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Cost Management in Sri Lanka: A Case Study on Volume, Activity and Time as Cost Drivers

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Abstract

Despite its theoretical superiority, the activity-based costing (ABC) model has had only moderate success in replacing the traditional volume-based absorption costing models in complex organizations worldwide. Even in organizations that have launched ABC projects, the implementations often do not sustain. In response to this general lack of enthusiasm worldwide for ABC, accountants developed the time-driven activity-based costing (TDABC) model as an alternative cost allocation model. This paper presents a comparison of the TDABC model with ABC, and considers if this alternative cost allocation model (1) is easier to implement from an international perspective and (2) provides comparable cost information for decision making. We use a case study in a country outside the model's country of origin to understand the similarities and differences in absorption costing systems that use 'volume,' 'activities,' and 'time' as the drivers of indirect cost allocations. We also use the case study to ascertain if any country-specific factors impede ABC implementation. We conclude the following: the TDABC model has similar implementation complexities to ABC if modelling conditions are strictly adhered to; these complexities are independent of country-specific factors; and in its simplest form, the model generates the same decision information errors of traditional costing.

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1. Introduction

Like the value of economic goods, the value of a management accounting system depends on its costs and benefits (Horngren, 2004). For an organization, the benefit of its management accounting system rests on the system's ability to provide relevant information for decision making (Anderson, 2007; Sprinkle, 2003). The cost management system, as part of a management accounting system, is no exception.

A cost management system has the ability to provide relevant information in part because of its costing model. In recent decades, advances in information technology have resulted in huge improvements in the collection and communication of cost data in organizations. Unfortunately, traditional volume-based cost allocation models (either full absorption costing or variable costing) still do not make good use of all available cost driver data available in modern organizations. Limited availability of cost data in the past led traditional volume-based cost allocation models to make simplified assumptions about cost behaviour (Cooper & Kaplan, 1988). Today, when organizations operate in a stable environment, with low variability in outputs, these models continue to serve organizations reasonably well. However, when the complexities in the business environment increase, these traditional volume-driven costing models are less capable of providing accurate cost information (Cooper, 1987; Drury, 1990).

2. The reign of ABC

To address the weaknesses of traditional volume-based cost allocation models, accountants developed the activity-based costing (ABC) in late 1980s (Fig. 1). The adoption of the ABC model helps organizations to avoid product cost cross-subsidisation between high-volume, low-complexity organizational outputs and low-volume, high-complexity organizational outputs, by allocating resource costs through the multiple activities performed at different levels within an organization (Cohen, Venieris, & Kaimenaki, 2005; Cooper & Kaplan, 1988; Swenson, 1995).

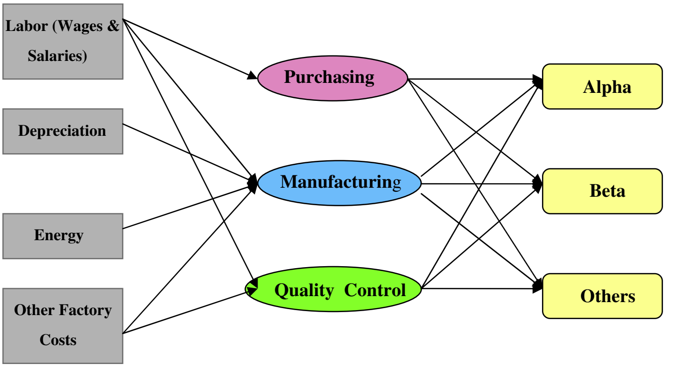

Fig. 1. ABC-based costing model: cost flows.

While the ABC model is technically superior to the volume-based cost allocation models, it has had limited success in replacing these traditional costing models. In addition to criticism in terms of methodology (Anderson, 1995; Gosselin, 1997, 2007; Krumwiede, 1998; Malmi, 1997), users have also criticized its complexity in implementation. Kaplan himself acknowledged this criticism and recommended abandoning it (Kaplan & Anderson, 2007).

Problems with implementation are true for complex organizations that ostensibly require dynamic cost allocation systems to keep pace with change in competitive environments. The adoption rate of the ABC model in business organizations remains low. A significant body of literature implementation difficulties worldwide result in a vast majority of ABC implementations not sustaining (being abandoned) in the long run (see Byrne, Stower, & Torry, 2009; Cobb, Innes, & Mitchell, 1992; Cotton, Jackson, & Brown, 2003; Foster & Swenson, 1997; Gosselin, 1997; Innes, Mitchel, & Sinclair, 2000; Kaplan & Anderson, 2004, 2007; Kiani & Sangeladji, 2003; McGowan & Klammer, 1997; Nguyen & Brooks, 1997; Shields, 1995).

Commonly cited reasons for failures in adopting and implementing the ABC model at the start-up phase include: (i) it takes a long time to collect data requiring significant resources commitments; (ii) the model requires recognizing too many activities and cost drivers for organizational complexity, thus requiring high data processing capacities; and (iii) the model does not recognize unused capacity in the statements of time.

Other problems cause projects to be abandoned. Users encountered the following issues: (i) the complex ABC-based cost management systems in large organizations necessitate repeat interviews in order to allot time to the activities (Kaplan & Anderson, 2004; Pernot, Roodhooft, & van den Abbeele, 2007); (ii) the ABC-based cost management systems did not integrate with other parts of organizational information systems (Sharman, 2003); and (iii) the model lacked ongoing management support (Cohen et al., 2005; Kaplan & Anderson, 2007; Kiani & Sangeladji, 2003).

