

Technological innovations, activity based costing and satisfaction

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Key words: Management accounting changes; diffusion; innovation, technological changes; satisfaction and activity-based costing.

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Abstract

Traditional cost and management accounting practices have been under substantial criticism for their failure to cope with the requirements of technological changes in manufacturing practices during the past two decades (Askarany, 2005, 2003; Baines & Langfield-Smith, 2003; Beng, Schoch, & Yap, 1994; Bork & Morgan, 1993; Cavalluzzo & Ittner, 2003; Cooper & Kaplan, 1991; Gosselin, 1997; Hartnett & Lowry, 1994; Kaplan, 1984, 1994; Maiga & Jacobs, 2003; Lefebvre & Lefebvre, 1993).

Shedding light on this debate, current study first addresses the evolution of recent cost and management accounting innovations and then examines the level of association between the diffusion of activity-based costing (ABC) as a proxy (or an example) of management accounting innovations and both the level of satisfaction with current implemented accounting systems and the implementation of technological changes in manufacturing practices. The first aim is to clarify whether (or not) the diffusion of ABC is associated with the implementation of technological changes in manufacturing practices. The second aim is to examine whether (or not) the level of satisfaction with implemented accounting techniques is associated with the diffusion of ABC.

Key words: Management accounting changes; diffusion; innovation, technological changes satisfaction and activity-based costing.

1. Introduction

This paper aims to address the diffusion of management accounting innovations in general and activity-based costing in particular in relation to the implementation of technological changes in manufacturing practices.

Rogers (1995) defines an innovation as ‘an idea, practice, or object that is perceived as new by an individual or other unit of adoption’. Further, he suggests that if the individual has no perceived knowledge about an idea and sees it as new, it is an innovation. Likewise, Damanpour and Gopalakrishnan (1998) define innovation as ‘the adoption of an idea or behaviour new to the organisation’. The common criterion in any definition of innovation is newness. According to Rogers (1995), newness in an innovation might be expressed not only in terms of new knowledge, but also in terms of first persuasion, or a decision to adopt. So, innovation can be related to both new administrative techniques and services and new technological changes and products.

Wolfe (1994) explains diffusion of an innovation as a way the new ideas are accepted (or not) by those to whom they are relevant. Rogers (1995) extends this definition to consider diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system. The members of a social system could be organisations, societal sectors or nations. A number of metaphors like translation, imitation, fashion and editing have also been used to describe the processes of travelling new ideas among the members of a social system (Røvik, 1996).

The literature on diffusion of innovations (eg. Rogers, 1995) has introduced a number of contextual factors influencing the diffusion processes of innovations. Technological change is one of the main driving factors addressed in this study. Given the escalating speed of recent technological innovations such as advanced, automotive and computerised production processes, communication and information systems, several authors (eg. Askarany & Smith,

2004; Askarany & Smith, 2003a; Beng et al., 1994; Bork & Morgan, 1993; Chenhall, 2003; Gosselin, 1997; Hartnett & Lowry, 1994; Lefebvre & Lefebvre, 1993; Spicer, 1992) suspect that traditional cost and management accounting practices may not be able to cope with the current needs of such ever changing environment in terms of providing detailed, frequent accurate and up to date information. This school of thought is consistent with system approach theory. According to the systems approach theory, all parts of a system are related to each other and any change in one part of a system may require the consideration of appropriate change(s) in other parts of the organisation, otherwise, the system may not work properly and this could dissatisfy the users of the implemented system. Implementing recent technological changes in manufacturing practices and the expectation of having more accurate/detailed and maybe online information could lead to the demand for more up to date cost and management accounting techniques. Given the above, the evolution of cost and management accounting innovations and their diffusion could be considered to fit such a model (system approach theory). So, it might be suggested that the escalating speed of recent technological innovations, such as innovations in manufacturing processes, internet, communication and information systems require the consideration of the subsequent innovations necessary in administration systems, particularly in cost and management accounting techniques and practices (Kellett & Sweeting, 1991).

Given that technological changes have been among the main driving factors for criticizing traditional management accounting techniques and low satisfaction of their users in the literature (eg. Askarany & Smith, 2004, 2003a; Beng et al., 1994; Bork & Morgan, 1993; Chenhall, 2003; Gosselin, 1997; Hartnett & Lowry, 1994; Lefebvre & Lefebvre, 1993; Spicer, 1992), this study examines the level of association between the diffusion of ABC (as a proxy or an example of management accounting innovations) and both the level of satisfaction with

current implemented accounting systems and the diffusion of technological changes in manufacturing practices.

