Assessment of Cost of poor quality in Automobile Industry

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Abstract

The cost of poor Quality would help in analyzing the operating costs for effective and profitable business management. In the era of cut throat completion, success achieved by market leaders is credited to their improvement initiatives. A common element within many of these successful companies is the use of powerful cost of poor quality concepts in connecting improvement priorities to strategic objectives, assessing the financial impact of poor quality, understanding the root causes of poor quality, selecting high payback improvement projects and managing the Improvement initiative to simultaneously deliver improved financial performance and greater customer satisfaction. A widely used rule of thumb says if a defect costs Rs 100 to fix in the field it would only cost Rs 10 to fix in your facility and only Rs 1 to prevent, so in this case an ounce of prevention is definitely greater than the pound of cure. This means in the manufacturing process we want to stop defects before they are created. The six sigma capability and SPC tools can stop the defects before they are created and reduce the cost of poor quality (COPQ) by allowing maintenance to move toward a predictive model instead of a reactive one. The ability to schedule downtime and get to issues root causes allow for less production interruptions and better quality.

Key words: Cost of poor quality (COPQ), six sigma, Taguchi Quality Loss Function (QLF), Deming Wheel: PDCA Cycle.

Introduction

A simple definition of the cost of poor quality (COPQ) is all the costs that would disappear if your manufacturing process was perfect. This includes all appraisal, prevention, and failure costs. Anyone running a company knows these costs exist, but what they may not realize is how much of their expenses are tied directly to COPQ. The industry average is around 20%

Of sales with a range of 1% of sales in a six sigma organization up to 40% of sales at a three sigma organization, meaning for the average company there is large potential for improvement.

By using the basic six sigma tools of Statistical Process Control (SPC) and Capability Processes, the average factory can reduce the cost of poor quality and increase their bottom line profits.

Symptoms for Need of Quality Cost Measurement:

Organizations that have no cost of quality measurement system often see the following symptoms:

- Slow rate of improvement
- Bureaucracy or complexity in processes that continues to worsen
- Changes in one area tend to have large, negative effects in one or more other areas
- Management gets personally involved in quality problems only during a major crisis
- Management is running out of ideas as to how to cut costs further
- All employees are not actively and personally involved in driving the organization's mission forward
- Many individuals and departments disagree on what the top priorities are for the organization
- Sub-processes and departments are operated in a manner that is detrimental to the organization's overall best interest

4.3 Goal of Quality Cost:

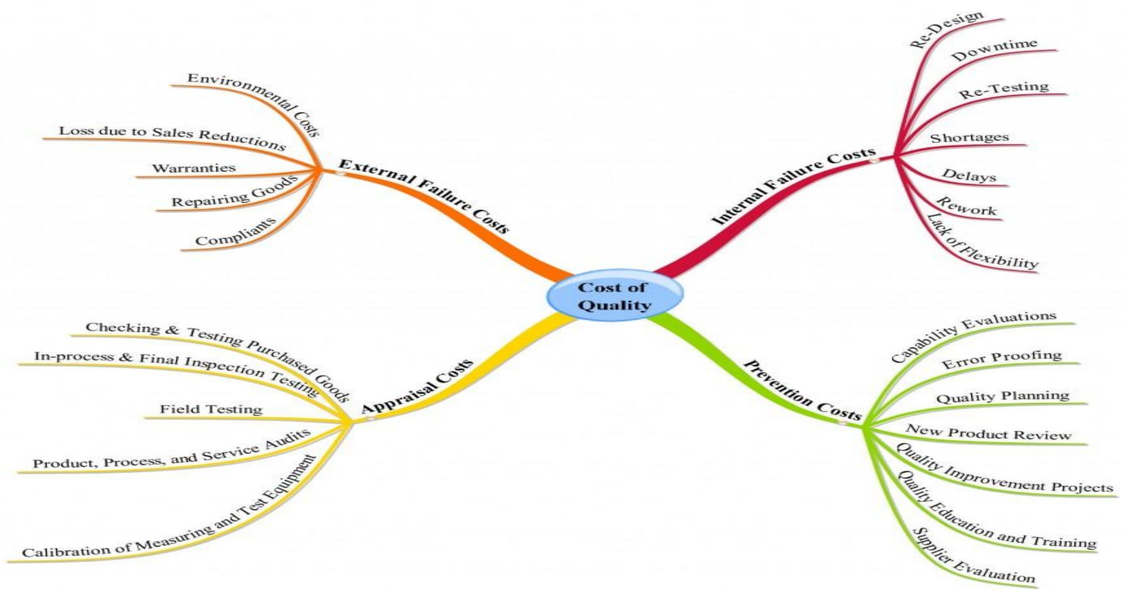
The goal of any quality cost system therefore is to facilitate quality improvement efforts that will lead to operating cost reduction opportunities. The strategy for using quality cost simple

