A Model-Driven Approach for Software Process Line Engineering (Appendices)

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This document contains the appendices of a paper with the above title. The paper proposes a novel MDD approach specifically intended for SPrLE; this approach can be used by method engineers and project managers to first define a SPrL, and then construct custom-built processes by instantiating it. The approach uses a modeling framework for modeling a SPrL, and applies transformations to provide a high degree of automation when instantiating the SPrL. The proposed approach has been validated through an industrial case study and an experiment. The appendices contain information on some of the methods used in the proposed approach, examples, and the datasets and results of the case study and experiment.

The structure of this file is organized as follows: Appendix A provides the questionnaire designed for specifying suitability of candidate companies for creating the SPrL; in Appendix B, the interview instruments used throughout the case study are described; in Appendix C, the resolution of variabilities pertaining to Sprint execution and Product planning through modeling levels are presented; an excerpt of applying the bottom-up approach to the case study is provided in Appendix D; in Appendix E, the values of situational factors for projects selected in the target organization are presented; in Appendix F, the questionnaire designed for getting feedback about the practices applied is provided; problems identified in existing processes of the target organization and the solutions proposed based on the produced processes are provided in Appendix G; in Appendix H, processes currently used in the target organization and the instantiated processes produced by resolving the variabilities of the SPrL are presented; the pre-experiment questionnaire designed for gathering demographic data about experiment subjects is presented in Appendix I; in Appendix J, the post-experiment questionnaire designed for evaluating users’ perceived usefulness and ease of use, as well as measuring the completeness of the process produced by the approach is provided; the hypothetical situation used as the object of the experiment is presented in Appendix K; in Appendix L, the instruments used throughout the experiment sessions are provided; the values of situational factors for the hypothetical situation are presented in Appendix M; in Appendix N, comparison of the processes produced through the experiment sessions is provided; answers given to the open-ended questions of the post-experiment questionnaire are presented in Appendix O; and in Appendix P, the transformations implemented in the tool for resolving the variabilities of the SPrL are presented.

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Appendix A: Questionnaire designed for specifying suitability of candidate companies for creating SPrL

A comprehensive list of the product/project/organization requirements was sent to the four companies (shown in Table A.1). The companies stated which of the requirements resulted in the tailoring/adaptation of the process/methodology used in their previous/current projects.

Table A.1. The requirements sent to the four companies

<table>
<thead>
<tr>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
</tr>
<tr>
<td>Significantly different criticality levels in different products</td>
</tr>
<tr>
<td>Significantly different product types produced</td>
</tr>
<tr>
<td>Significantly different product sizes produced</td>
</tr>
<tr>
<td>Significantly different security levels in different products</td>
</tr>
<tr>
<td>Significantly different complexity levels in different products</td>
</tr>
<tr>
<td>Significantly different maintainability needs in different products</td>
</tr>
<tr>
<td>Significantly different usability needs in different products</td>
</tr>
<tr>
<td>Significantly different performance efficiency levels in different products</td>
</tr>
<tr>
<td>Significant difference in the level of compatibility with organization laws/standards, or with existing systems, in different products</td>
</tr>
<tr>
<td>Significantly different reliability needs in different products</td>
</tr>
<tr>
<td>Significantly different complexity levels in predicting the requirements/project schedule/project cost in different products</td>
</tr>
<tr>
<td>Significantly different levels of rigidity in meeting stated and implied needs of different products</td>
</tr>
<tr>
<td>Project</td>
</tr>
<tr>
<td>Significantly different levels of resource constraints in different projects</td>
</tr>
<tr>
<td>Significant difference in the level of team members’ skill/knowledge in different projects</td>
</tr>
<tr>
<td>Projects of significantly different sizes/durations undertaken</td>
</tr>
<tr>
<td>Significantly different risk/complexity levels in different projects</td>
</tr>
<tr>
<td>Significant difference in the number of teams, or the size of teams in different projects</td>
</tr>
<tr>
<td>Significant difference in changeability, understandability, or feasibility of user/system requirements in different projects</td>
</tr>
<tr>
<td>Significant difference in the level of stakeholder involvement, number of stakeholders involved, and/or background/knowledge level of stakeholders in different projects</td>
</tr>
<tr>
<td>Significant difference in team cohesion (Distributed/Co-located) in different projects</td>
</tr>
<tr>
<td>Significantly different project types (i.e., outsourced and insourced) undertaken</td>
</tr>
<tr>
<td>Significant difference in technological environments (tool infrastructures, test environments, COTS products) and/or architectural decisions in different projects</td>
</tr>
<tr>
<td>Variable types of development (developing new systems/ modification of existing systems) undertaken in different projects</td>
</tr>
<tr>
<td>Significant difference in contract types (fixed date/fixed price) and/or the level of interaction between contractor and developers in different projects</td>
</tr>
<tr>
<td>Significant difference in customer cohesion and/or customer variety in different projects</td>
</tr>
<tr>
<td>Significant difference in the degree of novelty and/or the level of technology emerging in different projects</td>
</tr>
<tr>
<td>Significantly different productivity levels in the teams involved in different projects</td>
</tr>
<tr>
<td>Significant difference in the availability of legacy system information in different projects</td>
</tr>
<tr>
<td>Significant difference in the level of end-user variety, their availability, and/or their experience with the system in different projects</td>
</tr>
<tr>
<td>Significant difference in the number of deployed versions of applications, or the number of deployed applications in different projects</td>
</tr>
<tr>
<td>Significant difference in the importance of user interface in different projects</td>
</tr>
<tr>
<td>Significant difference in the rate at which emergent opportunities occur in different projects</td>
</tr>
<tr>
<td>Significant difference in the importance of status information for the top management in different projects</td>
</tr>
<tr>
<td>Significant difference in application reuse level in different projects</td>
</tr>
<tr>
<td>Organization</td>
</tr>
<tr>
<td>Significant difference in sizes of distributed organizations</td>
</tr>
<tr>
<td>Significant difference in structure/culture of distributed organizations</td>
</tr>
<tr>
<td>Significant difference in maturity levels of distributed organizations</td>
</tr>
<tr>
<td>Significant difference in the level of resource constraints in different organizations</td>
</tr>
<tr>
<td>Significant difference in the level of commitment, support, expertise, availability, accomplishment, and/or continuity among managers</td>
</tr>
<tr>
<td>Significantly different crucial forces behind the successful development of a project in different organizations</td>
</tr>
<tr>
<td>Significantly different product types in different organizations</td>
</tr>
<tr>
<td>Significant difference in standards or legal aspects</td>
</tr>
<tr>
<td>Significantly different stability levels in different organizations</td>
</tr>
<tr>
<td>Significantly different innovation levels in different organizations</td>
</tr>
</tbody>
</table>
Appendix B: Interview Instruments

The main source of information in the case study conducted was semi-structured interviews. Interview instruments were constructed to focus on the areas to discuss. The instruments were also adapted as the interviews progressed to gain further information about the process used in the organization and the problems occurring during its execution. The interview instruments used are as follows:

Session 1

- General (~ 15 min)
  - Subjects' personal history
  - The details of projects performed in the specific unit
- Explaining the study (~ 30 min)
  - The goal of the study
  - The proposed approach for creating the process line
  - How they will benefit from the results
  - Guaranteeing confidentiality and anonymity of the gathered data
- Problems and challenges (~ 15 min)
  - The main problems and challenges they have in projects

Session 2

- Scrum process (~ 60 min)
  - How they perform Scrum activities, including
    - Portfolio planning
    - Product planning
    - Release planning
    - Sprint planning
    - Sprint execution
    - Grooming the product backlog
    - Sprint review
    - Sprint retrospective
  - What roles are involved in each activity
  - What products are produced or received in each activity
  - Other activities performed
  - Guidance/techniques used throughout each activity
  - Problems occurred throughout performing each activity

Session 3

- The process line created (~ 25 min)
  - Explain the existing process line in the organization
  - Explain the proposed process line for the organization
- The target process created for the specific project (~ 25 min)
- Explain the specific process instantiated from the process line
- Present mapping relationships between the existing problems in the unit and the practices defined in the proposed process
- The subject feedback about the proposed approach (~ 10 min)
- Ending (~ 5 min)

Finish with a brief summary, thank the subject, and schedule for getting the feedback of applying some of the proposed practices
Appendix C: Resolution of variabilities throughout modeling levels

To conduct the case study, four projects were selected (A.1, A.2, A.3, and A.4). The variation points defined in the SPrL of case A were gradually resolved through nine modeling levels by executing the transformations based on the values of the context attributes in the four projects. The modeling levels are distinguished based on Granularity level of the method fragments, and Abstraction level of the context attributes. Resolution of variabilities pertaining to Sprint execution and Product planning through these levels for one of the projects in the target organization is shown in the following subsections. Input and output models of the transformations defined at each level are also shown in each subsection.

C.1: Level 1.1 (abstraction level: Organizational factors, granularity level: Phase, Activity)

The variation points dependent on the values of organizational factors and with the granularity of Phase or Activity are resolved at this level. If a variation point dependents on the values of factors with lower-abstraction levels, its resolution is performed at lower levels. There is no variation point in the product planning or sprint execution activities that can be resolved at this level.

C.2: Level 1.2 (abstraction level: Organizational factors, granularity level: Task, Role, Work product)

The variation points dependent on the values of organizational factors and with the granularity of Task, Role, or Work product are resolved at this level. There is no variation point in the sprint execution activity that can be resolved at this level. However, some variation points of the product planning activity are resolved at this level. The organizational context model and the core process model are fed to this activity as input models. These models which have been defined in the Medini QVT tool are shown in Figures C.2.1 and C.2.2, respectively. Variation points that are resolved at this level are highlighted.
Figure C.2.1. Organizational context model
Figure C.2.2. The core process model fed to level 1.2

An excerpt of the transformations implemented at this level is shown in Figure C.2.3.
By executing the transformation rules, the refined core process is produced. This model is shown in Figure C.2.4; the selected variants are highlighted in this figure.
C.3: Level 1.3 (abstraction level: Organizational factors, granularity level: Guidance)
The variation points dependent on the values of organizational factors and with the granularity of Guidance are resolved at this level. There is no variation point in the sprint execution activity that
can be resolved at this level. However, some variation points of the product planning activity are resolved at this level. The input models to this level are the organizational context model shown in Figure C.2.1 and the refined core process produced at the previous level. The variation points of the core process that are resolved at this level are highlighted in Figure C.3.1.

