



Cost of Poor Quality (CoPQ) – Method of Working

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Purpose:

Cost of Poor Quality (CoPQ) is measured as the financial cost of defects. Defects are defined as delivering a products and/or services that are not error free. CoPQ directly impacts EBIT and corporate profitability.

The overall purpose of measuring and monitoring Cost of Poor Quality (CoPQ) is to provide a qualitative and quantitative data-based reporting system to Management on the as part of an organization's Quality Management System (QMS) that facilitates Continuous Improvement (CI) Programs

Calculating and addressing CoPQ is an evolving methodology with multiple avenues to implementation which started with smaller scope and is evolving based upon changing market conditions driving innovative design solutions and data maturity and usage in an organization.

In practice, the QMS uses CoPQ data for identifying, planning and prioritizing CI programs. CoPQ is the link between Quality Performance and Financial Performance as all CI programs must have an overall positive business case and impact on an organization either in defect avoidance/prevention or reduction.

Relevant Abbreviations:

CoPQ – Cost of Poor Quality

COI – Cost of Investment (i.e. Cost of product/Process design changes activities, tooling, training, etc.)

LCOE – Levelized Cost of Energy (i.e. LCOE is the total cost of generating electricity for a power generating system whether renewable, natural gas or coal)

DMAIC(R) – Define, Measure, Analyze, Improve, Control, Replicate-Six Sigma Problem solving methodology

DFSS – Design for Six Sigma-Problem solving methodology

CI – Continuous Improvement quality approach for improving a product or process

Global 8D – Problem solving methodology comprised of 8 distinct steps originating from Ford Motor Company

Shainin – Statistical Problem-solving methodology using comparisons between the Best of the Best (BOB) and Worst of the Worst (WOW)

PDCA – Plan Do Check Act Problem Solving methodology

PPAP – Production Part Approval Process resulting in a customer approved Parts Submission Warrant (**PSW**)

ECM – Engineering Change Management

FFF – Fit Form and Function

There are 4 categories of CoPQ:

1) Avoidance / Prevention

Avoidance / Prevention is the first “line of defense” in avoiding CoPQ and protecting the customer. Designing out the product or process through re-design achieves avoidance and prevention.

2) Audits, Internal and External Inspection

Costs of all activities associated with inspections, including In-process, Final, Incoming, Transport/Yard or Site/Field, Product or Process Audits, etc. to ensure conformance to product and process quality standards and performance requirements. Inspection costs also include manual and automated methods and includes costs from the inspection equipment/tooling, its operation and supporting training, its calibration, equipment maintenance and its depreciation. Please note: All Costs associated with Internal and External Inspection activities can fall within CoPQ or COI.

3) Internal Defects

Costs arising from products or services not conforming to customer requirements occurring prior to delivery. Internal defect costs usually arise from product/component scrap, rework/repair cost, etc.

4) External Defects

Costs arising from products or services not conforming to customer requirements occurring after delivery. External defect costs usually arise from unscheduled maintenance/warranty claims and exposure, customer complaints, customer returns, etc

CoPQ Corporate Impacts:

CoPQ impacts LCOE directly. As CoPQ increases, LCOE increases. LCOE is the total cost of generating electricity for a power generating system whether renewable, natural gas or coal. It includes the economic assessment of the cost of the power generating system including all lifetime costs, including initial investment, operations and maintenance, cost of fuel and capital costs.

Sum of the total electricity generating costs divided by sum of total electricity produced equals the LCOE

Scope:

APQP4Wind follows Industry practices and learnings from ASQ Institute in defining its CoPQ model. It is recommended that all actions that are a result of CI Programs must have a positive business case by determining the costs of the design changes (i.e. Cost of Investment (COI) and comparing to the CoPQ):

- $COI < CoPQ$ = Positive Business Case for implementing design change = GO
- $COI > CoPQ$ = Negative Business Case for implementing design change = NO GO

Please note that there are exceptions to this recommendation when the defect involves safety or the critical characteristic in question is related to safety and not only FFF and Performance.

COI activities are the investment activities needed to prevent or reduce CoPQ in delivered products or services. These activities can be defined as the costs related to the following 6 areas:

1) Product and Process Design Changes

All investment costs that occur as a result of product and process design changes due to CoPQ. Design changes include design verification and validation testing.

2) Supplier Development Rating

All investment costs that occur as a result of supply chain readiness activities, including new equipment procurement/investment, PPAP and supporting Engineering Change Management (ECM) activities (i.e. drawing revisions, design guideline updates, etc.)

3) Internal Trainings, Production Trials/PPAP

All investment costs that occur as a result of Engineering Change Management activities after successful Design Validation. These activities include PPAP, final PSW sign off and supporting Engineering Change Management (ECM) activities (i.e. purchase specification updates, drawing revisions, design guideline updates, etc.)

4) Audits, Internal or External Inspection Programs

Costs of all activities associated with inspections, including In-process, Final, Incoming, Transport/Yard or Site/Field, Product or Process Audits, etc. to ensure conformance to product and process quality standards and performance requirements. Inspection costs also include manual and automated methods

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Please note: All Costs associated Audit, Internal and External Inspection activities can fall within CoPQ or COI.

5) CI Programs/Activities

All investment costs that occur as a result of CI Programs/Activities using various tools and methodologies. Examples include but are not limited to:

- 1) PDCA**
- 2) Global 8D**
- 3) DMAICR**
- 4) DFSS**
- 5) Shainin**