



Integration of quality cost and accounting practices

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Abstract

Purpose – The purpose of this paper is to suggest a quality cost measurement model which is managed in coordination and conjunction with the accounting reports, thereby creating a comprehensive management control tool for organizations.

Design/methodology/approach – The contents of this paper arise from studying the theory, analyzing the evolution and observing the practice restrictions of both quality cost and accounting systems.

Findings – By using this proposed model, it is possible to unify different management control tools (such as quality cost and financial accounting) into a single system, without neglecting their individual theoretical principles.

Research limitations/implications – This is a general model that is intended to be applicable to organizations of any size and type, thus requiring specific adaptations when implemented in particular cases.

Originality/value – Theoretical aspects of quality cost have been widely developed, especially in academic environments. The current model proposes an explicit and practical measurement procedure in order to calculate these costs relying on the accounting system.

Keywords Quality costs, Accounting, Quality Management Systems (QMS), Quality management

Paper type Research paper

1. Introduction

Managing any organization involves following a cycle that consists of setting objectives and controlling their degree of accomplishment. In recent years, the importance of maintaining consistency when establishing the goals for different processes, departments and hierarchical levels has been emphasized. Therefore, control activities reporting the degree of attainment of every goal should also disclose data about its influence over the other objectives of the company. Consequently, at present, organizations need to have comprehensive management control systems which display both financial and non-financial indicators, as well as the interdependencies between them.

Quality cost and accounting are among the various traditional management control tools which have extensively been developed up until now. Even though these tools have evolved during the last few years to become important information sources for decision making, the fact that they are managed by different departments means they are not being used optimally. Therefore, this paper aims to propose a model which contributes to achieving the unification of these different management control tools in order to make the decision-making process more effective and efficient.

2. Quality cost and accounting concepts

2.1 Quality cost

In regards to this concept, Joseph Juran (1962) states that quality cost is “The cost of carrying out the company’s quality mission (meeting the quality needs of consumers).”



Despite the existence of several different definitions, most authors agree that quality cost is composed of prevention costs (spent to avoid failures), appraisal costs (spent to detect failures) and failure cost (spent due to failure occurrence). There is a traditional model, initially designed by the same Joseph Juran, which separates prevention and appraisal costs from those of failures, and establishes a relationship between these two new categories. This classical view indicates that as the quality level rises, prevention and appraisal costs increase and failure costs decrease. The aim of this model is to find the quality level to which total quality cost is minimized.

2.2 Accounting

The American Accounting Association describes accounting as “the process of identifying, measuring and communicating economic information to permit informed judgments and decisions by users of information” (Tulsian, 2002). Even though it is difficult to reach a consensus on the concept of accounting, there is a general agreement on its main function, which consists in providing information about the financial situation and the economic result of companies by means of Balance Sheet and Income Statement reports. Simplified forms of both reports are exhibited in Table I.

3. Dissociation between quality cost and accounting

Despite the fact that company directors usually resort to quality cost and accounting systems to support decision-making processes, these management control tools are often used separately, thereby promoting ineffectiveness and inefficiency. In practice, it is common to observe general managers reducing prevention costs after having analyzed an accounting statement, and immediately having to change that decision due to the indicators displayed in a quality report. Conversely, it is not rare to find cases of managers who make the decision to implement a new production control system after receiving a quality report, but have to reverse that determination given that accounting statements qualify it as unfeasible.

The reasons why many companies are not able to integrate these management control systems are diverse. While some of them are attributable to specific limitations of each tool, others are associated with the way they are implemented.