![Image](image.png)

Figure C.3.1. The core process model fed to level 1.3

An excerpt of the transformations implemented for resolving the variation points at this level is shown in Figure C.3.2.
Figure C.3.2. Transformations implemented at level 1.3

By executing the transformation rules, the refined core process is produced, shown in Figure C.3.3; the selected variants are highlighted in this figure.
Figure C.3.3. The process model produced at level 1.3
C.4: Level 2.1 (abstraction level: environmental factors, granularity level: Phase, Activity)
The variation points dependent on the values of environmental factors and with the granularity of Phase or Activity are resolved at this level. There is no variation point in the product planning or sprint execution activities that can be resolved at this level.

C.5: Level 2.2 (abstraction level: Environmental factors, granularity level: Task, Role, work product)
The variation points dependent on the values of environmental factors and with the granularity of Task, Role, or Work product are resolved at this level. There is no variation point in the sprint execution activity that can be resolved at this level. However, some variation points of the product planning activity are resolved at this level. The input models to this level are the organizational context model shown in Figure C.2.1 and the refined core process produced at the level 1.3. The variation points of the core process that are resolved at this level are highlighted in Figure C.5.1.
Figure C.5.1. The core process model fed to level 2.2
An excerpt of the transformations implemented for resolving the variation points at this level is shown in Figure C.5.2.

Figure C.5.2. Transformations implemented at level 2.2

By executing the transformation rules, the refined core process is produced, shown in Figure C.5.3.; the selected variants are highlighted in this figure.
C.6: Level 2.3 (abstraction level: Environmental factors, granularity level: Guidance)
The variation points dependent on the values of environmental factors and with the granularity of Guidance are resolved at this level. The input models to this level are the organizational context
model shown in Figure C.2.1 and the refined core process produced at the previous level. The variation points of the core process that are resolved at this level are highlighted in Figure C.6.1.

![Core Process Model](image)

Figure C.6.1. The core process model fed to level 2.3

An excerpt of the transformations implemented for resolving the variation points at this level is shown in Figure C.6.2.
By executing the transformations, the refined core process is produced, shown in Figure C.6.3; the selected variants are highlighted in this figure.
Figure C.6.3. The process model produced at level 2.3
C.7: Level 3.1 (abstraction level: Project factors, granularity level: Phase, Activity)
The variation points dependent on the values of project factors and with the granularity of Phase or Activity are resolved at this level. The input models to this level are the organizational context model shown in Figure C.2.1 and the refined core process produced at the previous level. The variation points of the core process that are resolved at this level are highlighted in Figure C.7.1.

The transformation implemented for resolving this variation point is shown in Figure C.7.2.
By executing this transformation rule, the “Maintenance with Kanban” phase is added to the process model. A variation point with two variants are also added under this phase, as shown in Figure C.7.3. As this example indicates, it is possible that more process elements and variabilities be added to the process model by resolving a variation point.
C.8: Level 3.2 (abstraction level: Project factors, granularity level: Task, Role, Work product)

The variation points dependent on the values of project factors and with the granularity of Task, Role, or Work product are resolved at this level. The input models to this level are the organizational context model shown in Figure C.2.1 and the refined core process produced at the previous level. The variation points of the core process that are resolved at this level are highlighted in Figure C.8.1.

![Variation points at level 3.2](image)

Figure C.8.1. The core process model fed to level 3.2

An excerpt of the transformations implemented for resolving the variation points at this level is shown in Figure C.8.2.
Figure C.8.2. Transformation rules implemented at level 3.2

By executing the transformation rules, the refined core process is produced, shown in Figure C.8.3; the selected variants are highlighted in this figure.
Figure C.8.3. The process model produced at level 3.2
C.9: Level 3.3 (abstraction level: Project factors, granularity level: Guidance)
The variation points dependent on the values of project factors and with the granularity of Guidance are resolved at this level. The input models to this level are the organizational context model shown in Figure C.2.1 and the refined core process produced at the previous level. The variation points of the core process that are resolved at this level are highlighted in Figure C.9.1.

An excerpt of the transformations implemented for resolving the variation points identified at this level is shown in Figure C.9.2.
By executing the transformation rules, the refined core process is produced, shown in Figure C.9.3; the selected variants are highlighted in these figures.
Figure C.9.3. The process model produced at level 3.3 (the custom-built process)
C.10: Method base defined in the tool

The constructed process may not satisfy all organizational needs. To address this problem, a method base called Process Improvement Method Base (PIMB) is built for storing additional core assets. The relationships between context attributes and process elements are also stored in PIMB. If the instantiated process cannot satisfy all the needs, the context attributes are set with specific values and then fed to the transformations; by executing the transformations, suitable practices are automatically extracted from PIMB. PIMB defined in the tool is shown in Figure C.10.1.

![Figure C.10.1. Overview of the contents of the PIMB method base, implemented in Medini-QVT](image)
Appendix D: An excerpt of applying the bottom-up approach on case A

We proposed a multi-step bottom-up approach for building an initial core process. An excerpt of applying the proposed bottom-up approach on case A is shown in this section. Sprint execution currently used in units A.1 to A.4 is shown in Figures D.1 to D.4. These models are fed to the bottom-up approach as input models.

1. Identifying the elements common to the processes A.1 to A.4: the result of this step is shown in Figure D.5.

The steps of the bottom-up approach are as follows:

Figure D.1. Sprint execution currently used in A.1

Figure D.2. Sprint execution currently used in A.2

Figure D.3. Sprint execution currently used in A.3

Figure D.4. Sprint execution currently used in A.4

29
2- Identifying variation points and variants with phase, activity, and task types: based on the 2-a (1) state of this step, Daily Scrum is added to the core process as an optional variation point. The result of step 2 is shown in Figure D.6.

3- Identifying variation points and variants with role, work product, and guidance types: based on the step 3-a (1), Sprint goal and Sprint backlog are added to the core process as optional input products. The result of this step is shown in Figure D.7.

Based on the step 3-a (2), Pair programming and Refactoring are added to the core process as two variants of an alternative-OR variation point. The result of this step is shown in Figure D.8.
Based on the step 3-b, Development team and Product owner are added to the core process as mandatory roles involved in Daily Scrum. Furthermore, Updated task board is added as the output work product to Daily Scrum. The result of this step is shown in Figure D.9.

4- Adding the dependency relationships: In this step, a dependency relationship between Daily Scrum and Task performance are added to the core process. The result of this step is shown in Figure D.10.
Appendix E: Values of situational factors in projects A.1, A.3, and A.4

We have identified a set of situational factors that are relevant to agile methodologies, and that are also useful for resolving the variabilities identified in the proposed Scrum metaprocess. The situational factors are assigned with specific values based on the organization needs/project characteristics. The values of situational factors for projects A.1, A.3, and A.4 are shown in Table E.1.

<table>
<thead>
<tr>
<th>Factor Classification</th>
<th>Situational Factors</th>
<th>A.1</th>
<th>A.3</th>
<th>A.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>Number of Teams</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>(Collaborative, Harmonious)</td>
<td>(Collaborative, Harmonious)</td>
<td>(Collaborative, Harmonious)</td>
</tr>
<tr>
<td></td>
<td>Experience</td>
<td>(Experienced, Familiar)</td>
<td>(Experienced, Familiar)</td>
<td>(Experienced, Familiar)</td>
</tr>
<tr>
<td></td>
<td>Cohesion</td>
<td>(Normal, High)</td>
<td>(Normal, High)</td>
<td>(Normal, Normal)</td>
</tr>
<tr>
<td></td>
<td>Skill &amp; knowledge</td>
<td>Adequate</td>
<td>Adequate</td>
<td>Inadequate</td>
</tr>
<tr>
<td></td>
<td>Commitment</td>
<td>Adequate</td>
<td>Adequate</td>
<td>Adequate</td>
</tr>
<tr>
<td>Requirements</td>
<td>Changeability</td>
<td>(Normal, Normal)</td>
<td>(High, Normal)</td>
<td>(Normal, Normal)</td>
</tr>
<tr>
<td></td>
<td>Standards</td>
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<td>Adequate</td>
<td>Adequate</td>
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<tr>
<td></td>
<td>Degree of Risk</td>
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<td>Normal</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Complexity</td>
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<td>Normal</td>
<td>High</td>
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<tr>
<td></td>
<td>Size</td>
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<td>Normal</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Connectivity</td>
<td>High</td>
<td>Normal</td>
<td>High</td>
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<td></td>
<td>Reuse</td>
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<td>High</td>
<td>High</td>
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<td></td>
<td>Deployment Profile</td>
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<td>High</td>
<td>High</td>
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<tr>
<td></td>
<td>Quality</td>
<td>High</td>
<td>High</td>
<td>Normal</td>
</tr>
<tr>
<td>Organization</td>
<td>Maturity</td>
<td>Adequate</td>
<td>Adequate</td>
<td>Adequate</td>
</tr>
<tr>
<td></td>
<td>Management Commitment &amp; Expertise</td>
<td>(Adequate, Adequate)</td>
<td>(Adequate, Adequate)</td>
<td>(Adequate, Adequate)</td>
</tr>
<tr>
<td></td>
<td>Facilities</td>
<td>Adequate</td>
<td>Adequate</td>
<td>Adequate</td>
</tr>
<tr>
<td>Operation</td>
<td>End-User Experience</td>
<td>Adequate</td>
<td>Inadequate</td>
<td>Adequate</td>
</tr>
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<td>Business</td>
<td>Time to Market</td>
<td>Normal</td>
<td>Short</td>
<td>Normal</td>
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<td></td>
<td>External Dependencies</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
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<td></td>
<td>Opportunities</td>
<td>Normal</td>
<td>High</td>
<td>Normal</td>
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<td></td>
<td>Business Drivers</td>
<td>Maximizing customer satisfaction</td>
<td>Financial considerations, and maximizing customer satisfaction</td>
<td>Financial considerations, and maximizing customer satisfaction</td>
</tr>
<tr>
<td></td>
<td>Magnitude of Potential Loss</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>
Appendix F. Questionnaire designed for getting feedback about the practices applied

For obtaining feedback on the impact of the practices applied in project A.2, we designed a questionnaire. Through this questionnaire, participants were asked to state their opinion on whether each of the practices listed in Table F.1 would result in improving the process being used in their project.

