Cost of Quality

Dr. Ranjana Pathak
President Global Quality, Medical Affairs and Pharmacovigilance, at Cipla
Cost of Quality is a comprehensive methodology to measure the organization’s resources being used for prevention, detection and maintaining product quality (both direct and indirect costs) as opposed to the direct costs resulting from internal and external failures.
Why is cost of quality important
Small mistakes often lead to a high drain on costs / resources

Let’s discuss few cases to help us better realize the cost of Quality; i.e. how small mistakes in GMP documentation / practices can cost a lot to an organization; three examples to discuss:

- Training questionnaire evaluation
- Equipment cleaning
- ANDA application
Case 1: Training questionnaire evaluation

**Issue:** Employee forgot to mark answer and same was missed by reviewer

**Risk:** Data reliability concern

<table>
<thead>
<tr>
<th>Issues</th>
<th>Cost</th>
<th>Remediation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee forgot to mark answer and same was missed by reviewer</td>
<td>10 sec</td>
<td>Review of all previous training records of the individual and associated employees. (2 Hrs. each for 50 employees)</td>
<td>100 Hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review of all associated activities performed by the concern employee for last 2 years. (10 days of time)</td>
<td>80 Hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retraining on all applicable SOP’s to all employees. (CAPA) 30 days of time, 2 hrs. each day.</td>
<td>60 Hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time involved in writing of response. (3 days)</td>
<td>72 Hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hiring external consultancy for independent and comprehensive review. (10 days)</td>
<td>80 Hrs.</td>
</tr>
<tr>
<td><strong>Total Cost in Hrs.</strong></td>
<td></td>
<td></td>
<td>392 Hrs.</td>
</tr>
</tbody>
</table>

**Conclusion:** For the negligence of 10 seconds, organization has to spend 392 Hrs. of time and associated financial cost for its remediation; such a huge cost of resources !!!!
# Case 2: Equipment cleaning

**Issue:** White powder found on a process equipment due to improper cleaning and same was not identified during the line clearance  

**Risk:** Cross contamination

## Issues

White powder found on a process equipment due to improper cleaning and same was not identified during the line clearance.

## Remediation

- Time required for testing of white powder for its identification
- Cleaning of equipment chain
- Testing of reserve samples to eliminate the possibility of cross contamination
- Investigation and impact assessment
- Product recall in case of observed traces leads to cross contamination issue
- Compliance to warning letter and import alert
- Independent review through third party consultant to overcome the cross contamination issues.
- Re-inspection and its compliance

## Cost

- Time, laboratory occupancy and Manpower
- Time, utility and Manpower
- Time and Manpower
- Time and Manpower
- Financial loss
- Loss of business and brand image
- Time and financial cost
- Time, money and manpower

## Conclusion

Negligence of an individual costs time, money, manpower and reputation of organization.
**Case 3: ANDA review**

**Issue:** Typographical error in area classification in ANDA application  
**Risk:** Significant delay in approval

<table>
<thead>
<tr>
<th>Issues</th>
<th>Remediation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typographical error in area classification in ANDA application</td>
<td>Review of all submitted ANDA’s.</td>
<td>Time and Manpower</td>
</tr>
<tr>
<td></td>
<td>Notification to customers and regulatory agencies</td>
<td>Time and Manpower</td>
</tr>
<tr>
<td></td>
<td>Independent review through third party consultant</td>
<td>Time, money and Manpower</td>
</tr>
<tr>
<td></td>
<td>Investigation and impact assessment</td>
<td>Time and Manpower</td>
</tr>
<tr>
<td></td>
<td>Corrections and re-submission of supplementary ANDA applications</td>
<td>Time, money and Manpower</td>
</tr>
<tr>
<td></td>
<td>Response to inspection findings</td>
<td>Time and Manpower</td>
</tr>
<tr>
<td></td>
<td>Re-inspection and its compliance</td>
<td>Time, money and manpower</td>
</tr>
</tbody>
</table>

**Conclusion:** Negligence in preparation and review of ANDA application costs time, money and manpower
As a result, cost of poor quality has a significant impact on key operational outcomes

<table>
<thead>
<tr>
<th>Cost of poor quality – waste and rejects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CpK value</strong></td>
</tr>
<tr>
<td>Poor quality</td>
</tr>
<tr>
<td>Average quality</td>
</tr>
<tr>
<td>World class quality</td>
</tr>
<tr>
<td>Poor quality</td>
</tr>
<tr>
<td>Poor quality</td>
</tr>
</tbody>
</table>

SOURCE: FDA Science Board Meeting November 16, 2001
A large part of the cost of quality is hidden (e.g. cost of lost sales); only those parts that are ‘obvious’ are visible
Companies either do not measure cost of quality, or rely heavily on manual systems for measuring cost of quality

Most companies do not measure cost of quality . . .