Further analysis of the first two reasons for the lack of implementation/sustenance of ABC implementation projects shows that they arise from difficulties in controlling a key calculation in stage 1 of the process, i.e. allocating resource costs into activity cost pools.[1] In response to these stage 1 difficulties, many organizations elected not to implement fully an ABC-based cost management system after they performed analyses of organizational activities. Instead, they used the information gathered from the analyses to improve their existing volume-based cost allocation systems (Baird, Harrison, & Reeve, 2004; Gosselin, 1997).

Implementing the ABC model requires an organization to analyze links between organizational activities and organizational outputs. Therefore, even a partial analysis enables management to understand the values of organizational activities and helps to eliminate activities that do not add value (Gosselin, 1997; McNair, 2007). An activity analysis is beneficial to an organization even when an ABC-based cost management system is not subsequently implemented. However, once an ABC project is abandoned, it is unlikely that even a partial activity analysis will be carried out.

As the ABC model failed to provide a cost-effective and sustainable cost management solution (especially due to stage 1 difficulties in allocating resource costs into activity cost

[1] Stage 2 of an ABC allocation process is to map activity cost pools into cost objects such as products, customers, and organizational processes (white-collar departments). This is relatively easy to control via activity cost drivers.

pools), the time-driven activity-based costing (TDABC) model was developed to succeed the ABC model. Kaplan and Anderson proposed this model in 2004 as a method in its own right, although the first traces of this approach could be found in the Cooper and Kaplan and publication of 1998 (Cooper & Kaplan, 1998, p. 292–296).

The TDABC model was designed to address the implementation problems of the ABC model, especially the stage 1 difficulties referred to above. Kaplan and Anderson denied any relationship to the original ABC method[2] (2007, p. 6, 17–18), and insisted that this method was not 'Old Wine (ABC) in New Bottles (TDABC)'.[3] In this paper, we will look closely at the TDABC model and consider if it is a worthy and more user-friendly alternative to the ABC model. We will focus particularly on examining if country-specific factors cause stage 1 implementation difficulties in ABC, and if TDABC will alleviate these difficulties.

3. Time-driven activity-based costing (TDABC)

The TDABC model is a variant of the ABC model that is specifically designed to simplify the implementation and maintenance of activity-based cost management systems (Kaplan & Anderson, 2004, 2007). The main difference between the two methods is that the ABC method asks employees how long they spend on different activities in order to link costs with the activities, whereas the TDABC method estimates the time taken to perform these tasks and then multiplies it by the number of tasks and the hourly cost.[4] The model removes activity pools and the use of quantity-based resource-activity cost drives to address the difficulties faced by management in the stage 1 implementation of an ABC-based cost management system. It is based on an equivalence approach which uses duration drivers (standards of working hours) instead of transaction drivers (Everaert & Bruggeman, 2007). The standards can be revised when the production conditions change. To implement the TDABC model, organizations would need to combine standard costing into the ABC methodology. Supporters of the model suggest that TDABC-based cost management systems can provide equally accurate cost information, while removing the need for performing costly and time-consuming employee surveys[5] in developing and maintaining the costing model (Barrett, 2005; Kaplan & Anderson, 2004).

Kaplan and Anderson (2007, p. 3) claim that over 200 companies use the TDABC method.[6] However, the concept remains largely ignored in the academic literature. Only a few academic articles (e.g. Cardinaels & Labro, 2008; Everaert & Bruggeman, 2007; Hoozée & Bruggeman, 2007, 2010; Levant & Zimnovitch, 2008; Tse & Gong, 2009) and a few case

[2] Kaplan and Anderson have referred to the original version of the ABC model as 'Rate-Based ABC' (Kaplan & Anderson, 2003), 'Traditional ABC' (Kaplan & Anderson, 2004) or 'Conventional ABC' (Kaplan & Anderson, 2007), and have taken pains to contrast this to TDABC.

[3] This denial was as a result of issues raised earlier by Shank (1989) regarding management accounting research in general.

[4] This denial is a direct reference to Cooper's article (1997).

[5] There may be country specific factors that make surveying of employees more difficult in some cultures than in others. This could lead to problems in the activity analysis and data collection stages of ABC model building, and in the long-term sustenance of the ABC model.

[6] It is mainly used by one consultancy firm, Acorn, of which Anderson is the Founder Director and Kaplan is a Board Director.

studies (e.g. Bruggeman, Everaert, Levant, Saens, & Anderson, 2008; McDonach & Mattimore, 2008) appear to address the issue.

According to Kaplan and Anderson (2004), TDABC simplifies the ABC method in two significant areas:

1. The number of activities is reduced and analysis takes place at the level of the departments or processes. Kaplan and Anderson (2004) present a case study where 1200 activities have been reduced in 200 processes. [However, ABC can also reduce activities into a smaller number of processes, by re-defining what is meant by an 'activity' and/or using fewer cost drivers.][7]
2. The need to collect information from different services is limited because of the use of standards. Different types of drivers are expressed in terms of only one 'equivalent-time driver'. This perhaps directly addresses the stage 1 difficulties faced worldwide by ABC, and if the resultant allocations have similar decision information to ABC, then TDABC is a worthy contender as an ABC replacement.

4. Research objectives

From the ease of implementation perspective, the TDABC model shows some promise as the successor to both the traditional volume-based cost allocation model and the ABC model. The only theoretical justification for the switch is cost benefit. The reduction in the quality of information for a true ABC system has a lower reduction in benefits than the cost savings of TDABC. If TDABC is accepted by more firms than ABC then we can infer that the foregoing is true. However, there are limited empirical studies on either the usefulness or of the acceptance of the TDABC model. There is no research on whether the two models can alleviate problems in ABC implementations. As discussed above, stage 1 difficulties play a key role in ABC implementation failures, and country-specific factors may be at play here. Therefore, the ability to alleviate ABC implementation problems is an essential criterion for a costing model to succeed the ABC model.

