Towards Automated Process and Workflow Management: A Feasibility Study on Tool-Supported and Automated Engineering Process Modeling Approaches

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Motivation & Goals

Motivation:
- Different process approaches in heterogeneous engineering and multi-disciplinary environments.
- Vision: Process definition support towards automation-supported process management.

Key research questions focus on:
- Identify best-practice BPMN modelling tools to support efficient model definition and reuse.

Goals of the paper:
- Process approach for systematic (BPMN) tool evaluation.
- Identification of BPMN tools that support automated process definition.
Vision: Towards Automated Process and Workflow Management

- Process Definition and Modeling (Step 1) → Focus of this paper
- Automation Supported Process Implementation (Step 2)
- Process Verification (Step 3a)
- Process Validation (Step 3b)
BPMN Tool Support & Research Issues

- BPMN is a well-established approach for business modeling
  - Readable for Non-Process Experts (various disciplines are involved).
  - Formal definition could enable a transition from process definitions to process implementations (candidate for process automation).
  - Vendor-specific tool support for BPMN modeling (is it a limitation?)
    - Interoperability of different tools (data exchange)?
    - Ability to enable automation-supported workflow implementation in ASE* & ASB** context?

- Research Issues:
  - What are the requirements for tools to automate workflow definition steps in ASE projects?
  - Tool Evaluation Process: How can candidate BPMN tools be evaluated efficiently?
  - To which extend do the identified tools support the definition of executable processes and workflows?

*ASE: Automation Systems Engineering, e.g., Hydro Power Plants and Steel mills
** Automation Service Bus: Mittelware collaboration platform for distributed and heterogeneous engineering environments, http://cdl.ifc.tuwien.ac.at
Tool Evaluation Process


1. Identify Requirements
2. Define and Prioritize Selection Criteria
3. Identify Available Tools
4. Evaluate Tools and Find most suitable

- Adapted Tool Evaluation Process for BPMN Tool Evaluation:

4a. Scenario Development
4b. Evaluation Framework Definition
4c. Evaluate Tools and Find most suitable

Requirements & Tools

Step 1: Identification of Requirements
- Based on related work and workshops with industry partners and ASB developers.
- EasyWinWin* process approach.
- Classification of requirements and related weights of requirements:
  - Critical requirements
  - Important requirements
  - Less important
  - Nice-to-have features

Step 2: Definition and Prioritization of Selection Criteria.
- Definition of success-critical requirements (based on requirements classes).

Step 3: Identification of available tools for BPMN Support
- Based on existing work** and tool search (→76 candidate tools identified).

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Scenario Development (Step 4a)

- Typical scenarios and use cases can help to identify strengths and weaknesses of tools under investigation.
- Selection of a critical use case from industry partners, i.e., **signal change management**.
  - Hydro Power Plant Applications.
  - List of Signals as main outcome (of individual tools) that have to be synchronized.

- **Main Steps of Change Management:**
  1. Execute change in local tools.
  2. Difference analysis.
  3. Identify change and generate an Engineering Ticket.
  4. Notify related stakeholders.
  5. Checkout.
Evaluation Framework Definition (4b) and Execution (4c)

Definition of an Evaluation Framework*
1. List of Classified Requirement
2. Requirements Priorities
3. Candidate Tools (according to tool selection criteria)
4. Evaluation results: Scenario Execution and Assessment.
5. Scoring and aggregation of the results.

Case Study: Requirements and Selection Criteria

- 39 Identified requirements with focus on
  - ...  
  - Export Functionality and Interoperability between different tools.
  - BPMS Activity Support (on example for automation supported process implementation).
  - Process Simulation Capability.
  - ...