3.1 Specific limitations of each management control tool

On the one hand, quality cost theory is much more closely related to individual productive processes than it is to the whole organization, given that such a theory was originated when the quality concept was mainly about control rather than general management. As a result, it is not a simple task to apply these concepts to areas others than those of production, such as support, service or management departments.

| Balance sheet | | Income statement |
|---------------------|---------------------------|------------------------|
| Assets | Liabilities | Revenues |
| Cash | Accounts payable | Sales |
| Accounts receivable | Loans payable | Expenses |
| Inventories | Total liabilities | Raw material |
| Buildings | Stockholders' equity | Salaries – wages |
| Equipment | Capital stock | Equipment depreciation |
| Other assets | Retained earnings | Other expenses |
| Total assets | Total stockholders equity | Net income |

Table I.
Information provided by
accounting – Accounting
Statement models

On the other hand, despite the fact that the main purpose of accounting is to provide information about the company's functioning to both internal and external users, financial reports are ruled by standards which are mostly focussed on the necessities of the latter ones (such as shareholders, potential investors and government authorities). Consequently, countless organizations design their accounting system just in order to fulfill regulatory guidelines, and hence disregard the needs of internal users (such as managers or CEOs).

3.2 Problems associated with practical implementation of management control tools

Issuing quality cost reports is a function normally assigned to either quality or production departments; since there is a general assumption that, for this purpose, necessary data are originated exclusively in those areas and, therefore, accounting information is negligible.

On the other hand, the generation of accounting reports is a job carried out entirely by accounting and administrative divisions, without the contribution of either production or quality departments. This is mainly because the accounting information priority is frequently the accuracy and timeliness of monetary data rather than the real causes of the results.

This alleged dissociation between control objectives of quality and accounting areas is preventing managers from obtaining crucial information to the decision-making process, such as cause-effect relationships between the numerous indicators included in both reports. Moreover, this disconnection encourages each department of the company to undertake its activities in isolation from the others and be focussed just on its own goals.

4. Benefits of measuring quality cost in coordination with the accounting system

An overall advantage of unifying the quality cost measurement method and the accounting practice into one single system is that it enables companies to improve the check stage of PDCA cycle (plan, do, check, act) through increasing its effectiveness and efficiency.

On the one hand, this integration allows managers to connect financial information with its real causes, thereby providing further information so as to support coherent decisions made at different management levels (strategic, tactical and operative). In Table II some examples of decisions that could be made by use of this method are mentioned, classified according to the level at which they are carried out.

| Level | Description of the decision | Necessary information |
|-----------|---|--|
| Strategic | Deciding whether the quality program scope is extended to include other areas or branches | Revenues and costs generated by the quality program |
| Tactical | Determining whether an annual training program for personnel is executed or not | Economic impact of training programs |
| Operative | Deciding whether a non-conforming product is reprocessed, rejected or accepted | Economic effect of each of the possible alternatives |

Table II.
Examples of decisions supported through integrating quality cost and accounting systems

On the other hand, this unification promotes the coordination of different processes of the company since it involves permanent communication between some areas which are usually dissociated. In other words, undertaking quality cost measurement according to the principles of the proposed system demands the incorporation of accounting areas into the quality program, which should cause an increase in the efficiency of those specific processes and an improvement in the whole enterprise performance.

5. Evolution of management control tools

As detailed in Section 3.1, the dissociation between quality cost and accounting practices is, in part, due to specific limitations of each of these two management tools. Nevertheless, with the passing of time these control methodologies have been undergoing meaningful updates which have reduced such restrictions, thereby making possible the design of a comprehensive management control system. In this section the most important changes occurred in quality cost measurement techniques and accounting systems during the last few years are described, since they must be considered in order to propose practical actions to integrate both tools.

5.1 Changes observed in quality cost theory

Originally, quality programs were implemented only in manufacturing firms and their activities were exclusively associated with product appraisal, failures detection and acceptance or rejection decisions (quality control). Some years afterwards, besides the control activities, organizations began to carry out actions to solve the real causes of failures and, thereby, to stabilize the productive process (quality assurance). Finally, during the second half of twentieth century, the quality field was extended to encompass the entire organization through incorporating objectives related to customer satisfaction, process efficiency and employee training; and, therefore, the total quality management (TQM) concept was raised. At present, quality management systems (QMS) have become a guideline to manage organizations in an inclusive way, regardless of their size and branch of industry. The main demands to implement a QMS are listed and detailed in the International Standard ISO 9001:2008 "Quality management systems – Requirements."

