COST OF QUALITY: WHEN DATA GETS SMART
The ever more challenging environment of industry requires absolute control of all costs, and Cost of Quality is a key indicator for company performance.

Every organization must consider the costs associated with achieving quality, since their objective is not only to meet customer needs (and regulatory requirements), but also to do so at the lowest cost. This means understanding, measuring and reporting on Cost of Quality, which accounts for a considerable portion of a company’s total costs (about 20% - 30% of sales revenues in industrial companies [1]).

COMPANY OBJECTIVE = MEET CUSTOMER REQUIREMENTS… AT THE LOWEST COST

In most industries, quality costing models have matured but they are often not communicated freely as they convey information on companies’ cost structure, which remains a delicate topic. Poor quality cost structures negatively impact the company’s image when reported to the public.

This paper discusses definitions, concepts, practical cases and best practices on how to reduce the cost of quality by implementing a Cost of Quality approach, based on a benchmark and a Cross Industry Workshop organized by Altran with 20 VPs in charge of Quality from different industries.

Cost of Quality is the total expenses incurred by an organization in achieving and maintaining good quality as well as in managing poor quality throughout its line of operations with an aim of attaining the highest level of customer satisfaction.

→ COST OF QUALITY IS USUALLY UNDERSTOOD AS THE SUM OF COSTS OF GOOD QUALITY AND COSTS OF POOR QUALITY

The cost of good quality is the cost involved in making certain that things are done right the first time, which includes prevention and appraisal costs.

The cost of poor quality is the money wasted when work fails to meet customer requirements, usually calculated by quantifying the cost of correcting, reworking, scrapping, warranties… which corresponds to failure costs.

### FIGURE 1: COST OF QUALITY COMPONENTS

<table>
<thead>
<tr>
<th>Cost of Quality =</th>
<th>Description</th>
<th>Some examples</th>
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<tbody>
<tr>
<td>Prevention costs</td>
<td>• Design, implementation and maintenance of the TQMS&lt;br&gt;• Activities planned and designed to guarantee good quality and prevent poor quality</td>
<td>• Quality management&lt;br&gt;• Product design&lt;br&gt;• Process improvement&lt;br&gt;• Preventive maintenance&lt;br&gt;• Knowledge management&lt;br&gt;• Documentation &amp; Training&lt;br&gt;• CAPA&lt;br&gt;• Quality audits / Supplier rating&lt;br&gt;• Risk management</td>
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<tr>
<td>Appraisal costs</td>
<td>• Measuring and inspecting activities related to quality / ensuring conformance to quality requirements</td>
<td>• Sampling&lt;br&gt;• In-process control&lt;br&gt;• Product testing / Release</td>
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<td>Internal failure costs</td>
<td>• Remedy defects discovered before delivering the product or service</td>
<td>• Rework / Repair&lt;br&gt;• Scrap / Waste&lt;br&gt;• Material replacements&lt;br&gt;• Defect investigation time / CAPA&lt;br&gt;• Unscheduled service &amp; maintenance&lt;br&gt;• Lost process time / Delay&lt;br&gt;• Shortage</td>
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<tr>
<td>External failure costs</td>
<td>• Remedy defects discovered by customers which causes customer to be dissatisfied</td>
<td>• Complaints&lt;br&gt;• Replacing goods / Redoing services&lt;br&gt;• Warranties / Penalties&lt;br&gt;• Returned products / Customer’s</td>
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These key definitions have been further detailed per specific business or organization models [2]. The list of examples is intended only as a guideline and discussion aid.

Investments in preventive activities offer the best return: this is because the associated cost of non-quality increases exponentially as products move from manufacturing, to distribution and then to the end customer. A general rule of thumb to remember is 1/10/100 (FIGURE 2), meaning that when compared to prevention activities costing 1, poor quality is:

- 10 times costlier when identified during appraisal activities and internal failure
- 100 (and more) times costlier when identified after the product has shipped.

Some examples can be given to show what occurs when quality is unsatisfactory (FIGURE 3).

<table>
<thead>
<tr>
<th>When</th>
<th>What</th>
<th>Cost</th>
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<tbody>
<tr>
<td>2006</td>
<td>Dell recalls 4 million laptops due to faulty over-heating batteries</td>
<td>$400m</td>
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<tr>
<td>2007</td>
<td>Mattel recalls 19 million toys supplied from China</td>
<td>$30m</td>
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<td>2010</td>
<td>Toyota recalls 10 millions cars due to a faulty accelerator pedal</td>
<td>$1.2bn</td>
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<tr>
<td>2011</td>
<td>UK banks required to pay compensation for misselling of PPI (Payment Protection Insurance)</td>
<td>£40bn+</td>
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<tr>
<td>2013</td>
<td>Horsemeat scandal results in slide in sales of red meat in UK</td>
<td>Industry sales down 5%</td>
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<tr>
<td>2015</td>
<td>Alton Towers rollercoaster crash results in compensation claims &amp; lower customer visits</td>
<td>£40m+</td>
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The goal of a Cost of Quality system is to find the level of quality that minimizes total cost of quality.