Table F.1. Questionnaire designed for getting feedback about the practices applied

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holding daily scrum meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>specifying “definition of ready” criteria</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>specifying “definition of done” criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>writing acceptance criteria for each user story</td>
<td></td>
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</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Appendix G: Problems identified in processes being used in projects A.1, A.2, A.3, and A.4

Examples of problems in existing processes and the solutions proposed based on the produced processes are presented in Table G.1.

Table G.1. Problems identified through interview sessions and solutions proposed

<table>
<thead>
<tr>
<th>Project</th>
<th>Problems &amp; Solutions</th>
</tr>
</thead>
</table>
| A.1     | **Problem:** The capacity of team to complete work and then forecasting PBIs deliverable in the upcoming sprint is determined by an experienced person who has enough knowledge about capabilities of team members. Any change in the structure of the team can threat estimations performed.  
**Solution:** Specific practices, including Velocity, Planning poker, and Story point are proposed.  
**Problem:** User stories defined in the product backlog are not split into tasks.  
**Solution:** It is proposed that Sprint goal be defined for each sprint. Furthermore, specific practices, including Sprint backlog, and Task board are proposed.  
**Problem:** Due to time constraints, unit testing is not performed; only black-box testing is automatically performed for validating PBIs implemented through the current sprint.  
**Solution:** Specific practices, including Definition of ready and Definition of Done are proposed.  
**Problem:** The size of PBIs is not properly estimated.  
**Solution:** Planning poker is proposed. |
| A.2     | **Problem:** Some of the top-most PBIs are not groomed into a ready state.  
**Solution:** The practice “Definition of ready criteria” is proposed.  
**Problem:** The capacity of team to complete work and then forecasting PBIs deliverable in the upcoming sprint is determined by an experienced person who has enough knowledge about capabilities of team members. Any change in the structure of the team can threat estimations performed.  
**Solution:** Specific practices, including Velocity, Planning poker, and Story point are proposed.  
**Problem:** The size of PBIs is not properly estimated.  
**Solution:** Specific practices, including Planning poker and Story point are proposed.  
**Problem:** PBIs implemented in the current sprint are not properly presented to the product owner in sprint review meetings.  
**Solution:** Definition of Done is proposed. Furthermore, defining the “How to Demo” template for specifying contents that should be presented throughout sprint review meetings can help solve the problem. |
| A.3     | **Problem:** Prioritizing PBIs are not performed properly.  
**Solution:** Considering Cost, Value, Knowledge, and Risk factors for prioritizing PBIs is proposed.  
**Problem:** The product backlog is not groomed in just-enough and just-in-time manner.  
**Solution:** Specific practices, including Definition of ready, Planning Poker, and Task board are proposed. |
<p>| A.4     | <strong>Problem:</strong> The size of PBIs is not properly estimated. |</p>
<table>
<thead>
<tr>
<th><strong>Solution:</strong></th>
<th>Specific practices, including Planning poker and Story point are proposed.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong></td>
<td>There are problems with intra-team knowledge sharing.</td>
</tr>
<tr>
<td><strong>Solution:</strong></td>
<td>Specific practices, including “Moving people around”, and “Preparing documents of project status” are proposed.</td>
</tr>
<tr>
<td><strong>Problem:</strong></td>
<td>The capabilities of team members in writing high-quality code are significantly different from each other.</td>
</tr>
<tr>
<td><strong>Solution:</strong></td>
<td>“Training team members on code quality by a coach” practice is proposed.</td>
</tr>
</tbody>
</table>
Appendix H: Existing and produced processes in case A

The processes currently used in case A and the instantiated processes produced by resolving the variabilities are shown in the following subsections.

Appendix H.1: Project A.1

The process currently used in project A.1 and the instantiated process are shown through Figures H.1.1 to H.1.12.

![Diagram of existing seasonal planning for Project A.1](image)

Figure H.1.1. Seasonal planning currently used in A.1

![Diagram of proposed seasonal planning for Project A.1](image)

Figure H.1.2. Seasonal planning proposed for A.1
**Figure H.1.3. Sprint planning currently used in A.1**

**Figure H.1.4. Sprint planning proposed for A.1.**

**Figure H.1.5. “Grooming the product backlog” currently used in A.1**
Figure H.1.6. “Grooming the product backlog” proposed for A.1

Figure H.1.7. Sprint execution currently used in A.1

Figure H.1.8. Sprint execution proposed for A.1
Figure H.1.9. Sprint review currently used in A.1

Figure H.1.10. Sprint review proposed for A.1
Appendix H.2: Project A.2

The process currently used in project A.2 and the instantiated process are shown through Figures H.2.1 to H.2.9.
Figure H.2.1. Seasonal planning currently used in A.2

Figure H.2.2. Seasonal planning proposed for A.2
Sprint Planning

- Scrum team
  - Performs
  - Product backlog
  - Team velocity
  - Team capabilities
  - Constraints
  - Initial sprint goal

Is received by

Effort-hours

Feature buffer

Determine capacity

Using the predicted velocity

Refine sprint goal

Select PBIs

Acquire confidence

Finalize commitments

Definition of done

Selecting PBIs from top of the backlog

Produces

Sprint backlog

Sprint goal

Figure H.2.3. Sprint planning proposed for A.2

Sprint execution

- Development team
  - Refactoring
  - Task performance
  - Continuous integration

Potentially shippable product

Figure H.2.4. Sprint execution currently used in A.2

Sprint Execution

- Scrum team
  - Performs
  - Daily Scrum
  - Updated task board

- Three questions
- Task planning
- Flow management
- Task performance
- Communicating

- Pair programming
- Refactoring
- TDD
- Collective ownership
- Continuous integration

- Sprint Burnup chart
- Story point
- Task board

Potentially shippable product

Produces

Figure H.2.5. Sprint execution proposed for A.2
Figure H.2.6. “Grooming the product backlog” proposed for A.2

Figure H.2.7. Sprint review proposed for A.2
Appendix H.3: Project A.3
The process currently used in project A.3 and the instantiated process are shown through Figures H.3.1 to H.3.12.
Figure H.3.1. Seasonal planning currently used in A.3

Figure H.3.2. Seasonal planning proposed for A.3

Figure H.3.3. Sprint planning currently used in A.3
Figure H.3.4. Sprint planning proposed for A.3

Figure H.3.5. “Grooming the product backlog” currently used in A.3
Figure H.3.6. “Grooming the product backlog” proposed for A.3

Figure H.3.7. Sprint execution currently used in A.3

Figure H.3.8. Sprint execution proposed for A.3
Development team

Product owner

Figure H.3.9. Sprint review currently used in A.3

Scrum team

Internal stakeholders

External stakeholders

Other internal teams

Performs

Sprint goal

Sprint backlog

Potentially shippable product

Is received by

Sprint Review

Summarize

Demonstrate

Adapt

Discuss

Groomed product backlog

Sprint backlog

Potentially shippable product

Is received by

Sprint Review

Summarize

Demonstrate

Adapt

Discuss

Groomed product backlog

Updated release plan

Figure H.3.10. Sprint review proposed for A.3

Development team

Scrum master as a facilitator

Managers

Performs

Focus

Exercise

Objective data

Subjective data

Is received by

Sprint Retrospective

Event timeline

Emotions seismograph

Set the atmosphere

Create a shared context

Identify insights

Brainstorming

Determine actions

Close the retrospective

Review the committed actions

Appreciate people

Collect suggestions

Improved actions

Improved camaraderie

Produces

Figure H.3.11. Sprint retrospective proposed for A.3
Figure H.3.12. “Maintenance with Kanban” proposed for A.3
Appendix I: Pre-experiment questionnaire

To get information about the professional background of subjects and their knowledge about Scrum, a questionnaire is designed, shown in Table I.1.

Table I.1. Questionnaire designed for gathering demographic data about subjects

<table>
<thead>
<tr>
<th>Full Name (Optional)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Email Address</td>
<td></td>
</tr>
<tr>
<td>Which description matches best your current work status?</td>
<td>Academic, Professional</td>
</tr>
<tr>
<td>Which is your highest academic degree?</td>
<td>Bachelor, Master, PhD</td>
</tr>
<tr>
<td>How many software development projects have you been involved in?</td>
<td>None, 1-2, 3-4, 5-7, 8-10, Above 10</td>
</tr>
<tr>
<td>Have you ever used Scrum in a project?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Have you ever enrolled in university courses related to process engineering including Scrum?</td>
<td>Yes, Please specify: __________, No</td>
</tr>
</tbody>
</table>

The demographic data of the subjects is shown in Table I.2.

