



Business Process Modeling and Analysis in Banks

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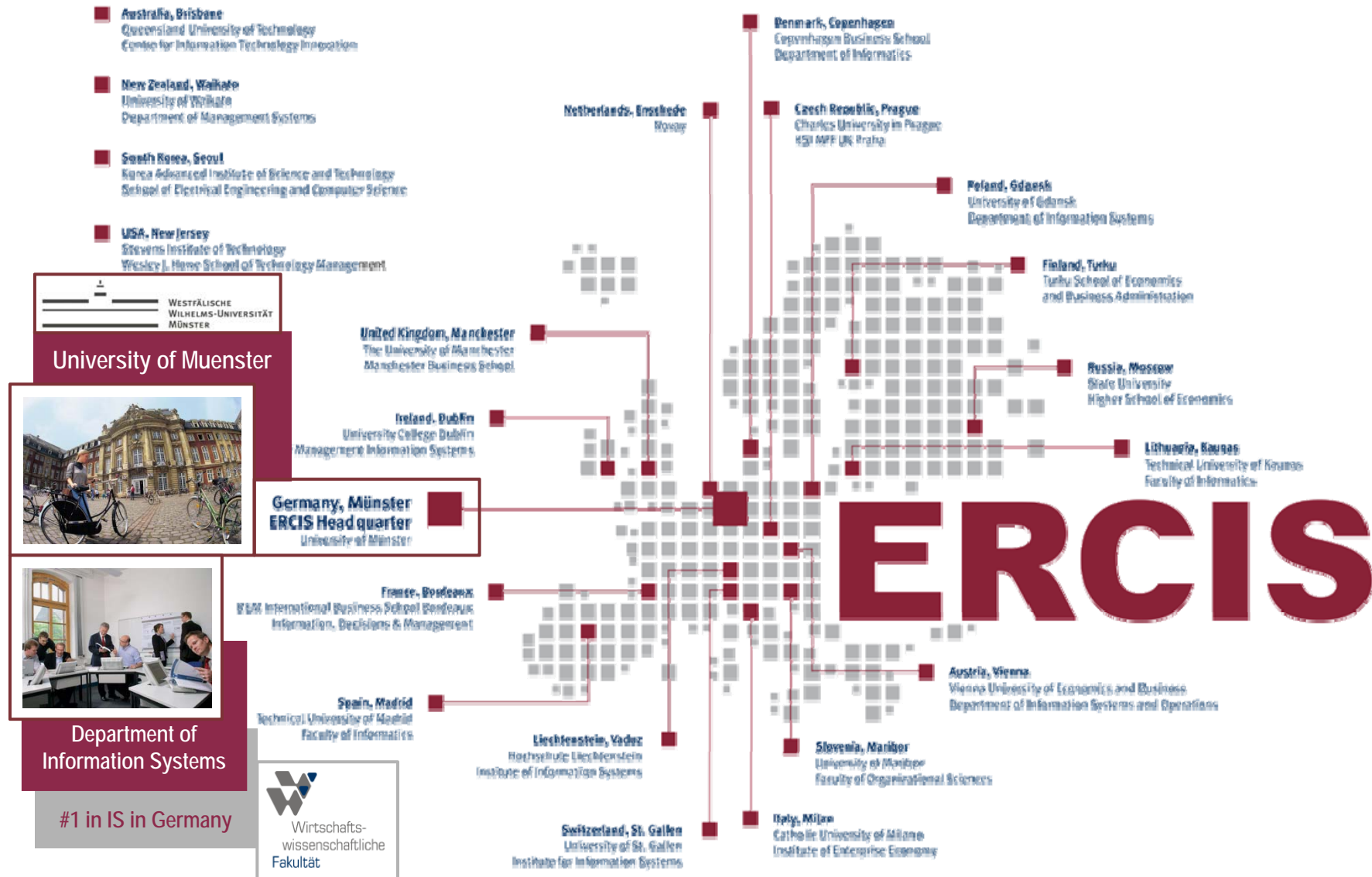
10.3.2011, Brisbane



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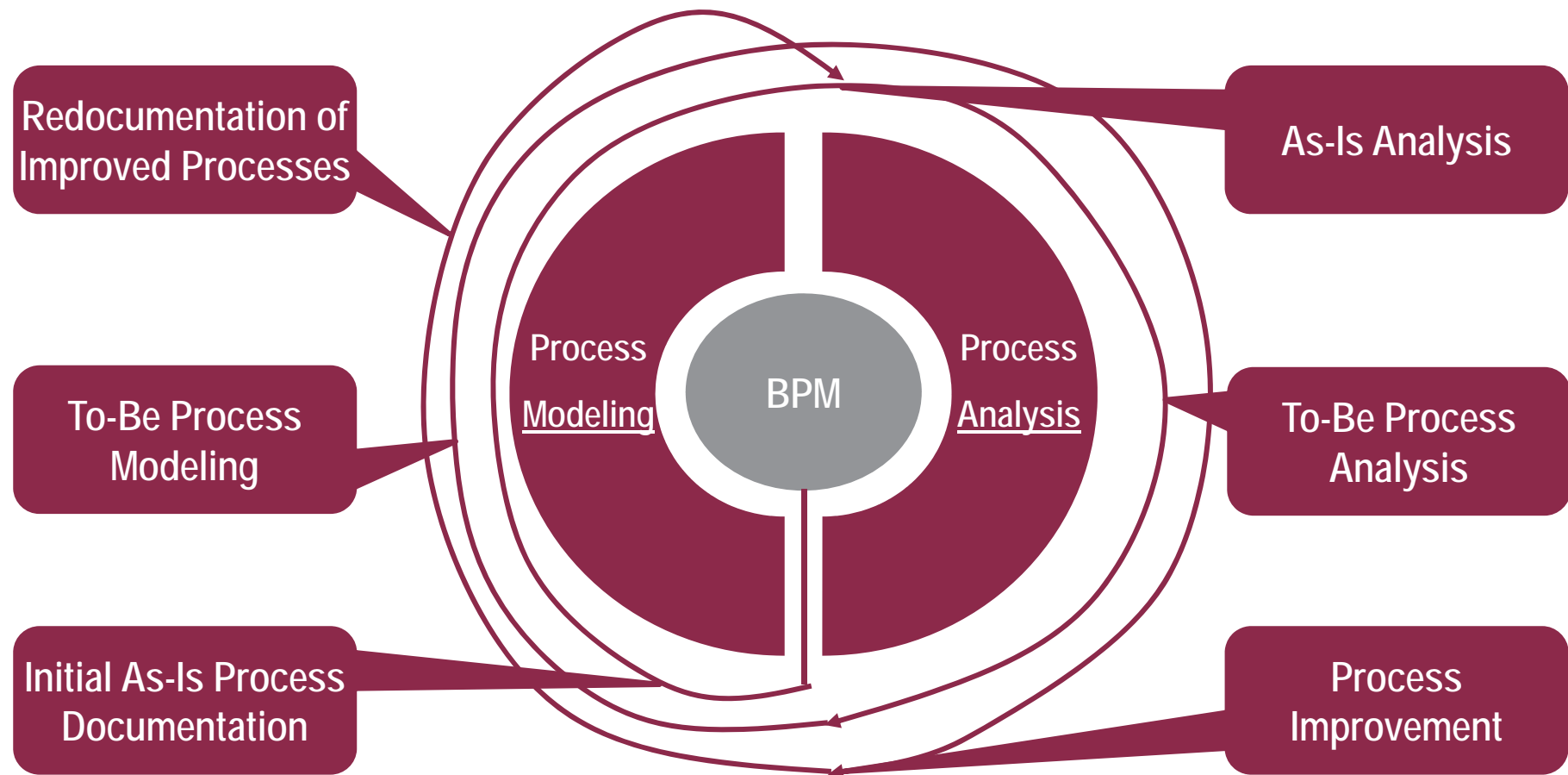
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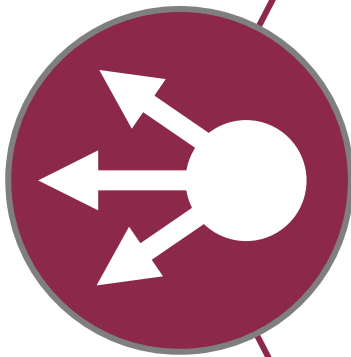
Business Process Modeling and Analysis in Banks