This evolution of quality theory has brought about innovations in the quality cost measurement technique, because the latter constitutes a control tool associated with the former. The most relevant changes observed in quality cost principles during the last few years are as follows:

- in the past, quality cost merely took into account preventive and appraisal measures related to short-term production, but as the quality theory evolved over the years this theory began to regard long-term actions affecting the whole company;
- indirect costs (profits not generated due to the impact of previous failures on customers' perception) was not a priority when quality was solely associated with individual manufacturing processes (quality assurance) but started to gain relevance as soon as TQM arose;
- another significant factor in quality cost evolution was the emergence of the "zero defect concept." Supporters of this new idea began to criticize the quality cost classical view given that it just pursued cost minimization and therefore did not promote continual improvement; and

- during the first years after the emergence of TQM, quality programs were almost exclusively focussed on effectiveness and customer satisfaction. Nonetheless, as the time went on, both efficiency and resources optimization began to acquire relevance and, hence, financial indicators necessary to quantify them also became important.

Taking into consideration the innovations described above, the quality cost theory may be redefined. Thus, it can be said that: "Quality costs represent the amount of money that a company has relinquished (lost; either expended or did not obtain) due to ineffectiveness or inefficiency when developing its activities" (Sedevich Fons, 2011). Moreover, at present, quality costs could be classified into:

- prevention cost: the costs of activities carried out so as to minimize the gap between planned objectives and achieved results in every process of the company. It comprises QMS implementation activities, employee training programs, preventive maintenance tasks, market researches, supplier capability improvement plans, etc.;
- appraisal cost: the costs of actions undertaken in order to detect differences between specifications or requirements established for process outputs and the actual results. It includes the execution of different control and audit activities throughout the organization;
- failure cost: the amount of money spent, due to deviations from objectives and specifications, either on operations generating outputs that are rejected and discarded (waste outputs) or on additional activities carried out to repair defective products and services (reprocesses). This category is usually subdivided into internal failure cost (when the deviation is detected by internal controls) and external failure cost (when the failure is discovered by customers); and
- indirect quality cost (or opportunity cost): it consists of potential profits that have not been obtained because of defects detected by customers. In other words, indirect quality cost is the net income a company would have earned had it accomplished sales transactions which were frustrated owing to previous external failures.

5.2 Changes observed in accounting practice

The accounting systems' mission is to provide different kinds of users with information to make decisions. On the one hand, they must inform external users (shareholders, investors, government) about the overall past performance of the company, and thus their reports ought to include monetary data such as revenues, expenses, cash and inventory. On the other hand, these systems should generate reports for internal users (managers, CEOs), who typically require more detailed information regarding performance causes, such as indicators about customer satisfaction, process efficiency and employee competence.

International and domestic standards regulating accounting information mainly focus on external users' necessities. Therefore, these norms merely contain general guidelines and do not take into consideration specific subjects that are important to supporting the management decision-making process, such as costing methods, opportunity cost and non-financial indicators. The insufficiency of these external standards has prompted the emergence and development of a sub-discipline, called

Management Accounting, to satisfy the needs of internal users. Over the last few years, this new field of study has quickly spread and evolved. The most important changes observed are as follows:

- Historically, costing methods have been suitable for manufacturing companies whose processes are intensive in raw materials and direct labor, but usually exhibited weaknesses when applied to companies with high indirect costs. A factor that has contributed to the Management Accounting change was the development of modern costing methods, such as activity-based costing (ABC), which are more appropriate to be used by service companies and organizations with more sophisticated manufacturing processes.
- Several years ago, accounting analysis solely included monetary information and thereby presented only financial indicators (return on capital employed, liquidity, leverage) by use of traditional scorecards. A decisive element for Management Accounting growth was the fact of considering non-financial indicators as causes of the outcomes displayed in the accounting statements through the usage of new management tools, such as The Balanced Scorecard by Kaplan and Norton (2002).
- In recent years, a new theme has emerged under the name of Strategic Accounting, which takes into account the whole value chain of the products or services provided by the organization. This concept encompasses the economic analysis of suppliers, customers and competitors in order to regard different possible strategic actions (vertical integration, horizontal mergers, outsourcing or distribution channel development). The strategic viewpoint allowed accounting to integrate comprehensive subjects like supplier chain, customer satisfaction and benchmarking into its scope.