Table I.2. Demographic data of the subjects

<table>
<thead>
<tr>
<th>No.</th>
<th>Current work status</th>
<th>Highest academic degree</th>
<th>Number of projects participated in</th>
<th>Experience in using Scrum</th>
<th>University courses related to process engineering including Scrum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Professional</td>
<td>Master</td>
<td>10+</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Professional</td>
<td>Master</td>
<td>1-2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Academic</td>
<td>Master</td>
<td>8-10</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Academic</td>
<td>Master</td>
<td>3-4</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Professional</td>
<td>Master</td>
<td>5-7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>Academic</td>
<td>Master</td>
<td>1-2</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Professional</td>
<td>Master</td>
<td>10+</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Professional</td>
<td>Master</td>
<td>3-4</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Academic</td>
<td>Master</td>
<td>8-10</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Professional</td>
<td>Master</td>
<td>8-10</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>Professional</td>
<td>Master</td>
<td>10+</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>Academic</td>
<td>PhD</td>
<td>8-10</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>Academic</td>
<td>Master</td>
<td>10+</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14</td>
<td>Professional</td>
<td>Master</td>
<td>5-7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Appendix J: Post-experiment questionnaire

To gather subjective data, we designed a two-part questionnaire. The first part was designed to evaluate the users’ perceived usefulness and ease of use. The second part was designed to measure the completeness of the process produced (as a measure of its effectiveness). Contents of each part are as follows:

**Part 1:** In this part, subjects were asked to state their opinion on whether each of the characteristics shown in Table J.1 is improved by using the proposed approach rather than using the ad hoc approach for defining an instance of Scrum.

<table>
<thead>
<tr>
<th>Complexity Management (automatic resolution of variation points)</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understandability (Clear enough to use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to use (Make easier producing a specific methodology)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy (Building more accurate processes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance (Building the target process in less time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please state your comment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Part 2:** In this part, subjects were asked to state their opinion about the suitability of the process elements identified by the tool for the described situation. The responses given by the subjects are shown in Table J.2.

<table>
<thead>
<tr>
<th>Sprint Execution</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
<th>Min</th>
<th>Max</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrum Team</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.82</td>
</tr>
<tr>
<td>Sprint Goal</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>4.45</td>
</tr>
<tr>
<td>Sprint Backlog</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>4.45</td>
</tr>
<tr>
<td>Potentially Shippable Product</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>4.18</td>
</tr>
<tr>
<td>Daily Scrum</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.73</td>
</tr>
<tr>
<td>Task Performance</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>4.09</td>
</tr>
<tr>
<td>Flow Management</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>2.82</td>
</tr>
<tr>
<td>Task Planning</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>4.45</td>
</tr>
<tr>
<td>Communicating</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>4.18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Daily Scrum</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
<th>Min</th>
<th>Max</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrum Team</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.73</td>
</tr>
<tr>
<td>Other People</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>3.27</td>
<td></td>
</tr>
<tr>
<td>Parking Lot</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>3.54</td>
</tr>
<tr>
<td>Three Questions</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>4.18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task Performance</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
<th>Min</th>
<th>Max</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair Programming</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>3.36</td>
</tr>
<tr>
<td>TDD</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>4.54</td>
</tr>
<tr>
<td>Refactoring</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.73</td>
</tr>
<tr>
<td>Collective Ownership</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>4.36</td>
</tr>
<tr>
<td>Continuous Integration</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.91</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communicating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Strongly Disagree</th>
<th>Not Sure</th>
<th>Min</th>
<th>Max</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprint Burndown Chart</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>3.73</td>
</tr>
<tr>
<td>Task Board</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4.82</td>
</tr>
<tr>
<td>Burndown Chart</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Effort-hours</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2.91</td>
</tr>
</tbody>
</table>

Total average= 4.1
Appendix K: Hypothetical situation
A hypothetical project situation was considered as the experiment object. Subjects defined Sprint execution suitable for this situation throughout two treatments. The description of this situation is as follows:
“we consider a hypothetical software development project in a small-sized software company as an example project situation. The company is CMMI level-2 certified, and its organizational software process is based on Scrum. The application to be built is a medium-sized, web-based application with high complexity. End-users have already used applications similar to the new one, and there are representatives of the end-user community that are capable of specifying the user requirements with high quality; however, these requirements can be changed easily over time in response to market needs. There is considerable time pressure to release the first version of the application by implementing a portion of the requirements that significantly increases customer satisfaction. The quality of the application is vital for the customer organization, and the competitive edge of the organization can be seriously affected if quality standards are not observed. One Scrum team, consisting of one Scrum master, one product owner and a development team of five, is responsible for building the application. Development team members are technical people who have worked together for two years, but they are unfamiliar with the application to be built. The development team is collocated in a collaborative workspace. The company and its managers provide adequate support to the Scrum team; e.g., by providing the facilities required for implementing agile practices.”
Appendix L: Instruments used throughout the experiment

Since the subjects were geographically distributed, the experiment was executed in an online manner. Therefore, a set of instruments were sent to the subjects, which are:

1- **Introductory document**: The experiment goal and the tasks of the study were explained through this document.

2- **Description of the hypothetical situation**

3- **The list of situational factors along with range of values**

4- **Transformations package**: Transformations implemented for resolving the variabilities of Sprint Execution were sent to the subjects via this package.

5- **Voice-recorded power point presentation**: A voice-recorded presentation was sent to the subjects before the experiment execution. Through this file, we explained the subjects how to install and configure the tool. We also provide subjects with an example of assigning values to situational factors and executing transformations for resolving the variabilities of Release Planning.

6- **Pre-questionnaire**: The demographic data were gathered through this questionnaire.

7- **Post-questionnaire**: The perceived usefulness and ease of use were quantified through this questionnaire. Furthermore, the suitability of the process elements identified by the tool was measured via this questionnaire.
Appendix M: The values of situational factors for the described situation

The values of situational factors for the hypothetical situation described in Appendix K are shown in Table M.1.

Table M.1. Important situational factors of the example, and their assigned values

<table>
<thead>
<tr>
<th>Factor Classification</th>
<th>Situational Factors</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>Number of Teams</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>(Collaborative, Harmonious)</td>
</tr>
<tr>
<td></td>
<td>Experience</td>
<td>(Inexperienced, Familiar)</td>
</tr>
<tr>
<td></td>
<td>Cohesion</td>
<td>(Normal, Normal)</td>
</tr>
<tr>
<td></td>
<td>Skill &amp; Knowledge</td>
<td>Adequate</td>
</tr>
<tr>
<td>Requirements</td>
<td>Changeability</td>
<td>(High, Normal)</td>
</tr>
<tr>
<td></td>
<td>Standards</td>
<td>Adequate</td>
</tr>
<tr>
<td>Application</td>
<td>Complexity</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Application Size</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Deployment Profile</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>High</td>
</tr>
<tr>
<td>Organization</td>
<td>Maturity</td>
<td>Adequate</td>
</tr>
<tr>
<td></td>
<td>Management Commitment &amp; Expertise</td>
<td>(Adequate, Adequate)</td>
</tr>
<tr>
<td></td>
<td>Facilities</td>
<td>Adequate</td>
</tr>
<tr>
<td>Operation</td>
<td>End-User Experience</td>
<td>Adequate</td>
</tr>
<tr>
<td>Business</td>
<td>Time to Market</td>
<td>Short</td>
</tr>
<tr>
<td></td>
<td>Business Drivers</td>
<td>Maximizing Customer Satisfaction</td>
</tr>
<tr>
<td></td>
<td>External Dependencies</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Magnitude of Potential Loss</td>
<td>High</td>
</tr>
</tbody>
</table>
Appendix N: Comparison of the process elements identified by the tool and by the subjects

To measure the effectiveness of the proposed approach, we compared the instances of "Sprint Execution" produced in the two treatments. The results of this comparison is shown in Table N.1. As shown in this table, only 32.79% of the process elements specified by the tool were identified by the subjects in the Ad hoc treatment. The fourth column of Table N.1 shows the different words used by the subjects for naming process elements of Sprint execution.

<table>
<thead>
<tr>
<th>Process Element</th>
<th>Number of subjects identifying the process element</th>
<th>Different words used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrum Team</td>
<td>14</td>
<td>-----</td>
</tr>
<tr>
<td>Sprint Goal</td>
<td>4</td>
<td>-----</td>
</tr>
<tr>
<td>Sprint Backlog</td>
<td>8</td>
<td>-----</td>
</tr>
<tr>
<td>Potentially Shippable Product</td>
<td>9</td>
<td>Potentially shippable increment, Deployable product, Increment, Potential product, Working application</td>
</tr>
<tr>
<td>Daily Scrum</td>
<td>10</td>
<td>Daily meeting, face to face conversations</td>
</tr>
<tr>
<td>Task Performance</td>
<td>14</td>
<td>Develop task, Development</td>
</tr>
<tr>
<td>Flow Management</td>
<td>4</td>
<td>Review &amp; Revise</td>
</tr>
<tr>
<td>Task Planning</td>
<td>5</td>
<td>-----</td>
</tr>
<tr>
<td>Communicating</td>
<td>3</td>
<td>-----</td>
</tr>
<tr>
<td>Scrum Team</td>
<td>10</td>
<td>-----</td>
</tr>
<tr>
<td>Other People</td>
<td>1</td>
<td>-----</td>
</tr>
<tr>
<td>Parking Lot</td>
<td>1</td>
<td>-----</td>
</tr>
<tr>
<td>Three Questions</td>
<td>0</td>
<td>-----</td>
</tr>
<tr>
<td>Pair Programming</td>
<td>3</td>
<td>-----</td>
</tr>
<tr>
<td>TDD</td>
<td>2</td>
<td>-----</td>
</tr>
<tr>
<td>Refactoring</td>
<td>4</td>
<td>-----</td>
</tr>
<tr>
<td>Collective Ownership</td>
<td>3</td>
<td>-----</td>
</tr>
<tr>
<td>Continuous Integration</td>
<td>4</td>
<td>-----</td>
</tr>
<tr>
<td>Sprint Burndown Chart</td>
<td>0</td>
<td>-----</td>
</tr>
<tr>
<td>Task Board</td>
<td>2</td>
<td>-----</td>
</tr>
<tr>
<td>Bar Chart</td>
<td>0</td>
<td>-----</td>
</tr>
<tr>
<td>Effort-hours</td>
<td>0</td>
<td>-----</td>
</tr>
</tbody>
</table>

Average = 32.79
Appendix O: Answers given to the open-ended questions of the post-experiment questionnaire

Qualitative data in the experiment were obtained from open-ended questions. Responses to these questions were categorized in three groups: Problems and challenges, Benefits, and Suggestions for improving the approach, shown in Table O.1.