Relevance of Process Modeling & Analysis in BPM ■

... a simplified view on the BPM lifecycle [Becker, Kugeler, Rosemann 2008]



Motivation: Initial Situation and Problem Statement ■

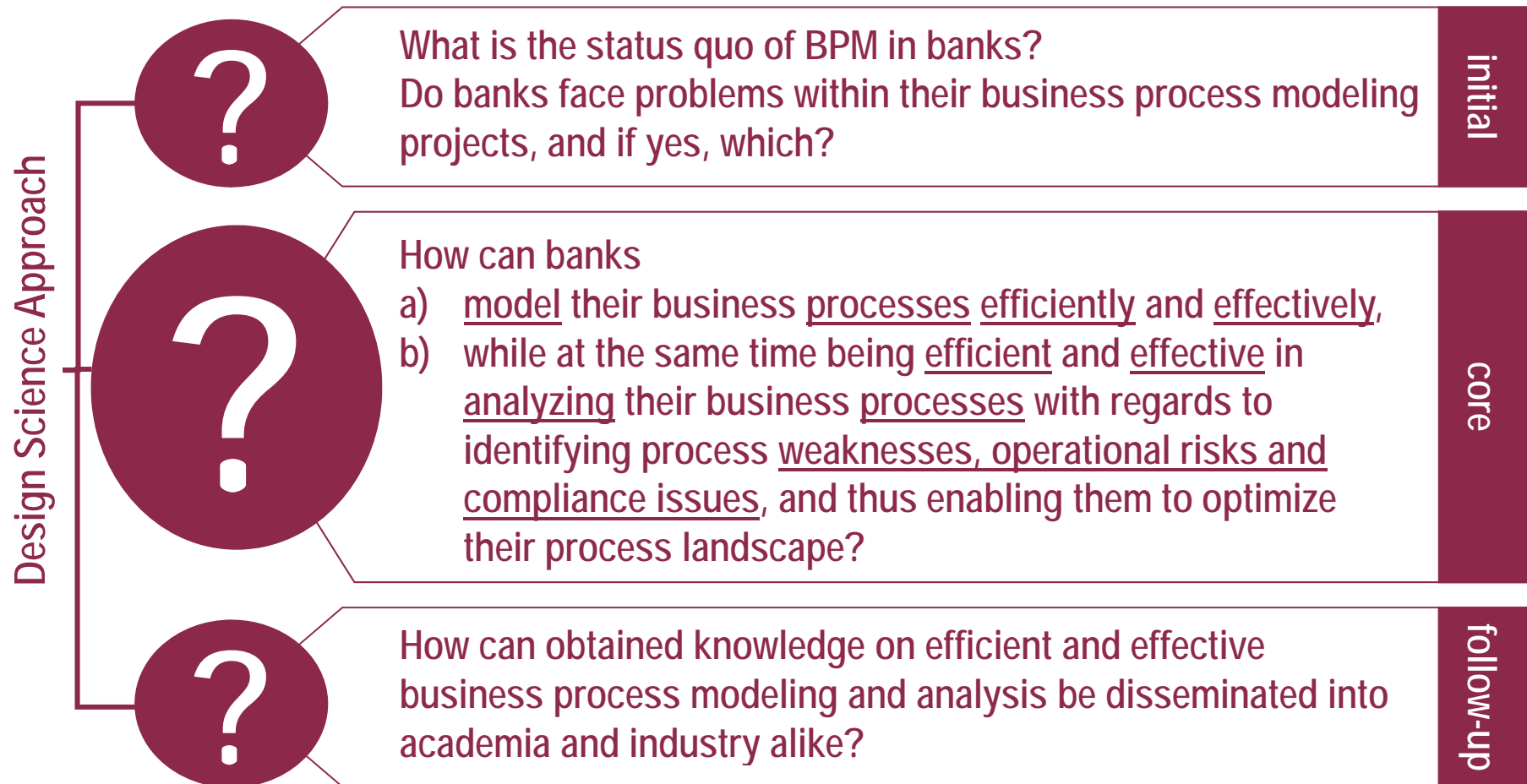


Initial situation:

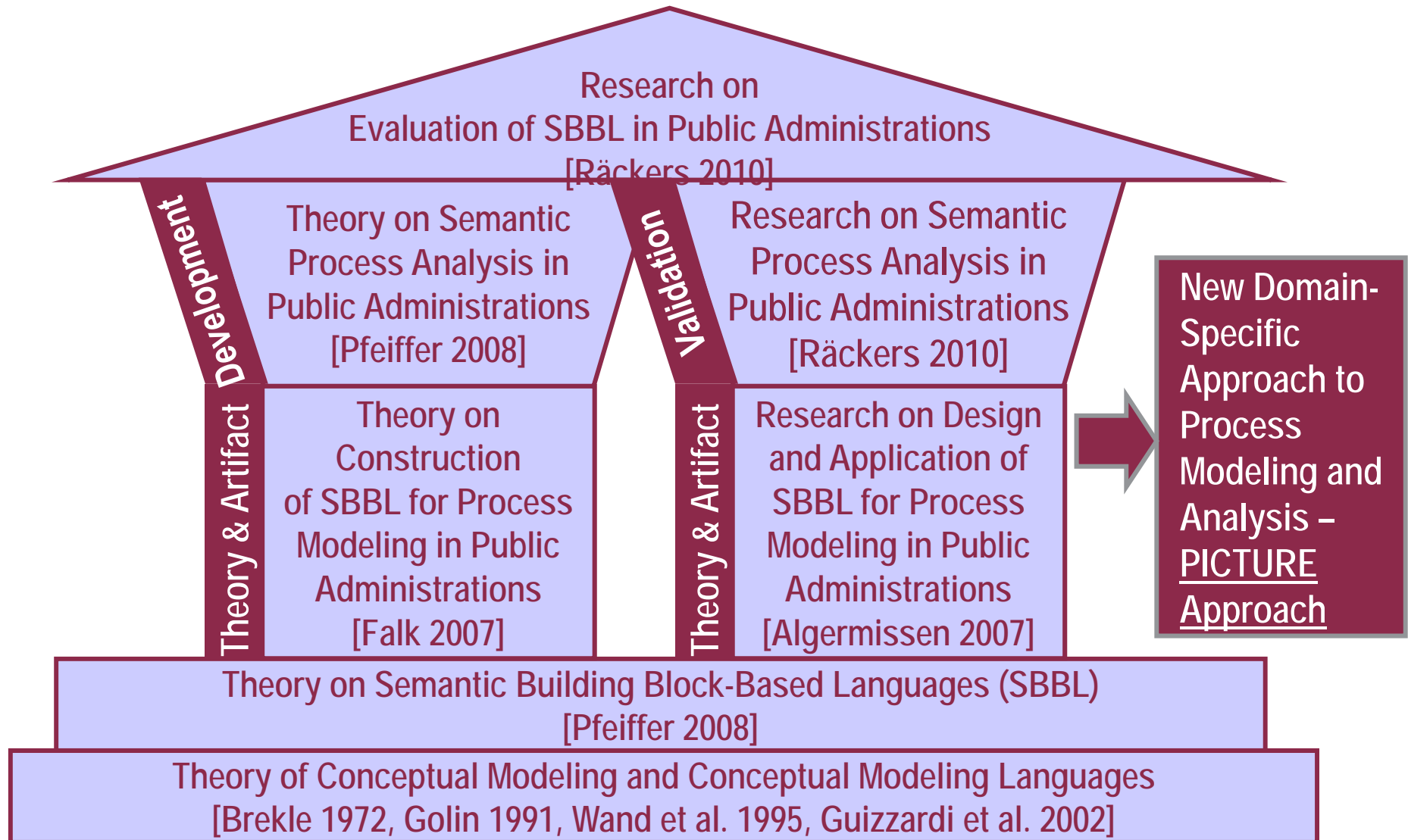
- a) banks face increased competition, pressure to reduce costs, financial crisis, cherry-picking by customers, ...
- b) as a response, banks try to optimize and reorganize or even industrialize their business,
- c) and in doing so, banks model their business processes and analyze these [Spath et al. 2007]