AND those which do, use mostly manual methods

<table>
<thead>
<tr>
<th>Method</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>53</td>
</tr>
<tr>
<td>ERP software</td>
<td>29</td>
</tr>
<tr>
<td>Histograms</td>
<td>12</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
</tbody>
</table>

SOURCE: Parenteral Drug Association survey Sep 2011 (reported in Gold Sheet Sep 2012)
Very often, pharma companies significantly underestimate total cost of poor quality: Deviations example

Costs associated with deviations

Materials and conversion cost: Cost of rejected batches as measured at the site

Quality Labor: 30-50% of time of Quality FTEs is spent on investigations, CAPA, etc. associated with deviations

Capacity stranded due to deviations: step function, relevant for growing volumes and determining need for new lines/investments

Foregone or postponed revenues

Other cost, e.g., inventory/WIP, additional safety stock at the marketing company – not considered site cost but is part of the total company’s cost

Total estimated cost of deviations at a well performing site

- Site’s estimate: $4.0 million
- Full cost estimate: $13.0 million

Paid quality labor
- >3x
- ~10.0 million

Stranded capacity, inventory/WIP, opportunity cost

- ~2.0 million

Rejected batches
- [VALUE]
- 1.0 million

Site’s estimate
- 1.0 million

Full cost estimate
- 1.0 million

DISGUISED PHARMA SITE
5 elements constitute the ‘Total Cost of quality’, covering both the Cost of good quality and the Cost of poor quality

- **Cost of good quality**
  - **Cost of prevention**
  - **Cost of detection**

- **Cost of poor quality**
  - **Direct costs - Internal**
  - **Direct costs - External**
  - **Indirect cost due to quality events**

**Definition**

- **Cost of prevention**: Costs associated with the prevention of future losses (unplanned problems, waste, breakdowns, stoppages)
- **Cost of detection**: Costs associated with appraisal of the process / product to ensure quality is met
- **Direct costs - Internal**: Costs associated with internal losses to correct or replace products that fail to meet specifications prior to delivery
- **Direct costs - External**: Costs associated with correction or replacement of products/services that fail to meet specifications/service level after delivery
- **Indirect cost due to quality events**: Estimated lost revenues — e.g., related to missed sales, out-of-stock, loss of goodwill
Total cost of quality goes well beyond the quality organization spend, and on avg. accounts for upto 25% of conversion costs at a site level

<table>
<thead>
<tr>
<th>Cost of Quality in Pharma as % of conversion cost (site level)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal cost of poor quality</strong></td>
</tr>
<tr>
<td>Cost (financial value) associated with rejected or reworked batches, machine repairs, scrap generated…</td>
</tr>
<tr>
<td><strong>External cost of poor quality</strong></td>
</tr>
<tr>
<td>Cost (financial value) associated with complaints, recalls or other non-routine events (regulatory actions, penalties, compliance consultant fees, etc.)</td>
</tr>
<tr>
<td><strong>Detection costs</strong></td>
</tr>
<tr>
<td>Labor cost of dedicated quality staff, non-quality site personnel engaged in quality activities (only based on time actually spent on quality work) and above-site resources engaged in Quality activities (as allocated to each respective site)</td>
</tr>
<tr>
<td><strong>Prevention costs</strong></td>
</tr>
<tr>
<td>Site quality labor cost dedicated to prevention (~50% of total quality organization budget)</td>
</tr>
<tr>
<td>Quality-related CapEx depreciation</td>
</tr>
<tr>
<td>Quality-related materials spending</td>
</tr>
<tr>
<td>Other quality-related costs (e.g., external quality audits)</td>
</tr>
</tbody>
</table>

**SOURCE: POBOS Quality**

- At site level total cost of quality is 25%+ of conversion cost. At company level it’s 10-12% of COGS
- Median financial cost of a recall is ~$35K and can exceed $500K for major recalls, without even considering reputation and market share loss
- On average revenue losses for companies with quality issues is estimated at 4-5% of COGS
How can companies think about monitoring their ‘true’ Cost of Quality?
To drive any improvement effort geared towards quality, the first step will be to create transparency.