Table O.1. Answers given to the open-ended questions

<table>
<thead>
<tr>
<th>Problems &amp; challenges</th>
<th>Benefits</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the tool for the first time was complex and hard to understand.</td>
<td>The proposed approach creates more accurate target process in less time.</td>
<td>Designing a website or application with the aim of method engineering rather than eclipse plugins is proposed.</td>
</tr>
<tr>
<td>Assigning values to situational factors was challenging.</td>
<td>The proposed approach significantly helps process engineers in defining a specific instance of Scrum via identifying the main, effective and important (situational or contextual) factors in defining a process, rather than using personal and subjective knowledge of Scrum.</td>
<td>Gaining tool-use experience over time will help the team manager use the tool better.</td>
</tr>
<tr>
<td>The flow of activities and dependency relationships were hard to understand from the output of the tool.</td>
<td>Using the tool gives us a more accurate and complete output and it is very useful in complex situations.</td>
<td>As a process engineer, I would rather prefer to see the relationships between the contextual factors and the output process model, e.g., which factor mandates/recommends a specific activity or task. It would be promising if it would be possible to see why each part or element exists with respect to the factors.</td>
</tr>
<tr>
<td>List of situational factors considered may not satisfied all the situations in an organization.</td>
<td>The approach and the tool can be helpful for inexperienced method engineers.</td>
<td>It is proposed that the tool provides guidelines for assigning values to situational factors.</td>
</tr>
<tr>
<td>Using the tool for the first time was hard. However, in my opinion, Integrated Development Environments (IDEs) such as Eclipse have a learning curve that can be improved by using special-purpose tools.</td>
<td>The proposed approach makes easier defining a specific process. Furthermore, it can reduce the possibility of not considering an important practice. This approach enables people with low-level process knowledge to define a specific process.</td>
<td>It is proposed that the output of the tool be shown as a graphical model, such as UML activity diagram.</td>
</tr>
<tr>
<td>List of situational factors considered may not satisfied all the situations in an organization.</td>
<td>The approach and the tool can be helpful for inexperienced method engineers.</td>
<td>It is proposed that the tool provides guidelines for assigning values to situational factors.</td>
</tr>
<tr>
<td>Using the tool for the first time was hard. However, in my opinion, Integrated Development Environments (IDEs) such as Eclipse have a learning curve that can be improved by using special-purpose tools.</td>
<td>The proposed approach makes easier defining a specific process. Furthermore, it can reduce the possibility of not considering an important practice. This approach enables people with low-level process knowledge to define a specific process.</td>
<td>It is proposed that the output of the tool be shown as a graphical model, such as UML activity diagram.</td>
</tr>
<tr>
<td>List of situational factors considered may not satisfied all the situations in an organization.</td>
<td>The approach and the tool can be helpful for inexperienced method engineers.</td>
<td>It is proposed that the tool provides guidelines for assigning values to situational factors.</td>
</tr>
</tbody>
</table>
Appendix P: Transformations implemented in the tool

Transformations implemented for resolving the variabilities of three activities of the process line proposed for the target organization (Release Planning, Product Planning, and Sprint Execution) are shown in Tables P.1, P.2, and P.3.

Table P.1. Transformations implemented for resolving variabilities of Release Planning

<table>
<thead>
<tr>
<th>Variation point</th>
<th>Transformation implemented</th>
</tr>
</thead>
</table>
| **Sprint Mapping** | transformation Level_2_2 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
| top relation | Rule1{
| checkonly domain | left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel',
| Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Number of Teams', Value = 'High' }}
| checkonly domain | left2 L2: SPrL_Metamodel::Activity{
| Name = 'Release Planning'
| enforce domain | right R1:SPrL_Metamodel::Task{
| Name = 'Sprint mapping', Is_Contained_by = L2
| }
| top relation | Rule2{
| checkonly domain | left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Business',
| Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'External dependencies', Value = 'High' }}
| checkonly domain | left2 L2: SPrL_Metamodel::Activity{
| Name = 'Release Planning'
| enforce domain | right R1:SPrL_Metamodel::Task{
| Name = 'Sprint mapping', Is_Contained_by = L2
| }
| **Sprint Map** | transformation Level_2_2 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
| top relation | Rule3{
| checkonly domain | left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Business',
| Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'External dependencies', Value = 'High' }}
| checkonly domain | left2 L2: SPrL_Metamodel::Work_Product{
| Name = 'Release plan'
| enforce domain | right R1:SPrL_Metamodel::Work_Product{
| Name = 'Sprint map', Is_Contained_by_WP = L2
| }
| top relation | Rule4{
| checkonly domain | left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel',
| Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Number of Teams', Value = 'High' }}
| checkonly domain | left2 L2: SPrL_Metamodel::Work_Product{
| Name = 'Release plan'
| enforce domain | right R1:SPrL_Metamodel::Work_Product{
| Name = 'Sprint map', Is_Contained_by_WP = L2
| }
## Level 2.2

### Transformation:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
</tr>
</thead>
</table>
| Rule 5 | **Range of Features**
| **checkonly domain** left1 L1: Context_Metamodel::Context |
|  | Contains = D1 : Context_Metamodel::Dimension [ Name = 'Business', |
|  | Contains = C1 : Context_Metamodel::ContextAttribute [ Name = 'Time to market', Value = 'Short' ], |
|  | Contains = D2 : Context_Metamodel::Dimension [ Name = 'Personnel', |
|  | Contains = C2 : Context_Metamodel::ContextAttribute [ Name = 'Experience_Business knowledge', Value = 'Experienced' ], |
|  | Contains = C3 : Context_Metamodel::ContextAttribute [ Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' ] |
|  | **checkonly domain** left2 L2: SPrL_Metamodel::Work_Product |
|  | Name = 'Release plan' |
|  | **enforce domain** right R1: SPrL_Metamodel::Work_Product |
|  | Name = 'Range of features', Is_Contained_by_WP = L2 |
| | Rule 6 |
| **checkonly domain** left1 L1: Context_Metamodel::Context |
|  | Contains = D1 : Context_Metamodel::Dimension [ Name = 'Business', |
|  | Contains = C1 : Context_Metamodel::ContextAttribute [ Name = 'Time to market', Value = 'Normal' ] |
|  | **checkonly domain** left2 L2: SPrL_Metamodel::Work_Product |
|  | Name = 'Release plan' |
|  | **enforce domain** right R1: SPrL_Metamodel::Work_Product |
|  | Name = 'Range of costs', Is_Contained_by_WP = L2 |
| | Rule 7 |
| **checkonly domain** left1 L1: Context_Metamodel::Context |
|  | Contains = D1 : Context_Metamodel::Dimension [ Name = 'Personnel', |
|  | Contains = C1 : Context_Metamodel::ContextAttribute [ Name = 'Number of Teams', Value = 'Normal' ] |
|  | **checkonly domain** left2 L2: SPrL_Metamodel::Work_Product |
|  | Name = 'Release plan' |
|  | **enforce domain** right R1: SPrL_Metamodel::Work_Product |
|  | Name = 'Range of costs', Is_Contained_by_WP = L2 |

### Transformation:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
</tr>
</thead>
</table>
| Rule 1 | **Fixed Date**
| **checkonly domain** left1 L1: Context_Metamodel::Context |
|  | Contains = D1 : Context_Metamodel::Dimension [ Name = 'Business', |
|  | Contains = C1 : Context_Metamodel::ContextAttribute [ Name = 'Time to market', Value = 'Short' ], |
|  | Contains = D2 : Context_Metamodel::Dimension [ Name = 'Personnel', |
|  | Contains = C2 : Context_Metamodel::ContextAttribute [ Name = 'Experience_Business knowledge', Value = 'Experienced' ], |
|  | Contains = C3 : Context_Metamodel::ContextAttribute [ Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' ] |
|  | **checkonly domain** left2 L2: SPrL_Metamodel::Work_Product |
|  | Name = 'Release plan' |
|  | **enforce domain** right R1: SPrL_Metamodel::Work_Product |
|  | Name = 'Fixed Date', Is_Contained_by_WP = L2 |
checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Review constraints'
};
enforce domain right R1: SPrL_Metamodel::Strategy{
    Name = 'Fixed date', Is_Contained_by_Task = L2
};
}

transformation Level_2_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule2{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Time to market', Value = 'Normal'}}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Review constraints'
    };
    enforce domain right R1: SPrL_Metamodel::Strategy{
      Name = 'Fixed scope', Is_Contained_by_Task = L2
    };
  }
  top relation Rule3{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Number of Teams', Value = 'Normal'}}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Review constraints'
    };
    enforce domain right R1: SPrL_Metamodel::Strategy{
      Name = 'Fixed scope', Is_Contained_by_Task = L2
    };
  }
}

transformation Level_3_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule1{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Application size', Value = 'Large'}}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Release Planning'
    };
    enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Product roadmap', Is_Received_by = L2
    };
  }
  top relation Rule2{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Complexity', Value = 'High'}}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Release Planning'
    };
    enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Product roadmap', Is_Received_by = L2
    };
  }
}
top relation Rule3{
  checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Deployment profile', Value = 'High' }}
  };  
checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Release Planning'
  };  
 enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Product roadmap', Is_Received_by = L2
  };
}  

top relation Rule4{
  checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Degree of risk', Value = 'High' }}
  };  
checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Release Planning'
  };  
 enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Product roadmap', Is_Received_by = L2
  };
}  

top relation Rule5{
  checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Operation', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'End-user experience', Value = 'Inadequate' }}
  };  
checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Release Planning'
  };  
 enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Product roadmap', Is_Received_by = L2
  };
}  