Problem statement:

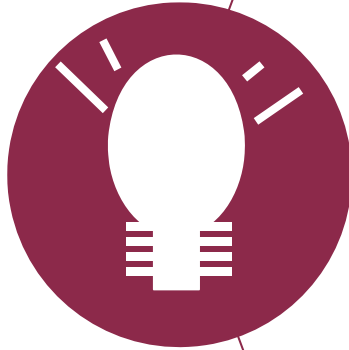
- d) according to a BPM study in the financial sector [Becker et al. 2010], banks, however, have high modeling efforts [Mendling, J.; Reckers, J.; Reijers, H. A. 2009] and fail to unlock the value of their models (utility), which primarily comes from process analysis that leads to optimization
- e) thus, there is a need to model and analyze processes more effectively and efficiently in banks, in order to identify process weaknesses



Related Work and Theoretical Background ■



Bridging Public Administrations and Banks ■

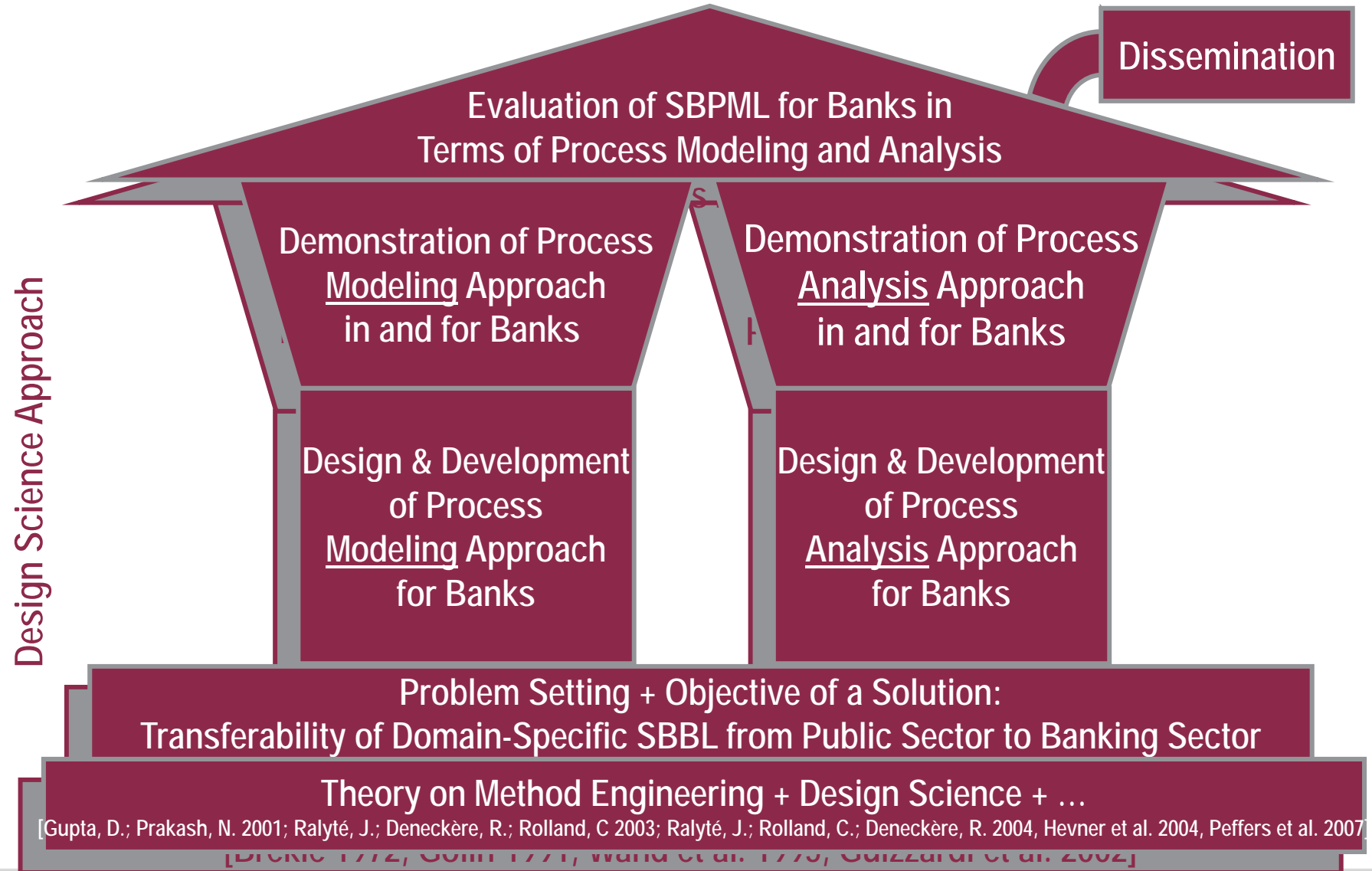


For public administrations a solution to effective and efficient process modeling and analysis has already been found.
For banks this is not the case yet!

However, banks and public administrations have many similarities:

- a) both largely offer services and almost no physical products to their customers
- b) both largely deal with information
- c) both have high personnel costs and depend upon human labour
- d) nevertheless, both also make use of IT to a large extent
- e) both have highly standardized business processes for most of their products / offered services
- f) both are under high cost pressure (banks largely due to competition / globalization and public administrations largely due to household deficits and insufficient tax income)
- g) ...