- Take direct attack on failure costs in an attempt to drive them to zero
- Invest in the right prevention activities to bring about improvements
- Reduce the appraisal costs according to results achieved.
- Continuously evaluate and redirect prevention efforts to gain further improvement.

The quality-costing approach is a proven means of tracking, guiding, and motivating quality improvement. The selection of best approach ultimately will be based on maturity of quality efforts, type of organization or process and other TQM tools applied concurrently.

Categories of Quality cost:

Figure1



The Six Sigma Philosophy of Cost of Quality:

(Table 1)

SIGMA LEVELS			
Sigma level	DPMO(Defects per million Opportunities)	Quality level	COPQ
1	691,000	31%	
2	309,000	69%	>40%
3	67,000	93.3%	25-40%
4	6,200	99.4%	15-25%
5	230	99.98%	5-10%
6	3.4	99.997%	0-5%

As a company moves toward becoming a six sigma corporation the COPQ as a percent of sales will drop drastically (Table1). The better your control over the process, the fewer defects you will have, reducing the cost of poor quality. The cost of poor quality is accounted as the annual monitory loss of an industry on its balance sheet. Apparently the cost of poor quality is not concerned with the quality only but cost of waste associated because of poor performance and process along with serious impact on companies market and good will. The cost of competition and customer satisfaction are the paramount challenge to the manufacturer and thus the cost of poor quality is now become most significant factor to bring down the same to its minimum and associated with culture of zero defects.

The Taguchi Quality Loss Function(QLF):

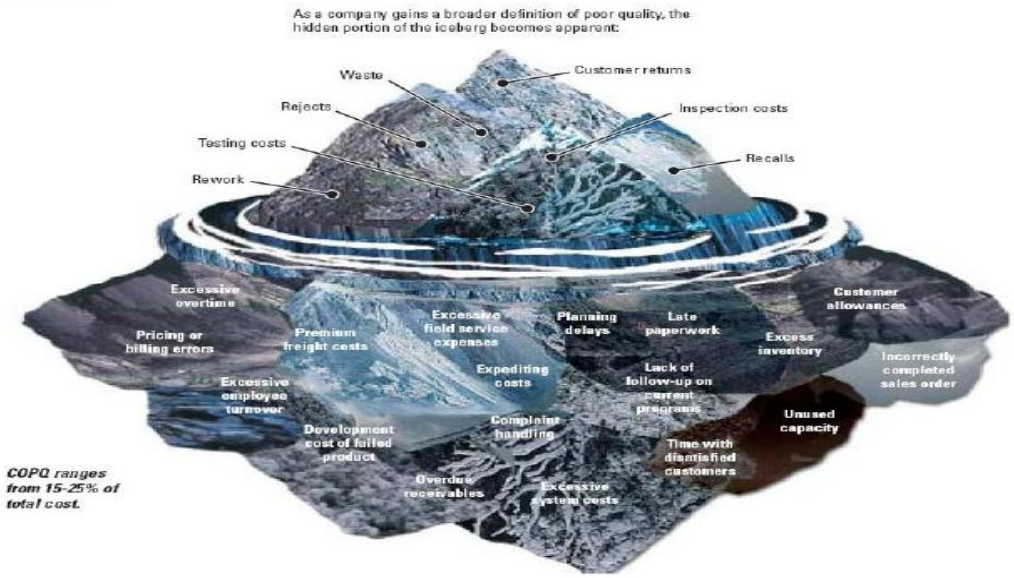
Dr.Genichi Taguchi developed Taguchi Methods-combined engineering and stastical methods that achive rapid improvents in cost and quality by optimizing product design and manufacuring process.

- We canot reduce cost without affecting quality
- We can improve quality without increasing cost
- We can reduce cost by reducing variartion , when we do so, performance and quality will automatically improve.

Taguchi defines quality as “ the loss imparted to society from the time the product is shipped. Fundamental to his approach to quality engineering is this concept of loss.

