An Empirical Model of Technical Debt and Interest

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Poor Quality  →  Growing Problems

SIG Quality Model

- How much should I invest?
- When does it pay back?
- Would I better-off doing nothing?
- Do I have enough resource for maintenance?
Technical Debt Model

Estimate the Cost of Quality (CoC) in software systems

- Repair cost model
- Maintenance cost model

**Technical Debt**

![Graph showing technical debt growth over time](image)

**Interest**

![Graph showing interest and maintenance](image)
Repair Cost Model

Estimate the effort to improve software quality

Quality assessment is based on SIG’s quality model

Aspects accounted for in the model:

- Rework Fraction (RF)
- Rebuild Value (RV)
- Refactoring Adjustment (RA)

\[
RE_{\text{man-months}} = RF_{\text{percent}} \times RV_{\text{man-months}} \times RA_{\text{percent}}
\]

<table>
<thead>
<tr>
<th>Rework Fraction (RF)</th>
<th>1-star</th>
<th>2-star</th>
<th>3-star</th>
<th>4-star</th>
<th>5-star</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-star</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-star</td>
<td></td>
<td></td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>3-star</td>
<td></td>
<td></td>
<td>100%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-star</td>
<td></td>
<td>135%</td>
<td>75%</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>5-star</td>
<td>175%</td>
<td>115%</td>
<td>75%</td>
<td>40%</td>
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</table>
Maintenance Cost Model

Estimate yearly effort spent on software maintenance

Aspects accounted for in the model:

- Estimated Maintenance Size (EMS)
- Rebuild Value (RV)
- Quality Level Adjustment (QF)

\[
ME_{\text{man-month}} = \frac{EMS_{\text{percent}} \cdot RV_{\text{man-month}}}{QF}
\]
Applying Technical Debt Model

System X

<table>
<thead>
<tr>
<th>Language</th>
<th>Size</th>
<th>EMS</th>
<th>RA</th>
<th>QL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java</td>
<td>125.3 KLOC</td>
<td>13%</td>
<td>20%</td>
<td>3 to 4</td>
</tr>
</tbody>
</table>

Repair Cost: 4 MY (EUR 400K)
Positive ROI in 7th year (16%)
Positive NPV in 7th year: EUR 24K