Theoretical Background for Igniting the Research Process ■



Business Process Modeling and Analysis in Banks

Business Process Modeling and Analysis

1. On Effort and Utility of Process Modeling in Banks

2. Semantic BPML for Modeling

3. Semantic BPML for Analysis

4. Semantic BPML for Operational Risk Management

5. Semantic BPML for Business Process Compliance

6. Outlook



Goal Setting: Need for A New Approach to BPM? ■



Lack of Studies: Currently there have not been sufficient studies on the effort and utility of process modeling and analysis in the financial sector



A New BPM Approach: Recently, however, a new approach to efficient and effective process modeling and analysis was developed for public administrations with a high potential to be also useful to the financial sector

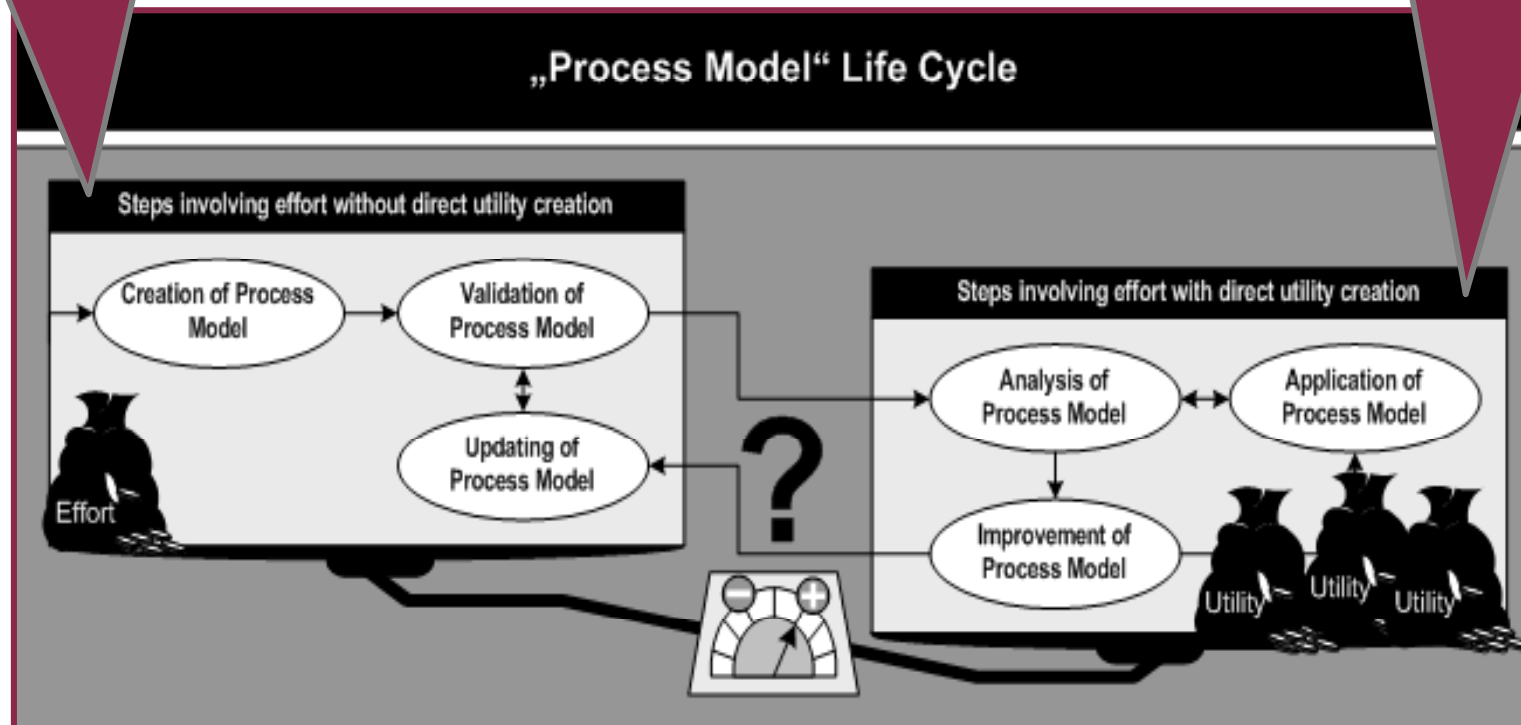


Goal: Exploratory investigation of the effort and utility of process modeling and analysis in the financial sector to identify need for new BPM approach for banks

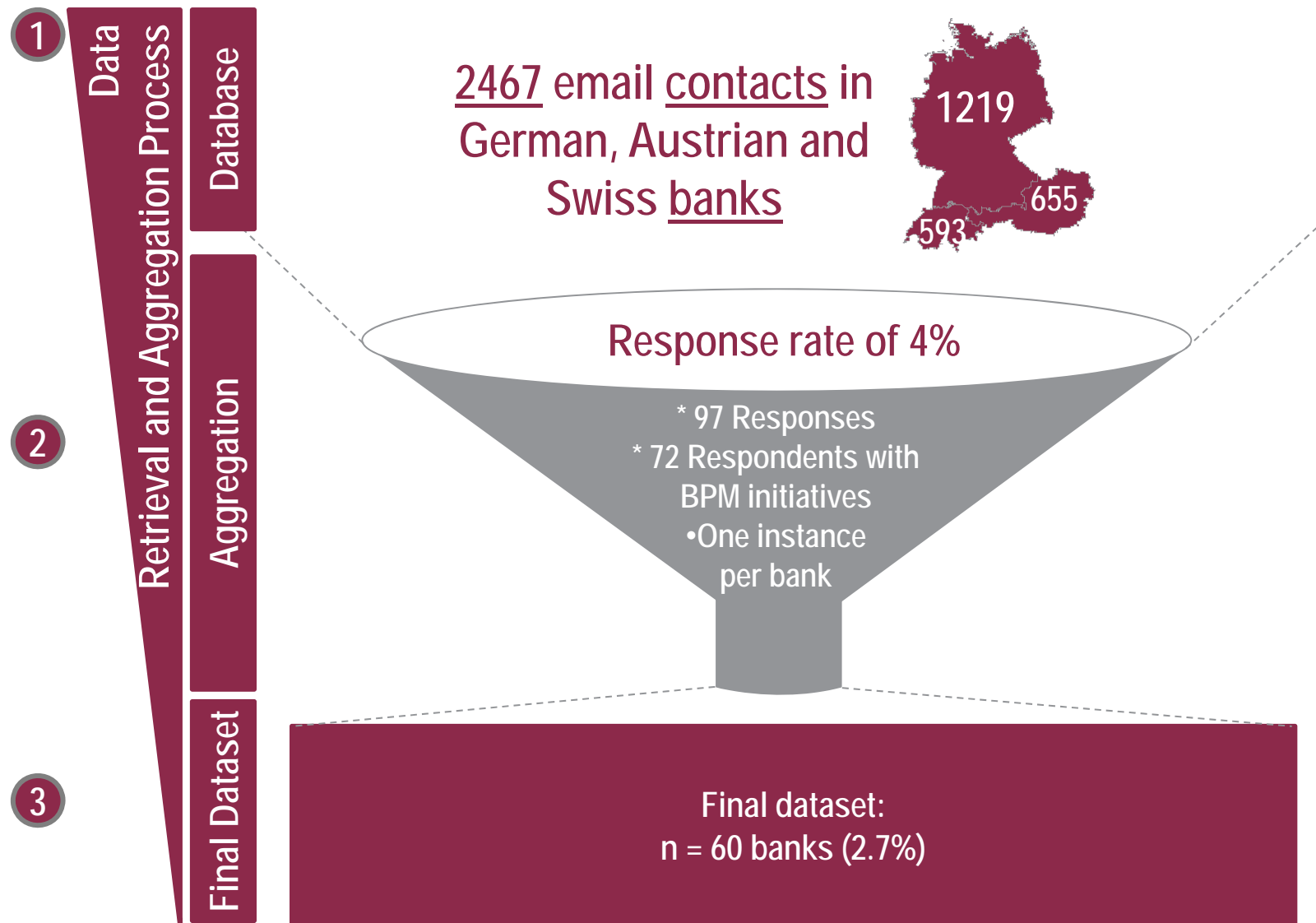
Studying BPM from a Process Model Lifecycle Perspective ■

How much effort, without direct utility creation, is spent for process modeling?