Quality costs are usually quantified in terms of scarp and rework , warranty or othertangible costs.As we saw however these constitute only the “tip of the iceberg”(figure2)

Figure 2

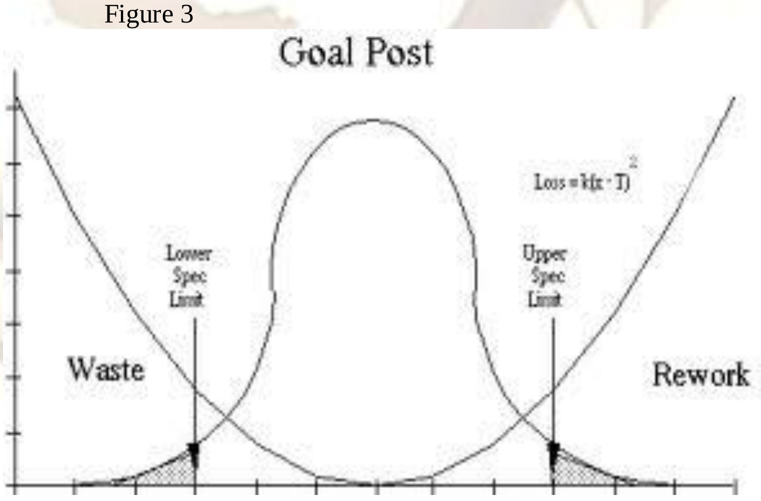


What about the hidden costs or long-termlosses related to engineering/managemnt time , inventory , customer dissatisfaction , and loss to company's bad reputation, which leads to eventual loss to market share. Indeed we need a way the largest contributators to taotal quality loss. Taguchi uses the Quality Loss Function(QLF) for this purpose. The way the QLF is established depends of the quality chararcteristic is whether to jugde the performance(quality). There are five types of Qaulity Charactristics.

1) Nominal the best (achiving a desired target value with minium variation, such as dimension)
2) Smaller the Better(Minimizing the response such as shrinkage & wear)
3) Larger the better(Maximizing a response, such as pull of force & tensile strength)
4) Attribute(clsifyong and/or counting data, such as apperance)
5) Dynamic(response varies dependingon input, such as speed of fan driveshould vary depending on th engine temperature)

Figure 3

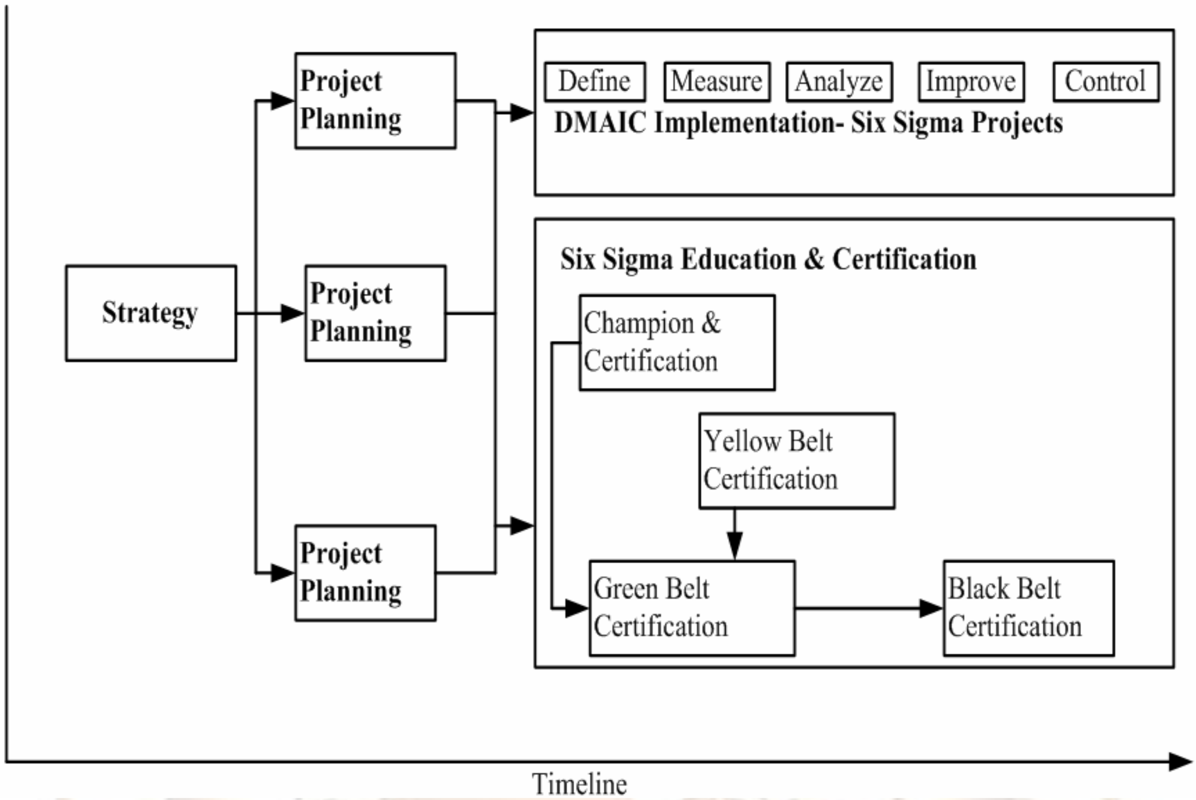
L=Loss in Rs.
K=Cost Coefficient
Y=Value of quality character
T=Target Value
$L = K(Y - T)^2$



