Implementation of the Activity-Based Costing Model for a Farm: An Australian Case

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Abstract

Due to the unique nature of agricultural production, costing of agricultural products presents a major challenge to the management of farms and other organisations that involved in agricultural production. Activity-Based Costing (ABC), with its ability to apply non-volume driven cost drivers and disentangle resource costs and cost objects through two-stage allocation process, has the potential to address issues in costing of agricultural products. This paper presents a case study of ABC implementation in a family-owned Australian farm.

The objectives of the study are to develop an understanding on how the ABC model can be implemented in farms and to examine issues associated with the implementation of the ABC model in farms. Findings from the case show that implementing the ABC model in farms is possible with the use of heuristics. Technical factors are found to be dominant over behavioural factors in the development of the ABC-based costing model for the farm.

Keywords

Activity-Based Costing
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Introduction

Accounting and agriculture are two influential economic sectors that respectively make significant contributions to global economy. However, researchers of the two sectors seldom collaborate with each other. Accounting researchers have traditionally shown little interest in exploring how accounting systems and management controls affect agricultural management. Meanwhile agricultural researchers have been focusing on the enhancement of productivity via scientific management, philosophies and economic models with limited appreciation of the roles of accounting in agricultural industry (Johnston and Mellor, 1961; Polopolus, 1965; Schnitkey and Sonka, 1986; Stollsteimer, 1963; King, Boehlje, Cook and Sonka, 2010).

A major driver of recent research in accounting for agricultural industry is the introduction of International Accounting Standard (IAS) 41. IAS 41 requires all biological assets including agricultural products to be measured by fair value. This represent a radical departure from the traditional historical cost-based accounting practices in the agriculture industry and has sparked controversy over the relevance of the new valuation method. Due to the significance of IAS 41, recent research in accounting for agricultural industry focuses on the appropriateness of IAS 41 and its application (Argilés, Aliberch and Blandon, 2012). As such, limited attention is paid to implications of other branches of accounting to agricultural industry.

For farms, a major accounting challenge is costing of agricultural products. Similar to manufacturing organisations, farms typically have diverse ranges of products (Rosset, 1999). Due to advances in technologies for agricultural production, many farms in developed countries have simultaneously increased the use of machinery and reduced the use of labour in late 20th century. With diverse range of products and increasing weighting of overhead costs, overhead cost allocation becomes an important issue for costing of agricultural products. However, the unique nature of agricultural production increases the difficulty in allocation of overhead costs to agricultural products. The production of agricultural products often spins across multiple financial periods. In addition, some agricultural products may remain unharvested after they mature. Attributing costs incurred in a particular financial period to agricultural products is therefore difficult.

This study presents a case study on the development of a costing Activity-Based Costing (ABC)-based costing model in a family-operated Australian farm. The objectives of the study are to develop an understanding on how the ABC model can be implemented in farms and to examine issues associated with the implementation of the ABC model in farms. The remainder of this paper is organised as follow. Section two presents a discussion on the theoretical underpinnings of the study. Section three outlines the research methodology for the study. The case is presented in section four and a concluding remark is made in section five.

Theoretical Development

In developed countries, a large proportion of farms are operated by individuals or families (ABS, 2014; USDA, 2014). Given their relatively small sizes, farms often do not have no legal obligation to prepare general purpose financial reports (Argilés and Slof, 2001; 2003; Burton, Schurle, Williams and Brester, 1996; Neilson, 1986). As such, many farm operators elect to prepare simplified accounting reports which only include information for satisfying the basic requirements of tax legislations (Baxendale, 2001; Neilson, 1986; Hicks, 1999). While these reports provide farm operators feedback on aggregate financial performance of their operations, they are of limited relevance for resource management (Burton et al., 1996). A particular issue of these reports is the absence of information on product costs except for aggregate cost of goods sold. As such, farm operators often have limited knowledge on the profitability of each product line. The lack of knowledge on product costs hinders farm operators' abilities to develop competitive strategy and improve financial performance.

Unlike materials for manufactured goods, it may not be possible to determine the fair value of all inputs for production of agricultural products. Certain inputs like seeds are derived from existing plants and no additional cost is incurred to "produce" the material. They may not be available for sales in open market as farm operators may elect to keep them for future use. In addition, future benefits of these inputs are uncertain due to the inherit risks of agricultural production. As such, determining the fair value of these inputs would be extremely difficult, if not impossible.