<table>
<thead>
<tr>
<th>Create transparency around true cost of quality</th>
<th>Define improvement program and initiatives</th>
<th>Execution and performance tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Benchmark</strong> total cost and their individual components against peers and best performing sites within internal network</td>
<td>• Align on highest impact areas (based on diagnostic or benchmarking)</td>
<td>• Establish systems and processes needed for efficient and continuous process</td>
</tr>
<tr>
<td>• Identify <strong>areas of high cost and drivers</strong></td>
<td>• Define <strong>improvement initiatives</strong>, relevant <strong>investments</strong>, and target <strong>impact</strong></td>
<td>• Establish <strong>performance monitoring</strong> based on key drivers of improvement (e.g., no. of deviations, recalls)</td>
</tr>
<tr>
<td>• Assess <strong>standard cost</strong> per unit for <strong>key drivers</strong> of quality cost</td>
<td>• Define <strong>systems and processes</strong> to establish for a scalable effort</td>
<td>• Setup <strong>regular analysis</strong> of the total cost of quality and impact of improvement initiatives</td>
</tr>
</tbody>
</table>

Three options for creating transparency detailed further
Transparency option 1: Detailed tracking of quality costs at activity level

Approach

Identify key quality activities

Establish activity based tracking for quality and non-quality personnel using HR data and hourly rates

Add tracking of direct poor quality cost (e.g., rejected batches, fees and penalties)

Analyze results on a regular basis identifying impact and areas for improvement

Pros

- Detailed information from accounting and HR
- High level of accuracy

Cons

- Complex to set up and execute monitoring and analysis
- Time consuming tracking
- Not at product level
Transparency option 2: Poor quality costs measured through “standard” costs of issues

**Approach**

- **Identify key drivers of the poor quality cost** (deviations, complaints, OOS, 483s, re-testing, batch record errors)
- **Assess average (standard) cost per unit for each driver** (Quality and non-quality labor, cost of rejected products, regulatory consulting fees, etc)
- **Use standard cost to assess cost of poor quality based on the key drivers** on the ongoing basis
- **Example drivers**
  - Number of deviations by source
  - Number of batch record errors
  - Right-first-time
  - # of environmental and maintenance OOS (not triggering a deviation)
  - # of customer complaints
  - # of 483s, etc.

**Pros**

- Easy to estimate on an ongoing basis and analyze performance based on key drivers
- Easy to set at product level based on typical issues levels

**Cons**

- Requires detailed diagnostic to define standard costs
- Doesn’t account for high variability of poor quality costs
- Doesn’t account for day-to-day costs (prevention and inspection)
Transparency option 3: Product allocation costs by activity and type of issue

Approach

- Identify **key quality activities and workload driver for each** (e.g., number of batches for QC testing, number of formulations for quality documentation, number of deviations for investigations work)
- **Assess average** (standard) **resource level per unit of the workload driver for each activity** (e.g. QC testing FTE per batch, Investigations FTE per deviation)
- **Allocate workload drivers by product** based on actual volume, number of issues, number of SOPs, points of use, etc (adjusting for double counting) and estimate “standard resources cost” by product
- **Estimate non-labor poor quality costs** (e.g. as in Option 2) and **allocate by product based on typical issues levels**

Pros

- Set at product level and possible to use for portfolio analyses
- Once set, easy to estimate on the ongoing basis and analyze performance based on key drivers

Cons

- Requires detailed diagnostic to define standard costs and allocations
- Does account for high variability of poor quality costs
- Possible overlap of workload drivers (multiple product for one point of use, for one piece of equipment)
Case example: Company imbibed a rigorous approach to minimizing variability in manufacturing processes

Minimizing process variability
- End-to-end process mapping and monitoring
- Input, Output (equipment)
- Control limits per technology requirements
- Process Improvements to CpK 1.33

Process monitor parameters
- **End-to-end process mapping** and monitor parameters defined by technology development team
- More added as appropriate in manufacturing

Target Cpk of 1.33
- At introduction of a technology, every monitor CpK may not be at 1.33
- Identify below target monitors and **reduce variabilities** (tool to tool, inputs, transfer functions, etc.)

Empowered change management
- Any process change must be approved by change management body
Case example: Approach to minimizing variability was also complemented by an organization wide strong, objective focus on quality

- Quality mindset across the organization
- Extensive automation to minimize human errors
- Enabling employees to execute quality mindset
- Data driven objective decision making
Thank you

If you have any questions, kindly write to

ranjana.pathak@cipla.com