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule1{
    checkonly domain left1 L1: Context_Metamodel::Context{
        Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Changeability_Scope creep', Value = 'Normal' }}
    };  
    checkonly domain left2 L2: SPrL_Metamodel::Strategy{
        Name = 'Fixed scope'
    };  
    enforce domain right R1: SPrL_Metamodel::Technique{
        Name = 'Burndown chart-Line chart', Is_Contained_by_Strategy = L2
    };
  }  

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule2{
    checkonly domain left1 L1: Context_Metamodel::Context{
        Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Changeability_Scope creep', Value = 'High' }}, Contains = D2 : Context_Metamodel::Dimension { Name = 'Organization', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Maturity', Value = 'Adequate' }}
    };  
  }
<table>
<thead>
<tr>
<th>Contains = D3 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Skill&amp;Knowledge', Value = 'Adequate'} };</th>
</tr>
</thead>
<tbody>
<tr>
<td>checkonly domain left2 L2: SPrL_Metamodel::Strategy{ Name = 'Fixed scope'}</td>
</tr>
<tr>
<td>enforce domain right R1: SPrL_Metamodel::Technique{ Name = 'Burndown chart-Bar chart', Is_Contained_by_Strategy = L2 }</td>
</tr>
<tr>
<td>---</td>
</tr>
</tbody>
</table>

**Burnup Chart**

| transformation | Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){ |
| top relation | Rule3{ |
| checkonly domain | left1 L1: Context_Metamodel::Context{ Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Changeability_Scope creep', Value = 'High'}} } |
| checkonly domain | left2 L2: SPrL_Metamodel::Strategy{ Name = 'Fixed scope'} |
| enforce domain | right R1: SPrL_Metamodel::Practice{ Name = 'Burnup chart', Is_Contained_by_Strategy = L2 } |
| --- |

<table>
<thead>
<tr>
<th>Parking-lot Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>transformation</td>
</tr>
<tr>
<td>top relation</td>
</tr>
<tr>
<td>checkonly domain</td>
</tr>
<tr>
<td>checkonly domain</td>
</tr>
<tr>
<td>enforce domain</td>
</tr>
<tr>
<td>---</td>
</tr>
</tbody>
</table>
enforce domain right R1: SPrL_Metamodel::Technique{
  Name = 'Parking-lot chart', Is_Contained_by_Strategy = L2
};
}
top relation Rule8{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',
    Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Complexity', Value = 'High' }}
  }
  checkonly domain left2 L2: SPrL_Metamodel::Strategy{
    Name = 'Fixed date'
  }
  enforce domain right R1: SPrL_Metamodel::Technique{
    Name = 'Parking-lot chart', Is_Contained_by_Strategy = L2
  }
}
top relation Rule9{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',
    Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Degree of risk', Value = 'High' }}
  }
  checkonly domain left2 L2: SPrL_Metamodel::Strategy{
    Name = 'Fixed date'
  }
  enforce domain right R1: SPrL_Metamodel::Technique{
    Name = 'Parking-lot chart', Is_Contained_by_Strategy = L2
  }
}
transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
top relation Rule6{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',
    Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Complexity', Value = 'High' }},
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Number of Teams', Value = 'High' }},
    Contains = D3 : Context_Metamodel::Dimension { Name = 'Business', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'External dependencies', Value = 'High' }}
  }
  checkonly domain left2 L2: SPrL_Metamodel::Strategy{
    Name = 'Fixed scope'
  }
  enforce domain right R1: SPrL_Metamodel::Technique{
    Name = 'Gantt chart', Is_Contained_by_Strategy = L2
  }
};
top relation Rule10{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',
    Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Complexity', Value = 'High' }},
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Number of Teams', Value = 'High' }},
    Contains = D3 : Context_Metamodel::Dimension { Name = 'Business', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'External dependencies', Value = 'High' }}
  }
  checkonly domain left2 L2: SPrL_Metamodel::Strategy{
    Name = 'Fixed date'
  }
  enforce domain right R1: SPrL_Metamodel::Technique{
    Name = 'Gantt chart', Is_Contained_by_Strategy = L2
  }
}
### Table P.2: Transformations implemented for resolving variabilities of Product Planning

<table>
<thead>
<tr>
<th>Variation Point</th>
<th>Transformation Implemented</th>
</tr>
</thead>
</table>
| **Scrum Master** | `transformation` Level_1_2 `left1: Context_Metamodel left2: SPrL_Metamodel right: SPrL_Metamodel`
| | `top relation` rule1 {
| | `checkonly domain` left1 L1: Context_Metamodel::Context {
| | Contains = D1 : Context_Metamodel::Dimension { Name = 'Organization', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Maturity', Value = 'Adequate' }}; }
| | `checkonly domain` left2 L2: SPrL_Metamodel::Activity { Name = 'Product Planning' }
| | `enforce domain` right R1: SPrL_Metamodel::Process_Role { Name = 'Scrum Master', Performs_Activity = L2 }; |
| **Development Team** | `transformation` Level_1_2 `left1: Context_Metamodel left2: SPrL_Metamodel right: SPrL_Metamodel`
| | `top relation` rule2 {
| | `checkonly domain` left1 L1: Context_Metamodel::Context {
| | Contains = D1 : Context_Metamodel::Dimension { Name = 'Organization', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Maturity', Value = 'Adequate' }},
| | Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Normal' },
| | Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'Normal' }}; }
| | `checkonly domain` left2 L2: SPrL_Metamodel::Activity { Name = 'Product Planning' }
| | `enforce domain` right R1: SPrL_Metamodel::Process_Role { Name = 'Development team', Performs_Activity = L2 }; |
| **Scrum Team and Stakeholders** | `transformation` Level_1_2 `left1: Context_Metamodel left2: SPrL_Metamodel right: SPrL_Metamodel`
| | `top relation` rule3 {
| | `checkonly domain` left1 L1: Context_Metamodel::Context {
| | Contains = D1 : Context_Metamodel::Dimension { Name = 'Organization', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Maturity', Value = 'Adequate' }},
| | Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel',
| | Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Normal' },
| | Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'Normal' }}; }
| | `checkonly domain` left2 L2: SPrL_Metamodel::Task { Name = 'High-level product backlog creation' }
| | `enforce domain` right R1: SPrL_Metamodel::Process_Role |
transformation Level_1_2 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation rule4 {
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Organization', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Maturity', Value = 'Inadequate' }},
      Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Low' },
      Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'High' }}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'High-level product backlog creation'
    }
    enforce domain right R1: SPrL_Metamodel::Process_Role{
      Name = 'Product owner and a few technical people', Performs_Task = L2
    }
  }
}

transformation Level_1_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation rule1 {
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Experience_Business knowledge', Value = 'Inexperienced' },
      Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'Personas and scenario', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_1_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation rule2 {
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel',
      Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Normal' },
      Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'Normal' },
      Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Culture_Collaboration Level', Value = 'Collaborative' },
      Contains = C4 : Context_Metamodel::ContextAttribute { Name = 'Culture_Interpersonal conflicts', Value = 'Harmonious' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'High-level product backlog creation'
    }
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'Definition of ready', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_1_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation rule3 {
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D3 : Context_Metamodel::Dimension { Name = 'Personnel',
      Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Experience_Business knowledge', Value = 'Experienced' },
      Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'Personas and scenario', Is_Contained_by_Task = L2
    }
  }
}
| Internal Stakeholder | transformation Level_2_2 (left1: Context_Metamodel , left2: SPRL_Metamodel, right: SPRL_Metamodel){
| top relation Rule1{
| checkonly domain left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Operation', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'End-user experience', Value = 'Adequate' }}
| checkonly domain left2 L2: SPRL_Metamodel::Activity{
| 'Name = 'Product Planning' |
| enforce domain right R1: SPRL_Metamodel::Process_Role{
| 'Name = 'Internal stakeholder', Performs_Activity = L2
| } |
| Market Research | transformation Level_2_2 (left1: Context_Metamodel , left2: SPRL_Metamodel, right: SPRL_Metamodel){
| top relation Rule2{
| checkonly domain left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' }}
| checkonly domain left2 L2: SPRL_Metamodel::Activity{
| 'Name = 'Product Planning' |
| enforce domain right R1: SPRL_Metamodel::Task{
| 'Name = 'Market research', Is_Contained_by = L2
| } |
| Competitive Analysis | transformation Level_2_2 (left1: Context_Metamodel , left2: SPRL_Metamodel, right: SPRL_Metamodel){
| top relation Rule3{
| checkonly domain left1 L1: Context_Metamodel::Context{
| Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' }}
| checkonly domain left2 L2: SPRL_Metamodel::Activity{
| 'Name = 'Product Planning' |
| enforce domain right R1: SPRL_Metamodel::Task{
| 'Name = 'Competitive analysis', Is_Contained_by = L2
| } |
| } |
| Creating a Rough Business Model | transformation Level_2_2 (left1: Context_Metamodel , left2: SPRL_Metamodel, right: SPRL_Metamodel){
| top relation Rule5{
| checkonly domain left1 L1: Context_Metamodel::Context{
Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Finance considerations' } }
};
checkonly domain left2 L2: SPrL_Metamodel::Activity{
  Name = 'Product Planning'
};
enforce domain right R1: SPrL_Metamodel::Task{
  Name = 'Creating a rough business model', Is_Contained_by = L2
};
}
}

transformation Level_2_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule6{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Market research output', Is_Produced_by = L2
    }
  }
}

transformation Level_2_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule7{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Experience_Business knowledge', Value = 'Inexperienced' }, Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Competitive analysis output', Is_Produced_by = L2
    }
  }
}