To reduce total Cost of Quality, the first reflex is often to reinforce appraisal costs. However, according to the 1/10/100 rule, 1 dollar spent on prevention is worth 10 spent for appraisal. In other words, it would be better to invest in prevention, as it costs less (even if Return on investment takes more time).

- So, investing in prevention saves money

Investment in prevention activities will reduce appraisal costs and finally reduce failure costs.

Cost of Quality is not widely used (only 20-30% of companies). However, it is well known that we manage only what we measure and lots of examples confirm that quality improvement and cost measurement processes bring about a huge reduction in a company’s Cost of Quality and better quality for customers.
Establishing a quality costing model makes it possible to express quality-related activities (hosted by the Quality department) as cost-related activities, talking the common language of the facility or department. The aim is to promote quality as an objective business parameter to influence strategic and business decisions. Another aim is to raise awareness among people focused on quality (e.g. industrial, sales and service departments) about these economic aspects.

→ DEFINE AND SHARE THE END-TO-END PROCESS OF COST OF QUALITY MANAGEMENT

The end-to-end process of Cost of Quality Management presented in FIGURE 6 has been defined in collaboration with Quality VPs from different industries. The final objective of this process is to use cost of quality to influence strategic or operational decisions.

**FIGURE 6 : END-TO-END PROCESS OF COST OF QUALITY MANAGEMENT**

**Define the Cost of Quality framework** - Identify management and business needs (what do they want? What do they need?). Define the Cost of Quality strategy: First objective: Balance prevention and appraisal costs. Second objective: Monitor impact of prevention costs on the total cost of quality to avoid falling into over-quality. Define KPIs. Identify the Cost of Quality data you must collect. Select Cost of Quality tools (for analysis and visualization). Design a robust organization. Clearly define a task force (R&R).

**Collect the data** - Automatize and standardize data collection. Adapt frequency of data collection.

**Clean the data** - Define the right unity. Validate analyzed data. Compare data to reality and adjust.

**Aggregate the data & Visualize** - Define granularity. Ensure the data is meaningful. Provide a clear data overview (for executive and business levels).

**Analyze the data** - Analyze across organizational levels from shop floor to senior management. Transform data to information.

**Propose actions** - Empower business and shop floor levels for action proposals.

**Influence strategic or operational decisions** - Include Cost of Quality metrics in business scorecard and project charters. Connect Cost of Quality metric to budget. Measure Cost of Quality evolution (globally and in detail).

**Continuously improve the process** - Consider the global results of Cost of Quality. Disseminate Cost of Quality information to all levels in the organization. Regularly review implemented actions showing impacts on Cost of Quality model (from reactive to preventive).
→ DEFINE THE ROADMAP AND RUN THE COST OF QUALITY MODEL IMPLEMENTATION AS A PROJECT

Such a Cost of Quality process can be reasonably implemented in less than 10 months. As described in FIGURE 7, the implementation must be managed as a project comprising:

3 phases:
- Design
- Preparation & Training
- Rollout

4 workstreams:
- Process & Organization
- Data & Tools
- Project management
- Communication management

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<thead>
<tr>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
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<td>DESIGN</td>
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<td>COST OF QUALITY &amp; ORGANIZATION</td>
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<td>• Define end-to-end process (process steps, governance, KPI tools...)</td>
<td>• Train people</td>
<td>• Deploy new Cost of Quality process</td>
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<td>• Define Cost of Quality organization (process owner, Site Master Expert and task force from shop floor to senior exec levels, required competencies...)</td>
<td>• Implement new Cost of Quality organization</td>
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<td>DATA &amp; TOOLS</td>
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<td>• Define Cost of Quality framework / data categories</td>
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<td>• Select Cost of Quality tool (for data collection, visualization &amp; analysis)</td>
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<td>PROJECT MGT</td>
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<td>• Define Cost of Quality project team</td>
<td>• Manage the project</td>
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<td>• Define Cost of Quality implementation planning and budget</td>
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<td>• Build communication plan</td>
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<td>• Communication all along the project</td>
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FIGURE 7: PROPOSAL FOR BASIC COST OF QUALITY IMPLEMENTATION ROADMAP

Project managers must be appointed to assure clear communication and reporting to top management and to ensure links with the timelines of the budget process. The success of the project is directly linked to the ability to overcome change management issues.

A clear timeline must be set out at the start of the project to monitor tasks and propose clear milestones.
How much time does it take to implement such a project and generate results?

It depends on the company's size, maturity and commitment to management.

