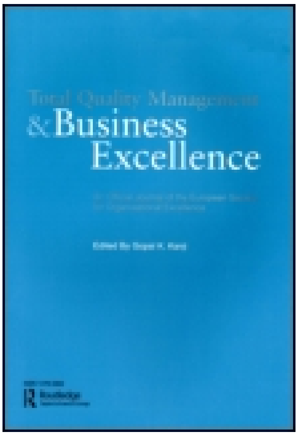

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Activity-based costing approach in the measurement of cost of quality in SMEs: a case study

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Since the 1950s, a considerable amount of attention has been given on the cost of quality (CoQ) in theory and in practice. Overall, it is argued that a precise measurement of the CoQ requires a well-established accounting system that provides accurate cost information. However, in the literature, it is generally considered that traditional cost accounting methods do not provide accurate cost data for the measurement of quality costs. Therefore, the aim of this study is to explore the role of activity-based costing (ABC) in supporting the measurement of CoQ in small and medium-sized enterprises in order to discuss the results of implementation, its benefits and drawbacks. Overall, it was found that the use of ABC in the CoQ measurement provides the organisation with the means to determine both value-added and non-value-added quality-related activites and to detect improvement opportunities in the production process.

Keywords: cost of quality; PAF scheme; activity-based costing; SMEs

Introduction

One way of gaining a competitive advantage in today's challenging business environment is to use quality and cost as differentiating factors. In order to increase customer satisfaction and the value of the products/services delivered to the market, organisations need to balance the quality and costs. Quality costs are considerable part of a company's total costs (Giakatis, Enkawa, & Washitani, 2001) and they are essential for organisational performance (Simga-Mugan & Erel, 2000). Therefore, problems with quality are likely to damage both competitiveness and reputation of organisations. Kajdan (2007) indicates that organisations use different total quality management (TQM) methods, such as labour analysis, preventive quality tools and eliminating non-value-added (NVA) activities to reduce costs without sacrificing quality. Cost of quality (CoQ) is among those fundamental techniques in TQM (Tsai, 1998) and it has become important for organisations (Letza & Gadd, 1994). CoQ is used as a progress indicator in measuring the overall performance of the organisations (Fassoula, 2005), and if CoQ is adequately measured and controlled, organisations are able to gain competitive advantage (Omurgonulsen, 2009). In general, CoQ is defined as all resources employed by organisations to assure quality standards (Bohan & Horney, 1991) and thus avoid losses resulting from failure.

There are two steps in CoQ reporting: classification and measurement. The classification of CoQ depends on the models developed, and measurement is resolved by traditional cost accounting *vs.* activity-based costing (ABC) methods. Measuring CoQ requires precise cost information records. However, traditional cost accounting systems fail to provide accurate cost information to management (Yang, 2008; Tsai, 1998),

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which in turn causes a distortion in the measurement of CoQ. One of the reasons for the deficiency of traditional cost accounting systems is that the cost/expense categorisation does not fit well with CoQ classification models (Schiffauerova & Thomson, 2006; Tsai, 1998). Moreover, in traditional cost accounting, several costs are incorrectly reported (Yang, 2008) due to the allocation of the overheads using a single driver based on a predetermined estimated allocation rate. Traditional cost allocation methods may be satisfactory where overhead allocations are not material (Higgins & Young, 2001). However, considering the significance of manufacturing overheads in the cost structure of current production environments, it is important to use more sophisticated costing methods to allocate overheads over products/services.

In the literature, several models have been developed to classify CoQ; the prevention–appraisal–failure (PAF) model (Feigenbaum, 1956), conformance and non-conformance model (Crosby, 1979), the opportunity cost model (Carr, 1992), the tangible–intangible model (Juran, Gryna, & Bingham, 1975) and the process cost model (Ross, 1977). CoQ classification models are mostly activity/process oriented (Schiffauerova & Thomson, 2006). However, as traditional cost accounting does not classify cost elements in accordance with activity/process orientation, it causes imprecise measurement of quality costs.