Analyzing the evolution of Management Accounting it may be concluded that this discipline has expanded its reach to include issues that are relevant to run the company in a holistic manner. In other words, it can be said that Management Accounting has shifted its focus “[...] from a simple or naive role of cost determination and financial control, to a sophisticated role of creating value through improved deployment of resources” (Abdel-Kader and Luther, 2006).

6. Actions to merge quality cost measurements with accounting systems

As described in Section 3.2, a second cause of dissociation between quality cost and accounting is the manner in which they are used in practice, given that their respective reports are generated and issued separately by different areas of the organization. That is to say, despite the fact of having implemented a QMS, many companies have never incorporated the bookkeeping activities into it and, therefore, the information does not flow dynamically between accounting and quality processes. A possible reason is that the requirements established in some international standards to certify these systems are explicitly centered on company's core processes (such as commercialization and production) and some support activities (such as human resources and purchasing), but overlook those tasks related to bookkeeping work (such as invoicing and payments).

Consequently, it could be asserted that a possible solution to this problem would be to integrate accounting processes into the QMS. This action would allow directors to manage the processes of the company in a coordinated manner, and, therefore, to merge

quality cost measurement practices and the accounting system into a single management control tool. As a result, the information available to support strategic, tactical and operative decisions would improve; and the processes involved in data collection would be more efficient.

Incorporating accounting activities into the QMS requires extending the process approach scope to cover these kinds of tasks. The most significant hindrance observed when companies undertake this integration is that they are prone to view the accounting department as a process in itself, without clearly identifying its relationships with the rest of the company's areas. In order to avoid making this mistake, some points must be taken into account in regards to the connections and the records of these processes.

In reference to accounting process connections, even when the organizational structure establishes that every bookkeeping task must be carried out by just one department of the company because of technical reasons, accounting procedures should be considered as sub-activities of the different main processes. That is to say, administrative tasks should be treated as support work for those processes regarded as core by international QMS standards. For example:

- invoicing and collection activities must be viewed as sub-units of the "customer-related processes" (clause 7.2 of International Standard ISO 9001);
- supplier payment activities ought to be regarded as a part of the whole purchasing process (clause 7.4 of International Standard ISO 9001);
- payroll tasks should be considered as components of human resources processes (clause 6.2 of International Standard ISO 9001); and
- accounting report issuance should be regarded as being part of the whole "measurement, analysis and improvement" macro-process (clause 8 of International Standard ISO 9001).

In regards to records and their respective forms, there are three kinds of them to be taken into account when incorporating accounting activities into the QMS:

- Traditional accounting records: bookkeeping work involves a myriad of records (such as invoices, receipts, payment orders, payrolls, price lists and so on). These records should be codified under the same criterion used for QMS documentation (clause 4.2 of International Standard ISO 9001: documentation requirements).
- Traditional QMS records: a conventional QMS requires using several records which are generated and codified according to documentation control procedures (clause 4.2 of International Standard ISO 9001). When incorporating bookkeeping processes into the QMS these records begin to relate to the accounting ones. For instance, sale contracts become necessary information to make invoices, and reading the purchasing agreement starts to be a mandatory step before paying a supplier. Consequently, the company must ensure that these traditional QMS records are available in the corresponding accounting departments.
- Additional records: the fact of integrating accounting processes into the QMS may create the need to design some supplementary forms in order to collect new data, such as unit costs or correlations between pairs of indicators. These additional records should be also handled and codified following the same rules as for QMS documentation (clause 4.2 of International Standard ISO 9001: documentation requirements).