Sharma and Ratnatunga (1997) demonstrated that a cost model evolves via a number of alternative routes; i.e. the costing method (job or process costing); cost type (actual or standard); treatment of overheads (full absorption or variable) and method of indirect cost allocation (volume, activity, time, capacity or resource).[8] The objective of this paper is to present a comprehensive case study that enables comparison and evaluation. We will also analyze the decision making information provided by the three competing cost allocation models, i.e. those using (1) volume; (2) activities; and (3) standard time equivalents, as platforms for indirect cost allocation.

This paper contributes to international accounting literature because it examines how different costing models alleviate country-independent difficulties in developing and maintaining cost management systems. Due to the absence of national regulatory standards,

[7] The logical extreme to this simplification is traditional volume based absorption costing in which 'manufacturing' is considered as one 'process'.

[8] The case study company presented in this paper initially used the job absorption costing method with actual costs and a volume-based traditional cost allocation system.

management accounting is international. However, Williams and Seaman (2001), O'Connor, Deng, and Luo (2006), and Hoozée and Bruggeman (2010) have stated that the adoption of management accounting practices in different countries is driven by both country-neutral factors (e.g. industry, management style) and country-specific factors (e.g. culture, governance structure, economic environment, etc.). Therefore, to understand the relevance of an emerging management accounting practice like TDABC to a particular country, we must examine both types of factors. As discussed in previous sections, stage 1 difficulties hinder the adoption of the ABC model in organizations, because of country-specific or country-independent factors, or both. Our understanding of the TDABC model's ability to alleviate stage 1 difficulties is a foundation for future research on the effects of these factors to the TDABC model. The use of data outside the country where the TDABC model was developed (i.e. the USA) and in a developing economic environment (i.e. Sri Lanka) enhances the validity of the findings because it reduces the risk of contamination by country-specific factors.

The remainder of this paper is organised as follows. In the next section, we introduce details of a company from which we extracted data to run comparisons of the costing models. We found information on two product lines from a traditional volume-based costing system and used it to implement an ABC-based costing model. We report the difficulties (if any) in the stage 1 activity analysis and data collection stages of implementation ascertain if there were country-specific factors that impeded ABC model building. Next, the ABC-based costing model is converted to one based on the TDABC model. We then compare the decision information provided by the two models, followed by a discussion of the issues raised in the cost modelling. In the final section, we draw conclusions to ascertain if TDABC provides equally useful decision information while alleviating the implementation problems of ABC.

5. Comparison of costing models: A case study

5.1. The case study company

The case study company (which we shall call 'Compariso Ltd') is a listed manufacturing company in Sri Lanka producing activated carbon. This is a product made out of coconut shells. The company has factories in Sri Lanka, Indonesia and Thailand. The data in this case study was obtained from the main Sri Lankan operations.

The production logistics are as follows. Outside suppliers burn the husked and used coconut shells in a controlled manner to produce 'charcoal'. The company then purchases the charcoal via individual purchase contracts, or from a vibrant trading market. As there are many 'grades' of charcoal, the purchased charcoal is stored in large bags of standard sizes (components). Therefore, the purchasing, material handling and storage of these 'components' are important activities of the company. The manufacturing process consists of crushing the charcoal to various size grades, and using large kilns where steam is injected into the micro-pores of the charcoal to 'activate' it. Depending on the final grades required, the activated carbon goes through a filtering process and further steam injection. The factory may do further work depending on if the end-use of the activated carbon is for gold absorption, water purification, pollution control, etc. There are also 'specialised' uses of activated carbon, such as for medicines, clothing, air purification, combating blue-green algae, etc. Depending on use, some of the carbon needs to be 'silver impregnated', and requires further processing. Consequently the company had about 10 different end product lines, some produced in extremely high volumes (with batch sizes ranging from 500 to 1000 metric tonnes) and in other cases the volumes were as low as a batch size of 1 metric tonne. This requires varying machine setups. Quality control is essential to test constantly the consistency of the activation levels in the different grades. Finally, once the grades are tested, the activated carbon is put into 50 kg bags, labelled and stored. The sales unit is a metric tonne, i.e. 20 × 50 kg bags.

The data presented was collected in January 2009, and pertains to the third quarter of company's financial year, which was the calendar year 2008. [Permission was obtained to present the information in a case study after the numbers were suitably modified for confidentiality and competitive reasons.] In the past few years, Compariso had been performing reasonably well, but its market share declined as a result of severe competition. We give the company's income statement for the third quarter of 2008 using traditional absorption costing in Appendix 1, Table 1.

5.2. The traditional costing system

Compariso uses absorption costing for both external reporting as well as for providing individual product line information for decision making. The production overhead application rate per direct labor hours for traditional absorption costing used for all product lines manufactured was $20.

In the period under observation, Compariso's senior management was concerned with the profit performance of some specific product lines. The production manager was surprised when the accountant showed him that some difficult and time-consuming product lines had similar profit margins to some of his favourite lines. For example, small batches for water purification etc. (Beta) sold equally well as products used for gold adsorption (Alpha) that sold very well and were produced in large quantities. The data relating to these two product lines are shown in Appendix 1, Table 2 and the resultant gross margin calculations are presented in Appendix 1, Table 3.

