A living story: measuring quality of developments in a large industrial software factory with Spago4Q

Daniele Gagliardi, Engineering Group

Productivity
Intelligence

Multi-Dimensional Analysis

QEST-3D

Net Promoter Score & Six-Sigma TF

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One year ago (OW2 Con' 2012)...

Engineering’s CMMi Infrastructure for Software projects

Dashboards and Reports

Project Intelligence with Spago4Q

Unified View

Project Managers & Quality Auditors Needs
Engineering Group – at a glance

40 branches in Italy and abroad.

The first Italian IT player.

7,000 PEOPLE
7% of the Italian market
more than 1,000 large accounts in all markets

System Integration & Application Maintenance
OUTSOURCING
Software
Consulting

USA
Brazil
Argentina
Belgium
Italy

Operating revenues

<table>
<thead>
<tr>
<th>Year</th>
<th>Public Administration &amp; Healthcare</th>
<th>Ebitda adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>12% revenue overseas</td>
<td>770.0</td>
</tr>
<tr>
<td>2012</td>
<td>96.1</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>10% revenue overseas</td>
<td>775.7</td>
</tr>
<tr>
<td>2011</td>
<td>92.2</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>7% revenue overseas</td>
<td>758.6</td>
</tr>
<tr>
<td>2010</td>
<td>92.0</td>
<td></td>
</tr>
</tbody>
</table>

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A new organization for production

Business Units (Bus) for different market sectors

Business Analysis

Account Managers

Project Managers

Service Desk

Sales Managers

Business Competence Center

Technical, Innovation & Research Division

Engineering's Software Labs (ESL)

Resource Management

RFP Technical Support

PRODUCTION

ESL 1-2: Project Development

ESL 3: Application Management

Architectural Design

Research & Development

Managed Operations

Infrastructure & System Services

Competition Centers

Worldwide Customers

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As the consequence: CEO's need

I want to know the productivity of our software factory. Using Function Point Metric.
More: managers' needs

Is there REALLY a way to measure performance?

- How productive is my organization?
- How can I improve performance?
- How can I compare different labs?
- Which is users' and customers' level of satisfaction?
- Which is the quality level of my product?
- Which are corporate audit results?
- How can I improve the development process?
- Is my project on track?
More: compliance to quality standard

- Continuous Quality Improvement in Engineering's projects
- Unified Infrastructure supporting quality processes granting flexibility and adaptability
- CMMI-DEV and ISO certifications, as independent method to validate the compliance of processes and infrastructures with quality standards
- Set-up of Engineering's Software Labs (ESL) to enhance and measure productivity and improve quality practices
Productivity Intelligence lets Quality emerge as the result of Economic benefits, Social impacts, Technical properties
The model

- **QEST nD** model, a conceptual framework for measuring process performance based on multiple analysis dimensions
  
  [Link to QEST nD model](http://www.semq.eu/leng/modtechqlm.htm)

The tool

- **Spago4Q**, the open source platform to measure, analyze and monitor quality of products, processes and services
  
  [Link to Spago4Q](http://www.spago4q.org)
Input: data sources and interactions
Three dimensions of analysis:

- Economic (E)
- Social (S)
- Technical (T)

Performance values for each dimension allow to identify process areas that need improvements.
**Method**: Performance is expressed as the combination of the specific ratios selected for each of the 3 dimensions of the *quantitative* assessment (Productivity - PR) and the perceived product quality level of the *qualitative* assessment (Quality - Q).

\[
\text{Performance} = \text{PR} + \text{Q}
\]

**Model**: QEST (Quality factor + Economic, Social & Technical dimensions) is a "structured shell" to be filled according to management objectives in relation to a specific project.

- **Target**: measuring project performance (P) using 3 distinct viewpoints
- **Input Data**: list of weighted ratios for each dimension and quality questionnaires
- **Output Data**: an integrated normalized value of performance
The Integrated Environment

• QEST model is fully supported by Spago4Q

• The procedure is coherent with the PMAI (Plan-Measure-Assess-Improve) cycle:
  • **PLAN**, defining a set of metrics, based on the GQM approach, and possible dimensions of analysis (perspectives) characterizing the analysis
  • **MEASURE**, including the collection of data, and the computation of metric values and global performance value
  • **ASSESS**, presenting results through dashboards and reports
  • **IMPROVE**, analyzing in detail each value that is less than the expected thresholds, in order to find possible problems or bottlenecks from a process-based viewpoint
3D analysis: main goals

The ESL model selected goals for each analysis dimension:

