead percentage, hypotheses 1, 2 and 3 are rejected. The ordinal regression equations are:

For sales revenue:

$$\ln\left(\frac{p(\text{not considered ABC})}{p(\text{considering or considered ABC})}\right) = 0.897 - 0.099(\text{COMP}) - 0.061(\text{CUST}) - 0.029(\text{MANUO/D}) - 0.822(\text{SALES})$$

$$\ln\left(\frac{p(\text{not considered or considering ABC})}{p(\text{considered ABC})}\right) = 1.931 - 0.099(\text{COMP}) - 0.061(\text{CUST}) - 0.029(\text{MANUO/D}) - 0.822(\text{SALES})$$

For number of employees:

$$\ln\left(\frac{p(\text{not considered ABC})}{p(\text{considering or considered ABC})}\right) = 1.005 - 0.169(\text{COMP}) - 0.055(\text{CUST}) + 0.134(\text{MANUO/D}) - 0.789(\text{EMPLOYEES})$$

$$\ln\left(\frac{p(\text{not considered or considering ABC})}{p(\text{considered ABC})}\right) = 2.030 - 0.169(\text{COMP}) - 0.055(\text{CUST}) + 0.134(\text{MANUO/D}) - 0.789(\text{EMPLOYEES})$$

This shows that the log odds of an operating unit either having not considered ABC or having not considered or currently considering ABC was negatively related to operating unit size. It is necessary to test that the two regression lines are parallel, that is the relationship between independent constructs and the two link functions is the same for each pair of link functions. The test for parallel lines compares the model assuming that the two lines are parallel with the model assuming that the model consists of separate lines. A non-significant chi-square statistic is indicative of parallel lines and that the relationship between the independent constructs is the same for the different link functions in the dependent construct. If the chi-square statistic is significant then different models are required for the different link functions. The test for parallel lines when the ordinal regression included size measured by annual sales revenue gives chi-square = 0.834, $p = 0.934$ and when size was measured by the number of employees, chi-square = 2.246, $p = 0.691$. The non-significant chi-square indicates that the two lines were parallel.

If the model provides a good fit of the data, the observed and expected cell counts are similar, and, hence, there is no significant difference between them. When size was measured by annual sales revenue the goodness-of-fit statistics were:

Pearson: chi-square = 98.936, $p = 0.722$ and

Deviance: chi-square = 113.467, $p = 0.341$.

When size was measured by the number of employees, the goodness of fit statistics were:

Pearson: chi-square = 95.212, $p = 0.805$ and

Deviance: chi-square = 107.793, $p = 0.488$.

The non-significant goodness-of-fit statistics indicate that the model provided a good fit of the data, and, hence, the observed and expected cell counts were similar. In addition, the model fitting test compares the model with predictors to the model without predictors. A significant chi-square indicates that the model with predictors provided a better fit to the data. When size was measured by the annual sales revenue: chi-square = 17.154, $p = 0.002$, and when size was measured by the number of employees: chi-square = 14.627, $p = 0.006$. In both cases the models including predictors provided a better fit to the data than if they were not included.

Although the objective of the research was to develop a model of the factors influencing the level of consideration for ABC, various measures of the strength of the association between the two size measures and the dependent construct are reported for completeness. When size was measured by annual sales revenue the strength of the associations were Cox and Snell pseudo $R^2 = 0.082$, Nagelkerke pseudo $R^2 = 0.094$ and McFadden pseudo $R^2 = 0.041$. Similarly, when size was measured by the number of employees they were Cox and Snell pseudo $R^2 = 0.071$, Nagelkerke pseudo $R^2 = 0.081$ and McFadden pseudo $R^2 = 0.035$. Hence, the explanatory variance was low.

5. Conclusion

This paper has developed and tested a model of the factors influencing operating units' level of consideration for ABC in British manufacturing industry. The model was tested by ordinal regression analysis with the level of consideration for ABC as the dependent construct and the level of competition, the level of product customization, the percentage share of the manufacturing overhead costs to total manufacturing costs and operating unit size as independent constructs. The results indicate that, regardless of how operating unit size is measured, operating unit size has a significant influence on the level of consideration for ABC. Specifically, the log odds of an operating unit having not considered ABC and the log odds of an operating unit having not considered or considering ABC is negatively related to size, or, alternatively, operating unit size is positively related to the level of consideration for ABC when defined as the log odds of an operating unit having considered ABC, or currently considering or considered ABC. Thus, there is no difference between the impact of the independent constructs and the different link functions, however these are defined.

The non-significant effect of the other constructs indicates that the level of competition, product customization, manufacturing overhead percentage do not impact on the decision to consider ABC. This is consistent with Brown et al. (2004) who found that technological factors, such as product customization and cost structure are not related to whether operating units are considering or have considered ABC. Furthermore, the non-significant effect of environmental factors, such as competition is consistent with Booth & Giacobbe (1998). Operating units appear to consider ABC based on their size. They consider ABC when they believe that they are sufficiently large, in terms of, for example, financial, labour, computing and time resources, to consider it. Until this point is reached they do not consider it. Future research needs to consider when this point arises, and when it does arise do operating units immediately start to consider ABC or is there some time gap before they start to consider it. This could be done using longitudinal research to see when and how their considerations have been completed.

