

# COST OF QUALITY (COQ): WHICH COLLECTION SYSTEM SHOULD BE USED?

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## SUMMARY

It is hard to believe that it has been fifty years since Juran introduced “Gold in the Mine”, in which he likened costs resulting in defects to a gold mine in which profitable digging could be done (Juran 1951). Since that time, several publications have addressed the topic, including the latest edition of “Principles of Quality Costs: Principles, Implementation, and Use,” numerous papers, and hundreds of presentations on cost of quality (COQ) and its applications. However, despite all of the information published on this powerful quality improvement tool, there are two questions that still remain unanswered: “What collection system should be used when starting a COQ system?” and “What are the advantages and disadvantages of each?” These are questions that have been asked on many occasions and hopefully this paper will help others with similar questions.

## KEY WORDS

cost of quality, collection, failure

## INTRODUCTION

This paper compares the different collection systems available to individuals or organizations currently using a COQ system or beginning to use one. As with any quality improvement initiative, choosing the “right” tool/method can be the most difficult decision, and that is why this paper was written. The goal of this paper is to provide a framework that will be used by its readers to select the right method to receive the most benefit from a COQ system.

## COLLECTION METHODS

There are many different ways to collect cost of quality within an organization. However, this paper will focus on the four methods that are the most widely used: the Traditional method, the Defect Document method, the Time and Attendance method, and the Assessment method. The foregoing designations were chosen to best reflect the methods’ functions in an attempt to make this comparison of COQ collection systems easy to follow.

Regardless of the collection system selected, it is imperative to focus analytical and corrective time and energy on the area of *failure costs*. As Juran discussed in 1950 about “Gold in the Mine,” there is still much “mining” that can be performed. This mining should be considered a long-term investment, since failure costs usually constitute 65–70% of corporation’s quality costs, whereas appraisal is normally 20–25% and prevention is 5%.

### ***Traditional Method***

The Traditional collection method is one of the most often used methods and is modeled from Juran’s original writings. This method uses data already existing within an organization, via the standard accounting and finance department records. This information may be obtained from time sheets, expense reports, purchase orders, rework

reports, and other similar type of reports. Although this may be one of the easiest methods to implement, good planning and follow-through are essential for a successful implementation. The following steps should be followed if a Traditional method is being used:

- First, as in any quality improvement program, senior management must be willing to support the program. Having quality control experts estimate the organization's total quality costs with available existing accounting or financial data can facilitate this. With this information in hand, the senior management will hopefully see the "gold" that is available to be mined and will allow the "digging" to start.
- Once senior management is convinced of the gold to be mined, determine the type, quantity, and quality of the existing data. This will vary from organization to organization depending on the level at which costs are broken down and tracked.
- Organize or break out costs by cost category. Using the quality code definitions and accounts in Figures 1 and 2 can help accomplish this. Only failure cost categories should be used at first unless the organization has a mature quality program.
- Report the cost category data on a weekly or monthly basis.

The following are good resources if more information about the Traditional method is required:

- *Principles of Quality Costs: Principles, Implementation and Use*, Third Edition
- *Quality Control Handbook*
- *Linking Quality to Profits*
- *Total Quality Control*

**Advantages:**

- The Traditional method is probably the easiest of all methods when first starting a COQ cost collection system. This is because most organizations already have accounting and finance departments collecting a majority of the data. For example, training, quality, safety, major rework, and warranty costs are usually collected using job orders or some other form of collection system.
- This method is good if first starting a COQ system or trying to sell the concept of COQ cost collection to upper management.
- The traditional method can be used in small or large businesses, universities, software manufacturers, or any other type of business.
- This method provides a quick look at the organization's total cost of quality.
- There is very little maintenance required.

**Disadvantages:**

- It is difficult to collect non-value-added cost using this method. Accounting doesn't usually collect this type of data. The concept of an iceberg, which has most of the ice (failure costs) below the water, is a good analogy of how the majority of failure costs can be missed using the traditional method.
- If it is decided that an existing collection system will be used, and the system is inadequate, then the cost of quality system will also be inadequate.