2. Background

Traditional cost and management accounting practices have been under substantial criticism for their lack of efficiency and capability in coping with the requirements of a changing environment during the last two decades (Askarany & Smith, 2004; Beng et al., 1994; Bork & Morgan, 1993; Chenhall, 2003; Gosselin, 1997; Hartnett & Lowry, 1994; Lefebvre & Lefebvre, 1993; Spicer, 1992). Such criticism relate to the failure of traditional cost and management accounting practices to provide detailed information on activities important for organisations. Lawrence & Ratcliffe (1990) support this argument by providing survey evidence of levels of dissatisfaction among both management accountants and managers with the cost and management accounting techniques then being used in industry. Bork & Morgan (1993) echo this observation, suggesting that traditional cost and management accounting systems have failed to keep up with the increasing demands imposed on them by technological change in manufacturing environments. They also suggest that research has shown that both the preparers and users of cost accounting information are dissatisfied with their product cost and management accounting techniques. Unsurprisingly, therefore, the management accounting literature has witnessed a growing interest into the study of the diffusion of cost and management accounting innovations (Anderson & Young, 1999; Askarany, 2003; Askarany & Smith, 2001, 2003b; Booth & Giacobbe, 1998; Chenhall & Langfield-Smith, 1998; Cooper & Kaplan, 1991; Gosselin, 1997; Johnson, 1992; Johnson & Kaplan 1987; Hartnett & Lowry, 1994; Maiga & Jacobs, 2003; Malmi, 1999).

Reviewing cost and management accounting innovations of the last two decades, Björnenak & Olson, (1999, p.327) identify the major recently developed cost and management

accounting techniques in the literature as follows: “activity based costing (ABC); activity management (AM) and activity based management (ABM); local information system (LS); balanced scorecard (BS); life cycle costing (LCC) and target costing (TC); strategic management accounting (SMA).”

Consistent with Björnenak & Olson (1999), Chenhall & Langfield-Smith's (1998) study suggests that most popular recently developed cost and management accounting innovations in Australia could be identified as: performance measurement and balanced scorecard techniques, activity based costing, valued added concepts, total quality management, strategic management, risk management, benchmarking, economic value added and target costing.

However, according to Chenhall & Langfield-Smith (1998), the take-up of these management accounting innovations is dismally low and the level of adoption of most of these new techniques lags relatively behind those of traditional ones. For example, Chenhall & Langfield-Smith (1998) findings show that the ranking in terms of adoption of some of these new techniques in Australian firms are: activity based costing ranked (24), activity based management (21), product life cycle analysis (20), target costing (27) (ibid). Chenhall and Langfield-Smith compare this ranking with some of traditional cost and management accounting techniques such as analysis for budgeting for planning financial position (1), capital budgeting (2), performance evaluation using return on investment (3). In a comparative analysis they conclude that the rates of adoption of recently-developed techniques in other countries such as U.S.A., U.K. and mainland Europe are even lower than those applied in Australia.

Supporting this view, with a particular reference to ABC, Askarany and Smith (2003a) find that only 19 percent of organisations registered with CPA in Australia have implemented and accepted ABC by the end of year 2002. Prior to this study Chenhall and Langfield-Smith (1998) found that adoption rate for ABC was generally below 14%. Other studies on the

adoption of ABC also indicate that the take-up of ABC is following same pattern overseas. For instance, Innes and Mitchell (1995) in the UK find that the adoption rate for ABC is generally below 14%. Further, Ness and Cucuzza (1995), in the US, suggest that as few as 10% of ABC-adopters continue to support the innovation.

Given the above, we may propose that technological innovations lead to the diffusion of management accounting innovations and this could result in increased satisfaction of users of management accounting innovations. With particular reference to activity-based costing (ABC) as an example (or proxy) of management accounting innovations, the above proposed statement can be expressed in terms of following hypotheses:

H₁ The diffusion of ABC is positively associated with the level of adoption of technological change in manufacturing practices.

H₂ The level of satisfaction with implemented costing systems is positively associated with the diffusion of ABC.

3. Research Method

To examine the above hypotheses, a survey was designed in 1997 to gather information on both technological changes in manufacturing practices and cost and management changes/innovations implemented in the targeted organisations. The survey was administered to all 200 manufacturing firms registered with the Australian plastics industry (PACIA). The selection of the plastics industry for this investigation was due to the fact that organisations in this industry are known to implement considerable technological changes in their manufacturing practices.

The survey aimed to investigate the level of the diffusion of both technological and management accounting changes and examine their associations. It also aimed to examine the

level of association between the diffusion of activity based costing and satisfaction of users of implemented management accounting techniques.

