Metrics for Simplifying and Standardizing an Enterprise Architecture: An Experience Report from an Oil and Gas Organization

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ECOPETROL S.A. – Oil and Gas Company

1st
Colombian Company

4th
Latin American Oil and Gas Company

1 M
Barrels 2015

Top
40
Top World Oil and Gas Companies

How can IT contribute?
Reliable and Secure Information in Real Time

1. Standardization and simplification of enterprise platforms
2. Consistent and complete information
3. Timely information for taking business decisions
4. Confidential information treated like an asset
5. Information security and quality practices

24 hours
GQM+Strategies in Practice: Ecopetrol excerpt

- **G1:** Be positioned among the first XX companies by 20XX
  - **S1:** Increase oil and gas reserves
  - **S2:** Achieve an effectively balanced exploration portfolio
  - **S3:** Decrease analysis time for finding reserves
  - **S4:** Improve information quality
    - **S4.1:** Improve internal data management for faster decision making
    - **S4.2:** Develop/maintain/integrate applications that provide high quality inf.
  - **G4:** Improve and maintain information quality
  - **S4.3:** Improve business process definition and information processing
  - **G5:** Improve and maintain quality of applications (Quality Model)

- **G2:** Increase the oil and gas reserves by X MMBOE p.a.
  - **C1:** In 20XX: Z MMBOE reserves and increase by Y
  - **A1:** There are sufficient funds to do the exploration
  - **A5:** Balanced portfolio leads to increased reserves

- **G3:** Decrease analysis time for finding reserves
  - **A2:** If portfolio is of good quality, faster decisions
  - **A3:** If portfolio is of good quality, decisions less risky
  - **A4:** Getting good data faster leads to better decisions

**Source:** Basili, Lampasona, Ocampo: Aligning Corporate and IT Goals and Strategies in the Oil and Gas Industry. PROFES 2013
Quality Model Development Process

- Survey
  - ISO25010 quality characteristics
  - Type of software
  - Programming languages
  - Areas addressed

- On-site workshop
  - GQM workshops

- Final comprehensive quality model
Survey Results

The chart shows the survey results for various attributes:

- Portability
- Performance Efficiency
- Security
- Usability
- Maintainability
- Reliability
- Functional Suitability
- Compatibility

The attributes are ranked from less relevant to more relevant.
Survey Results

Which type of software do you develop?

- Embedded systems: 67%
- Business information sys.: 6%
- Development tools: 7%
- Platforms: 20%

What are the primary programming languages?

- ABAP: 25%
- C++: 30%
- Cobol: 13%
- ASP .Net: 17%
- C#: 4%
- Visual Basic: 8%
- Java: 13%
- Java Script: 4%
- Oracle: 8%
- PHP: 4%
- Delphi: 12%

Which areas are addressed by your products?

- Upstream: 45%
- Downstream: 30%
- Corporate: 25%
On-site Workshop

• Survey provided little differentiation among quality attributes
• Informally applied UMD approach and asked:

  What do you think it should not happen?
  What causes you the most problem?

• Result: list of issues that should be mitigated
• From major issues quality goals were derived
Quality Model Mapping to ISO 25010

ISO 25010 Quality Attributes
- Compatibility
  - Interoperability
- Reliability
  - Fault tolerance
- Maintainability
  - Reusability
  - Modifiability
  - Testability
  - Analyzability
- Security
- Confidentiality

Quality goals
- G1: Requirements characterization
- G2: Hardcoded parameters
- G3: Design internal dependencies
- G4: Design external dependencies
- G5: Code reusability
- G6: Code defect density
- G7: Enterprise architecture coupling
- G8: Test coverage
- G9: Conformance of design to implementation
- G10: Traceability
G7: Enterprise Architecture Coupling
Provision and Consumption of Application Interfaces
G7: Enterprise Architecture Coupling

- Base area equals # related information units
- Height equals the sum of used and provided interfaces,
- Color equals status field of application
G4: Design External Dependencies

Application Coupling

- Blue bars represent the number of afferent applications (which deliver input through used interfaces).
- Red bars represent the number of efferent applications (which use output through provided interfaces).

Number of afferent applications: APP 1 (2), APP 2 (2), APP 3 (2), APP 4 (2), APP 5 (2), APP 6 (2), APP 7 (2), APP 8 (14), APP 9 (2), APP 10 (2), APP 11 (2), APP 12 (2), APP 13 (10), APP 14 (2), APP 15 (2), APP 16 (2), APP 17 (2), APP 18 (2).

Number of efferent applications: APP 1 (2), APP 2 (2), APP 3 (2), APP 4 (2), APP 5 (2), APP 6 (2), APP 7 (2), APP 8 (14), APP 9 (2), APP 10 (2), APP 11 (2), APP 12 (2), APP 13 (10), APP 14 (2), APP 15 (2), APP 16 (2), APP 17 (2), APP 18 (2).
G4: Design External Dependencies
Provided Interfaces not used by other Applications
### G3: Design Internal Dependencies Coupling Between Objects

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- **1st Quartile**
- **Min**
- **Max**
- **3rd Quartile**
- **Median**
Deployment at ECP – Implications

Lanscape view 2012

- Production
- Refining
- Logistics and Transportation
- Exploration
- Human Resources
- Procurement
- Project Management
- Finance
- Marketing
- Asset Management
- HSE

- Integrated Platform
- Industry Platforms
- Mixed Platforms (Third parties/ In-house)
- Applications Redundancy

*** Información Restringida *** Comité Auditoria Junta Directiva, Marzo de 2013
Deployment at ECP – Implications

Lanscape view 2017

- Production
- Refining
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Deployment at ECP – Decreasing Interfaces
Summary

**Standardization** by identifying the major platforms and moving towards them (G7: EA coupling)

Mesuring G4: Application coupling contributes to **Simplification**

**The Quality Model**
Provided the baseline for simplification and standardization goals

Traditional models are not close to **Real Issues** therefore a different approach was used for generating the Quality Model

**Providers** have to apply the model and comply with the baseline in order to be accepted