- 5 (13%) Critical Requirements (Selection Criteria for Tool Pre-Selection)

<table>
<thead>
<tr>
<th>Requirement Category</th>
<th>Requirements</th>
<th>No</th>
<th>%</th>
<th>No of Critical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Requirements</td>
<td></td>
<td>4</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>BPMN 2.0 Support</td>
<td></td>
<td>1</td>
<td>3%</td>
<td>1</td>
</tr>
<tr>
<td>Export Functionality and Interoperability</td>
<td></td>
<td>9</td>
<td>23%</td>
<td>1</td>
</tr>
<tr>
<td>Usability</td>
<td></td>
<td>11</td>
<td>28%</td>
<td>1</td>
</tr>
<tr>
<td>BPMS Activiti Support</td>
<td></td>
<td>2</td>
<td>5%</td>
<td>0</td>
</tr>
<tr>
<td>Process Simulation Capability</td>
<td></td>
<td>12</td>
<td>31%</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>39</td>
<td>100%</td>
<td>5 (13%)</td>
</tr>
</tbody>
</table>
Case Study: Tool Selection

- Initially 76 Candidate Tools.
- → Application of Selection Criteria

<table>
<thead>
<tr>
<th>Requirement Category</th>
<th>Individual Critical Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Requirements</td>
<td>Availability for Testing Purpose</td>
</tr>
<tr>
<td>BPMN 2.0 Support</td>
<td>Support of the BPMN 2.0 standard</td>
</tr>
<tr>
<td>Export Functionality and Interoperability</td>
<td>Export model in xml that can enable interoperability with other tools.</td>
</tr>
<tr>
<td>Usability</td>
<td>Tool installation performance</td>
</tr>
<tr>
<td>BPMS Activiti Support</td>
<td>-</td>
</tr>
<tr>
<td>Simulation Support</td>
<td>Offering UI for specifying simulation parameters and executing a simulation</td>
</tr>
</tbody>
</table>

→ 8 remaining tools for in-depth evaluation.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Abacus</td>
<td>5. iGrafx Process</td>
</tr>
<tr>
<td>2. AccuProcess Modeler</td>
<td>6. inubit BPM Suite</td>
</tr>
<tr>
<td>3. Agilian</td>
<td>7. Logizian</td>
</tr>
</tbody>
</table>
Case Study: Evaluation Scenario

- Signal Change Management Process
  - Tool Specific data (e.g., Engineering Plans)
  - Export (CSV)
  - Engineering Database
  - Automated comparison / classification of changes
  - User Input: Accept/Reject changes
  - Synchronization of the Engineering Database
Case Study Results

- Tool application based on the defined scenario, i.e., the change management process.
- Snapshot of the results of selected requirements.

Details and the full evaluation results are available at:
Case Study: Summarized Results & Limitations

- Share of requirements coverage (per category) based on the weighted assessment results.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Tool</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logizian</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>Agilian</td>
<td>87%</td>
</tr>
<tr>
<td>3</td>
<td>Signavio Process Editor</td>
<td>80%</td>
</tr>
<tr>
<td>4</td>
<td>Bonita BPM Suite</td>
<td>78%</td>
</tr>
<tr>
<td>5</td>
<td>iGrafx Process</td>
<td>76%</td>
</tr>
<tr>
<td>6</td>
<td>inubit BPM Suite</td>
<td>70%</td>
</tr>
<tr>
<td>7</td>
<td>AccuProcess Modeler</td>
<td>62%</td>
</tr>
<tr>
<td>8</td>
<td>Abacus</td>
<td>37%</td>
</tr>
</tbody>
</table>

- The results showed strengths and weaknesses and can be the starting point for further development of tools towards automated process management.

- Limitations:
  - Requirements and Scenarios are based on real-world settings.
  - Tool selection focuses on available tools (i.e., OSS, test versions), excluding commercial tools from the current evaluation.
  - Data collection is based on subjective assessment that needs to be revisited to increase evidence.
Summary & Future Work

Summary

- BPMN Tools can support engineers and non-experts in efficiently capturing workflows and processes.
- The tool evaluation framework provide systematic support for tool evaluation.
- Results can support tool vendors in improvement their tools and practitioners in selecting the most valuable tool for their purposes.

Future Work

- Refinement of the tool evaluation study (additional tools and requirements).
- Elaborating on automation-supported generation of workflow implementation (execution, verification, and validation).
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