

Contents

List of figures	vi
List of Tables.....	viii
1. Introduction	1
2. State of the Art.....	5
2.1. The Knowledge Acquisition Bottleneck	5
2.2. From Mining to Modelling: The Knowledge Level.....	5
2.3. Ontologies and Problem Solving Methods in the Knowledge Acquisition Modelling Paradigm	7
2.4. Knowledge Acquisition by Knowledge Engineers	8
2.5. Knowledge Acquisition by Subject Matter Experts.....	9
2.6. Process Knowledge and Subject Matter Experts	11
2.7. The Process Knowledge Lifecycle.....	14
2.8. Conclusions.....	15
3. Work Objectives.....	17
3.1. Goals and Open Research Problems	17
3.2. Contributions to the State of the Art	19
3.3. Work Assumptions, Hypotheses, and Restrictions.....	20
4. Acquisition of Process Knowledge by SMEs.....	24
4.1. Introduction.....	24
4.1.1. Knowledge Acquisition and Formulation by SMEs in the Halo Project	26
4.2. Knowledge Types in Scientific Disciplines	27
4.2.1. Domain Analysis.....	28
4.2.2. A Comprehensive Set of Knowledge Types in Scientific Disciplines	30
4.3. The Process Metamodel.....	32
4.3.1. Process Entities in the Process Metamodel.....	33
4.4. Problem Solving Methods for the Acquisition of Process Knowledge	35
4.4.1. A PSM Modelling Framework for Processes.....	36
4.4.2. A Method to Build a PSM Library of Process Knowledge.....	39
4.4.3. A PSM Library for the Acquisition of Process Knowledge.....	41
4.5. Enabling SMEs to Formulate Process Knowledge	54
4.5.1. The DarkMatter Process Editor	55
4.6. Related Work	59
5. Representing and Reasoning with SME-authored Process Knowledge	61
5.1. A Formalism for Representing and Reasoning with Process Knowledge	61
5.2. F-logic as Process Representation and Reasoning Language	65
5.3. The Process Frame.....	67
5.4. Code Generation for Process Knowledge	69
Synthesis of precedence rules for data flow management.....	75
5.5. Code Synthesis for Iterative Actions.....	76
5.6. Soundness and Completeness of Process Models.....	79
5.7. Optimization of the Synthesized Process Code	81
5.8. Reasoning with Process Models	83
6. Analysis of Process Executions by SMEs	89
6.1. Towards Knowledge Provenance in Process Analysis	89
6.2. Problem Solving Methods for the Analysis of Process Executions.....	92
6.3. A Knowledge-oriented Provenance Environment	96
6.4. An Algorithm for Process Analysis Using PSMs	99
7. Evaluation.....	103

7.1. Evaluation of the DarkMatter Process Component for Acquisition of Process Knowledge by SMEs	103
7.1.1. Evaluation Syllabus	103
7.1.2. Distribution of the Formulated Processes across the Evaluation Syllabus	105
7.1.3. Utilization of the PSM Library and Process Metamodel	107
7.1.4. Usage Experience of the SMEs with the Process Editor	110
7.1.5. Performance Evaluation of the Process Component.....	113
7.2. Evaluation of KOPE for the Analysis of Process Executions by SMEs.....	114
7.2.1. Evaluation Settings	115
7.2.2. Evaluation Metrics.....	117
7.2.3. Evaluation Results	119
7.3. Evaluation Conclusions	121
8. Conclusions and Future Research.....	127
8.1. Conclusions.....	127
8.2. Future Research Problems	129
REFERENCES.....	133
Appendix. Sample F-logic Code for a Process Model.....	142