Although operating unit size is the only significant construct in the ordinal regressions, the pseudo R^2 measures are low. This indicates that other constructs affect the consideration decision and have been omitted from the model. These omitted constructs could relate to constructs referred to above that influence the consideration decision directly, like the level of financial, labour, computing and time resources. These could be measured in future research using psychometric measures. In addition, future research needs to consider the impact of organizational factors on the level of consideration of ABC. These have been included in ABC consideration research by Brown et al. (2004), where top management support and having an internal champion to support the implementation of ABC had a positive effect on operating units considering or having considered ABC. Krumwiede (1998) observed significant effects on the level of consideration of ABC for not only size, but also the complexity of manufacturing and costing systems, and whether the operating unit used job shop as opposed to non-job shop manufacturing. Further research needs to include these constructs in models of the level of consideration as operationalized in this research. Other research has found that organizational structure influences the likelihood of adopting innovations (Damanpour, 1991). In the context of ABC, Gosselin (1997) found that more centralized and formalized organizations were more likely to implement ABC. This research could be extended to see if this relationship holds for the consideration of ABC.

The main limitation of this research is that the independent constructs are coded on a three-point ordinal scale. This reduces the data that is included in these constructs, and, hence, the discrimination between different levels of intensity of these constructs. Notwithstanding this limitation, the research illustrates the application of a research method that has been used rarely in accounting research, namely ordinal regression. The method has the potential of overcoming the limitation of only having a binary coded dependent construct in binary logistic regression and of applying an ordinal coded dependent construct in OLS regression analysis. It is hoped that the technique described in this paper will encourage other accounting researchers to apply the ordinal regression method in future research.

References

Al-Omiri, M., & Drury, C. (2007). A survey of factors influencing the choice of product costing systems in UK organizations. *Management Accounting Research*, 18, 399-424.

- Bjørnenak, T. (1997). Diffusion and accounting: The case of ABC in Norway. *Management Accounting Research*, 8, 3-17.
- Booth, P., & Giacobbe, F. (1998). Predicting the adoption of activity-based costing in Australian manufacturing firms. Paper presented to the European Accounting Association Annual Congress, Antwerp, Belgium.
- Brown, D. A., Booth, P., & Giacobbe, F. (2004). Technological and organizational influences on the adoption of activity-based costing in Australia. *Accounting and Finance*, 44, 329-356.
- Clarke, P. J., Hill, N. T., & Stevens, K. (1999). Activity-based costing in Ireland: Barriers to, and opportunities for, change. *Critical Perspectives on Accounting*, 10, 443-468.
- Cooper, R., (1988). The rise of activity-based costing – Part two: When do I need an activity-based cost system? *Journal of Cost Management for the Manufacturing Industry*, 2, 41-48.
- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34, 555-590.
- Drury, C., & Tayles, M. (2005). Explicating the design of overhead absorption procedures in UK organizations. *British Accounting Review*, 37, 47-84.
- Dugdale, D., & Jones, T. C. (1997). How many companies use ABC for stock valuation? A comment on Innes & Mitchell's questionnaire findings. *Management Accounting Research*, 8, 233-240.
- Gosselin, M., (1997). The effect of strategy and organizational structure on the adoption and implementation of activity-based costing. *Accounting, Organizations and Society*, 22, 105-122.
- Groot, T. L. C. M. (1999). Activity-based costing in U.S. and Dutch food companies. *Advances in Management Accounting*, 7, 47-63.
- Joshi, P. L. (1998). An exploratory study of activity based costing practices and benefits in large size manufacturing companies in India. *Accounting and Business Review*, 5, 65-93.
- Kaplan, R. S., & Cooper, R. (1998). *Cost and Effect: Using Integrated Systems to Drive Profitability and Performance*. Boston, MA: Harvard Business School Press.
- Khandwalla, P. N. (1972). The effects of different types of competition on the use of management controls. *Journal of Accounting Research*, 10, 275-285.
- Krumwiede, K. R. (1998). The implementation stages of activity-based costing and the impact of contextual and organizational factors. *Journal of Management Accounting Research*, 10, 239-277.
- Malmi, T. (1996). Activity-based costing in Finnish metal and engineering industries. *Finnish Journal of Business Economics*, 45, 243-264.
- Malmi, T. (1999). Activity-based costing diffusion across organizations: An exploratory empirical analysis of Finnish firms. *Accounting, Organizations and Society*, 24, 649-672.
- Mia, L., & Clarke, B. (1999). Market competition, management accounting systems and business unit performance. *Management Accounting Research*, 10, 137-158.
- Norusis, M. J. (2005). *SPSS 13: Advanced Statistical Procedures Companion*, New York, NY: Prentice Hall.
- Schoute, M. (2004). Determinants of the adoption and use of activity-based costing. Paper presented to the American Accounting Association Management Accounting Section Meeting, Miami, Florida, USA.
- Turney, P. B. B. (2005). *Common Cents: The ABC Performance Breakthrough* (2nd ed.). New York, NY: McGraw-Hill

Notes

Note 1. Given that this study is confined to operating units in manufacturing industry, the identification of prior research into the adoption of ABC is confined to manufacturing industry.

