A Taxonomic Attempt at Comparing SPI Frameworks
(-- in an Efficient and Objective Way?)

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Agenda

- General discussion of SPI
- Comparison of SPI frameworks
  - Why compare?
  - Four classes of comparison methods
- Our new taxonomy
  - General discussion of the taxonomy, with six categories
  - Proposed classification of 6 frameworks using the taxonomy
Software Process Improvement (SPI)

- Usual assumption: Product quality depends on process quality
  \[ \text{Quality}(\text{Process}) \Rightarrow \text{Quality}(\text{Product}) \]
- Structured in various SPI frameworks, e.g. CMM, ISO 9000, SPICE
- Problem areas between technology and organization

Why Compare SPI Frameworks?

- Practical insight and guidance needed for SPI framework selection
  - Which SPI framework is appropriate for the organization? (for novices)
  - How to combine aspects of several frameworks? (for experts)
- Organizational context:
  - No prior SPI strategy in place
  - Implementation of several SPI frameworks
Comparison Difficulties

- Costly and time-consuming
- No comparison method appropriate for all situations
- Knowledge-level of user
  - Appropriate level of detail
- Point of view
  - General or from a specific framework?

Classes of Comparison Methods

- Characteristics
- Framework mapping
- Bilateral comparison
- Needs mapping
### Characteristics
- High-level/general overview
  - Starting-point for further investigations
- Characteristics should be objective, measurable and comparable
- Purpose: Point out areas of interest when investigating SPI frameworks

### Framework Mapping
- Map from statements/concepts of one framework to those of another
  - Beneficial when several SPI frameworks are used
- Purpose: Identify overlap/correlation between frameworks, i.e. which parts are equal?
- Ex.: Tingeys book, 1997

### Bilateral Comparison
- Textual description
- Can describe one framework in terms of another
- Purpose: Summarize or explain findings from other comparison methods
- Ex.: Pauk's ISO 9001 vs. CMM

### Needs Mapping
- Identification of requirements from organization or environment
  - May limit choice of SPI framework
- Purpose: Examine external requirements that influence SPI framework selection
- Ex.: Customer requiring ISO 9001 certification
Attributes of the Proposed Taxonomy

- Characteristics comparison method
  - 25 characteristics from misc. literature
  - Grouped into 5 categories:
    - General
    - Process
    - Organization
    - Quality
    - Result

- Starting point for further investigation

- Proposed classification of TQM, CMM, ISO 9000, SPICE, EF/QIP/GQM, SPIQ

SPI Characteristics: First two categories

1. General
   - Geographic origin/spread
   - Scientific origin
   - Development/stability
   - Popularity
   - Software specific
   - Prescriptive/descriptive
   - Adaptability

2. Process
   - Assessment
   - Assessor
   - Process improvement method
   - Improvement initiation
   - Improvement focus
   - Analysis techniques
## SPI Characteristics: Last three categories

### 3. Organization
- Actors/roles/stakeholders
- Organization size
- Coherence

### 4. Quality
- Quality perspective
- Progression
- Causal relation
- Comparative

### 5. Result
- Goal
- Process artifacts
- Certification
- Cost of implementation
- Validation

### Table: Characteristics and Measures

<table>
<thead>
<tr>
<th>Category</th>
<th>Characteristic</th>
<th>CMM v1.1</th>
<th>EF/QIP/GQM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic</td>
<td>Geographic Origin/Spread</td>
<td>U.S./World</td>
<td>U.S./World</td>
</tr>
<tr>
<td>Scientific</td>
<td>TQM, SPC</td>
<td></td>
<td>Partly TQM</td>
</tr>
<tr>
<td>Development</td>
<td>Since 1986</td>
<td></td>
<td>Since 1976</td>
</tr>
<tr>
<td>Popularity</td>
<td>Top (esp. in U.S.)</td>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td>Software</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptive</td>
<td>Both</td>
<td></td>
<td>Descriptive</td>
</tr>
<tr>
<td>Adaptable</td>
<td>Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>Org. maturity</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Assessor</td>
<td>Internal and external</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Process</td>
<td>IDEAL</td>
<td></td>
<td>QIP</td>
</tr>
<tr>
<td>Improvement</td>
<td>Top-down</td>
<td></td>
<td>Iterative bottom-up</td>
</tr>
<tr>
<td>Focus</td>
<td>Management processes</td>
<td></td>
<td>Experience reuse</td>
</tr>
<tr>
<td>Analysis</td>
<td>Assessment questionnaires</td>
<td></td>
<td>GQM</td>
</tr>
<tr>
<td>Organization</td>
<td>Management</td>
<td></td>
<td>Experience factory, project organization</td>
</tr>
<tr>
<td>Organization</td>
<td>Large</td>
<td></td>
<td>All</td>
</tr>
<tr>
<td>Coherence</td>
<td>Internal</td>
<td></td>
<td>Internal</td>
</tr>
</tbody>
</table>
### Causal Relations in SPI Frameworks

- **Process quality difficult to determine:**
  - Quality indicators
  - Multi-factor problem: Experiment

- **Comparison method influences quality:**
  \[ F''(\text{Comparison method}) \Rightarrow F'(\text{SPI framework}) \Rightarrow F(\text{Quality indicator}) \Rightarrow \text{Quality(Process)} \Rightarrow \text{Quality(Product)} \]

<table>
<thead>
<tr>
<th>Category</th>
<th>Characteristic</th>
<th>CMM v1.1</th>
<th>EFQM/GQM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Quality Perspective</td>
<td>Management</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Progression</td>
<td>Staged</td>
<td>Continuous</td>
</tr>
<tr>
<td>Causal Relation</td>
<td>F(Key process areas) ⇒ F(Maturity level) ⇒ Q(Process) ⇒ Q(Product)</td>
<td>F(Experience reuse) ⇒ Q(Process) ⇒ Q(Product)</td>
<td></td>
</tr>
<tr>
<td>Comparative</td>
<td>Yes, maturity level</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>Process improvement, supplier capability determination</td>
<td>Organization specific</td>
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<tr>
<td>Process Artifacts</td>
<td>Process documentation, assessment result</td>
<td>Experience packages, QM models</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Implementation Cost</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Validation</td>
<td>Surveys and case studies</td>
<td>Experimental and case studies</td>
<td></td>
</tr>
</tbody>
</table>
Concluding Remarks

- Proposed taxonomy is not final
- Empirical evaluation of the taxonomy is necessary
  - Guidelines for filling-in the table?
  - Reliability of classification between observers?
- How should the taxonomy be used in the selection process -- company-specific weights, number scale?