In this wayof thinking, loss occurs not only when a product is outside the specifications, but also when a product falls withinthe specifications. Further it's reasonable to belive that loss contiually increases as product deviates further from the target value, as the parabola/(QLF) as shown in figure3 above.While a loss function may take on many forms.In short the the QLF is a measure of quality in monetary units that reflects not only immediate costs, such as scrap and rework, long term losses as well.

Six Sigma implementation frameworks:

Figure 4



Six Sigma is not restricted to large corporate and manufacturing companies but it can be equally Applicable to small and medium-sized enterprises and service organizations too. Although the key findings in Indian small medium enterprises are promising but still there is a huge research gap yet to be explored with respect to Indian medium scale automotive industries for feasibility of implementing Six Sigma. Six Sigma Methodology is a proven tool set for Driving and achieving transformational change within an organi zation. Six Sigma is a continuous Improvement process focusing an organization on: Customer Requirements, Process Alignment, and Timely Execution. Therefore, to be globally competitive, it is essential for the Indian automobile sector to follow Six Sigma program as an effective continuous improvement tool to deploy TQM philosophy. This tool will help the Indian automobile sector to track their performance overtime and to take requisite counter-measures.

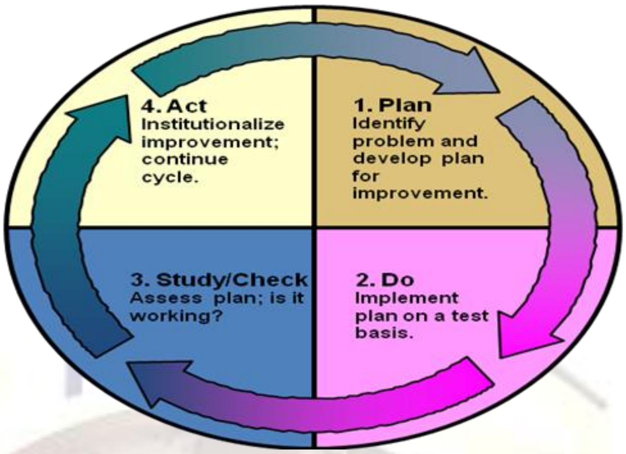
Deming Wheel: PDCA Cycle approach to problem solving and implementing solutions:

Where the consequences of getting things wrong are significant, it often makes sense to run a well-crafted pilot project. That way if the pilot doesn't deliver the results you expected, you get the chance to fix and improve things before you fully commit your reputation and resources. A popular tool for doing just this is the Plan-Do-Check-Act Cycle (Figure5). This is often referred to as the Deming Cycle or the Deming Wheel. Deming is best known as a pioneer of the quality management approach and for introducing statistical process control techniques for manufacturing, which is used them with great success. It is believed that a key source of production quality lay in having clearly defined, repeatable processes. And so the PDCA Cycle as an approach to change and problem solving is very much at the heart of Deming's quality-driven philosophy.

The four phases in the Plan-Do-Check-Act Cycle involve:

- **Plan:** Identifying and analyzing the problem;
- **Do:** Developing and testing a potential solution;
- **Check:** Measuring how effective the test solution was, and analyzing whether it could be improved in any way; and
- **Act:** Implementing the improved solution fully.