One of the researchers of this paper was brought in as Compariso's financial consultant, and advised management to try an ABC system for 2009 (using 2008 data), while still retaining the traditional costing system. That researcher advised that an ABC system would provide more accurate product cost and margin information to guide the company's strategic production and marketing effort, and would highlight value adding and non-value adding activities the company performed. The data gathered for this project was used in this paper to generate not only the ABC-based reports, but also to test how the numbers would look if the company decided to adopt the TDABC model.

5.3. Development of ABC-based costing system

Fig. 1 presents the cost mapping of an ABC-based cost allocation model. The model identifies four resource pools: labor (wages and salaries), depreciation, energy and other factory costs.

The four cost pools are linked to three activity pools: purchasing, manufacturing, and quality control (there are more activity pools in the data, not shown for the sake of simplicity).

After allocating resource costs to the activity pools, activity costs are subsequently allocated to the two cost objects (the Alpha and Beta product lines) of interest in this case.

Impariso had a very good ERP system. It also had excellent document flow charts prepared by the Internal Audit section that helped greatly in the activity mapping (stage 1) of the ABC project. We used the information from interviews, the general ledger, and ERP and MRP systems to map resource costs to activity cost pools, identify cost drivers, and compute driver units actually used in the third quarter of 2008 (Appendix 1, Tables 4 and 5).[9]

In the activity analysis and date collection stages, especially in conducting the interviews, there was no evidence of any country-specific factors causing implementation difficulties. Certainly country-neutral factors such as the industry in which the company operated and its management style affected model building. However, in Compariso's case, these had a positive effect as no impediments were placed on conducting interviews in the subsequent cost modelling.[10] Thus, we could directly compare the TDABC model and its results to the results the ABC model obtained without any country-specific factors contaminating it.

For the purpose of comparing ABC with TDABC, standard times allowed (in hours) were determined for certain driver units (e.g. it was estimated that it would take 0.5 h to prepare an average purchase order) and these are shown in Appendix 1, Table 6. Some volume-based cost drivers could not be converted because they were unrelated to time, and these were left unchanged (e.g. number of components, units, sales dollars etc.). Using the resource cost information from Appendix 1, Tables 4 and 5, and the cost driver information from Appendix 1, Table 6, we provide cost per cost driver calculations in Appendix 1, Table 7. The cost drivers relating to the two product lines under investigation are shown in Appendix 1, Table 8 and the resultant gross margin calculations under ABC are presented in Appendix 1, Table 9.

The decision information we obtained from the ABC project was in keeping with the perceptions of the management. Management thought that the low-volume and more complex Beta product line made a significantly lower gross margin than the standard Alpha product line. In fact, it was a loss product line if marketing costs were allocated to it. These benefits are well documented in ABC literature.

We will now undertake cost modelling to illustrate how the data collected in the case study company would be presented under the TDABC cost allocation model.

6. From ABC to TDABC

Converting an ABC-based costing model to a TDABC-based one should be a relatively simple process. Relationships between resource cost pools, activities and cost objects identified in the ABC-based costing model can be adopted in the TDABC-based model via 'resource groups' (e.g. purchasing, manufacturing, selling) using multiple time-based drivers to allocate costs to cost objects or using a single time-based driver if the data has

[9] Note that production wages were classified as an overhead expense in the ABC- system. It was also decided not to allocate administration (general) expenses, advertising and promotions, and sales administration expenses to product lines under the ABC- system.

[10] The country-neutral complexity arising out of maintaining the homogeneity condition in TDABC will be discussed later.

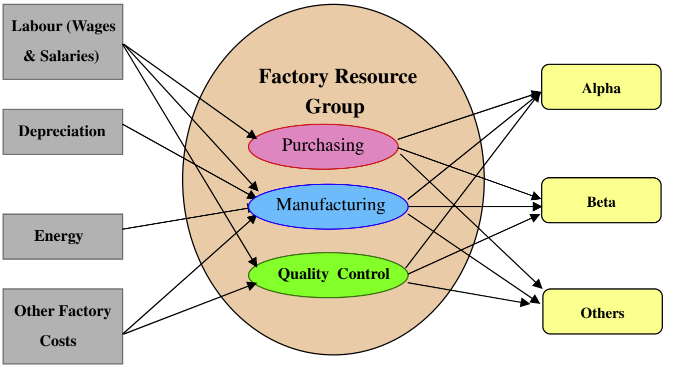

Fig. 2. The TDABC-based costing model: the resource groups (multi-driver) variant.

complexities. Fig. 2 illustrates the allocation via a resource group using multiple-drivers and Fig. 3 illustrates the allocation via a resource group using a single time-based driver.

A “resource group” could be an organizational unit, department or section that may consist of many different activities. As there are fewer “resource groups” than activities, the method seems to be reduce the complexity of data collection and reduce measurement errors. This is due to the use of time standards. In ABC, complex operations require adding more activities into the model. In TDABC, this complexity is accounted for by using ‘equivalent-time’ equations to determine how many resources each group consumes. Equivalences are established in a “resource group” by means of a single driver: the time needed to perform them.[11] Using these equivalency equations, the model should be easy to update. For example, one could add an extra activity (if performed within a resource group), add variables to explain the time spent, take into account changes in productivity, etc. that no longer present an ongoing maintenance problem. It is not necessary to conduct regular and time-consuming surveys just to determine if the distribution of work time between different activities has changed. This simplifies the method’s maintenance and enhances the sustainability of the costing project. The program requires conducting regular surveys to ensure that these equivalent-time standards remain consistent with the latest practices in the organization.