ABC was developed by Cooper and Kaplan (1988) in order to accurately allocate overheads and mitigate the distortion on cost allocation and measurement, thus it is assumed to overcome the shortcomings of traditional cost accounting (Higgins & Young, 2001). Besides its application in cost accounting, ABC is also proposed as a supportive costing method in measuring CoQ in quality studies (Schiffauerova & Thomson, 2006).

In the quality literature, studies have been attempted to measure CoQ both in theory (Weinstein, Vokurka, & Graman, 2009; Schiffauerova & Thomson, 2006; Freiesleben, 2004; Tsai, 1998; Feigenbaum, 1956; Juran, 1951) and in practice (Fassoula, 2005; Mukhopadhyay, 2004; Krishnan, Agus, & Husain, 2000; Simga-Mugan & Erel, 2000; Keogh, Brown, & McGoldrick, 1996; Carr, 1992; Bohan & Horney, 1991). Nevertheless, in the accounting literature, there is a very limited number of studies concerning the measurement and reporting of CoQ (Williams, van der Wiele, & Dale, 1999). Omurgonulsen (2009) argues that one possible reason for this is the belief that quality cannot be measured in terms of cost. Another important reason may be the use of traditional cost accounting system in the CoQ measurement. Therefore, in order to gather activity/process-oriented cost information which supports CoQ measurement, the ABC approach is proposed in the literature (Tsai, 1998). Moreover, Mandal and Shah (2002) claim that quality costs can be measured through teamwork under the responsibility of both accounting and quality professionals.

It is likely that the benefits of TQM and CoQ reporting are less understood by small- and medium-sized enterprises (SMEs) (Desai, 2008). Primarily, this might be due to the slow implementation of TQM in SMEs (Ghobadian & Gallear, 1996). Additionally, the overall effect of a well-established TQM on both operating and financial performance may not be apparent in the short run. Thus, especially in the case of result-oriented SMEs, the management may choose not to measure quality costs. Another potentially important factor is their lack of sophisticated accounting systems and cost management tools due to higher initial costs. This reluctance of SMEs to account for CoQ is supported by the fact that most previous research on CoQ implementation relates to large, profit-oriented organisations.

SMEs are characterised as flexible, innovative, open to change, operating in highly competitive markets and they constitute large portion of total enterprises in the world economy. Therefore, the motivation of this study originates in the economic contributions of SMEs, the value of CoQ measurement in competitive business environment and the lack of the studies on the implementation of CoQ in SMEs.

In light of the above arguments, the main aim of this study is to gain a comprehensive understanding of the measurement and reporting of CoQ under ABC using a case study development in a small enterprise.

A brief summary of this study is as follows: the CoQ literature is reviewed, the use and support of ABC in measurement CoQ is explained and the case study is presented, respectively. Finally, the findings of the case study are summarised with the emphasis on the importance, the advantages and the role of ABC/CoQ model in all organisations, including SMEs.

Cost of quality (CoQ)

CoQ was first introduced in 1951 under the name of the 'cost of poor quality' by Juran, who defines it as 'the sum of all costs that would disappear if there were no quality problems' (Juran, 1951). Bohan and Horney (1991) define CoQ as 'the total of all resources spent by any organization to assure that quality standards are met on a consistent basis'. In a bottomline view, the quality costs are the loss of profit and therefore called 'gold in the mine' (Su, Shi, & Lai, 2009). In the past, quality costs were assumed to be only rework, repair and warranty costs (Williams et al., 1999; Giakatis et al., 2001, Keogh et al., 1996). However, the CoQ perspective has developed over the years, and several models have been developed to classify and report CoQ.

Among other CoQ models, Feigenbaum's (1956) PAF model is widely accepted in quality management (Branca & Catalão-Lopes, 2011). This study makes use of PAF, in which the quality costs are categorised as PAF. Prevention costs are all those incurred in order to prevent failure and ensure the quality of product/services. Appraisal costs are all measuring and testing costs expensed in order to prevent failure. Failure costs are those incurred to correct the quality of product/services; divided into two groups, internal and external failure. The former are correction costs occurring before the delivery of product/services, while the latter are those occurring after the delivery. Due to interrelations among CoQ categories, it is assumed that investment in prevention and appraisal activities is more likely to decrease the cost of failure. In a similar manner, investments in prevention activities are also more likely to result in a reduction in the appraisal costs.