7. Measurement of quality cost through the use of the accounting system

Once both management tools have been integrated through the incorporation of bookkeeping processes into the QMS, managers can start to estimate quality costs at the end of each period. In this section, the necessary steps to carry out this activity are described through a simplified practical example.

This is a hypothetical situation in which an organization has implemented a conventional QMS some years ago and during the last period has extended its scope to encompass accounting processes, following the actions suggested in Section 6. In other words, accounting activities have been included in the quality program and additional records have been designed and codified according to documentation procedures. As a result, at the end of this last period the information displayed in Table III is available.

Having this information and before performing the measurement activities, managers must devise a quality chart of accounts. It consists of a list of codified categories and subcategories to be used to group costs related to quality. The number of items encompassed by the quality chart of accounts may vary in particular cases; depending on the type, the size and the goals of each company. In this example the company has designed the quality chart of accounts exhibited in Table IV.

After having defined the quality chart of accounts, the company may start calculating quality costs. Measurement activities for a given period consist of filling out a form called "detailed quality cost" in order to quantify the quality cost per subcategory, disaggregated into the financial accounts of the Income Statement (see Table I). The "detailed quality cost" record for the present example is shown in Table V.

The figures in Table V are obtained using the last period's information (Table III) by means of formulae presented in the Appendix.

As soon as the company has filled out the "detailed quality cost" form, it will be ready to issue the final reports. The fact of having integrated the accounting processes and the QMS enables managers to obtain various reports from the same source of data, thereby improving the information consistency and optimizing the collection resources.

The first report to be generated is called "quality cost – summary" and provides information about the QMS, but expressed in monetary terms. The "quality cost – summary" report for the present example is exhibited in Table VI.

The data source for this report is the "detailed quality cost" record (Table V) and the calculations are in the appendix. The information disclosed in this report allows managers to be aware of the magnitude and composition of actual quality costs and, therefore, to compare them with budgeted figures. Moreover, analyzing the evolution of these percentages should lead to valuable conclusions about the quality program performance.

The second report is named "accounting costs – quality perspective" and supplies the same data as the Financial Income Statement, but sorted according to a quality dimension. This report for the present example is displayed in Table VII.

The data sources for this report are Table III (last period information), Table V (detailed quality cost) and Table VI (quality cost – summary). The calculation procedure is described in the Appendix. The information included in this report allows managers to gauge the quality costs per financial account (raw materials, salaries, etc.) and compare them with the total costs. Hence, the basic or standard costs could be obtained, which represent the hypothetical amount of money the company should have spent had it performed its activities at the highest level of effectiveness and efficiency.

Table III.
Last period's
information

| Description | Manufacture unit | Amount | Information source record | Process/area |
|--|---------------------|--------|---|---------------------------------------|
| Time spent on employee training (outsourced activity) | Hours | 50 | Employee training | Human resources |
| Time spent on raw material inspection (manual activity) | Hours | 200 | Activities per employee | Human resources |
| Time spent on final product inspection (manual activity) | Hours | 300 | Activities per employee | Human resources |
| Labor cost (per hour) of raw material inspection | Dollars | 0.50 | Labor cost | Human resources |
| Labor cost (per hour) of final product inspection | Dollars | 0.60 | Labor cost | Human resources |
| Labor cost (per hour) of production | Dollars | 0.40 | Labor cost | Human resources |
| Time spent on preventive maintenance (outsourced activity) | Hours | 30 | Preventive maintenance | Maintenance |
| Average price per product unit sold | Dollars | 20 | Price list/customer contract | Commercialization |
| Compensation cost paid to customers per failed product ^b | Dollars | 7 | Customer contract | Commercialization |
| Product units rejected by internal inspection (internal failures) ^a | Units | 20 | Non-conforming | Quality control |
| Product units rejected by customers (external failures) ^b | Units | 15 | Non-conforming | Quality control |
| Raw material consumed per product unit | Pounds | 4 | Product design | Design and development |
| Labor consumed per product unit | Hours | 10 | Product design | Design and development |
| Cost (per hour) of employee training (fees paid to trainers) | Dollars | 2 | Outsourced service costs | Purchasing |
| Cost (per hour) of preventive maintenance | Dollars | 1 | Outsourced service costs | Purchasing |
| Cost (per pound) of raw material | Dollars | 1.50 | Raw material cost | Purchasing |
| Average cost per product unit | Dollars | 10 | Product costing | Measurement, analysis and improvement |
| Average number of non-sold units per each external failure ^b | Units | 4 | Customer satisfaction surveys/scorecard | Measurement, analysis and improvement |
| Raw material total cost (last period) | Dollars | 1,200 | Income statement | Measurement, analysis and improvement |
| Labor total cost (last period) – (salaries/wages) | Dollars | 1,080 | Income statement | Measurement, analysis and improvement |
| Outsourced services total cost (last period) | Dollars | 600 | Income statement | Measurement, analysis and improvement |
| Other expenses (last period) | Dollars | 350 | Income statement | Measurement, analysis and improvement |