At first glance, the TDABC-based model shown in Fig. 2 does not look much different from the ABC-based model in Fig. 1.[12] The two models share the same resource cost pools, the same activities and the same cost objects. The difference is that the activity cost pools reside within a ‘resource group’ and some cost drivers are converted to equivalent-time drivers (Barrett, 2005; Kaplan & Anderson, 2004).

[11] Kaplan and Anderson (2007) state that capacity drivers may also be used, and if so, that the method should be called Capacity-Driven ABC rather than Time-Driven ABC.

[12] The basic TDABC model is in fact an ABC model that uses time as a cost driver, where the obtaining of structural cost drivers is cumbersome (e.g. time to do purchase orders rather than the total number of purchase orders).

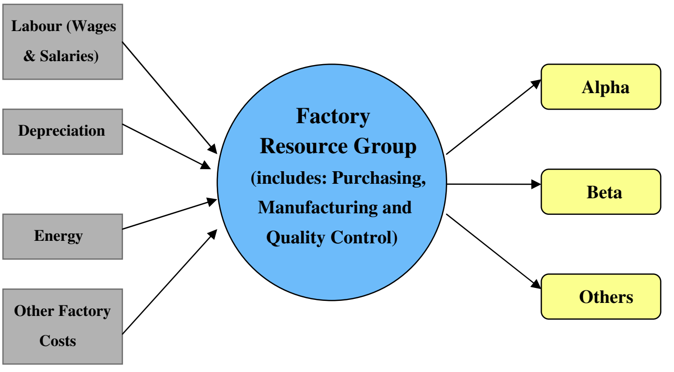

Fig. 3. The TDABC-based costing model: the resource groups (single-driver) variant.

The value of a resource time-activity cost driver equals resource costs for a unit of the resource (hours) multiplied by the number of hours for an activity (Everaert & Bruggeman, 2007; Kaplan & Anderson, 2004). The number of resource-activity cost drivers between a resource pool and a cost object depends on each activity's resources consumption patterns. For instance, wage and salary cost is consumed by all of the activities (such as purchasing, assembly and quality control), while energy cost bears no relationship with the purchasing activity. Therefore, wage and salary cost is linked to each cost object through three separate resource time-activity cost drivers, while energy cost is only linked via one.

In the case study company, we first modelled the multiple-driver variant of TDABC (Fig. 2). Here, resource costs are linked to resource time-activity cost drivers via activity pools, just as in ABC. The only difference is the model uses resource time drivers instead of cost drivers wherever data complexity issues arose.[13] The link between a cost driver and the standard resource time to undertake an activity was shown in Appendix 1, Table 6. With this information, the cost per cost driver under TDABC can be calculated, as shown in Appendix 1, Table 10.

Resource time drivers are derived from the cost drivers, so the links to the cost object would maintain a similar relationship. Therefore, the calculation of product line gross margins (Appendix 1, Table 11) would be the same as under ABC (compare Appendix 1, Table 9 with Table 11). The conclusion we can draw from this modelling exercise is that if transaction-based cost drivers are accurately converted to standard equivalent-time drivers (Appendix 1, Table 6) and idle capacity issues are at a minimum, then the decision information provided to management would be almost identical.

[13] Even when using TDABC, managers in the case study company argued that some non-time based volume measures (where the cause-effect relationship is more appropriate than time measures and there is no complexity in collecting the data) should be used (e.g. number of components; no. of products). This was done in the cost modelling.

The differences arise when the links to cost objects through a resource group (consisting of all related activities) use a single time-based driver (and not via separate activity pools) (Fig. 3). Here we need to make some simplifying equivalent-time assumptions. For example, we assume that with regards to the 'purchasing' activity, each cost object (i.e. product line) consumes the same amount of purchasing capacity/time. In such cases, the cost per resource time driver for purchasing will be the cost of running the purchasing activity ($1,200,000) divided by either the number of units produced (625,000 units) or labor hours (500,000 h). Here the complexity of purchasing is assumed to be related to the complexity of manufacturing.[14]

Of course if all activity costs are allocated to cost objects using a volume measure such as units or labor hours, then as Appendix 1, Tables 12 and 13 show, the gross margins are no different than traditional absorption costing (compare the gross margins of Appendix 1, Table 3 with Table 13).[15] The conclusion we can draw from this modelling exercise is that if the organization is so complex that transaction-based cost drivers cannot be accurately converted to standard equivalent-time drivers, then we need to make assumptions at a 'resource group' aggregative level or the decision information provided to management would have all of the cross-subsidisation imperfections between cost objects that caused managers to question the validity of traditional absorption costing. Cleary, 'Single-driver TDABC" is a retrograde step, and trades perceive 'simplicity' in place of 'accuracy'. The easiest way to understand this is with respect to batch level costs. Suppose one person has to watch a batch of charcoal as it is processed and the batch also costs the same amount whether there are 1 or 1000 units. Using time as the driver, the cost of the batch would be the same regardless of size and thus large batches would be significantly overcosted. This is a typical situation with volume-based allocation and it is one of the original justifications for ABC.

7. Issues arising

In undertaking this comparative modelling exercise using actual data, four issues arose that warrant further discussion: (i) the use of standard costs vs. actual costs; (ii) the treatment of idle capacities; (iii) the maintenance of the homogeneity condition; and (iv) the estimation of time in a time-based model.