Although well known in the quality literature, some argue that the PAF model and its CoQ categorisation, as prevention, appraisal or failure, is in itself deficient in the measurement of quality costs and should be revised (Chiadamrong, 2003; Dahlgaard, Kristensen, & Kanji, 1992). Such a criticism has long been directed by the users of the PAF/traditional cost accounting model, where the classification of indirect costs (overheads such as depreciation and utilities) creates difficulties. Tsai (1998) enlightens the issue by arguing that the lack of unity in the allocation of overheads to CoQ categories leads to failure in identifying the source of quality costs. As a result of the use of PAF/traditional cost accounting models, for all practical purposes, CoQ has been seen as impossible to measure (Chiadamrong, 2003; Yang, 2008).

Activity-based costing (ABC)

ABC is a cost accounting method that identifies the activities involved in the production and the resources consumed by each activity in order to properly allocate activity costs over product/services. An ABC model is different from traditional cost accounting in terms of overhead allocation (Cooper & Kaplan, 1988). Traditional cost accounting is characterised by (i) absorption of overheads into the cost of the products/services and (ii) allocation of overhead costs to product/services using a single driver based on a predetermined estimated allocation rate. Therefore, it could be described as a costing method which is not sophisticated enough to determine product/service costs precisely. ABC is a two-stage methodology; first, it assigns the resources to activities, then to cost objects using a different cost driver for each activity.

CoQ measurement under ABC

In traditional cost accounting, the measurement of CoQ starts with the identification of events causing poor quality, and matching them with related quality costs under the PAF scheme. In the second step, within the cost/benefit approach, the frequencies and resource costs of those are used to determine whether these events occur systematically and are worth measuring regularly, or whether they are one-time events. Allocation of indirect costs on each quality cost category is heavily dependent on estimations by managers, using a single cost driver.

CoQ/ABC, as an alternative costing method overcomes the deficiencies of traditional cost accounting, by analysing the activities of the production process, determining the costs of the resources consumed by each activity and allocating activity costs using an appropriate cost driver for each quality-related (according to PAF scheme) and quality-unrelated cost.

Cooper and Kaplan (1988) developed ABC as a sophisticated costing method which enables cost assignments by eliminating waste through NVA activities and identifying opportunities for improvement. In other words, ABC also supports quality improvements to overcome the deficiencies that organisations face (Maiga & Jacobs, 2008). In order to improve quality, ABC provides information in the recognition of activities that cause poor quality (Carolfi, 1996) by classifying all activities as either value-added (VA) or NVA. According to this categorisation, VA activities are those that contribute to the value (increase the quality and effectiveness of the use) of the product/services delivered. As NVA activities make no contribution to the value of the product/services, their elimination decreases the related costs and has no effect on the value of the products/services.

In the CoQ/ABC framework, ABC and CoQ use a common database in order to promote productivity, eliminate waste, reduce costs and improve quality (Tsai, 1998).

The CoQ/ABC framework is summarised in Figure 1.

The first step in CoQ measurement under ABC is the activity analysis and categorisation of activities as VA or NVA. In the second step, each activity of ABC is categorised as quality-related or quality-unrelated activities using the PAF. In the third step, resource costs (including overheads) are traced to quality-related and quality-unrelated activities. Where the resources are used in a single quality-related activity, they are traced directly, and where used in several activities, they are assigned among the activities using a resource driver. CoQ is measured as the sum of the costs of quality-related activities. After activity costs are calculated, they are traced to cost objects using activity drivers.

