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How much does software quality cost?

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Cost of software quality

Cost of quality for the supplier:

Is the purchaser ready to pay that?
How does the purchaser see it?

![Chart showing development and enhancement expenses and value over time.](chart)

QLK-1.30

What can the supplier do?

→ either increase the value for the same price provide
  ♦ more useful functionality in the same time frame
  ♦ the same functionality in less time

→ or decrease the expenses for a lower price provide
  ♦ in the same time the same value, i.e. decrease the cost of development
How can the supplier achieve it?

speed up development  
→ increase efficiency  
→ do more simultaneously  
→ do less  

decrease cost of development  
→ increase efficiency  
→ do it with cheaper resources  
→ do less  

efficiency = output / time  
resources from Slovenia  
simultaneous defect detection  

less work to do  
topic for defect removal strategy  

What type of work can be omitted?

requirements specification  
design specifications  
coding  

user documentation  
configuration management  
project management  

requirements review  
design reviews  
code reviews  
unit testing  
integration testing  
system testing  
documentation review  

requirements repair  
design repair  
code repair  
requirements & design & code repair  
documentation repair
Universal laws of repair avoidance

1. don’t make mistakes
2. if it so happens that you can’t avoid mistakes then do your best to detect the defects you produced
3. repair the defects applying rule 1

<table>
<thead>
<tr>
<th>approach</th>
<th>defect detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>justification</td>
<td>it prevents propagation of defects (if they are repaired)</td>
</tr>
<tr>
<td>the only thing is</td>
<td>it’s not for free</td>
</tr>
</tbody>
</table>

How much might defect detection cost?

Cost of Poor Quality

Cost of Detection

Cost of Repair

minimal

100% Defects

optimal

0% Defects
Where is the optimum?

"Interestingly, a cumulative defect removal efficiency of 95% appears to be a powerful nodal point for software projects. Projects which achieve overall removal efficiencies approximating or exceeding 95% tend to be optimal in three other aspects as well:

1. they have the shortest schedule for projects of their size and type
2. they have the lowest quantity of effort in terms of person-months
3. they have the highest levels of user satisfaction after release."

Capers Jones, Applied Software Measurement, p. 166-167

Effectiveness of defect detection techniques

Capers Jones: Applied Software Measurement, p. 278
Yes, but reviews are expensive, aren’t they?

And how is it with the cost of repair?
It looks like reviews are really efficient

Indeed, they are!

<table>
<thead>
<tr>
<th>Reviews</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Defect Detection</td>
<td>1 : 1.5 .. 2</td>
</tr>
<tr>
<td>Cost of Repair</td>
<td>1 : 1 .. 5 (at least)</td>
</tr>
<tr>
<td>Defect Detection Effectiveness</td>
<td>1.5 .. 2 : 1</td>
</tr>
</tbody>
</table>

Traditional way of doing things

- **Effectiveness:**
  - 30%
  - 70%
  - 80%
- **# of Defects:**
  - 1200
- **Detection / FP:**
  - 0.25 h
  - 1.25 h
  - -
- **Detection Cost:**
  - 8'000
  - 40'000
  - -
- **Repair / Defect:**
  - 1 h
  - 3 h
  - 6 h
- **Repair Cost:**
  - 40'000
  - 168'000
  - 115'200
- **Cost of Poor Quality:**
  - 48'000
  - 216'000
  - 115'200
A better way to do it

Effectiveness:

<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>70%</th>
<th>50%</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Defects</td>
<td>1200</td>
<td>360</td>
<td>180</td>
</tr>
<tr>
<td>320 FP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 Euro / Hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detection / FP</td>
<td>0.75 h</td>
<td>1.25 h</td>
<td>0 h</td>
</tr>
<tr>
<td>Detection Cost</td>
<td>24'000</td>
<td>40'000</td>
<td>0</td>
</tr>
<tr>
<td>Repair / Defect</td>
<td>1 h</td>
<td>3 h</td>
<td>6 h</td>
</tr>
<tr>
<td>Repair Cost</td>
<td>84'000</td>
<td>54'000</td>
<td>86'400</td>
</tr>
<tr>
<td>Cost of Poor Quality</td>
<td>108'000</td>
<td>94'000</td>
<td>86'400</td>
</tr>
</tbody>
</table>

Net result

<table>
<thead>
<tr>
<th></th>
<th>traditional</th>
<th>a bit better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defects Detected in Reviews</td>
<td>30 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Defects Detected in Tests</td>
<td>70 %</td>
<td>50 %</td>
</tr>
<tr>
<td>Defects Detected Before Delivery</td>
<td>80 %</td>
<td>85 %</td>
</tr>
<tr>
<td>Defects Detected in First Year Maintenance</td>
<td>80 %</td>
<td>80 %</td>
</tr>
<tr>
<td>Cost of Defect Detection</td>
<td>48 kEuro</td>
<td>64 kEuro</td>
</tr>
<tr>
<td>Cost of Repair Before Delivery</td>
<td>208 kEuro</td>
<td>138 kEuro</td>
</tr>
<tr>
<td>Cost of Maintenance (Repair only)</td>
<td>115 kEuro</td>
<td>86 kEuro</td>
</tr>
<tr>
<td>Cost of Poor Quality</td>
<td>371 kEuro</td>
<td>278 kEuro</td>
</tr>
</tbody>
</table>

Change in Cost of Poor Quality - 25 %
Conclusions

1. Quality costs 100% or 0% (it depends on your point of view)
2. What really matters is the cost of poor quality
3. Key figures for project controlling (among others):
   - defect removal efficiency before delivery =
     \[
     \frac{\text{cost of defect detection and repair before delivery}}{\# \text{ of defects removed before delivery}}
     \]
   - defect detection effectiveness before test =
     \[
     \frac{\# \text{ of defects detected in reviews}}{\# \text{ of defects detected in reviews and tests}}
     \]