Notes: ^aIt is assumed that every failed product unit detected by internal inspection (internal failure) must be discarded (reprocessing is not possible). Besides, the only resources used in the productive process are raw material and labor; ^bif a product unit is rejected by a customer (external failure) the product is discarded and the price is reimbursed (plus a compensation amount). Moreover, through customer satisfaction surveys and indicators of the evolution of sales, it has been proven that every external failure provokes the loss of other three sale transactions due to the decline in reputation

8. Conclusions

Organizational management control not only must allow verifying the achievement of goals, but also must propose various courses of action depending on the results obtained. When used individually, Financial Statements and quality cost reports are useful tools to perform the first of these functions, but present some limitations in

| Quality cost category | Quality cost subcategory |
|----------------------------|---|
| I. Prevention cost | I.1 Employee training cost I.2 Preventive maintenance cost |
| II. Appraisal cost | II.1 Raw material inspection cost II.2 Final product inspection cost |
| III. Internal failure cost | III.1 Cost of products rejected internally |
| IV. External failure cost | IV.1 Cost of products returned by customers |
| V. Indirect quality cost | V.1 Earnings forgone due to lost sales |

Table IV.
Quality chart of accounts

| Company's name | Detailed quality cost | | | | | Code: Date: |
|---|-----------------------|----------------------|----------------------|--------------------|--------------------|----------------|
| | Measurement period | | Financial account | | | |
| Quality cost sub-category | (a) Raw materials | (b) Salaries – wages | (c) Outsour services | (d) Other expenses | (e) Indirect costs | Total |
| I.1 Employee training cost | – | – | \$100.00 | – | – | \$100.00 |
| I.2 Preventive maintenance cost | – | – | \$30.00 | – | – | \$30.00 |
| II.1 Raw material inspection cost | – | \$100.00 | – | – | – | \$100.00 |
| II.2 Final product inspection cost | – | \$180.00 | – | – | – | \$180.00 |
| III.1 Cost of products rejected internally | \$120.00 | \$80.00 | – | – | – | \$200.00 |
| IV.1 Cost of products returned by customers | \$90.00 | \$60.00 | – | \$105.00 | – | \$255.00 |
| V.1 Earnings forgone due to lost sales | – | – | – | – | \$600.00 | \$600.00 |
| Total | \$210.00 | \$420.00 | \$130.00 | \$105.00 | \$600.00 | \$1,465.00 |

Table V.
Detailed quality cost

| Company | Quality cost – summary | Code: Date: |
|----------------------------|------------------------|----------------|
| Measurement period | Information source | (%) |
| Quality cost category | Amount | |
| I. Prevention cost | \$130.00 | 9 |
| II. Appraisal cost | \$280.00 | 19 |
| III. Internal failure cost | \$200.00 | 14 |
| IV. External failure cost | \$255.00 | 17 |
| V. Indirect quality cost | \$600.00 | 41 |
| Total quality cost | \$1,465.00 | 100 |

Table VI.
Quality cost – summary
(Report I)

Table VII.