Figure 5



Cost of quality models:

Table 2

Generic model	Cost/Activity categories
P-A-F Model	Prevention + appraisal + failure
Crosby's model	Prevention + appraisal + failure + opportunity
Opportunities/intangible cost models	Conformance + non-conformance Conformance + non-conformance + opportunity Tangibles + intangibles P-A-F (failure cost includes opportunity cost)
Process cost model	Conformance + non-conformance
ABC models	Value-added + non-value-added

The P-A-F model is the most recognized internationally approach for quality costing. However the P-A-F model is mainly a cost categorization scheme and it has serious limitations. A promising alternative for quality costing is the family of process cost models. Models based on the activity based costing (ABC) methodology. Which are activity –oriented for the cost assignment view and process oriented for the process view could be also applied for quality cost. Every quality cost model is limited because of the complex nature of the problem that they face. The company should develop a proper quality cost reduction program. It is important that organization should focus on how to achieve the cost-efficient quality and come to an acceptable quality level and should treat the quality cost system as a worthy investment project and get the profit from it. An integrated COQ-ABC framework was proposed in 1998 and it was stated that "the cost and non-financial information achieved from the integrated COQ-ABC system can be used to identify the magnitude of the quality improvement opportunities, to identify where the quality improvement opportunities exist, and to continuously plan the quality improvement programs and control quality costs" In general, one serious limitation of the ABC approach is the need to conduct a full-blown activity-based costing analysis to identify and rank each activity. However, a wide variety of service and manufacturing firms have found that simplified activity-based costing concepts can be used to identify non-value-added activities and quality improvement opportunities, without the time and expense required to implement a full ABC system.

Comparison between main COQ approaches and ABC:

Table 3:

Aspect of comparison	CoQ		ABC
	PAF approach	Process cost model	
Orientation	Activity-oriented	Process-oriented	Activity-oriented (cost assignment view) Process-oriented (process view)
Activity/cost categories	Prevention Appraisal Internal failure External failure	Conformance Non-conformance	Value-added Non-value-added
Treatment of overhead	No consensus method to allocate overhead to CoQ elements under current CoQ measurement systems and traditional cost accounting		Assigning overhead to activities by using resource drivers in the first stage of ABC cost assignment view
Tracing costs to their sources?	No adequate method to trace quality costs to their sources		Tracing activity costs to cost objects by using activity drivers in the second stage of ABC cost assignment view
Improvement objects	CoQ-related activities	Processes activities	Processes/activities
Tools for improvement	Quality circle Brainstorming Nominal group technique Cause and effect analysis Force-field analysis		Process/activity value analysis Performance measurement Benchmarking Cost driver analysis
Information outputs	The cost elements of PAF categories Total quality cost and the costs of PAF categories and their percentages of various bases	The CoC and CoNC elements of the processses investigated Total process cost, CoC and CoNC of the processses investigated and their percentages of various bases	The costs of activities and processes The costs of value- added and non-value- added activities and their percentages of various bases Accurate costs of various cost objects (product, departments and customers) Activity-based performance measures Cost drivers of activities

Conclusion:

- The overall awareness of quality tools in India lacks in depth. TQM is the only mechanism to either sustain competitive advantage or survive competitive disadvantage. This tool will help Indian automobile sector to track their performance overtime and to take requisite counter-measures.
- The market is saturated while the market scale has remained unchanged. A set of effective quality control performance and improvement models needs to be established. By initiating a mechanism of low cost and high processing speeds, an improved competitiveness will develop in this highly competitive, highly demanding, and constantly changing environment. This, in turn, will create a product of high customer satisfaction, which is needed for the industry to survive.
- The increase in demand of the growing customer looking for a better quality of product has compelled corporations to adopt Six Sigma in order to improve the quality for enhanced competitive advantage.
- Though most TQM tools are not new ideas in manufacturing or quality, they just need to be implemented properly as every quality cost model is limited because of the complex nature of the problem, a proper analysis is necessary before implementation, which leads to bring down cost of poor quality and increase the overall profit of an organisation.
- By limiting to obvious costs like scrap and rework, companies completely overlook the most damaging hidden costs. And hence can analyze the tool necessary for implementation which leads to performance enhancement.
- A realistic estimation of quality costs is an essential element of any TQM initiative.TQM system requires a process approach and P-A-F model generally fails in this area. A promising alternative for quality costing is a family of process cost models.

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