Note 2. The Brown et al. (2004) sample consists of both manufacturing and non-manufacturing operating units. Although their results may not be strictly comparable to Booth & Giacobbe (1998) and Krumwiede (1998) because of the inclusion of non-manufacturing operating units, their paper is included in the introduction to this research area because, to the author's knowledge, it is the only paper into the consideration for ABC that has defined operating units that have considered ABC, as including those that have both adopted and rejected ABC.

Note 3. A copy of the questionnaire is available on request.

Note 4. The results of the Mann Whitney tests, and other subsequent Mann Whitney tests and Kruskal Wallis tests are available from the author on request. All subsequent statistical significance levels are at the $p = 0.05$ level and all statistical tests are two-tailed tests.

Note 5. A factor analysis with a varimax rotation confirmed that the two, two-item measures of competition and product customization each loaded on to a single factor. In addition, both of these measures displayed satisfactory reliability scores. The Cronbach's alpha for competition and product customization were 0.825 and 0.791 respectively.

Note 6. A Mann Whitney test did not reveal any significant differences across the five independent measures between operating units that were currently using and intending to use ABC. Kruskal-Wallis tests did not reveal any significant differences across the five independent measures between operating units that had rejected ABC in one of four ways listed on the questionnaire.

Note 7. Operating units that had accepted ABC before abandoning it may have different characteristics to those that had rejected it initially. Mann Whitney tests, however, did not reveal any significant differences across the five independent measures between operating units that had accepted ABC and those that had rejected ABC, excluding the two operating units that had implemented and subsequently abandoned ABC. Furthermore, the operating units that have rejected ABC, but established a system of activity analysis or cost driver analysis may also have different characteristics from those that had rejected ABC, because these operating units have embraced activity-based principles. There were no significant differences, however, between those that had accepted ABC and those that had rejected ABC and had never embraced activity-based principles. This reinforces the view that operating units that have accepted and operating units that have rejected ABC are similar on these characteristics because they have both considered ABC.

Table 1. Operating units consideration of ABC

	No.	No.	%
Considered ABC			
Currently using ABC	5 ^a		
Intending to use ABC	15		
Rejected ABC, but established a system of activity analysis or cost driver analysis	25		
Implemented ABC and subsequently abandoned it	2		
Investigated using ABC and rejected it	43		
Rejected ABC, but never investigated its possible use	9	99	49.5
Considering ABC			
Currently investigating ABC	14		
Intending to investigate using ABC	31	45	22.5
Not considered ABC			
Never considered ABC	56	<u>56</u>	<u>28.0</u>
		<u>200</u>	<u>100.0</u>

^a The number of respondents shown in Table 1 that were currently using ABC agreed with the number of respondents to another question about the treatment of overhead costs in product costs, which asked respondents to indicate whether they were using ABC.

Table 2. Distribution of responses for the independent constructs^a

	Score 1		Score 2		Score 3		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Level of competition	13	(6.5)	78	(39.0)	109	(54.5)	200	(100)
Level of product customization	68	(34.0)	64	(32.0)	68	(34.0)	200	(100)
Manufacturing overhead percentage	50	(25.0)	95	(47.5)	55	(27.5)	200	(100)
Annual sales revenue	71	(35.5)	98	(49.0)	31	(15.5)	200	(100)
Number of employees	25	(12.5)	110	(55.0)	65	(32.5)	200	(100)

^a Scored on a three-point scale with low score = 1 and high score = 3.

Table 3. Spearman rank correlation coefficients^a

	1	2	3	4	5	6
1. Consideration for ABC	1.000					
2. Level of competition	0.060	1.000				
3. Level of product customization	0.034	0.044	1.000			
4. Manufacturing overhead percentage	-0.053	-0.045	-0.068	1.000		
5. Annual sales revenue	0.282**	0.099	0.027	-0.174*	1.000	
6. Number of employees	0.252**	-0.025	-0.010	0.023	0.679**	1.000

^a * $p < 0.05$, ** $p < 0.001$

Table 4. Ordinal regression analysis

	Regression coefficient	Standard error	Wald statistic	df	p
Panel A: Including annual sales revenue as the measure of operating unit size					
Constant (α_1)	0.897	0.858	1.092	1	0.296
Constant (α_2)	1.931	0.867	4.961	1	0.026
Level of competition	0.099	0.223	0.196	1	0.658
Level of product customization	0.061	0.167	0.134	1	0.714
Manufacturing overhead percentage	0.029	0.191	0.023	1	0.880
Annual sales revenue	0.822	0.213	14.913	1	0.000
Panel B: Including number of employees as the measure of operating unit size					
Constant (α_1)	1.005	0.887	1.283	1	0.257
Constant (α_2)	2.030	0.896	5.131	1	0.023
Level of competition	0.169	0.221	0.588	1	0.443
Level of product customization	0.055	0.166	0.112	1	0.738
Manufacturing overhead percentage	-0.134	0.188	0.507	1	0.477
Number of employees	0.789	0.219	12.963	1	0.000