1. Economic (E)
   - E.G1 Reduce the effort of corrective maintenance (corrective + preventive, ISO/IEC14764:2006)
   - E.G2 Improve ESL resource/assets allocation
   - E.G3 Reduce effort due to hardware system unavailability ('downtime')
   - E.G4 Reduce rework (Analysis/Design SLC phases)
   - E.G5 Improve productivity (note: different 'sizing' units)

2. Social (S)
   - S.G1 Reduce the number of non-conformity issues (QA inspection)
   - S.G2 Improve artifacts reuse (functional reuse)
   - S.G3 Evaluate training skills for organizational resources
   - S.G4 Improve customer satisfaction (e.g. Customers/Prospects, Business Units, Developers)
   - S.G5 Improve knowledge sharing ("social 2.0", communities)

3. Technical (T)
   - T.G1 Reduce the resolution time for defects and technical issues
   - T.G2 Reduce the number of pre-delivery defects
   - T.G3 Improve delivery time for deliverables
   - T.G4 Improve code quality
   - T.G5 Improve the testing process (e.g. coverages, # req’s, # tests, …)
<table>
<thead>
<tr>
<th>Metric ID</th>
<th>Metric DESC</th>
<th>Formula</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.M1.1</td>
<td>Incidence of corrective maintenance effort</td>
<td>Corrective Maintenance Effort/Development Effort</td>
<td>ALM &amp; prj registry</td>
</tr>
<tr>
<td>E.M2.1</td>
<td>Allocation of ESL resources</td>
<td>Nr. of Res (hours) allocated on prj/Tot of Res (hours)</td>
<td>ALM &amp; Corp. Systems</td>
</tr>
<tr>
<td>E.M3.1</td>
<td>Hardware System Availability</td>
<td>Percentage System Availability</td>
<td>System Monitoring</td>
</tr>
<tr>
<td>E.M4.1</td>
<td>Incidence of rework</td>
<td>Rework Effort / Development Effort</td>
<td>ALM &amp; prj registry</td>
</tr>
<tr>
<td>E.M5.1</td>
<td>Development capability</td>
<td>FP/Effort</td>
<td>ALM &amp; prj registry</td>
</tr>
<tr>
<td>S.M1.1</td>
<td>n. Of Non Conformity issue</td>
<td>% of NC for project</td>
<td>ALM &amp; QA Registry</td>
</tr>
<tr>
<td>S.M2.1</td>
<td>Incidence of artifact reuse</td>
<td>Nr downloads/tot nr of artifacts stored</td>
<td>Component repo</td>
</tr>
<tr>
<td>S.M3.1</td>
<td>Skill improvement</td>
<td>% new (or modify) skills for resource</td>
<td>Skill management tool</td>
</tr>
<tr>
<td>S.M4.1</td>
<td>Customer Satisfaction</td>
<td>Results of survey</td>
<td>Survey tool</td>
</tr>
<tr>
<td>S.M5.1</td>
<td>Knowledge sharing improvement</td>
<td>% of interaction with collab. tools</td>
<td>Collaboration tools</td>
</tr>
<tr>
<td>T.M1.1</td>
<td>Incidence of defects</td>
<td>% nr. of defects (errors + defects) for project</td>
<td>ALM</td>
</tr>
<tr>
<td>T.M2.1</td>
<td>Defects Mean Resolution Time</td>
<td>Tot. resolution time/Tot. defects</td>
<td>ALM</td>
</tr>
<tr>
<td>T.M3.1</td>
<td>Incidence of delayed deliverables</td>
<td>% nr. delayed deliv. / Tot. deliverables</td>
<td>ALM</td>
</tr>
<tr>
<td>T.M4.1</td>
<td>Code Quality</td>
<td>Results of automatic static test</td>
<td>Code analysis tool</td>
</tr>
<tr>
<td>T.M5.1</td>
<td>Testing process improvement</td>
<td>Test coverage</td>
<td>ALM</td>
</tr>
</tbody>
</table>
Social Analysis

- **Social Dimension** is a *First Class Citizen*

- **Quantitative data** about how people adhere to corporate processes

- **Qualitative data** from LimeSurvey about satisfaction level of customers, integrators, developers

- **Net Promoter Score (NPS)** approach, using Six-Sigma Transfer Functions

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Drill down views

Top Manager (TM)

Level 1
ESL Chief Manager

Level 2
ESL Lab Manager

Level 3
Project Manager (PM)

ESL
Engineering's Software Labs

ESL 1
Project Development
PRJ 1
PRJ n

ESL 2
Project Development
PRJ 1
PRJ n

ESL 3
Application Maintenance
PRJ 1
PRJ n
### Unified view on Engineering Software Labs

- Global performance indicator
- Performance comparison (time, labs)