transformation Level_2_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule8{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrL_Metamodel::Work_Product{
      Name = 'Competitive analysis output', Is_Produced_by = L2
    }
  }
}

transformation Level_2_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule9{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Finance considerations' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrL_Metamodel::Work_Product{
transformation Level_2_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule4{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 :
        Context_Metamodel::ContextAttribute{
          Name = 'Time to market', Value = 'Short', Contains = C2 : Context_Metamodel::ContextAttribute{
            Name = 'External dependencies', Value = 'Normal'}
        }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation',
    }
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'User story', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_2_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule5{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 :
        Context_Metamodel::ContextAttribute{
          Name = 'Time to market', Value = 'Normal', Contains = C2 : Context_Metamodel::ContextAttribute{
            Name = 'External dependencies', Value = 'High'}
        }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation',
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Use case', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_2_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule6{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Operation', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'End-user experience', Value = 'Inadequate'}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation',
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'User conference slides', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_2_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule7{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Operation', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'End-user experience', Value = 'Inadequate'}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation',
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Press release', Is_Contained_by_Task = L2
    }
  }
}
transformation Level_2_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){
    top relation Rule9{
        checkonly domain left1 L1: Context_Metamodel::Context{
            Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' }}
        }
        checkonly domain left2 L2: SPrL_Metamodel::Task{
            Name = 'Vision Creation'
        }
        enforce domain right R1: SPrL_Metamodel::Technique{
            Name = 'Press release', Is_Contained_by_Task = L2
        }
    }
    top relation Rule5{
        checkonly domain left1 L1: Context_Metamodel::Context{
            Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Business drivers', Value = 'Marketing activities' }}
        }
        checkonly domain left2 L2: SPrL_Metamodel::Activity{
            Name = 'Product Planning'
        }
        enforce domain right R1: SPrL_Metamodel::Process_Role{
            Name = 'Other specialists', Performs_Activity = L2
        }
    }
    top relation Rule6{
        checkonly domain left1 L1: Context_Metamodel::Context{
            Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Complexity', Value = 'High'} }
        }
        checkonly domain left2 L2: SPrL_Metamodel::Activity{
            Name = 'Product Planning'
        }
        enforce domain right R1: SPrL_Metamodel::Process_Role{
            Name = 'Other specialists', Performs_Activity = L2
        }
    }
    top relation Rule7{
        checkonly domain left1 L1: Context_Metamodel::Context{
            Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Application size',
        }
Value = 'Large'

transformation Level_3_2 (left1: Context_Metamodel, left2: SPrl_Metamodel, right: SPrl_Metamodel){
  top relation Rule12{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application',
        Contains = C1 : Context_Metamodel::ContextAttribute{ Name = 'Deployment profile',
        Value = 'High'}
    }
    checkonly domain left2 L2: SPrl_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrl_Metamodel::Task{
      Name = 'Product roadmap definition', Is_Contained_by = L2
    }
  }
  top relation Rule13{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Business',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'External dependencies',
        Value = 'High'}
    }
    checkonly domain left2 L2: SPrl_Metamodel::Activity{
      Name = 'Product Planning'
    }
    enforce domain right R1: SPrl_Metamodel::Task{
      Name = 'Product roadmap definition', Is_Contained_by = L2
    }
  }
}

transformation Level_3_3 (left1: Context_Metamodel, left2: SPrl_Metamodel, right: SPrl_Metamodel){
  top relation Rule1{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Standards', Value = 'Inadequate'}
    }
    checkonly domain left2 L2: SPrl_Metamodel::Task{
      Name = 'High-level product backlog creation'
    }
    enforce domain right R1: SPrl_Metamodel::Technique{
      Name = 'INVEST', Is_Contained_by_Task = L2
    }
  }
  top relation Rule2{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Complexity', Value = 'Normal'},
        Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Application size', Value = 'Normal'}
    }
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel',
      Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Experience_Business knowledge',
        Value = 'Experienced'},
      Contains = C4 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar'}
    }
    checkonly domain left2 L2: SPrl_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrl_Metamodel::Technique{
transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule3{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Complexity', Value = 'High' } }, Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Unfamiliar' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Product datasheet', Is_Contained_by_Task = L2
    }
  }
}

Product Datasheet

transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule4{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Application size', Value = 'Large' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Product datasheet', Is_Contained_by_Task = L2
    }
  }
}

Product Vision Box

transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule5{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Degree of risk', Value = 'High' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Product vision box', Is_Contained_by_Task = L2
    }
  }
}

transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule6{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Experience_Business knowledge', Value = 'Inexperienced' }, Contains = C4 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar' } }
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Vision Creation'
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Product vision box', Is_Contained_by_Task = L2
    }
  }
}
Table P.3: Transformations implemented for resolving variabilities of Sprint Execution

<table>
<thead>
<tr>
<th>Variation Point</th>
<th>Transformation Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>transformation</strong> Level_2_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){</td>
<td></td>
</tr>
<tr>
<td>top relation Rule1{</td>
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</tr>
<tr>
<td>checkonly domain left1 L1: Context_Metamodel::Context{</td>
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</tr>
<tr>
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<tr>
<td>);</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Name = 'Daily Scrum'</td>
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</tr>
<tr>
<td>);</td>
<td></td>
</tr>
<tr>
<td>enforce domain right R1: SPrL_Metamodel::Practice{</td>
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<tr>
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<tr>
<td>}</td>
<td></td>
</tr>
<tr>
<td>top relation Rule2{</td>
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</tr>
<tr>
<td>Name = 'Culture_Collaboration Level', Value = 'Non-collaborative'}</td>
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<td></td>
</tr>
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<tr>
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<td>);</td>
<td></td>
</tr>
<tr>
<td>enforce domain right R1: SPrL_Metamodel::Practice{</td>
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</tr>
<tr>
<td>Name = 'Three questions', Is_Contained_by_Task = L2</td>
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<tr>
<td>}</td>
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<tr>
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<tr>
<td>Name = 'Time to market', Value = 'Short'}</td>
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<tr>
<td>Name = 'Daily Scrum'</td>
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<tr>
<td>enforce domain right R1: SPrL_Metamodel::Practice{</td>
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<tr>
<td>Name = 'Three questions', Is_Contained_by_Task = L2</td>
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<td>}</td>
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<tr>
<td><strong>transformation</strong> Level_3_2 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){</td>
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<tr>
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<tr>
<td>Name = 'Daily Scrum'</td>
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<td>);</td>
<td></td>
</tr>
<tr>
<td>enforce domain right R1: SPrL_Metamodel::Process_Role{</td>
<td></td>
</tr>
<tr>
<td>Name = 'Other people', Performs_Task = L2</td>
<td></td>
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<tr>
<td>);</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
</tr>
</tbody>
</table>

Three Questions

Other People
checkonly domain left1 L1: Context_Metamodel::Context{
  Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',  Contains = C1 :
  Context_Metamodel::ContextAttribute {  Name = 'Degree of risk', Value = 'High'}}
};

checkonly domain left2 L2: SPrL_Metamodel::Task{
  Name = 'Daily Scrum'
};
enforce domain right R1: SPrL_Metamodel::Process_Role{
  Name = 'Other people', Performs_Task = L2
};
}

top relation Rule3{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Personnel',  Contains = C1 :
    Context_Metamodel::ContextAttribute {  Name = 'Experience_Business knowledge',
    Value = 'Inexperienced'},  Contains = C2 : Context_Metamodel::ContextAttribute {  Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar'}}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Daily Scrum'
  };
enforce domain right R1: SPrL_Metamodel::Process_Role{
    Name = 'Other people', Performs_Task = L2
  }
}

top relation Rule4{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Personnel',  Contains = C1 :
    Context_Metamodel::ContextAttribute {  Name = 'Skill&Knowledge', Value = 'Inadequate'}}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Daily Scrum'
  };
enforce domain right R1: SPrL_Metamodel::Process_Role{
    Name = 'Other people', Performs_Task = L2
  }
}

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right:
  SPrL_Metamodel){
  top relation Rule7{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',  Contains = C1 :
      Context_Metamodel::ContextAttribute {  Name = 'Complexity', Value = 'High'}}
    };
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Daily Scrum'
    };
enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Parking lot chart', Is_Contained_by_Task = L2
    };
  }
}

Parking-lot Chart

top relation Rule8{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',  Contains = C1 :
    Context_Metamodel::ContextAttribute {  Name = 'Degree of risk', Value = 'High'}}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Daily Scrum'
  };
enforce domain right R1: SPrL_Metamodel::Technique{
    Name = 'Parking lot chart', Is_Contained_by_Task = L2
  };
}
enforce domain right R1: SPrL_Metamodel::Technique{
  Name = 'Parking lot chart', Is_Contained_by_Task = L2
};
}

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right:
SPrL_Metamodel){
  top relation Rule9{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'Quality', Value = 'High'}
    };
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Task performance'
    };
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'Pair programming', Is_Contained_by_Task = L2
    };
  }
  top relation Rule10{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'Quality', Value = 'High'}
    };
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Task performance'
    };
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'Pair programming', Is_Contained_by_Task = L2
    };
  }
  top relation Rule11{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'Quality', Value = 'High'}
    };
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Task performance'
    };
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'TDD', Is_Contained_by_Task = L2
    };
  }
  top relation Rule12{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 :
        Context_Metamodel::ContextAttribute { Name = 'Complexity', Value = 'High'}
    };
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Task performance'
    };
    enforce domain right R1: SPrL_Metamodel::Practice{
      Name = 'TDD', Is_Contained_by_Task = L2
    };
  }
}
<table>
<thead>
<tr>
<th>Name</th>
<th>Is_Contained_by_Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDD</td>
<td>L2</td>
</tr>
</tbody>
</table>