The uncertainties associated with agricultural production further increase the difficulty in calculating agricultural product costs. Agricultural production has multiple stages including soiling, sowing, watering, planting, cultivating, and harvesting (Allen and Lueck, 1998). Each production stage is associated with a number of internal and external uncertainties. Internal uncertainty is associated with agricultural products' natural growths and their physical quantities (e.g. quantity of soil, quantity of breed/seed, maturity pattern) (Argilés and Slof, 2001). For agricultural production, consumption of resources varies seasonally subject to individual product's physical state. Many plants have life that extend across multiple financial periods and the harvest of fruits and flowers can be deferred for one or more financial periods. Variations in resource consumption and time gap between production and harvest make identification of actual costs incurred for producing agricultural products harvested in a particular financial period very difficult.

External uncertainty is driven by biological factors that have significant relationship with outputs of agricultural products (e.g. rainfall, pests, diseases, weather, and temperature). Agricultural industry is the most environmental sensitive economic sector.

Natural environment not only influences the production, distribution and storage of agricultural products but also has implications on their prices and profitability. As such, climate change is considered as one of the key determinants of agricultural production levels. It is estimated that the annual effect of climate change on U.S. agricultural industry reach $10.4 billion (Changnon, 2004). In order to cope with changes in natural environment, distribution of resources and focus of activities in farms vary over time. For example, activities associated with drought/flood prevention and pest control would only emerge and consume relatively more resources in extreme weather conditions but are barely required in normal condition. Due to the low predictability of changes in natural environment, shifts in resource usages across activities driven by environmental changes are also difficult to predict. As such, the use of a limited set of predetermined overhead rates to allocate agricultural production costs would be inappropriate as the suitability of selected cost drivers varies with the shifts in resource usages over time.

A possible solution for costing of agricultural products is the Activity-Based Costing (ABC) model. The limitations of traditional volume-based costing models have been extensively discussed in accounting literature since late 1980s (Cooper and Kaplan, 1988; Miller and Vollmann, 1985; Tse, 2014; Tse and Gong, 2009). As discussed in Tse and Gong (2009), each costing model is developed on the basis of a specific view on how organisations operate. Traditional costing models like job costing and process costing are built upon the assumption that production volume drives, either directly or indirectly, production costs.

As such, it is unsurprising that the models are not well-suited to farms. In comparison, the ABC model considers operating activities as key drivers of production costs. Under the ABC model, production costs are allocated through a two-stage process (Cooper, 1987a; 1987b). The costs are first to allocated to activity pools in accordance with the way that operating activities consume costs, and subsequently allocated from each activity pool to individual cost objects based on their usage of activities. Production volume is only one of the possible drivers of operating activities. In addition, allocation of costs from an activity pool to a cost object is contingent upon the actual usage of activities by the cost object. Activity costs would not be allocated to the cost object if it does not use the activities from an activity pool.

The features of the ABC model put it into a better position to cope with issues in costing of agricultural products. As discussed above, agricultural production is characterised by large proportion of overhead costs, time lags between incurrence of costs and harvest of products as well as significant variations in resource consumption under different operating environments. The two-stage allocation process of the ABC model enables farms to avoid forced allocation of all overhead costs to products and the ability to use non-volume driven activity drivers enable farms to select cost drivers that better reflect the resource consumption patterns.

As the ABC model can potentially be adopted as a solution for agricultural product costing, it would be worthy to consider issues associated with the implementation of the ABC model in farms. A wide range of technical and behavioural factors are known to be influential to the success of ABC implementations in organisations (Cohen, Venieris and Kaimenaki, 2005; Shields and Young, 1989; Tse and Gong, 2009). Given the unique nature of agricultural production, it would be of interest to examine whether the technical and behavioural factors identified in prior studies influence the ABC implementation in farms and the relative importance of these factors on successful implementation of the model.

Research Methodology

Research Site

The research site of the study was a farm in the State of Victoria, Australia (hereafter S Ltd). S Ltd was family-owned and operated and engages in production and sales of plants, flowers and berries. The establishment of the farm could be traced back to the late 19th century. The farm had one full-time employee who performed miscellaneous activities and a few seasonal staff members who mainly involved in pruning and potting. With a size of 21 acres, the farm produced more than one hundred type of flowers, berries and fruits for recreation centres, supermarkets and local nurseries. As most plants were seeded and cultivated many years ago, direct material costs accounted for a small proportion to the total production cost. The owner admitted that he did not know the exact cost of individual products and simply set the price based on guesstimates. The lack of cost information in S Ltd gave rise to the need to develop an ABC-based costing system that enabled the owner to develop an understanding on the costs profitability of individual products.

The site is selected for three reasons. First, the site exhibited characteristics of typical farms in Australia. It was owned by the same family for substantial period, relatively small in size and had few permanent employees. Second, the selected site had a strong stimulus towards the implementation of the ABC model as the owner was aware of the lack of relevant cost information for decision making. Third, the research site was able to supply quantitative information that allowed the implementation of the ABC model.