<p><b>Internal Failure:</b> These are costs that would disappear if no defects existed prior to shipment to the customer. These costs include rework, scrap, recheck or reinspection, corrective action, redesign, vendor defects, and other like defects.</p>
<p><b>External Failure:</b> These are also costs that would disappear if no defects existed in the product after shipment to the customer. These costs include warranty and repair costs, product liability, and product recall.</p>
<p><b>Appraisal:</b> These are costs incurred while performing inspections, checking, testing, or other planned activities to assure the hardware and software confirm to a certain requirement. These costs include first time inspection, checking, supplier surveillance, receipt inspection, and other like costs.</p>
<p><b>Prevention:</b> These are the cost related to all activities to prevent defects from occurring and to keep appraisal and failure to a minimum.</p>

**Figure 1.** Cost of quality categories.

Account #	Description	Account #	Description
11XX	Planning	21XX	Inspection of internal products
12XX	Supplier evaluation	22XX	Calibration & maintenance
13XX	Training	23XX	Inspection of supplied products
14XX	Quality program administration	24XX	Special tests and audits
15XX	Teams		
1XXX	Prevention	2XXX	Appraisal
31XX	Scrap	41XX	Warranty expense
32XX	Rework-production	42XX	Post-warranty expense
33XX	Rework-supplier	43XX	Customer service
34XX	Design failure		
35XX	Retesting & reinspection	4XXX	External failure
36XX	Extra steps & extra operations		
3XXX	Internal failure		

**Figure 2.** Cost of quality codes by account.

### ***Defect Document Collection Method***

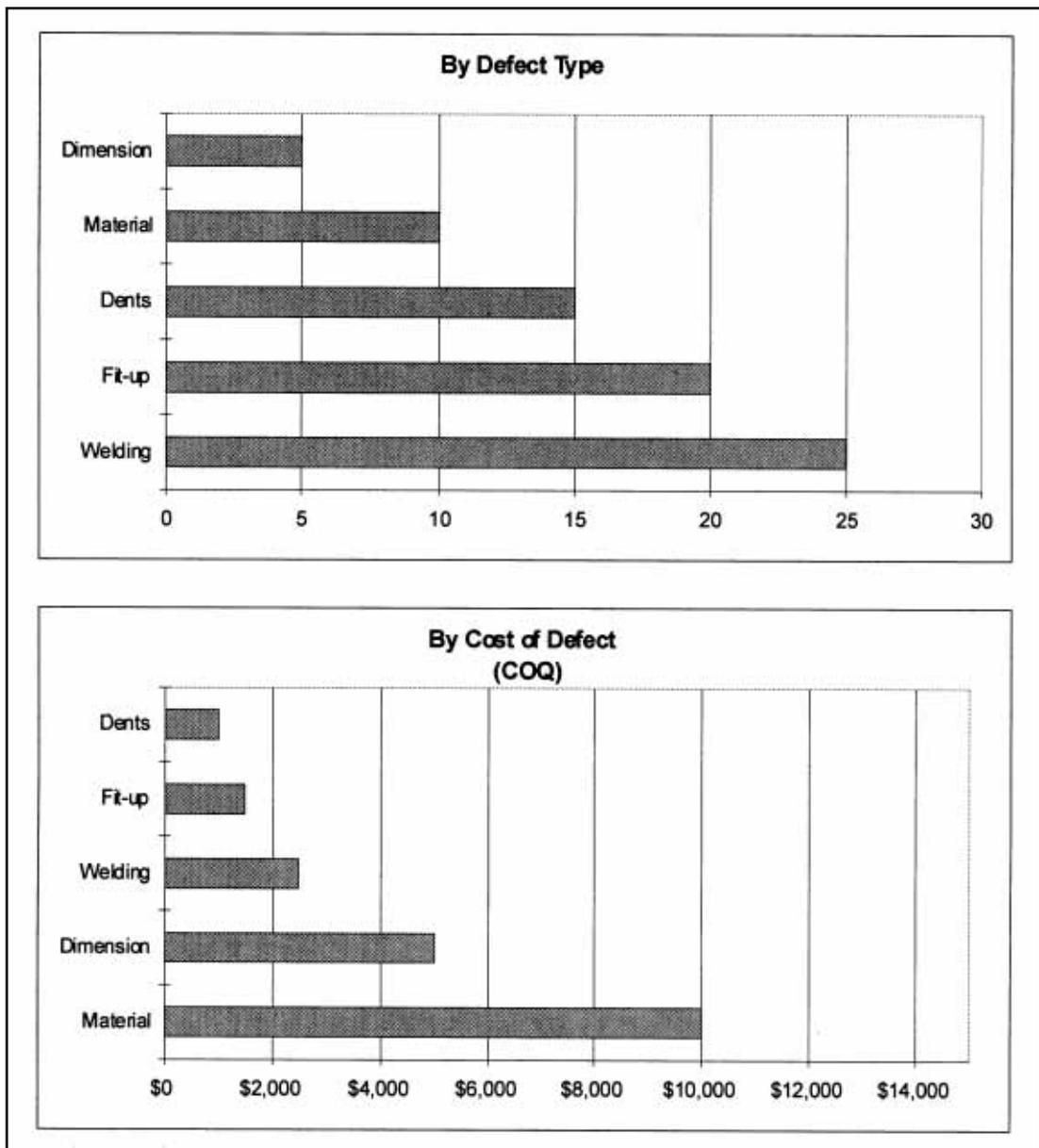
The Defect Document Collection method is sometimes used in conjunction with the Traditional method. However, there are several organizations that started off using this method without the Traditional method and have been very successful. This success is linked to using the existing defect document/tracking system, with which most people in the organization are already familiar. The organizations that are the most effective are the ones that have a mature defect document/tracking system. The following are the steps to be used in implementing the Defect Document Collection method:

- a. Determine how defect records are currently collected within the organization. If they are collected in one system, then this process is easy. However, defect data can still be collected even if more than one system exists.
- b. Once the collection system is identified, determine the average cost of a defect. This is fairly simple to do, depending on the complexity of the organization. The following are a few steps that can be used to collect average defect costs:
  1. Provide a log or time sheet along with the defect document at its start, requiring people who work the defect to record their portion of the cost required to correct the defect.
  2. Perform this on a good statistical sample in each area where the defects are occurring. For example: If an organization has several areas, then log sheets should accompany the documents for each area.
  3. If you do not want to use a log sheet, you can perform an assessment in each area by "walking through" the defect document, recording the time spent at each stage resolving the defects. Although possibly more accurate, this can be time consuming and expensive and is not recommended.
- c. Once the average cost per defect is determined, simply multiply the cost per defect times the number of defects to obtain the total failure cost for that defect (number of defects  $\times$  cost per defect = total failure cost).
- d. If the organization already has a good defect code system, then translating the defect code to a quality cost category is simple and a matrix can be developed to translate one to another.
- e. A simple spreadsheet can be developed and updated either daily or weekly to show both the number of defects and the largest cost drivers (defect categories).

Figure 3 demonstrates the advantage of using cost data and trend data to make informed decisions. For example; by looking only at the first graph, a team would likely have made a decision to attack the welding problem. However, the material issue is costing the organization three times as much. This is the power of using COQ in your analysis. Having both defect and cost data available allows management to make more informed decisions and attack the problems that can give the biggest return. Note that there may also be other factors that should be considered such as customer satisfaction and regulatory or specification compliance issues.

**Advantages:**

- Provides management with another way to look at defect data.
- Can use an existing defect collection system to provide most of the data.
- Requires only a minimal amount of time to collect cost data.
- Can be used to sell senior management on the importance of a COQ system.



**Figure 3.** Advantages of using cost and trend data.

**Disadvantages:**

- Like the Traditional method, it is difficult to collect non-value-added costs using this method.
- If used alone, it can only collect failure costs.

***Time and Attendance Collection Method***

Research indicates that the Time and Attendance method is probably one of the least utilized methods. However, organizations that have used this method have been very successful in getting a good understanding of the organization's total cost of quality. The following are steps that can be used if a Time and Attendance collection system is selected to collect quality cost.

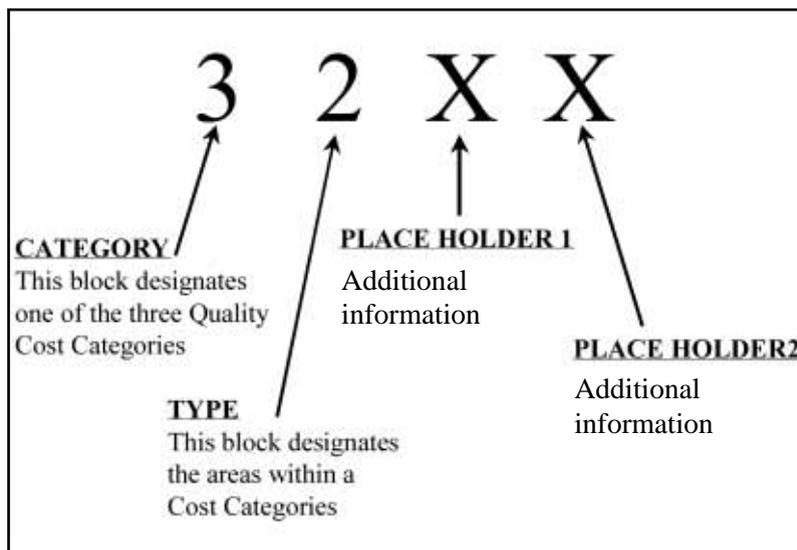
- As with the other methods, top management's support is required. However, in addition to passive support, this method it may well require their full (active) commitment.
- Determine the type of time collection system to be used. Most organizations utilize automated systems, however several use manual time cards. (See Figure 4.) Experience has shown that either system will work as long as employees have the flexibility to collect the time whenever it is convenient.
- Develop a manageable list of quality codes for employees to use when documenting their time. Figure 2 is an example of suggested codes.
- Train every employee on the definition of prevention, appraisal, failure, the associated codes, and when he or she should charge to these codes.
- Purchase or develop a data collection system to collect the time charged to each of these codes.