How much utility is gained by „using“ process models for different purposes?

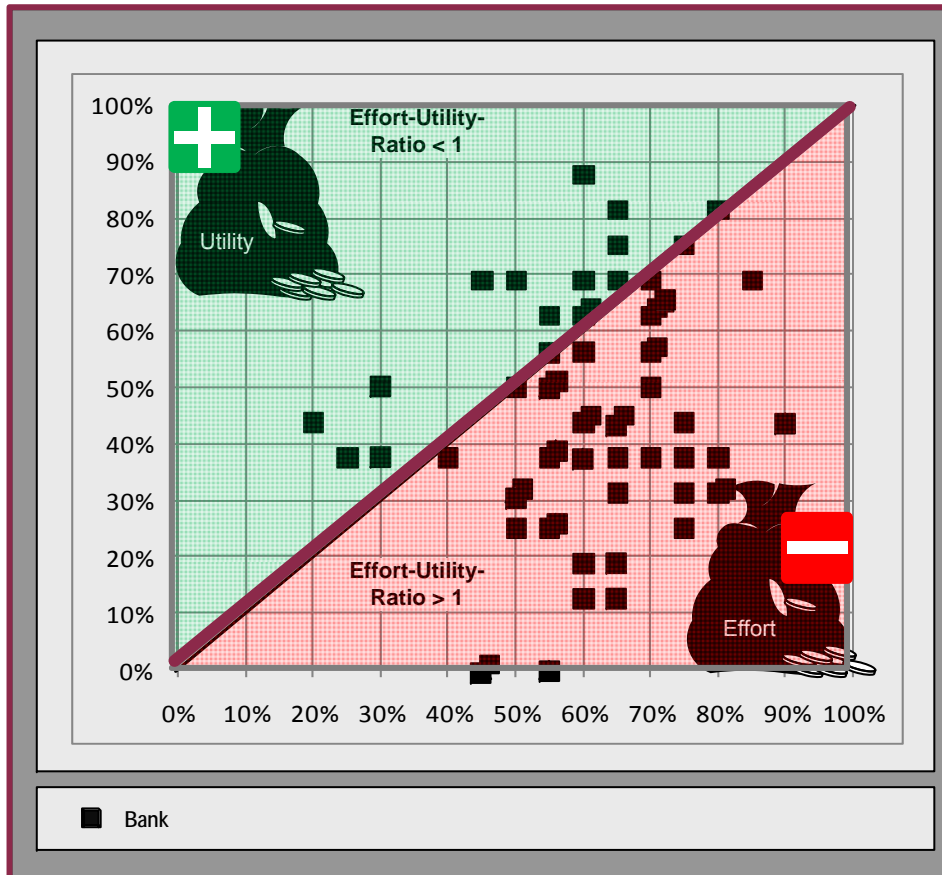


Investigating BPM in the Financial Sector – Database ■



Data Presentation: Effort-Utility-Ratios ■

Benchmarking of Banks regarding Effort-Utility-Positions



Banks invested 61% of the maximum possible efforts.

Banks only got a return of 45% of the maximum possible utility.

Thus, the 60 banks participating in our study seemed to be investing more on the effort side than they actually got back as a possible benefit from their business process modeling effort.

Data Analysis: Idea of Discriminating Variable ■

?

Question:

?

What may be the factor that influences, if a bank has a positive or a negative effort-utility-ratio?

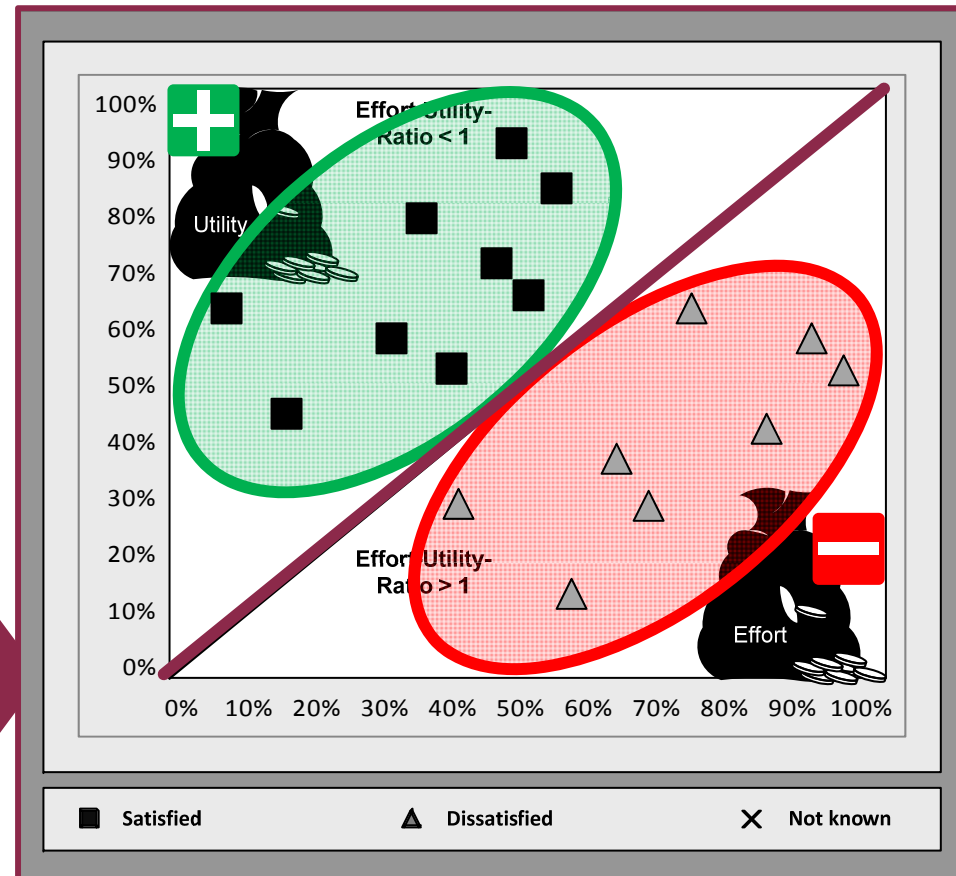
!

Idea:

!

Is there an item in our survey, which can be used to explain why banks have a positive or negative effort-utility-ratio?