Case study

TQM increases efficiency and productivity in organisations (Aslan & Özçelik, 2009). Therefore, SMEs need to focus on quality management (Kuratko, Goodale, & Hornsby, 2001). However, in practice, because of information deficiencies or inaccurate accounting

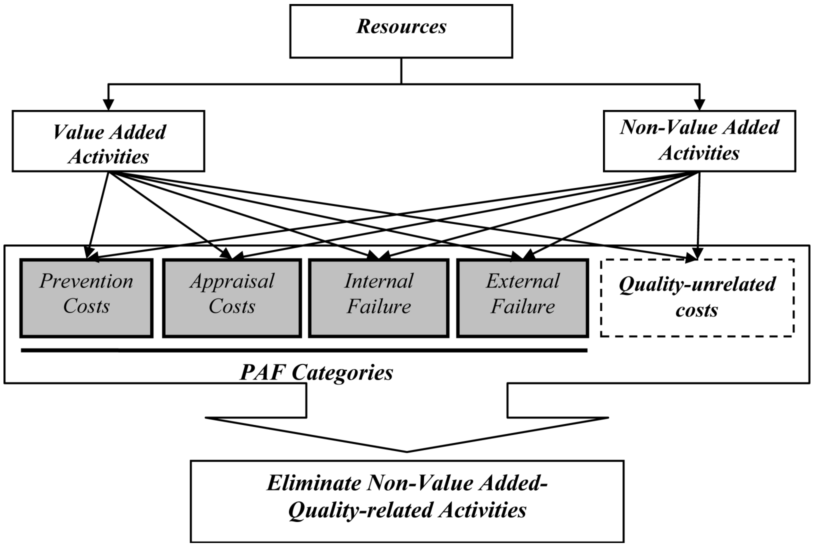

Figure 1. CoQ categorisation: ABC approach.

and costing systems, most SMEs are unlikely to use quality management tools and techniques effectively. In this paper, following Tsai (1998), CoQ measurement under ABC was implemented in a small engineering company in order to analyse the results, benefits and drawbacks associated with this method.

The company selected for the case study is a small assembly-oriented engineering company that produces high-pressure testing (HPT) and hydraulic power (HP) units to order. In addition to standardised products, customisations are also made in accordance with demand.

As indicated previously, teamwork with the active participation of managers and employees is required for the accuracy of the CoQ measurement and quality management. A cross-functional team was therefore formed to carry out the CoQ analysis in the company. The importance of CoQ measurement and the detailed plan of the implementation were previously explained to the team, all other employees and production manager. Previously, the organisation had no well-established cost tracing system and activity analysis in production. Therefore, in the first step, to ensure the accurate measurement of CoQ in the manufacturing department, an activity analysis was carried out. Nine activities are undertaken in the process of manufacturing HPT and HP and five employees work in the manufacturing department; an engineer, a technician and three workers. The engineer works on the design of the customers' demand specifications for the product and tests of the finished products. The technician works on drawing, inspection of the materials used, any rework resulting from internal failure, testing of the finished products and on maintenance activities. Workers carry out machining, warranty repair and maintenance activities, but also assist the engineer and technician in other activities. The production process starts with the designing activity, where model specifications are customised. After the design, technical drawings of the units are created in order to identify the operating cycle of the unit and determine the material requirement (inputs) for the production. Following this, during the material handling activity, materials are moved to the relevant units for storage until they are assembled. Before the assembly activity, the main components of the units are tested for quality. The next step is machining activity, in which materials are processed through general-purpose machines as a preparation for assembly. Rework and warranty repair activities are NVA internal and external failure activities, respectively. If any failure related to the working system or any defect associated with the material is detected during the production process, the product is reworked. If the product is returned after sales because of any failure related to operating break-downs, it is repaired under warranty. In the testing activity, products are tested in order to prevent failure after sale. The maintenance activity is not associated specifically with the products, but rather involves the maintenance of the machines used in the manufacturing area. However, this activity is an essential step in the process of preventing quality-related failure in production.

Once the activities are determined, in the second step, they are classified as VA or NVA according to ABC and quality-related or quality-unrelated according to the PAF. Inspection, rework, warranty repair, testing and maintenance activities are categorised as quality-related activities. Among these, only maintenance is a VA activity for manufacturing. Table 1 presents the details of activities and their categorisation under PAF and ABC including the activity drivers.