**Rule 13**

```
checkonly domain left1 L1: Context_Metamodel::Context
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Degree of risk', Value = 'High' }}
checkonly domain left2 L2: SPrL_Metamodel::Task
    Name = 'Task performance'

enforce domain right R1: SPrL_Metamodel::Practice
    Name = 'TDD', Is_Contained_by_Task = L2
```

**Rule 14**

```
checkonly domain left1 L1: Context_Metamodel::Context
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Standards', Value = 'Inadequate' }},
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Skill&Knowledge', Value = 'Adequate' }}
checkonly domain left2 L2: SPrL_Metamodel::Task
    Name = 'Task performance'

enforce domain right R1: SPrL_Metamodel::Practice
    Name = 'TDD', Is_Contained_by_Task = L2
```

**Transformation** Level 3.3

```
transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel)


top relation Rule15{
    checkonly domain left1 L1: Context_Metamodel::Context
        Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Reuse', Value = 'High' }}
    checkonly domain left2 L2: SPrL_Metamodel::Task
        Name = 'Task performance'
    enforce domain right R1: SPrL_Metamodel::Practice
        Name = 'Refactoring', Is_Contained_by_Task = L2
}
```

**Rule 16**

```
checkonly domain left1 L1: Context_Metamodel::Context
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Quality', Value = 'High' }}
checkonly domain left2 L2: SPrL_Metamodel::Task
    Name = 'Task performance'

enforce domain right R1: SPrL_Metamodel::Practice
    Name = 'Refactoring', Is_Contained_by_Task = L2
```

**Rule 17**

```
checkonly domain left1 L1: Context_Metamodel::Context
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Connectivity', Value = 'High' }}
checkonly domain left2 L2: SPrL_Metamodel::Task
    Name = 'Task performance'
```
enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Refactoring', Is_Contained_by_Task = L2
};
}

top relation Rule18{
checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Personnel',  Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Cohesion_Turnover rate', Value = 'High'}}
};
checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
};
enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Refactoring', Is_Contained_by_Task = L2
};
}

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel){

top relation Rule19{
checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Personnel',  Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Cohesion_Turnover rate', Value = 'High'}}
};
checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
};
enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Collective ownership', Is_Contained_by_Task = L2
};
}

top relation Rule20{
checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Application',  Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Quality', Value = 'High'}}
};
checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
};
enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Collective ownership', Is_Contained_by_Task = L2
};
}

top relation Rule21{
checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension {  Name = 'Business',  Contains = C1 : Context_Metamodel::ContextAttribute {  Name = 'Time to market', Value = 'Short'}},
    Contains = D2 : Context_Metamodel::Dimension {  Name = 'Personnel',  Contains = C2 : Context_Metamodel::ContextAttribute {  Name = 'Skill&Knowledge', Value = 'Adequate'}},
    Contains = C3 : Context_Metamodel::ContextAttribute {  Name = 'Culture_Collaboration Level', Value = 'Collaborative'}},
    Contains = C4 : Context_Metamodel::ContextAttribute {  Name = 'Culture_Interpersonal conflicts', Value = 'Harmonious'}}
};
checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
};
enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Collective ownership', Is_Contained_by_Task = L2
};
}
transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
top relation Rule22{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Deployment profile', Value = 'High' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Continuous integration', Is_Contained_by_Task = L2
  };
}
top relation Rule23{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Business', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Time to market', Value = 'Short' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Continuous integration', Is_Contained_by_Task = L2
  };
}
top relation Rule24{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Application', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Degree of risk', Value = 'High' }}
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Business', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Magnitude of potential loss', Value = 'High' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Continuous integration', Is_Contained_by_Task = L2
  };
}
top relation Rule25{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Changeability_Scope creep', Value = 'High' }}
    Contains = D2 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Unfamiliar' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Task performance'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Continuous integration', Is_Contained_by_Task = L2
  };
}
}
Task Board

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel)

top relation Rule27{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Skill&Knowledge', Value = 'Inadequate' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Communicating'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Task board', Is_Contained_by_Task = L2
  }
}

Sprint Burndown Chart

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel)

top relation Rule28{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Requirements changeability', Value = 'High' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Communicating'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Sprint burndown chart', Is_Contained_by_Task = L2
  }
}

Sprint Burnup Chart

transformation Level_3_3 (left1: Context_Metamodel , left2: SPrL_Metamodel, right: SPrL_Metamodel)

top relation Rule30{
  checkonly domain left1 L1: Context_Metamodel::Context{
    Contains = D1 : Context_Metamodel::Dimension { Name = 'Requirements', Contains = C3 : Context_Metamodel::ContextAttribute { Name = 'Changeability_Scope creep', Value = 'Normal' }}
  };
  checkonly domain left2 L2: SPrL_Metamodel::Task{
    Name = 'Communicating'
  };
  enforce domain right R1: SPrL_Metamodel::Practice{
    Name = 'Sprint burnup chart', Is_Contained_by_Task = L2
  }
}
<table>
<thead>
<tr>
<th>Transformation Level 3.3 (left1: Context Metamodel, left2: SPrL Metamodel, right: SPrL Metamodel)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>top relation</strong> Rule31{</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left1 L1: Context Metamodel::Context{</td>
</tr>
<tr>
<td>Contains = D1 : Context Metamodel::Dimension { Name = 'Personnel', Contains = C1 :</td>
</tr>
<tr>
<td>Context Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Normal'},</td>
</tr>
<tr>
<td>Contains = C2 : Context Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'Normal'}}</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left2 L2: SPrL Metamodel::Task{</td>
</tr>
<tr>
<td>Name = 'Communicating' };</td>
</tr>
<tr>
<td><strong>enforce domain</strong> right R1: SPrL Metamodel::Technique{</td>
</tr>
<tr>
<td>Name = 'Burndown chart: Effort-hours', Is_Contained_by_Task = L2</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformation Level 3.3 (left1: Context Metamodel, left2: SPrL Metamodel, right: SPrL Metamodel)</th>
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<tbody>
<tr>
<td><strong>top relation</strong> Rule32{</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left1 L1: Context Metamodel::Context{</td>
</tr>
<tr>
<td>Contains = D1 : Context Metamodel::Dimension { Name = 'Personnel', Contains = C1 :</td>
</tr>
<tr>
<td>Context Metamodel::ContextAttribute { Name = 'Cohesion_Cooperation history', Value = 'Low'},</td>
</tr>
<tr>
<td>Contains = C2 : Context Metamodel::ContextAttribute { Name = 'Cohesion_Turnover rate', Value = 'High'},</td>
</tr>
<tr>
<td>Contains = C3 : Context Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar'}}</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left2 L2: SPrL Metamodel::Task{</td>
</tr>
<tr>
<td>Name = 'Communicating' };</td>
</tr>
<tr>
<td><strong>enforce domain</strong> right R1: SPrL Metamodel::Technique{</td>
</tr>
<tr>
<td>Name = 'Burnup chart: Story point', Is_Contained_by_Task = L2</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformation Level 3.3 (left1: Context Metamodel, left2: SPrL Metamodel, right: SPrL Metamodel)</th>
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<tbody>
<tr>
<td><strong>top relation</strong> Rule33{</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left1 L1: Context Metamodel::Context{</td>
</tr>
<tr>
<td>Contains = D1 : Context Metamodel::Dimension { Name = 'Personnel', Contains = C1 :</td>
</tr>
<tr>
<td>Context Metamodel::ContextAttribute { Name = 'Skill&amp;Knowledge', Value = 'Adequate'},</td>
</tr>
<tr>
<td>Contains = C2 : Context Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar'}}</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left2 L2: SPrL Metamodel::Task{</td>
</tr>
<tr>
<td>Name = 'Communicating' };</td>
</tr>
<tr>
<td><strong>enforce domain</strong> right R1: SPrL Metamodel::Technique{</td>
</tr>
<tr>
<td>Name = 'Burnup chart: Effort-hours', Is_Contained_by_Task = L2</td>
</tr>
<tr>
<td>};</td>
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<tr>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformation Level 3.3 (left1: Context Metamodel, left2: SPrL Metamodel, right: SPrL Metamodel)</th>
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</thead>
<tbody>
<tr>
<td><strong>top relation</strong> Rule34{</td>
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<tr>
<td><strong>checkonly domain</strong> left1 L1: Context Metamodel::Context{</td>
</tr>
<tr>
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</tr>
<tr>
<td>Context Metamodel::ContextAttribute { Name = 'Skill&amp;Knowledge', Value = 'Adequate'},</td>
</tr>
<tr>
<td>Contains = C2 : Context Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method', Value = 'Familiar'}}</td>
</tr>
<tr>
<td>};</td>
</tr>
<tr>
<td><strong>checkonly domain</strong> left2 L2: SPrL Metamodel::Task{</td>
</tr>
<tr>
<td>Name = 'Communicating' };</td>
</tr>
<tr>
<td><strong>enforce domain</strong> right R1: SPrL Metamodel::Technique{</td>
</tr>
<tr>
<td>Name = 'Sprint Burndown Chart: Bar Chart'</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>
transformation Level_3_3 (left1: Context_Metamodel, left2: SPrL_Metamodel, right: SPrL_Metamodel){
  top relation Rule35{
    checkonly domain left1 L1: Context_Metamodel::Context{
      Contains = D1 : Context_Metamodel::Dimension { Name = 'Personnel',
        Contains = C1 : Context_Metamodel::ContextAttribute { Name = 'Skill&Knowledge',
          Value = 'Inadequate'},
        Contains = C2 : Context_Metamodel::ContextAttribute { Name = 'Experience_Level of familiarity with the development method',
          Value = 'Unfamiliar'}}
    }
    checkonly domain left2 L2: SPrL_Metamodel::Task{
      Name = 'Communicating'
    }
    enforce domain right R1: SPrL_Metamodel::Technique{
      Name = 'Sprint burndown chart: Line chart', Is_Contained_by_Task = L2
    }
  }
}