7.1. Actual costs or standard costs

In the case study company, managers preferred to use actual costs (against standard costs) to determine the unit cost of objects. Kaplan and Anderson (2007) recognized that most

[14] This approach to cost allocation, linking activity pools to cost objects using direct labor hours was first suggested by Ratnatunga (1983); well before the "Relevance Lost' seminal work by Johnson and Kaplan (1987) that ushered in ABC.

[15] Appendix 1, Tables 12 and 13 provide more detail than required if a single-time equivalence driver is used. In reality total factory resource costs of $17.5 million will be divided by 500,000 direct labor hours to get a single cost driver of $35 per direct labor hour. Similarly, total distribution resource costs of $2.9 million will be divided by $40 million sales driver units to get a single cost driver of $0.07 per sales dollar.

companies base their cost calculations on actual costs because: (i) these costs are directly based on reality and therefore perceived by the users as being more credible; (ii) there is a stronger link between the general ledger and management accounting; and (iii) companies do not need to make budget forecasts in order to use the model. When companies use actual costs, they may experience delays from invoicing or slow recognition of expenses that can skew the calculations (Kaplan & Anderson, 2007).[16] They can solve this problem by ensuring that data gathering periods are not too short and by spreading charges across the financial year using statistical and other smoothing techniques.

7.2. Idle capacity in a resource group

One of TDABC's advantages is that it can isolate idle capacity within a resource group (Kaplan & Anderson, 2007; Tse & Gong, 2009). However, this advantage is not unique to TDABC because ABC also has arguments in favor of capacity costing (Cooper & Kaplan, 1991, 1992; Robinson, 1990).

In the case study company, a 'normal level' of activity was defined as the normal capacity, which we also used as the budgeted/practical capacity. The company defined this normal capacity as being about 80% of theoretical capacity, which is in keeping with Kaplan and Anderson (2003, 2004) who proposed a ratio between practical capacity and theoretical capacity for labor hours. The managers of the case study company stated that there were wide variations in capacity (mainly due to the availability of the machines, i.e. kilns), with capacity often being leased from competitors who had excess capacity. Idle capacity was a non-issue in the case study company.

7.3. The homogeneity condition

An important condition of the single-driver version of TDABC (Fig. 3) is that the activities or transactions performed in one resource group and allocated to different cost objects should consume resources in the same proportions; i.e. for the calculation to be correct, the time must remain proportional to the average consumption of the department. This is referred to as the condition of homogeneity (Gervais, 2005; Kaplan & Anderson, 2007).

The case study company had special equipment for manufacturing silver-impregnated activated carbon. Here, the silver-impregnation process must be separated from other types of activation, as the resources used and the rate at which they are used are not the same. The critics of the TDABC method do not seem to highlight the importance of this condition, and most likely the users are also unaware of it.

In TDABC, any major changes to the production process and productivity gains must be taken into account when using standard times, as these changes could alter the proportionality between times and thus alter the homogeneity condition. Rigorous maintenance and regular

[16] That may be true for ABC adopters however this goes against other survey evidence. Shields, Chow, Kato, and Nakagawa (1991) in a cross-country study, showed that a majority of manufacturers - about 60% of Japanese and 70% of US - used standard costs.

revision are thus necessary, which runs contrary to the simplification of data collection and analysis claimed as a benefit of the TDABC method.

We have already modelled and shown that the single-driver version of TDABC is a retrograde step with all of the problems of traditional costing (Appendix 1, Tables 12 and 13). When the complexity of maintaining the homogeneity condition is added to the list, there appears to be no merit in adopting the TDABC as a cost allocation approach.

7.4. The estimation of time

The reason complex companies started using ABC was because using direct labor hours to allocate indirect costs was perceived as being outdated in terms of changing production technologies (including automation) and lean manufacturing processes of organizations (Cooper, 1987; Cooper & Kaplan, 1988; Johnson & Kaplan, 1987). However, the use of labor times still remains relevant in service organizations. Purportedly, TDABC enables such organizations to model the variety and complexity that they encounter in the production of services. In fact, the examples provided in the work of Kaplan and Anderson (2007) are based on service activities.

However, labor times are more difficult to measure in service companies than in manufacturing, due to the more diverse range of activities performed by the workforce. The common practice is for employees to estimate the percentage of time spent on their various activities. Kaplan and Anderson (2003, 2004, 2007) are critical of this data collection approach, as they claim that often the total of these percentages is often equal to or greater than 100%; thus, that unused capacities have been ignored.

Kaplan and Anderson (2007) prefer to determine the time necessary to perform tasks by means of a direct estimation in minutes or hours based on contextual observation, interviews and comparative information by the cost modellers. However, other authors have done studies that contradict what Kaplan and Anderson (2007) say. They show that estimation errors by cost modellers were more prone to errors than those obtained from the employees (Cardinaels & Labro, 2008; Hoozée & Bruggeman, 2007).

These estimation issues did not arise in the comparative cost modelling of the case study company, as (i) it was a manufacturing organization, (ii) it had ERP and MRP systems that largely provided this time equivalence information and (iii) non-time-based drivers were used (where appropriate) in the multi-driver application of the model (Appendix 1, Table 10).

8. Conclusion

From the comparative gross margin results presented using the case study data, it appears that ABC is superior to traditional volume-based cost allocation systems. However, the multi-driver version of TDABC seems no different to ABC, if standard-activity times are used as cost drivers. We also showed that attempting to simplify the stage 1 activity analysis stage of ABC implementation (by using a single-volume related cost driver) ultimately makes TDABC no different than traditional costing systems.

Both ABC and TDABC models can provide two types of information for decision making: (1) costs allocated to cost objects and (2) links between resource pools and cost pools. However, they provide such information in different ways with different levels of accuracy.