The company produced 5 units of HPT and 12 units of HP for the month in which the case study carried out. In the third step, in order to measure CoQ, resource costs are assigned to quality-related and quality-unrelated activities, using the information from the activity analysis and the resource drivers. The details of the labour costs for each employee by the manufacturing activities are given in Table 2. Each employee works 176 hours per month, with an average wage of €6.11 per hour for engineers, €2.55 for workers and €4.12 for technicians.

Table 1. Activity analysis in accordance with PAF and ABC.

			Activity driver quantity			
Activities	Activity drivers	Employees	ABC categories	PAF scheme	HPT for 5 units	HP for 12 units
Designing	Labour hours	Engineer, technician	VA	–	8.50	3.00
Drawing	Labour hours	Technician	VA	–	4.50	1.00
Materials handling	Number of moves	Workers	NVA	–	10	12
Inspection	Number of tests	Technician, workers	NVA	Appraisal	20	36
Machining	Machine hours	Workers	VA	–	177.00	219.60
Rework	Number of reworks	Technician, workers	NVA	Internal failure	1	–
Warranty repair	Number of warranty repairs	Workers	NVA	External failure	1	–
Testing	Number of tests for finished products	Engineer, technician	NVA	Appraisal	10	12
Maintenance	Machine hours	Workers, technician	VA	Prevention	11.50	25.20

Table 2. Labour hours usage and cost assignment to activities.

	Engineer[a]	Technician			Workers		
Activities	No. 1	No. 2	No. 3	No. 4	No. 5	Total labour hours of workers	Total labour costs[b]
Designing	11.50	11.50					117.65
Drawing		5.50			22.66		
Material handling				8.60		8.60	21.93
Inspection		76.00	96.00			96.00	557.92
Machining			68.40	164.50	168.00	400.90	1022.30
Rework		6.00	11.60	2.00		13.60	59.40
Warranty repair		2.00					8.24
Testing	108.00	36.00					808.20
Maintenance		36.70			8.00	8.00	171.60
Idle		2.30		0.90		0.90	11.77
Total	119.50	176.00	176.00	176.00	176.00	528.00	2801.67

Note: [a]The engineer spent the remainder of the working time on other non-manufacturing responsibilities in the organisation.
[b]€ per hour for workers: €2.55; per technician: €4.12; per engineer €6.11.

Both of the products are processed through three general-purpose machines on an assembly-oriented production line. These machines are used in machining, rework, warranty repair and testing activities. The average machine cost is €17.00 per hour. The working hours of the machines used in the activities are given in Table 3.

In the fourth step, activity costs are traced to cost objects, HPT and HP, using activity drivers. Table 4 presents the cost of each activity, the cost and activity driver information and unit products costs.

In the final step, using the cost information provided in Table 4, a CoQ report for the manufacturing department is prepared (Table 5). The report presents the cost for direct materials and activities separately. In addition, both total VA and NVA costs are reported in terms of quality cost categories. In the production process, while 50.32% of the cost of HPT and 29.08% of the cost of HP constitutes the cost of the direct material, the remaining 49.68% and 70.92, respectively, constitute the cost of activities. For HPT, of €5640.22 total activity costs, €3571.88 is VA, which is 31.46% of total product costs. Similarly, for HP, of €6401.92 total activity costs, €4386.64 is VA, which is 48.60% of total product costs.

In the same manner, total CoQ is €2112.26 for HPT and €2121.34 for HP, 18.60% and 23.50% of total product costs, respectively. Table 5 also shows that total NVA cost is

Table 3. Machine cost assignment to activities.

Activities	Total machine hours	(€) per hour	Total machine costs (€)
Machining	389.70	17.00	6624.90
Rework	28.00	17.00	476.00
Warranty repair	3.00	17.00	51.00
Testing	62.00	17.00	1054.00
Idle	45.30	17.00	770.10
Total	528.00	17.00	8976.00

Table 4. Activity cost assignment to product.