Perfectly Discriminating Variable



Data Analysis: Idea of Discriminating Variable ■

4 items with respect to business process modeling languages that could possibly explain the difference of banks having a positive or negative effort-utility-ratio were analyzed from the original set of the questionnaire

a) the usage of individual (enhanced) modeling methods compared to standard modeling methods (without any enhancements)

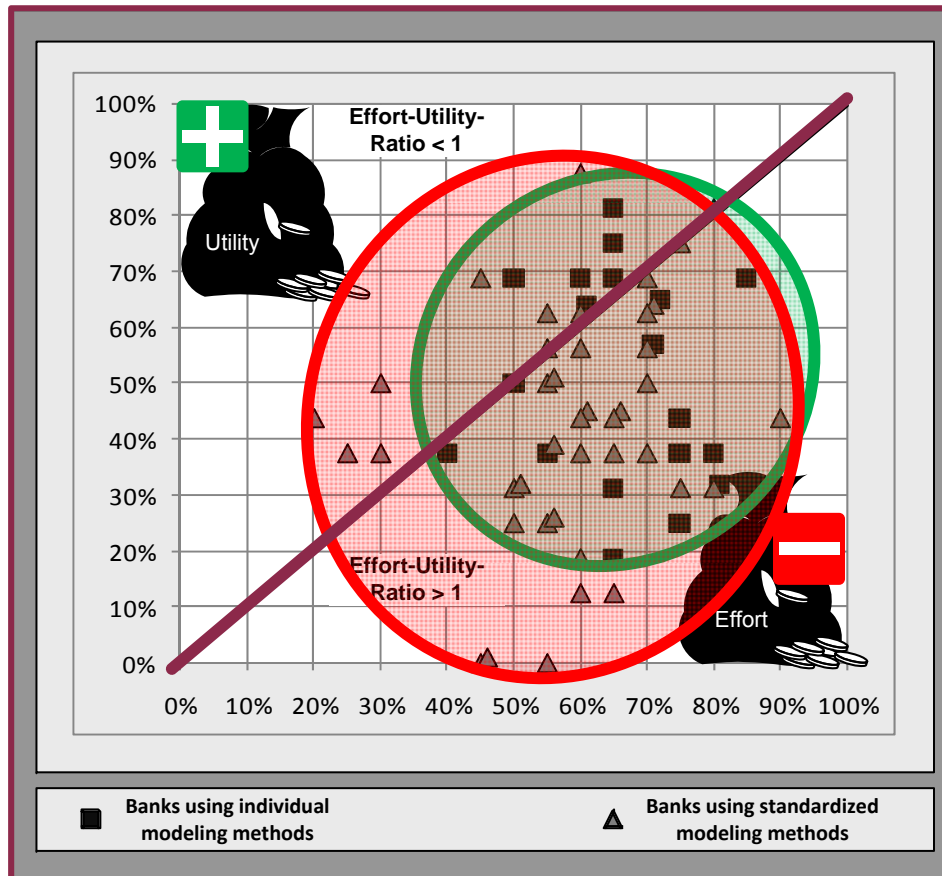
b) the satisfaction with the cost-effectiveness of creating business process models (modeling and validation) with respect to a certain used process modeling method

c) the satisfaction with the cost-benefit-ratio of process model maintenance with respect to a certain used process modeling method

d) the satisfaction with analysis possibilities offered by the used process modeling method

Data Analysis: Standard vs. Specialized BPML ■

Usage of Individual vs. Standardized Modeling Methods

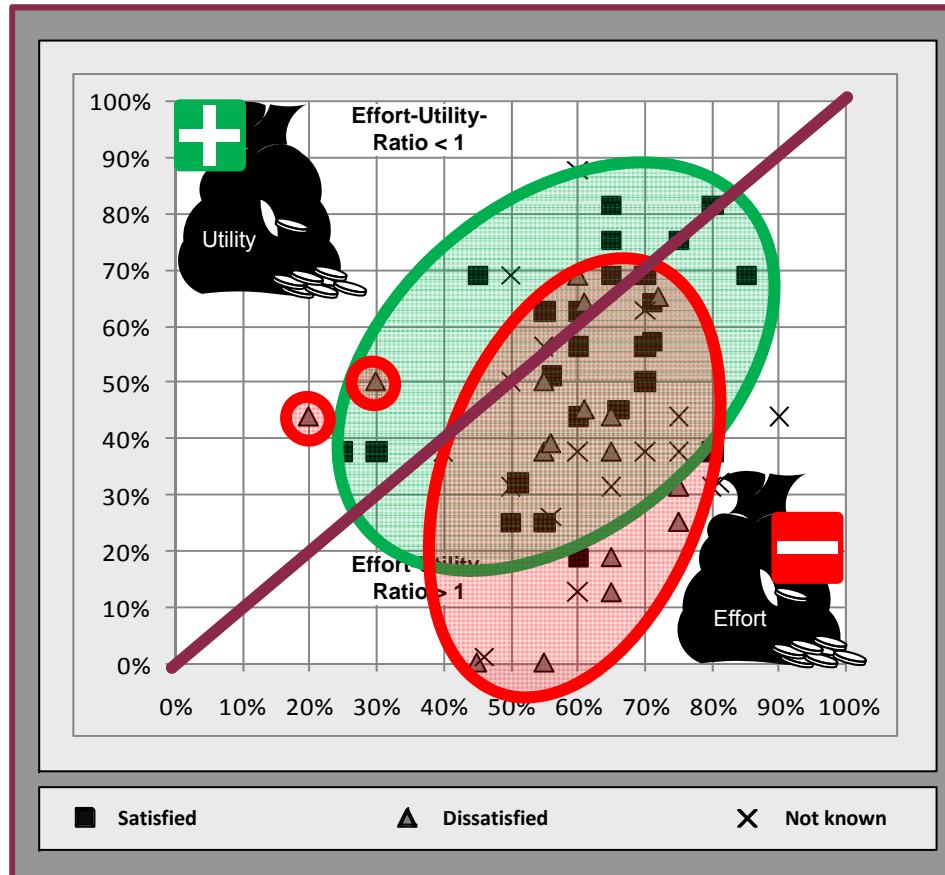


Not good for explaining satisfaction with process modeling initiatives.

However, using standardized modeling methods without any extensions often seems to have a negative influence on overall satisfaction with process modeling initiative.

Data Analysis: Cost-Effectiveness of Model Creation Due to BPML

Cost-Effectiveness of Creating Process Models

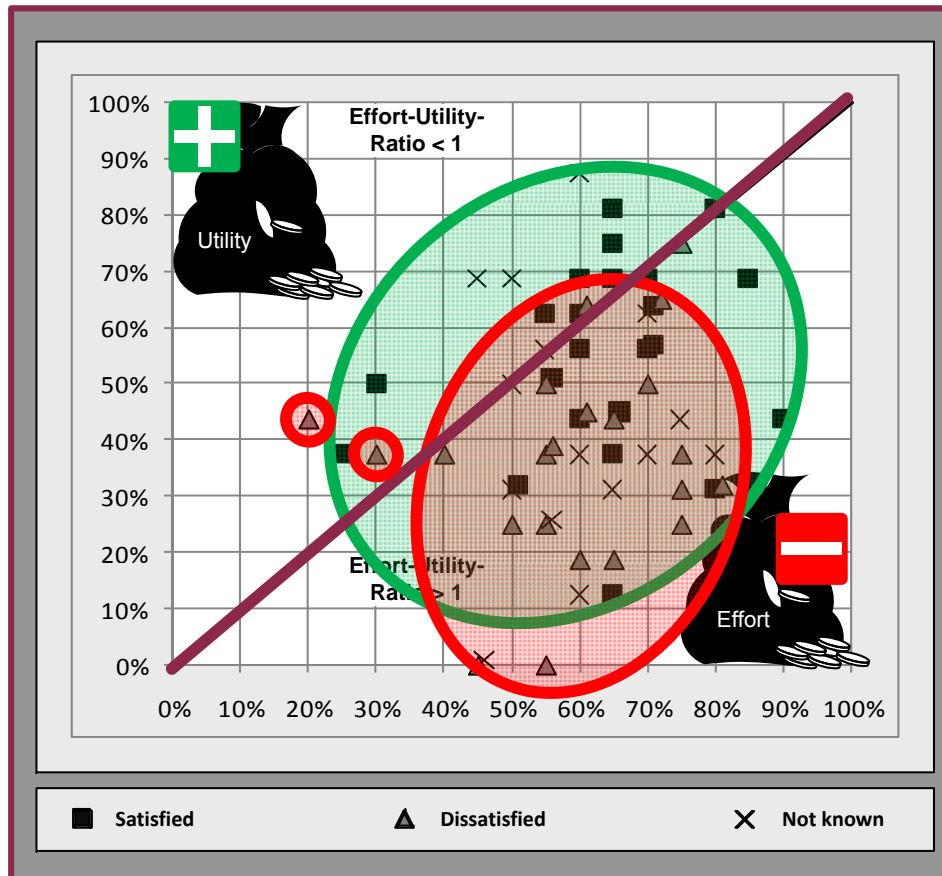


Not good for explaining satisfaction with process modeling initiatives.