Accounting costs – quality perspective (Report II)

| Company | Accounting costs – quality perspective | | Code: Date: |
|---------------------------|--|--------------------|---------------------|
| | Measurement period | Information source | |
| Financial account | Total cost | Quality cost | Basic/standard cost |
| (a) Raw materials | \$1,200.00 | \$210.00 | \$990.00 |
| (b) Salaries – wages | \$1,080.00 | \$420.00 | \$660.00 |
| (c) Outsourced services | \$600.00 | \$130.00 | \$470.00 |
| (d) Other expenses | \$350.00 | \$105.00 | \$245.00 |
| Total financial cost | \$3,230.00 | \$865.00 | \$2,365.00 |
| (e) Indirect quality cost | \$600.00 | \$600.00 | \$0.00 |
| Total costs | \$3,830.00 | \$1,465.00 | \$2,365.00 |

assisting managers to accomplish the second one; given that their practices do not go further in analyzing the association between the objectives of the company's different areas.

With the passing of time there has been a trend toward increased integration of the various management control practices. On the one hand, quality cost theory started to adapt to modern quality programs and, therefore, to regard new concepts such as opportunity cost, continuous improvement and resource optimization. On the other hand, up-to-date accounting topics began to emerge, such as ABC, non-financial indicators and strategic accounting.

Consequently, in order to attain a definitive coordination between quality cost and accounting procedures, companies only need to link its activities in practice through the incorporation of bookkeeping processes into the QMS. As a result, organizations will be able to issue comprehensive reports, which provide quality cost measurements based on accounting data without disregarding the theoretical features of each discipline.

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Appendix*Formulae Table V: detailed quality cost*

I.1 Employee training cost: the only financial account affected by employee training is “outsourced services” given that it is assumed that this activity is performed by external teachers. Fees paid to trainers may be calculated by multiplying the time spent (50 hours) and the cost per hour (\$2.00) of employee training (see Table III):

$$50 \times 2 = 100 \quad (1)$$

I.2 Preventive maintenance cost: the only financial account modified by preventive maintenance is also “outsourced services” because it is assumed that this activity is carried out by external suppliers. The total cost for this account may be calculated by multiplying the time spent on preventive maintenance (30 hours) by its cost per hour (\$1.00) (see Table III):

$$30 \times 1 = 30 \quad (2)$$

II.1 Raw material inspection cost: given that the inspection of raw materials is performed manually by internal staff, it only generates labor costs and, therefore, modifies the “salaries – wages” financial account. The time spent on raw material inspection amounts to 200 hours whereas the labor cost of this activity is \$0.50 per hour (see Table III):

$$200 \times 0.50 = 100 \quad (3)$$

II.2 Final product inspection cost: the inspection of final product has an impact solely on the “salaries – wages” account; given that, being a manual activity, it only generates labor costs. The total cost for this financial account may be estimated by multiplying the time spent on final product inspection (300 hours) by its cost per hour (\$0.60) (see Table III):

$$300 \times 0.60 = 180 \quad (4)$$

III.1 Cost of products rejected internally: it is assumed that every product unit rejected by internal inspection must be discarded and that the only resources used in the productive process are raw material and labor.

The amount of raw material waste equals 80 pounds (4 pounds per product unit by 20 internal failures) and the cost per pound is \$1.50 (see Table III). Hence, raw material cost amounts to:

$$80 \times 1.50 = 120 \quad (5)$$

The time spent on labor activities of these products is 200 hours (ten hours per product unit by 20 internal failures) and the cost per hour equals \$0.40 (see Table III). Therefore, salary cost amounts to:

$$200 \times 0.40 = 80 \quad (6)$$

IV.1 Cost of products returned by customers: another assumption made is that, when an external failure happens, the product is discarded, the price is reimbursed and a compensation amount is paid to the client.