Data Collection

The study utilised both quantitative and qualitative information. The combination of quantitative and qualitative data enriched the creative potential of the study and enhanced validity of the findings (Eisenhardt, 1989; Mintzberg, 1979).

An ABC model was built upon empirical data gathered from the case firm through direct observation, interviews and archival records. With a triangulation of multiple sources of evidence, the same phenomenon could be measured in more than one ways. This helped to relieve some potential concerns regarding validity of the study (Yin, 2009). Archival records included daily transactions, financial statements, price lists, and work sheets in 2011-2012's financial year were collected in the first field visit.

One site interview and three telephone interviews were conducted across a two-month period. In the first site visit, the researchers received the permission to conduct the case study and have been given an opportunity to observe how S Ltd operated. An interview was conducted in an informal way as it allows more flexibility and promotes the efficiency.

During the interview the owner expressed a strong interest in knowing how to properly prepare accounting information to help his business to improve operational efficiency.

The face to face interview paved the way for useful data collection for the development of an ABC-based costing model for the farm. Subsequent telephone interviews were conducted to gather further information for costing model development. Detailed information such level of cost allocation base and time of resources consumed were scrutinised by the owner and communicated through emails. To develop a better understanding on how flowers and berries were planted, the researchers requested several reference materials that the owner had been used in cultivating.

Case Analysis

Development of the ABC-Based Costing Model

The comprehensive ABC-based costing model that covered all operating costs except for direct material was developed for S Ltd. An activity analysis was conducted to identify the activity pools for the costing model. Through field observation and interviews, twelve activity pools, namely picking and pruning, potting, packaging, bunching, collecting buckets and loading, planting, weeding, planting plastic cover, watering, fertilising, spraying chemicals, and others, are identified. All of the aforementioned activity pools were related to normal activities that sustain the farm's operations regardless of climate conditions. Due to the sensitivity of agricultural production to climate conditions, some agricultural activities were performed differently under extreme climate conditions.

For example, S Ltd had two separate systems for watering activity. Plants were regularly watered via a fixed sprinkler system powered by small petrol driven pump. Meanwhile a diesel pump located at a creek 1 kilometre away from the site was available for open land irrigation. In the year when the study was conducted, S Ltd did not use open land irrigation as Victoria had very heavy rainfall.

In contrast, it was used a lot in previous years. In addition, some activities like pest control and epidemic prevention could be major activities for the farm and consumed a lot of resources in the season of plague. However, the probability of having a plague in Victoria was very low. As the costing model was developed with a view to provide an overview of product costs for the farm under normal operating condition, activities related to extreme operating conditions were excluded from the model.

After identifying the activity pools, the types of resources consumed by each activity pool and drivers for the resources were identified. Data of resource costs and resource drivers were then used to allocate resource costs to activity pools. Most of the resource costs were directly associated with activities and thereby can be directly charged while labour and fuel costs were assigned to their related activities based on labour hours and machine hours respectively. Depreciation, heat and power costs, and other miscellaneous expenses were all allocated to the others activity pool. Table 1 presents the costs allocated to each activity pool from resources associated with each pool.

Table 1: Allocation of Resource Costs to Activity Pools

Activity Pool	Resources Consumed	Resource Driver	Activity Cost
Picking and Pruning	Cost of casual labour	Direct charging and labour hours	$17,021.83
Potting	Cost of potting mix, pots and casual labour	Direct charging and labour hours	$23,242.31
Packaging	Cost of labels, boxes and trays	Direct charging	$7,122.2
Bunching	Full-time labour salary	Labour hours	$4,567.68
Collecting buckets and Loading	Full-time labour salary	Labour hours	$20,675.97
Planting	Full-time labour salary	Labour hours	$4,872.19
Weeding	Full-time labour salary and fuel	Labour hours and machine hours	$2,747.97
Planting plastic cover	Cost of plastic cover	Direct charging	$1,267.85
Watering	Cost of water and fuel	Direct charging and machine hours	$1,971.27
Fertilising	Full-time labour salary and cost of fertilizer	Direct charging and labour hours	$1,655.94
Spraying chemicals	Cost of chemicals and fuel	Direct charging and machine hours	$1,812.64
Others	Cost of electricity, administrative spending, travel cost, rates, depreciation and reference materials	Direct charging	$3,3721.89

Activity costs were subsequently allocated to cost objects based on their usage of activity drivers.

For S Ltd, product lines were selected as cost objects for the model. During the data collection process, 75 product lines were identified. One major concern in the allocation process was the difficulty in identifying the volume for each product line. The exact quantity of agricultural products that were ready for harvest was not known until they were actually harvested.