However, many costs invested during initial process model creation seems to reflect negatively on overall satisfaction with process modeling initiative.

Data Analysis: Cost-Benefit-Ratio of Process Model Maintenance Due to BPML

Cost-Benefit-Ratio of Process Model Maintenance

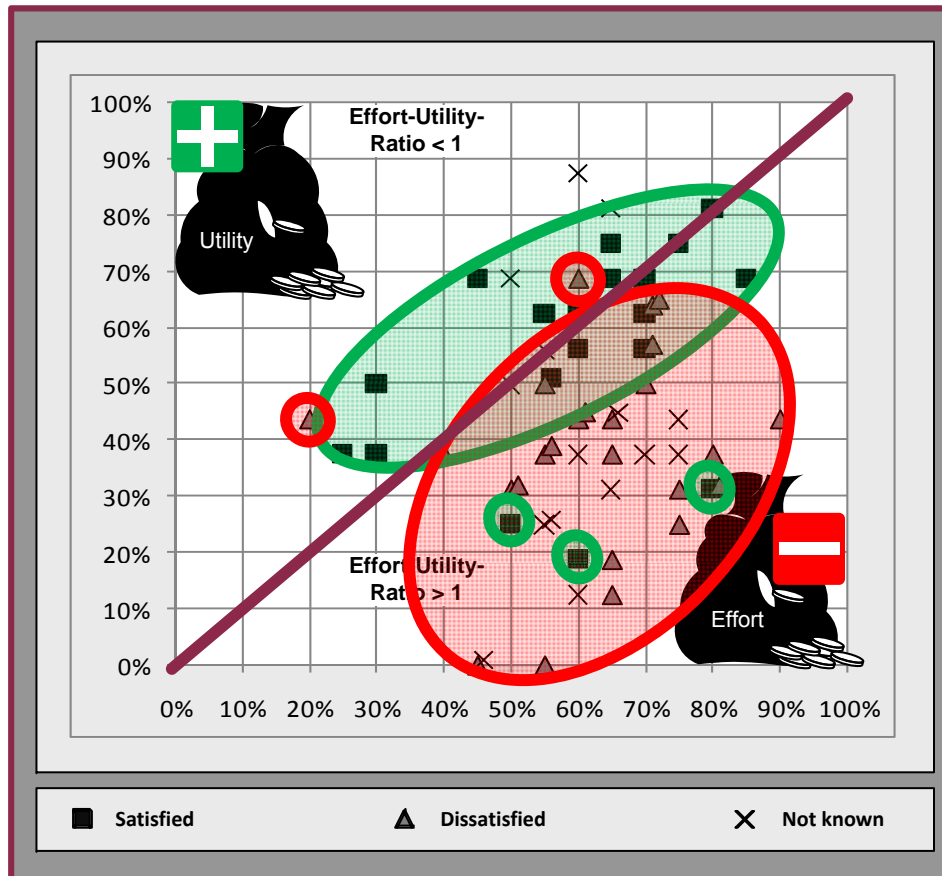


Not good for explaining satisfaction with process modeling initiatives.

However, low cost-benefit-ratio regarding process model maintenance seems to reflect negatively on overall satisfaction with process modeling initiative.

Data Analysis: Analysis Benefits Due to BPML ■

Benefits of Analysis Possibilities Offered by Modeling Method



Analysis possibilities of applied modeling method seems to be a fairly good indicator (with a few exceptions) for explaining or detecting satisfaction or dissatisfaction with overall process modeling projects and especially positive or negative effort-utility-ratios.

Key Findings

Existing BPM languages are not ideal:
51% of banks were not satisfied with available methods and partially even willing to create own methods

Many general purpose modeling languages (e.g. EPC, UML AD, BPMN) support automated analysis only to a very limited degree and consume many human resources for modeling.

Combining both ease of modeling and analysis and integrating these aspects into the methods used and tools seems to be a promising approach.

Business Process Modeling and Analysis

1. On Effort and Utility of Process Modeling in Banks

2. Semantic BPML for Modeling

3. Semantic BPML for Analysis

4. Semantic BPML for Operational Risk Management

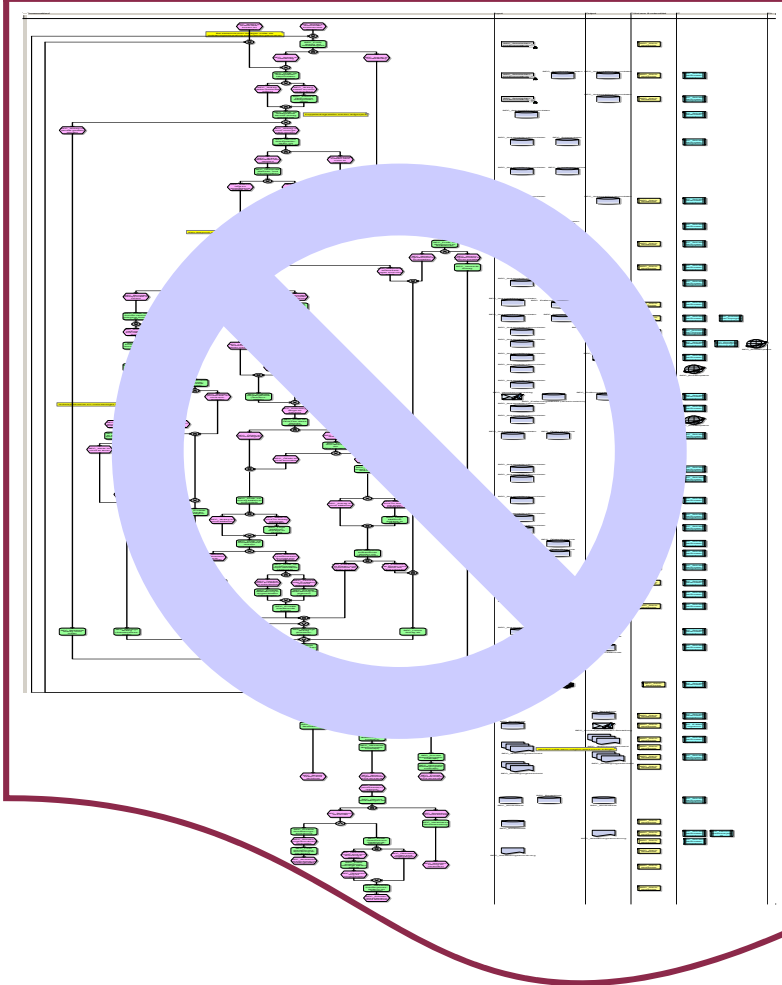
5. Semantic BPML for Business Process Compliance