The amount of raw material waste equals 60 pounds (4 pounds per product unit by 15 external failures) and the cost per pound is \$1.50 (see Table III). Thus, raw material cost amounts to:

$$60 \times 1.50 = 90 \quad (7)$$

The time spent on labor activities of these products is 150 hours (ten hours per product unit by 15 external failures) and the cost per hour equals \$0.40 (see Table III). Then, salary cost amounts to:

$$150 \times 0.40 = 60 \quad (8)$$

The total compensation cost paid to clients may be calculated by multiplying the compensation cost per failed unit (\$7.00) by the number of external failures occurred (15 failures) (see Table III):

$$7 \times 15 = 105 \quad (9)$$

This cost is included in account "other expenses" of the Income Statement.

V.1 Earnings forgone due to lost sales: the amount of product units whose sale has been lost due to external failures during the period equals 60. It may be estimated by multiplying the number of external failures occurred (15 failures) by the average amount of lost sale transactions per each of these failures (four units) (see Table III).

The profit forgone per each of these units equals \$10.00, which may be determined by subtracting the cost per unit (\$10.00) from the average price (\$20.00) (see data in Table III). Therefore, this indirect cost amounts to:

$$60 \times 10 = 600 \quad (10)$$

Table VI: quality cost-summary, report

Amount column: the amount for each quality cost category may be calculated by adding up the total cost of those subcategories it comprises. These data may be extracted from the "detailed quality cost" record (Table V). That is to say:

I. Prevention cost equals employee training cost (I.1) plus preventive maintenance cost (I.2):

$$100 + 30 = 130 \quad (11)$$

II. Appraisal cost equals raw material inspection cost (II.1) plus final product inspection cost (II.2):

$$100 + 80 = 180 \quad (12)$$

III. Internal failure cost equals the cost of products rejected internally (III.1), \$200.

IV. External failure cost equals the cost of products returned by customers (IV.1), \$255.

V. Indirect quality cost equals the earnings forgone due to lost sales (V.1), \$600.

Percentage column: the percentage for each quality cost category may be calculated by dividing each amount by the total quality cost.

Table VII: accounting cost-quality perspective (Report II)

Total cost column: most of the figures in "total cost" column derive from the Financial Statements and may be found explicitly in Table III. The exception is the "indirect quality cost" which is not taken into account by the accounting system and, therefore, had to be estimated afterwards (see Table VI).

Quality cost column: the figures in "quality cost" column are obtained by adding up the amounts for each financial account included in the "detailed quality cost" record (Table V). That is to say:

(a) Raw materials: this account was affected by the subcategories "products rejected internally" (III.1) and "products returned by customers" (IV.1):

$$120 + 90 = 210 \quad (13)$$

- (b) Salaries – wages: this account was affected by the subcategories “raw material inspection” (II.1), “final product inspection” (II.2), “products rejected internally” (III.1) and “products rejected by customers” (IV.1):

$$100 + 180 + 80 + 60 = 420 \quad (14)$$

- (c) Outsourced services: this account was affected by the subcategories “employee training” (I.1) and “preventive maintenance” (I.2):

$$100 + 30 = 130 \quad (15)$$

- (d) Other expenses: this account was just affected by the subcategory “products rejected by customer” (IV.1), \$105.

- (e) Indirect quality cost: this account was just affected by the subcategory “earnings forgone due to lost sales” (V.1), \$600.

Basic/standard cost column: the figures in this last column may be obtained by subtracting “quality costs” from “total costs” for each financial account.

About the author

Leonardo A. Sedevich Fons achieved a degree in Accounting from Universidad Nacional de Córdoba in 2000, and is completing his PhD in Economic Science from the same institution. He has held several positions related to accounting and management in different Argentine companies, before becoming a Freelance Advisor in 2007. Since then he has led various consultant projects for Argentine companies. As a Researcher, he has taken part in several projects and papers in Management Control for Universidad Nacional de Córdoba. As a Professor he has worked as a Trainer for IRAM Filial Mediterráneo (Argentine standardization and certification institute). Leonardo A. Sedevich Fons can be contacted at: lsedevich@napcc.com.ar or nonsedevich@hotmail.com

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