As discussed above, not all agricultural products were harvested at the time when they were ready. In any particular financial period, a number of uncontrollable factors such as quality of seed, weather conditions, and timely provision of working capital could affect the quality and quantity of unharvested agricultural products from both current and previous financial periods.

For example, a strong wind might damage flowers in the field regardless when they were first planted. As such, production volume was considered as inappropriate for allocation of agricultural product costs. Instead the sales volume for each product was used as the measure of volumes. The activity driver selected for each activity pool is presented in Table 2. Table 3 presents a list of total activity costs allocated to major product lines.

Table 2: List of Activity Drivers

Activity	Activity Driver
Picking and Pruning	Sales volume
Potting	Number of pots sold
Packaging	Number of products that need package
Bunching	Number of bunches sold
Collecting buckets and Loading	Sales volume
Planting	Quantity of products that were planted during the financial period
Weeding	Sales volume
Planting plastic cover	Quantity of products that were covered by plastic cover during the financial period
Watering	Sales volume
Fertilising	Sales volume
Spraying chemicals	Sales volume
Others	Not allocated to cost objects

Table 3: Activity Costs for Major Product Lines

Product Line	Total Activity Costs
Berries Long short red green bunches	$3,720.17
English Lavender Bunch fresh	$9,205.38
Figs - Long/med/short/med-long/	$4,631.37
Ginger	$2,074.48
Gooseberry 17cm pot	$5,460.79
Kiwi Fruit - Male	$2,155.81
Raspberry Nootka	$2,217.39
Red Currant	$2,163.64
Snow Berry	$9,043.23
Thornless Blackberry	$10,995.14
Thornless Logan Berry	$3,434.15
Thornless Young Berry	$2,493.64

Issues in the Development of ABC-Based Costing Model for S Ltd

Technical issues such as the availability of data and limited availability of resources were found to be influential in the development of ABC-based costing model for S Ltd. During the development process, a number of heuristics were used to enable the implementation of the ABC model due to limited availability of data. For example, sales volume was widely used in the allocation of activity costs as alternative measures of volume were not readily available. While the use of these heuristics was considered as necessary for implementing the ABC model in farms like S Ltd, they might have negative impact on the reliability of the cost information generated from the model. The limited availability of data was partially by the lack of investment of accounting systems. Prior to the study, the owner of S Ltd did not have any computerised accounting system to record and process accounting information. All transactions including sales and purchases were recorded manually. The absence of computerised accounting system increased the difficulty in collecting information for the development of costing model. Another issue in the development of the costing model was the reliability of the results under different operating conditions. As effects of changes in operating activities under different climate conditions were not reflected in the costing model for S Ltd, results from the model could only shed light on product costs in normal operating environments. Product costs generated from the model could potentially be misleading under extreme operating conditions as resources and activities associated with those conditions were not included in the model.

Apart from technical factors, implementation of the ABC model in farms also influenced by the degree of communication between operators of farms and developers of the costing models. The innate divergence between accounting and agriculture professions exaggerated the gap in communicating between accountants and managers. Accountants might not have any background of agricultural industry while operators of farms may also know little about accounting systems and management accounting innovations. In S Ltd, the researchers were able to gather the required information within a two-month period with the full support of the owner. The greater complexity of the ABC implementation project, the more interactions between the developers of the costing model and operators of farms were required to ensure effective information flows for the development process.

Conclusion

The ABC model, as one of the major management accounting initiatives in the late 20th century, has been empirically investigated by accounting researchers in manufacturing and service industries, and more recently, in public and health care sectors. Nonetheless, little is known about the application of the ABC model in agricultural industry. The study presents a case study on the implementation of the ABC model in an Australian family-owned farm. Based on a triangulation of multiple sources gathered from the research site, it is found that the successful implementation of the ABC model is influenced by various technical factors. Communication between operators of farms and developers of the costing models also play an important role.

Two limitations of the study are acknowledged. First, quantities for a number of activity based are based the owner's estimates rather than records in the accounting system. Unlike large organisations with established information systems, S Ltd does not have resources to deploy those sophisticated management decision making tools. Second, the study is unable to demonstrate the impacts of ABC implication on future performance of S Ltd as the model is abandoned after the completion of the project.

Notwithstanding its limitations, the study offers some insights into the potential of the ABC model for farms. Future studies can explore the relationship between changes in operating conditions and agricultural product costs as well as the effects of other contextual variables on the suitability of the ABC model in farm. Longitudinal case study on farms that adopt and implement the ABC model over an extended period of time can potentially provide insights into the aforementioned issues.

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