	Activity costs					Activity driver quantity					
	Labour	Machine	Others	Total	Cost driver	HPT	HP	Total	€/activity driver	Activity cost for HPT (€)	Activity cost for HP (€)
Activities	1	2	3	4		5	6	7	8	9	10
Designing	117.65			117.65	labour hours	8.50	3.00	11.50	10.23	86.96	30.69
Drawing	22.66			22.66	labour hours	4.50	1.00	5.50	4.12	18.54	4.12
Material handling	21.93			21.93	Number of moves	10.00	12.00	22.00	0.99	9.90	11.88
Inspection	557.92		594.00	1151.92	Number of tests	20.00	36.00	56.00	20.57	411.40	740.52
Machining	1022.30	6624.90		7647.20	Machine hours	177.00	219.60	396.60	19.28	3412.56	4233.89
Rework	59.40	476.00		535.40	Number of reworks	1.00	–	1.00	535.40	535.40	–
Warranty repair	8.24	51.00		59.24	Number of warranty repairs	1.00	–	1.00	59.24	59.24	–
Testing	808.20	1054.00	453.00	2315.20	Number of tests for finished products	10.00	12.00	22.00	105.24	1052.40	1262.88
Maintenance	171.60			171.60	Machine hours	11.50	25.20	36.70	4.68	53.82	117.94
Idle	11.77	770.10		781.87	–	–	–	–	–	–	–
Total	2801.67	8976.00	1047.00	12,824.67	–	–	–	–	–	–	–
						Total activity cost				5640.22	6401.91
						Direct material cost				5714.00	2625.00
						Total product cost				11,354.22	9026.91
						Production quantity				5	12
						Unit product cost				2270.84	752.24

Table 5. CoQ report.

	Manufacturing department – CoQ report					
			HPT (5 units)		HPT (12 units)	
	ABC categories	CoQ categories	In Euro (€)	(%)	in Euro (€)	(%)
Direct materials costs			5714.00	(50.32)	2625.00	(29.08)
Activity costs						
Designing	VA	–	86.96	(0.77)	30.69	(0.34)
Drawing	VA	–	18.54	(0.16)	4.12	(0.05)
Material handling	NVA	–	9.90	(0.09)	11.88	(0.13)
Inspection	NVA	Appraisal	411.40	(3.62)	740.52	(8.20)
Machining	VA	–	3412.56	(30.06)	4233.89	(46.90)
Rework	NVA	Internal failure	535.40	(4.72)	–	–
Warranty repair	NVA	External failure	59.24	(0.52)	–	–
Testing	NVA	Appraisal	1052.40	(9.27)	1262.88	(13.99)
Maintenance	VA	Prevention	53.82	(0.47)	117.94	(1.31)
Total activity cost			5640.22	(49.68)	6401.92	(70.92)
Total product cost			11,354.22	(100)	9026.92	(100)
Unit product cost			2270.84	752.24		
Total VA cost			3571.88	(31.46)	4386.64	(48.60)
Total NVA cost			2068.34	(18.22)	2015.28	(22.33)
Total CoQ			2112.26	(18.60)	2121.34	(23.50)
Total CoQ per unit			€422.45		€176.78	

€2068.34 for HPT and €2015.28 for HP, that is, 18.22% and 22.33% of total product costs consist of NVA activities.

Inspection, rework, warranty repair, testing and maintenance activities are quality-related, where inspection, testing and rework activities are three high-cost quality-related and NVA activities (Tables 4 and 5). Therefore, initial attention should be paid to these three activities to seek any improvement opportunity, thus reduce the cost of the products.

Pros and cons in the implementation of CoQ/ABC

Research indicates that TQM is valuable for the overall performance of an organisation (Terziovski & Samson, 2000). In spite of the capital limitations of SMEs, quality management could be applied successfully with the use of available resources (Ahire, Golhar, & Waller, 1996). Martínez-Costa and Jiménez-Jiménez (2009) recommend SMEs to invest in quality management tools, which could increase the productivity and competence of organisations. CoQ is essential in quality management and could be applied by SMEs in order to manage costs through controlling the cost of poor quality.