**Advantages:**

- Provide a means of collecting all quality costs.
- Employees have a better understanding of quality costs.
- Allows employees to be aware that they are performing tasks that are related to quality costs.
- Allows employees to be more involved in the process.
- Can provide the most accurate data if the employees are trained and monitored properly.

**Disadvantages:**

- Requires more commitment from senior management than the other methods.
- Requires training all employees on how to use the correct quality costs.
- Requires the most overhead funding to start.
- Requires an administrator to maintain the database and auditing to assure cost are collected accurately.



**Figure 4.** Time card example.

## Assessment Method

The last method available for collecting quality costs is the Assessment method. As mentioned above, the initial stages of a cost of quality program often include assessments to help estimate the organization's cost of quality. However, use of the Assessment method as the primary method is not a common practice in most organizations, although research shows that a few organizations have switched to the Assessment method as the primary method and are experiencing great results. There have been numerous articles concerning cost of quality assessments. However, a good resource on this topic is *Principles of Quality Costs: Principles, Implementation and Use* (ASQ Press 1999). The following are some thoughts that should be considered when using the assessment method to collect quality costs.

- a. This method is no different than the others in that it too requires the support of senior management.
- b. Determine what quality process stage the organization is currently in. If the organization is in the initial stage, then it should focus its attention in the area of internal and external failure costs. However, if the organization is more mature, then the following three steps should be followed. Step one: Determine the internal and external failure cost with the emphasis on waste and non-value added costs. Step two: Combine the failure cost assessment with examination of the organization appraisal cost. Step three: Add prevention to the other three quality categories.
- c. Once the stage of the organization is determined, select team members who will perform the assessment. The team members should be individuals who understand the operations, activities, and processes of the department that is being assessed.
- d. Train all participants. The training is not limited to the assessors but also applies to all of management in the areas being assessed. Once the assessment is complete, it is important to ensure that the management in that area understands how to interpret the data and results and knows what appropriate actions to take.
- e. Select the right area and the appropriate number of areas to assess (important!). If too many areas are selected and not properly completed from start to finish, including the improvement actions, then the assessment may become a waste of time. Therefore, up front planning to target the appropriate number of areas is important.
- f. Gather information. The two most often used techniques are surveys and interviews. Although both approaches are useful, observing the work being performed and then discussing it with the person performing it provides the best results.
- g. Report the information, organizing the results by cost code categories.

### Advantages:

- The advantage of the assessment method is the *focus* on one area at a time. With the other methods, there is collection occurring concurrently throughout the organization and unless everyone in the organization has the same focus some areas get a lot of attention and other get overlooked, resulting in inaccurate data.
- Another advantage is that after the improvements are implemented, another assessment can easily be performed to assure the improvements are successful.
- Fewer people are required to be trained.
- No formal collection system needs to be developed.

### Disadvantages:

- Not having to train all employees can be both a disadvantage as well as an advantage, since it is sometimes difficult to predict the participants.
- This method is time consuming and potentially more expensive to implement throughout the organization.
- Some employees are intimidated by having someone "assess" them.
- Surveys are not always accurate.

## CONCLUSION

There have been numerous quality improvement tools introduced over the last one hundred years. However, it will be no surprise to practitioners of cost of quality to see most organizations of the future using some form of cost of quality to identify and improve processes, products and global competitiveness. As discussed throughout this paper,

cost of quality collection systems depend on data handling and communication technology. Considering how this technology has progressed (until recently, there were no Pentium computers, Internet, Palm Pilots, wireless communication, etc.), future advancements will undoubtedly improve and enhance the cost of quality collection methods.

## **ACKNOWLEDGMENTS**

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