Given the expectation that the implementation of recently developed management accounting techniques such as ABC could increase as time goes by, a second survey targeted the same population in 2002. Conducting the second survey, it was also thought that there might be a time lag between the implementation of an innovation and the evaluation of its performance in terms of satisfaction. As with the first survey, the second survey intended to examine the level of association between the diffusion of ABC and the level of satisfaction of users of management accounting techniques. PACIA agreed to distribute the questionnaires to the firms registered with them in both surveys, but did not divulge the name of the firms concerned to the researcher. This restriction resulted in lack of opportunities both for follow-up enquiries and for interview. This restriction also prohibits the researcher to examine whether (or not) the respondents of both surveys were the same. However, given that the targeted industry was the same, overall results can be applied to the industry as a whole.

4. Survey Findings

Responses to both surveys were provided by 51 firms in the first survey and 31 firms in the second survey, representing two response rates of 25% and 15% respectively. Non-response bias was examined in both surveys using the aggregate details provided by PACIA including: number of employees, year of establishment, and the activities of the firms. The examination showed that there was no meaningful difference between characteristics (in terms of number of employees, number of activities and the year of establishment) of those organisations which responded and those of aggregated details provided by PACIA. Furthermore, a comparison (of same characteristics) between the early responses and late responses (in both

surveys) showed there was no perceived difference between these responses, suggesting that non-response bias would not influence the outcomes.

As a result of consultation with PACIA, technological changes in manufacturing practices addressed in the first survey were specified as follows:

- computer aided design (CAD)
- computer aided engineering (CAE)
- computer aided machining
- computer aided manufacturing (CAM)
- computer aided process planning (CAPP)
- computer-integrated manufacturing (CIM)
- direct numerical control (DNC)
- flexible manufacturing system (FMS)
- just in time (JIT)
- numerical control (NC)
- robot
- testing machine

According to the findings, above manufacturing techniques have been widely implemented by the Australian plastics industry. The findings indicate that more than 92 per cent of respondents have experienced one or more types of above manufacturing changes up to the time of the investigation. Also, the proportion of establishments, which have used more than one type of manufacturing change, was more than 76 per cent; only 15.7 per cent of establishments have used one single type of above manufacturing technology.

The findings also indicated that more than 35 per cent of organisations had commenced implementation of their first manufacturing change prior to 1975. Less than 6 per cent of the establishments did not specify the commencement year of employing their manufacturing

techniques. The majority of the respondents (between 70 and 76.5 percent) commenced the implementation of such techniques in the 1980s or before. In other words, the majority of the population had more than a decade of experience in observing technological change in their manufacturing practices. It can therefore be concluded that the Australian plastics industry was an appropriate sample for the study of technological change in manufacturing processes.

The survey also sought information on the level of implementation of cost and management accounting changes. Of greater concern to us in this study was the level of association between technological change in manufacturing practices and the diffusion of ABC. Activity based costing is an approach to costing that focuses on activities as the fundamental cost objects. It uses the cost of these activities as the basis for assigning costs to other cost objects such as products, services, or customers. One of the expectations of the application of technological changes in manufacturing processes is to increase the demand for the adoption of activity based costing by changing the cost structure of products through increasing overhead costs, but decreasing labour costs. The first survey results of the plastics industry didn't show a noticeable change in cost structure of products (of firms within the industry) for the investigated period of ten years (1986-1996). According to the findings, the average proportions of direct material costs, labour costs and overhead cost of products in the plastic industry didn't change by more than two percent in ten years. The average proportion of direct material costs remained at 50 to 51 per cent, direct labour costs at 25 to 26 percent and manufacturing overhead costs at 22 to 23 per cent of total costs of products during the period of investigation. The findings do not support the perception that overhead cost has increased dramatically in recent years.

Consistence with the above findings, allocation of costs based on each activity was less prevalent than the other overhead allocation methods in the establishments under investigation. Indeed, allocation of overhead costs based on each activity had the lowest

prevalence among the establishments. According to the findings of first stage survey, about 75 percent of the establishments have not used such a method, and only 14 percent of establishments were allocating overhead costs based on each activity up to the time of the survey. Another 11 per cent of establishments identified that they would like to use ABC in the near future. The findings of the second survey show a further 7 percent of establishments were using ABC at the time of the investigations. Supporting the literature, the findings suggest that in terms of the scope and the speed, the diffusion of ABC lag behind technological changes in manufacturing processes. However, the results do not provide evidence to support the perception that such technological changes have dramatically reshaped the cost structure of products and therefore more accurate costing techniques are needed. This could justify the low diffusion rates of ABC in the targeted population in both surveys (14% in first survey and 22% in the second survey).

Tables 1 and Table 2 detail the correspondence of ABC adoption with the level of the implementation of technological changes in the targeted population.