The measurement of CoQ requires the active participation of accountants, production engineers and quality professionals. In most SMEs, due to limited resources, quality assurance is included in the responsibility of production engineers or managers. In the organisation where the case study was conducted, the engineer and technician were also responsible for quality control. In order to minimise resistance to quality management practices, before the implementation, the general framework of the study, possible benefits and burdens of this management approach, and changes in the work of employees and workers were explained in detail.

Throughout the CoQ/ABC implementation in the company, since it is the first time of applying ABC and CoQ measurement and reporting, several management issues were raised. As expected, during the activity analysis and classification of activity costs as quality-related and quality-unrelated, there was strong resistance to change from the accounting and production departments. As the outcomes of a more sophisticated costing method and a CoQ report cannot be derived in the short term, these issues were explained in detail to minimise this resistance. The management's willingness to control quality costs facilitated the recognition of the proposed costing and quality management methods by the employees. In addition, size was another factor that facilitated change. As the company is a small enterprise, the change was managed more easily. Throughout the implementation of CoQ/ABC, due to the lack of a database, a comprehensive study was carried out to gather cost information.

The CoQ report provided several considerable advantages to the company. First, with the use of CoQ/ABC, the activities and associated costs were classified as quality-related or quality-unrelated and VA or NVA in terms of activities. This classification allows management to detect the opportunities for cost reduction and the elimination of NVA activities which could be used in cost management while improving the quality of the product. Second, the measurement and reporting of CoQ provide opportunities which could be used by the organisation as long-term performance measurements. Finally, the CoQ report presents the cost of each product by activity and quality basis, which could be used to compare the contribution of each product to the company.

Discussion and conclusion

TQM and CoQ have become strategic management issues both for academics and practitioners since the 1950s. In the quality literature, there are several studies attempting to measure CoQ both in theory and practice; however, the number of such studies in the accounting literature is very small. The attempts to correct quality with cost information are rare, due the difficulties encountered in the measurement of CoQ under traditional cost accounting methods. Moreover, some studies assert the impossibility of measuring quality costs. In addition, TQM and CoQ measurements are usually presumed to be strategic tools for larger organisations. However, considering that many SMEs are flexible, innovative, open to change, operate in highly competitive markets, and constitute a large portion of the total enterprises in the world economy, this study aims to explore the role of ABC as an alternative costing method in supporting the measurement of CoQ for these organisations.

The results of the case study show that the use of ABC facilitates measuring and reporting CoQ by detecting NVA quality-related costs. The CoQ report under ABC provides organisation with the opportunity for improving cost and quality control, and therefore competitiveness, and it has been shown that CoQ measurement under ABC can be effectively used by small enterprises.

This study also suggest that with the use of CoQ/ABC, organisations may be able to detect and monitor the areas of poor performance that require improvement, control and manage quality-related costs and, consequently, gain competitive advantage by improving the quality and reduce costs. Overall findings of the case study are in compliance with Prickett and Rapley (2001), Bottorff (1997) and Weinstein et al. (2009).

While the findings of the study stem from a single small enterprise case, it should be noted that these findings are still generalisable, because the proposed methodology of CoQ/ABC is not solely designed for small enterprises and can be implemented by a wide range of organisation types regardless of size, and whether for profit or non profit.

The case study also showed that the success of ABC/CoQ implementation depends on an awareness of CoQ, and understanding of the process/activity view in the organisation, strong communication between technical and accounting personnel, a high level of managerial support and involvement, and a well-organised cross-functional team.

The main limitation of the study is its narrow focus on manufacturing-related CoQ. It is clear that CoQ measurement should include the analysis of all kinds of activities in an organisation. Thus, further research may consider both manufacturing and non-manufacturing activities of the organisations in order to provide organisation-wide CoQ information. Moreover, studies concerning service organisations also have the potential to make a valuable contribution to the CoQ literature.

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