The adoption of an activity-based paradigm (via either ABC or TDABC) enables cost management systems to provide information on how operating activities add value to organizational outputs through linkages between resource pools and cost pools. With information on costs allocated to cost objects, management can manage product costs by changing quantities of organizational outputs. Management can also reduce product costs by reducing or eliminating non-value-added activities with this type of information (Gosselin, 1997).

While the TDABC model is designed to address implementation problems faced by the ABC model, the adoption of the model in the case study company did not help to alleviate the country-independent stage 1 activity analysis complexities of an ABC implementation, especially if it tried to maintain the homogeneity condition. Thus, TDABC is unable to help organizations solve implementation problems in a manner that will not compromise accuracy. If implementation problems are the only criterion for organizations to adopt a costing system, then adoption of TDABC will not alleviate this problem.

In this study we did not test if TDABC can provide valuable information on idle resources to support decision making (Kaplan & Anderson, 2007; Tse & Gong, 2009). Future research could focus on testing the usefulness of TDABC in providing information on idle resources. Alternately, it could determine if information on idle resources is useful for decision making.

In summary, this case study determines that the TDABC model is ABC in sheep's clothing. In its extreme form, TDABC provides decision information as erroneous as that produced by traditional volume allocations. As such, we predict that TDABC will result in even fewer implementations sustaining than ABC has managed.

Appendix 1

Table 1
Compariso Ltd. income statement for 3rd quarter 2008.

Sales				$40,000,000
Less	Cost of goods sold			
	Materials		$8,000,000	
	Labor		$7,500,000	
	Production overheads			
	Depreciation	$7,000,000		
	Energy	$2,500,000		
	Other Factory Costs	$500,000	$10,000,000	
	Total			$25,500,000
Gross margin				$14,500,000
Less	Marketing expenses			
	Delivery expenses	$400,000		
	Sales commissions	$2,000,000		
	After sales service	$500,000		
	Advertising & promotions	$2,000,000		
	Sales administration	$1,000,000	$5,900,000	
Less	Administration expenses		$3,000,000	
	Total			$8,900,000
Net income before tax				$5,600,000

Table 2
Sales and cost data for 2 product lines.

Product lines	Alpha	Beta
Per unit data:		
Price	$80.00	$400.00
Direct materials costs	$20.00	$120.00
Direct wages	$15.00	$60.00
Labor hours	1	4

Table 3
Product line gross margins under traditional absorption costing.

			Alpha		Beta
Sales			$2,400,000		$800,000
Costs					
	Materials	$600,000		$240,000	
	Labor	$450,000		$120,000	
	Overheads	$600,000		$160,000	
			$1,650,000		$520,000
Gross margin			$750,000		$280,000
Gross margin percent			31.25%		35.00%

Table 4
Production expenses.

Activity cost pools	Cost $
Purchasing	1,200,000
Materials handling and storage	1,000,000
Machine setup	1,350,000
Quality control	800,000
Labor and other overhead	10,650,000
Packaging	2,500,000

Table 5
Marketing expenses.

Activity cost pools	Cost $
Delivery expenses	400,000
Sales commission	2,000,000
After sales service	500,000

Table 6
Driver units.

Activity cost drivers	Driver units	Std. time in hours per driver unit	Time equivalent driver units
No. of components used	5,000,000	N/A	N/A
No. of setups	9,000	4.0000	36,000
No. of batches	3,200	1.0000	3,200
No. labor hours	500,000	1.0000	500,000
No. machine hours	500,000	1.0000	500,000
No. of units	625,000	N/A	N/A
No. of sales orders	4,000	0.5000	2,000
Sales dollars	$40,000,000	N/A	N/A
No. of service calls	10,000	1.0000	10,000

Table 7
Cost per cost driver calculations under ABC.

Activity cost pool	Cost driver identified	Resource costs	Driver units	Cost per driver unit
Mat. handling and storage	No. of components used	$1,000,000	5,000,000	$0.20
Machine setup	No. of setups	$1,350,000	9,000	$150.00
Quality control	No. of batches	$800,000	3,200	$250.00
Manufacturing	No. labor hours	$10,650,000	500,000	$21.30
Packaging	No. machine hours	$2,500,000	625,000	$4.00
Delivery expenses	No. of sales orders	$400,000	4,000	$100.00
Sales commissions	Sales dollars	$2,000,000	40,000,000	$0.05
After sales service	No. of service calls	$500,000	10,000	$50.00
Total costs allocated		$20,400,000		
Sustaining costs unallocated		$4,000,000		
Total production direct costs		$8,000,000		
Total costs		$32,400,000		

Table 8
Cost driver data for 2 product lines under ABC.

Product lines	Alpha	Beta	All product lines
ABC cost drivers			
No. purchase orders	200	200	3,000
No. of components used	450,000	100,000	5,000,000
No. of setups	50	1,000	9,000
No. of batches	50	200	3,200
Total labor hours	30,000	8,000	500,000
Total machine hours	30,000	8,000	500,000
No. of units produced and sold	30,000	2,000	625,000
No. of sales orders	300	400	4,000
Sales dollars	$2,400,000	$800,000	$40,000,000
No. of service calls	50	500	10,000

Table 9
Product line gross margins under ABC absorption costing.