Implementation (for a medium-sized company):

- About 3 months with external facilitation and expertise
- About 6-10 months without external facilitation (managed internally and part of daily work)

Visible results (impact on ROI):

- About 6 months
- Feedback: a 10% increase in prevention and appraisal costs implies reduction of failure cost of about 20%. A Cost of Quality reduction of about 50% could be expected within 5 to 10 years after implementation.
The Cross Industry Benchmark and Workshop allowed sharing of experience feedback regarding the implementation of different Cost of Quality models. Best practices have been identified and are summarized as follows.

→ SELECT THE RIGHT DATA AND TOOLS

**Identify and categorize costs** - Sort out quality-related and activity-related costs and their correlation with good or poor quality.

**Merge costs as far as possible with in-house reporting** - Reuse costs that can be readily available (e.g. from financial monitoring). If data is missing, set up a simple collection system to accelerate the measurement phase. Set up automatic data collection to minimize human error.

**Be reasonable, clear and readable** - Do not attempt to be unnecessarily exhaustive. Use simple, self-explanatory, precise and accurate data. It is better to make decisions based on a small amount of accurate data than extensive but unmanaged data. Make it simple!

→ COMMUNICATE, INVOLVE & ENSURE MANAGEMENT COMMITMENT

**Communicate on your project at every level of your company** - The Cost model approach must be explained to all members of the company to ensure the success of the project. Believe in Cost of Quality and convince.

**Engage top management** - If top management is not convinced, the project will fail as an improvement process. Ensuring the commitment of top management is decisive for the success of a Cost of Quality initiative because the project requires strong resource investment.

**Appeal to business people and motivate management commitment** - A top-down approach must be implemented to make sure all stakeholders will be involved in the project. The Cost of Quality project needs to be "sold" like any product, and must be marketed with this in mind.

**Use visual management** - To simplify communication to stakeholders.

→ ESTABLISH COST OF QUALITY AS A STRATEGIC OUTCOME MEASURE

**Talk money, do not talk quality (put monetary values on quality issues)** - This is possible by taking a proactive Quality approach (reliable and understandable company-wide metrics and figures, improvement- and prevention-based) rather than a submissive Quality approach (based on assumptions and investigating defects). Cost of Quality ownership can fall under both the Financial and Quality department.

**Make use of Cost of Quality as both a business performance indicator and a decision-making tool** - Push the Cost of Quality model as the driver of your company’s decision-making. Establish links between the Cost of Quality project and overall company performance.
Cost of Quality: When data gets smart

<table>
<thead>
<tr>
<th>Corporate level:</th>
<th>Operational level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Quality management makes it possible to:</td>
<td>Cost of Quality management makes it possible to:</td>
</tr>
<tr>
<td>• Persuade top management to initiate improvement projects (top management is more influenced by data expressed in monetary terms rather than technical data such as defect rates)</td>
<td>• Monitor activities</td>
</tr>
<tr>
<td>• Incorporate all the separate quality activities into an overarching quality system and monitor performance across the organization</td>
<td>• Identify, prioritize and select projects</td>
</tr>
<tr>
<td>• Provide a communicating bridge between line and top management</td>
<td>• Provide financial benefits of process improvement</td>
</tr>
<tr>
<td>• Identify the need for action to decrease costs of poor quality</td>
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<tr>
<td>• Improve managerial planning, control and decision-making</td>
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**FIGURE 8:**
COST OF QUALITY AS BUSINESS AND STRATEGIC DRIVER
(At Operational and Corporate Levels)
We all agree that Quality should be managed in a proactive way by considering prevention and appraisal costs rather than only failure costs, and should get complete management’s attention.

However, several challenges to implement Cost of Quality models remain, such as:

**How can data collection be simplified?**
Data collection remains a critical point. But how to use analytics, automated data extraction, etc. in an efficient way and how to ensure the connection with existing tools?

**How can data be read and interpreted in a relevant and practical way?**
People need some keys to interpret massive and complex data. But how can this data be used, manipulated and translated? How can “intelligence” be extracted from the data? And how can this “intelligence” help make the right decisions?

**How to link Cost of Quality to the budget process?**
The aim is to achieve sustainable benefits. Why the increase of prevention costs must lead to the reduction of appraisal costs?

These and many more questions still need to further be explored. Multiple Cost of Quality initiatives are currently ongoing in diverse industries and continuous benchmarking and exchange with experts through communities will allow building further knowledge and best practices in this domain.

**Switching from “Quality at any price” to “Quality at the right price” is a real challenge...**
ABOUT THE AUTHOR

Camille MARCEL is a Consulting Manager of the Altran Life Sciences Process Excellence World Class Center, specialized in Performance, Compliance and Business Process Improvement. She has worked on diagnostic redesign and quality process optimization projects for a large number of pharmaceutical industries in France and internationally.

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