Table 1: The frequency of firms experiencing technological changes in manufacturing practices and implementing ABC

Using activity based costing	Experiencing technological changes in manufacturing practices		Total
	Yes	No	
Yes	7	0	7
No	40	4	44
Total	47	4	51

Table 2: The frequency of technological changes in manufacturing practices and implementation of ABC

ABC Adoption	The frequency of technological changes													Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	
No	4	8	4	6	8	4	6	3	1	0	0	0	0	44
Yes	0	0	1	0	0	0	0	1	1	1	1	1	1	7
Total	4	8	5	6	8	4	6	4	2	1	1	1	1	51

Considering the nature of data and the number of responses received in both surveys and as a result of discussion with statistical professionals, Kendall’s tau-b is thought to be the most appropriate statistical test to examine the relationship between the variables in this study.

Table 3: Contingency Table for ABC and technological changes

ABC Adoption	The frequency of technological changes		Total
	Low 0-5	High 6-12	
No	34	10	44
Yes	1	6	7
Total	35	16	51

Table 3 summarises the number of implemented manufacturing technologies into two groups for the purpose of statistical tests. Kendall’s tau-b has a value of -0.412 (standard error 0.099), which is statistically significant at the 0.003 level. We can, therefore, accept our first proposed hypothesis and conclude that the diffusion of ABC is associated with the implementation of technological changes in manufacturing practices within the targeted sample. According to the findings, statistically significant positive relationships are observed between technological changes and implementation of ABC.

To examine the second proposed hypothesis, the establishments were asked directly (in both surveys) to clarify how well they were satisfied with their employed cost and management accounting techniques based on the following scale: very satisfied, moderately satisfied, needs improvement, dissatisfied, and very dissatisfied. The findings of first survey show that only 8 percent of the establishments were very satisfied and 38 percent were moderately satisfied with their implemented cost and management accounting techniques. The majority of the establishments (52 percent) stated that the cost and management accounting techniques they employed needed improvement and 2 percent were very dissatisfied.

As with the results of first survey, the findings of the second survey indicate that less than half of the organisations (a total of 45.1 percent of respondents) were satisfied with their implemented cost and management accounting techniques by the end of 2001 and a majority

of 54.9 percent of respondents were either dissatisfied or believed their implemented cost and management accounting techniques need improvement. Although the findings of the second survey indicate a moderate increase in satisfaction with implemented accounting systems, the statistical tests show no significant differences between the level of satisfaction of adopters and non-adopters of ABC in both surveys. In other words, the findings of both surveys suggested no significant association between the diffusion of ABC and the level of satisfaction of users of management accounting techniques. Kendall's tau-b has a value of 0.162 (standard error 0.154), which is statistically significant only at the 0.365 level. We can, therefore, reject our second stated hypothesis and conclude that our findings do not show a significant association between the diffusion of ABC and the level of satisfaction of users of management accounting techniques.

5. Discussion

The results of current study are largely confirmatory of those of other studies, with innovations largely confined to the technological changes in manufacturing practices, rather than in the introduction of new management accounting techniques. Despite the innovative stance apparent in other aspects of the industry under consideration, cost and management accounting systems were apparently not perceived as priority areas for innovative activity. Findings indicate that the extent of changes in cost and management accounting techniques during a fourteen-year period of investigations have been slow. The findings indicate that neither the cost structure of products nor the level of satisfaction of users of management accounting practices has changed dramatically in recent years.

The lack of a sudden and huge cost structure change (in terms of overhead costs) which has been mentioned as one of the main driver of ABC could justify the slow diffusion of ABC. Provided evidence by Chenhall and Langfield-Smith (1998) that the benefits obtained from

traditional management accounting techniques is higher than those of newer techniques could be another justification for slow diffusion of ABC.

6. Conclusions and Reflections

The results of current investigation revealed that cost and management accounting changes lag behind technological changes in manufacturing practices. The findings show a significant relationship between technological change in manufacturing practice and the diffusion of ABC but no significant association between the diffusion of ABC and the level of satisfaction with implemented management accounting techniques. In other words, there was no perceived difference between the responses of firms employing ABC and those which do not in terms of the level of satisfaction, suggesting that as with traditional cost and management accounting techniques ABC might have its own shortcomings. This suggestion might be consistent with the fact that some firms which had started to implement ABC and decided to stop the implementation after a short period (Innes & Mitchell, 1991; Madison & Power, 1993). This view can also be supported by the findings of Chenhall and Langfield-Smith (1998, p.1) who concluded that “the benefits obtained from traditional management accounting techniques were higher than those of newer techniques” and accordingly, the adoption rate of traditional techniques were higher than the newer ones. This paper suggests that the reality behind slow diffusion of cost and management accounting innovation might link to the shortcomings of new techniques and recommends further investigation into the influence of shortcomings of cost and management accounting innovations on their diffusion.

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