#### TM dashboard – sample #1

<table>
<thead>
<tr>
<th>Efficienza</th>
<th>Prodottività</th>
</tr>
</thead>
<tbody>
<tr>
<td>97,3%</td>
<td>115%</td>
</tr>
<tr>
<td>48,6%</td>
<td></td>
</tr>
</tbody>
</table>

#### Qualità della produzione

<table>
<thead>
<tr>
<th>Qualità del servizi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1658</td>
</tr>
<tr>
<td>8.73</td>
</tr>
</tbody>
</table>

#### Qualità del servizio

<table>
<thead>
<tr>
<th>Progetti in ALM</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requisiti</th>
</tr>
</thead>
<tbody>
<tr>
<td>1632</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Copertura Test/Req.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TM gg chiusura bug</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4</td>
</tr>
</tbody>
</table>

#### Global performance indicator

- Progetti anno
  - 42
  - 11 ESL1
  - 28 ESL2
  - 3 ESL3

- Progetti in ALM
  - 17
  - 4 ESL1
  - 11 ESL2
  - 2 ESL3

- Requisiti
  - 1632
  - 350 ESL1
  - 1000 ESL2
  - 282 ESL3

#### Performance comparison (time, labs)

- Rispetto stime
  - 84,6%
  - 0% ESL1
  - 83% ESL2
  - 82% ESL3

- Rispetto piani
  - 91%
  - 90% ESL1
  - 94% ESL2
  - 83% ESL3

- TM gg chiusura requisiti
  - 9.2
  - 9.5 ESL1
  - 10.9 ESL2
  - 7.1 ESL3

- TP/gg
  - 0.7
  - 0.5 ESL1
  - 0.9 ESL2
  - 1.1 ESL3

- Richieste dell'anno
  - 1658
  - Rinnovo personale tecnico: 29.7%
  - Personale tecnico: 23.0%
  - Attività sviluppo preassegnata: 11.8%

- TM gg. chiusura
  - 8.73
  - Rinnovo personale tecnico: 5.13
  - Personale tecnico: 8.65
  - Attività sviluppo preassegnata: 8.39

- Progetti su M.O.
  - 52
  - Utilizzo CPU: 85.7%
  - Utilizzo disco: 57.2%
  - N. Incidenti: 47

- Indice QEST
  - 0,443
  - Economico: 0.4547
  - Tecnico: 0.6497
  - Sociale: 0.4130
TM dashboard – sample #2
1658
Richieste
di cui 112 aperte
al 07-11-2013

Richieste per tipologia

Richieste per stato chiuso

Richieste per stato aperto

<table>
<thead>
<tr>
<th>Top 5 Tipologie</th>
<th>Tutti</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimozione personale tecnica</td>
<td>493  28.7%</td>
</tr>
<tr>
<td>Descrizione terminale</td>
<td>483  27.9%</td>
</tr>
<tr>
<td>Top 5 Settori</td>
<td>Tutti</td>
</tr>
<tr>
<td>FINANZA</td>
<td>442  28.7%</td>
</tr>
<tr>
<td>RISCHI FINANZIARI E EFFETTI FINANZIARI</td>
<td>275  10.4%</td>
</tr>
<tr>
<td>Top 5 CdC</td>
<td>Tutti</td>
</tr>
<tr>
<td>PPS1153</td>
<td>80  4.8%</td>
</tr>
<tr>
<td>XXXXXXX</td>
<td>73  4.3%</td>
</tr>
<tr>
<td>Top 5 Clienti</td>
<td>Tutti</td>
</tr>
<tr>
<td>Non disponibile</td>
<td>1091  65.8%</td>
</tr>
<tr>
<td>SOCIETÀ ITALIANE A.S.D.</td>
<td>105  6.2%</td>
</tr>
</tbody>
</table>

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The QEST in a nutshell

3-Dimensional Analysis on Productivity

Technical = 0.7
Social = 0.9
Economic = 0.8
Now I know how productive my organization is!

The development process is under control and I can improve it!

Now I can compare Labs performance!

Finally we can REALLY measure performance!

Productivity Intelligence enables performance improvement!

Users & Customers feedbacks are now integrated with corporate data!

I can monitor the quality level of my product!

I know if my project is on track & I can identify issues!

Through audit dashboards, corporate QA is under control!
Furthermore

What do you think?

The model is generally applicable to several context, including OSS communities:
What about using it in SQuAT program to measure OW2 performance?

OW2 SQuAT
building Trust
into Open Source Software
That's all folks!

Thank you for your attention!

Tweet?

Questions?

• The QEST Model: http://www.semq.eu/leng/modtechqlm.htm

• Spago4Q website and resources: http://www.spago4q.org

• Contacts & Info: spago4q@eng.it  🎨  @ dangagliar