	Alpha			Beta		
	units	Price	Value	units	Price	Value
Sales	30,000	$80	$2,400,000	2,000	$400	$800,000
Production costs						
Direct materials	30,000	$20.00	$600,000	2,000	$120	$240,000
Indirect costs	Cost per driver unit	Driver units	Allocated costs		Driver units	Allocated costs
Purchasing	$400.00	200	$80,000		200	$80,000
Mat. handling and storage	$0.20	450,000	$90,000		100,000	$20,000
Machine setup	$150.00	50	$7,500		1,000	$150,000
Quality control	$250.00	50	$12,500		200	$50,000
Manufacturing	$21.30	30,000	$639,000		8,000	$170,400
Packaging	$4.00	30,000	$120,000		2,000	$8,000
Total production costs			$1,549,000			$718,400
Gross margin			$851,000			$81,600
Marketing costs						
Delivery expenses	$100.00	300	$30,000		400	$40,000
Sales commissions	$0.05	$2,400,000	$120,000		$800,000	$40,000
After sales service	$50.00	50	$2,500		500	$25,000
Total			$152,500			$105,000
Net income			$698,500			($23,400)
Gross margin percent			35.46%			10.20%
Net margin percent			*29.10%*			*-2.93%*

Table 10
Cost per cost driver calculations under TDABC (multi-driver) variant).

Activity cost pool	Cost driver identified	Resource costs	Driver units	Cost per driver unit
Mat. handling and storage	No. of components used	$1,000,000	5,000,000	$0.20
Machine setup	Time per setup	$1,350,000	36,000	$37.50
Quality control	Time per batch	$800,000	3,200	$250.00
Manufacturing	No. machine hours	$10,650,000	500,000	$21.30
Packaging	No. of units	$2,500,000	625,000	$4.00
Delivery expenses	Time per sales order	$400,000	2,000	$200.00
Sales commissions	Sales dollars	$2,000,000	40,000,000	$0.05
After sales service	Time per Service Call	$500,000	10,000	$50.00
Total costs allocated		$20,400,000		
Sustaining costs unallocated		$4,000,000		
Total production direct costs		$8,000,000		
Total costs		$32,400,000		

Table 11
Product line gross margins under TDABC absorption costing (multi-driver variant).

	Alpha			Beta		
	units	Price	Value	units	Price	Value
Sales	30,000	$80	$2,400,000	2,000	$400	$800,000
Production costs						
Direct materials	30,000	$20.00	$600,000	2,000	$120	$240,000
Indirect costs	Cost per driver unit	Driver units	Allocated costs		Driver units	Allocated costs
Purchasing	$800.00	100	$80,000		100	$80,000
Mat. handling and storage	$0.20	450,000	$90,000		100,000	$20,000
Machine setup	$37.50	200	$7,500		4,000	$150,000
Quality control	$250.00	50	$12,500		200	$50,000
Manufacturing	$21.30	30,000	$639,000		8,000	$170,400
Packaging	$4.00	30,000	$120,000		2,000	$8,000
Total production costs			$1,549,000			$718,400
Gross margin			$851,000			$81,600
Marketing costs						
Delivery expenses	$200.00	150	$30,000		200	$40,000
Sales commissions	$0.05	$2,400,000	$120,000		$800,000	$40,000
After sales service	$50.00	50	$2,500		500	$25,000
Total			$152,500			$105,000
Net income			$698,500			($23,400)
Gross margin percent			35.46%			10.20%
Net margin percent			29.10%			-2.93%

Table 12
Cost per cost driver calculations under ‘single-driver’ TDABC.

Activity cost pool	Cost driver identified	Resource costs	Driver units	Cost per driver unit
Mat. handling and storage	No. labor hours	$1,000,000	500,000	$2.00
Machine setup	No. labor hours	$1,350,000	500,000	$2.70
Quality control	No. labor hours	$800,000	500,000	$1.60
Manufacturing	No. labor hours	$10,650,000	500,000	$21.30
Packaging	No. labor hours	$2,500,000	500,000	$5.00
Total factory resource cost		$17,500,000		$35.00
Delivery expenses	Sales dollars	$400,000	40,000,000	$0.01
Sales commissions	Sales dollars	$2,000,000	40,000,000	$0.05
After sales service	Sales dollars	$500,000	40,000,000	$0.01
Total costs allocated		$20,400,000		
Sustaining costs unallocated		$4,000,000		
Total production direct costs		$8,000,000		
Total costs		$32,400,000		

Table 13
Product line gross margins under 'single-diver' TDABC absorption costing.

	Alpha			Beta		
	units	Price	Value	units	Price	Value
Sales	30,000	$80	$2,400,000	2,000	$400	$800,000
Production costs						
Direct materials	30,000	$20.00	$600,000	2,000	$120	$240,000
Indirect costs	Cost per driver unit	Driver units	Allocated costs		Driver units	Allocated costs
Purchasing	$2.40	30,000	$72,000		8,000	$19,200
Mat. handling & storage	$2.00	30,000	$60,000		8,000	$16,000
Machine setup	$2.70	30,000	$81,000		8,000	$21,600
Quality control	$1.60	30,000	$48,000		8,000	$12,800
Manufacturing	$21.30	30,000	$639,000		8,000	$170,400
Packaging	$5.00	30,000	$150,000		8,000	$40,000
Total production costs			$1,650,000			$520,000
Gross margin			$750,000			$280,000
Marketing costs						
Delivery expenses	$0.01	2,400,000	$24,000		800,000	$8,000
Sales commissions	$0.05	2,400,000	$120,000		800,000	$40,000
After sales service	$0.01	2,400,000	$30,000		800,000	$10,000
Total			$174,000			$58,000
Net income			$576,000			$222,000
Gross margin percent			31.25%			35.00%
Net margin percent			24.00%			27.75%

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