6. Outlook



Problems of Traditional Approaches ■

Universal Business Process Modeling Languages

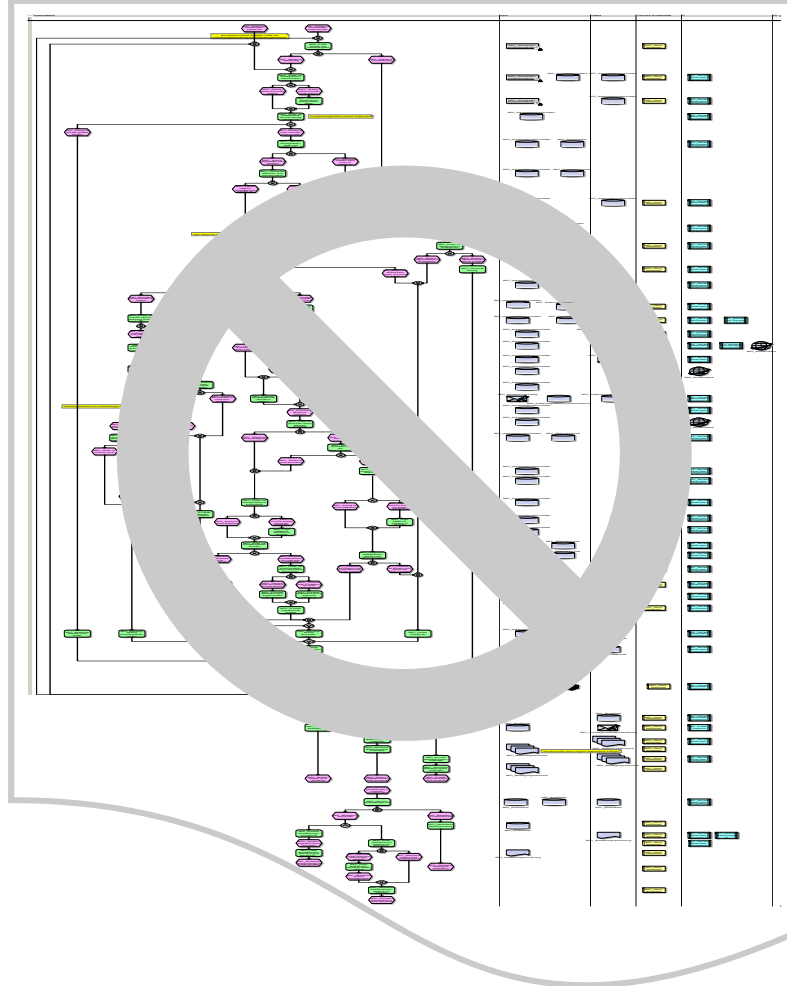


Problems of traditional approaches

- hard to understand
(domain neutral)
- hard to compare
(high freedom degrees)
- hard to explain
(expert knowledge necessary vor modeling)
- hardly affordable
(very detailed modeling / not economically)
- hardly usable
(missing semantic analysis capabilities)

Requirements for Solving the Process Modeling Dilemma ■

Universal Business Process Modeling Languages



Solution

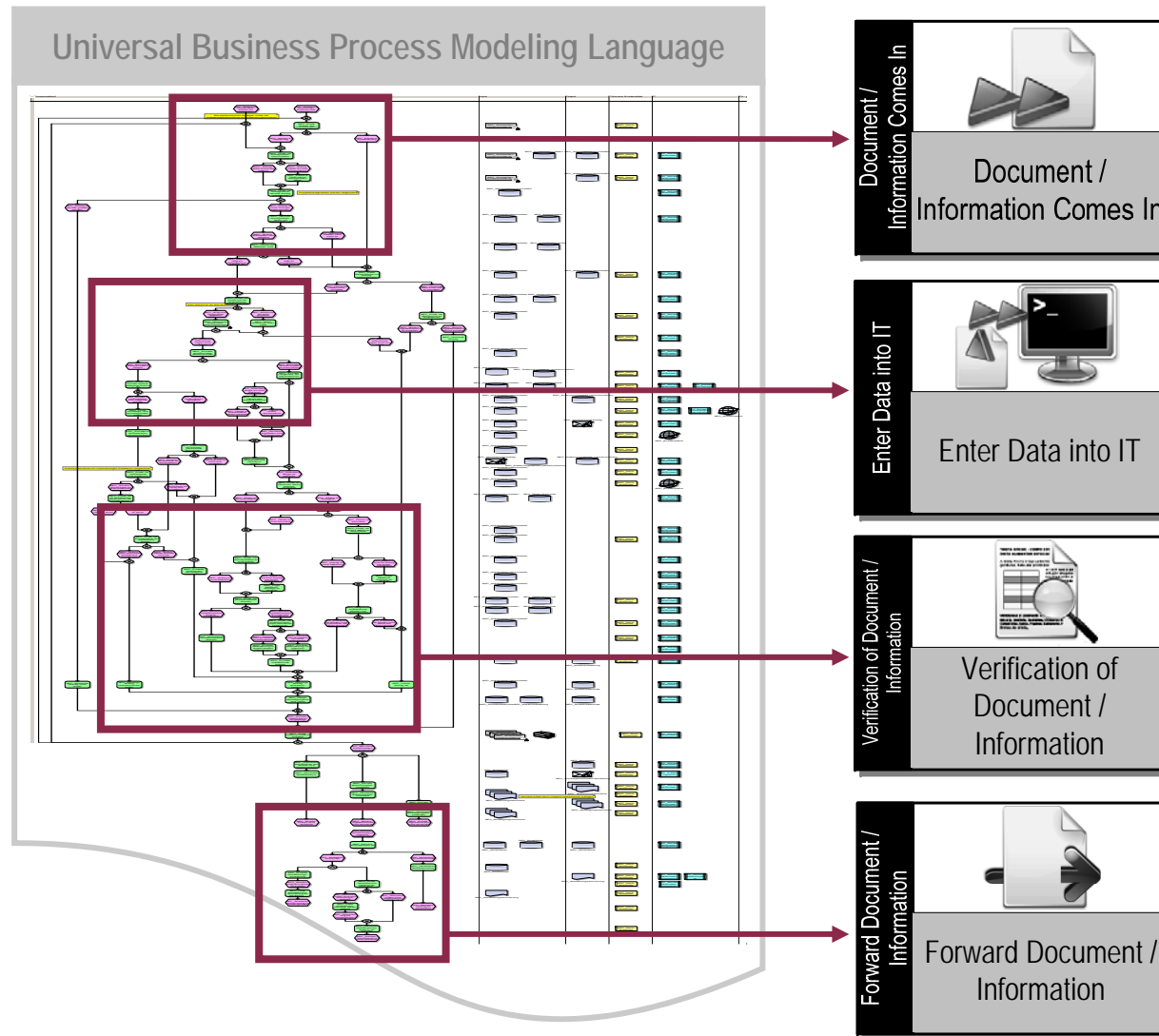
Modeling

- predefined building blocks
- domain-specific languages
- decentral and distributed modeling activities
- direct interaction with business specialists
- simple syntactical rules

Use / Analysis

- comparison of models
- goal-focused modeling (relevance / economically)

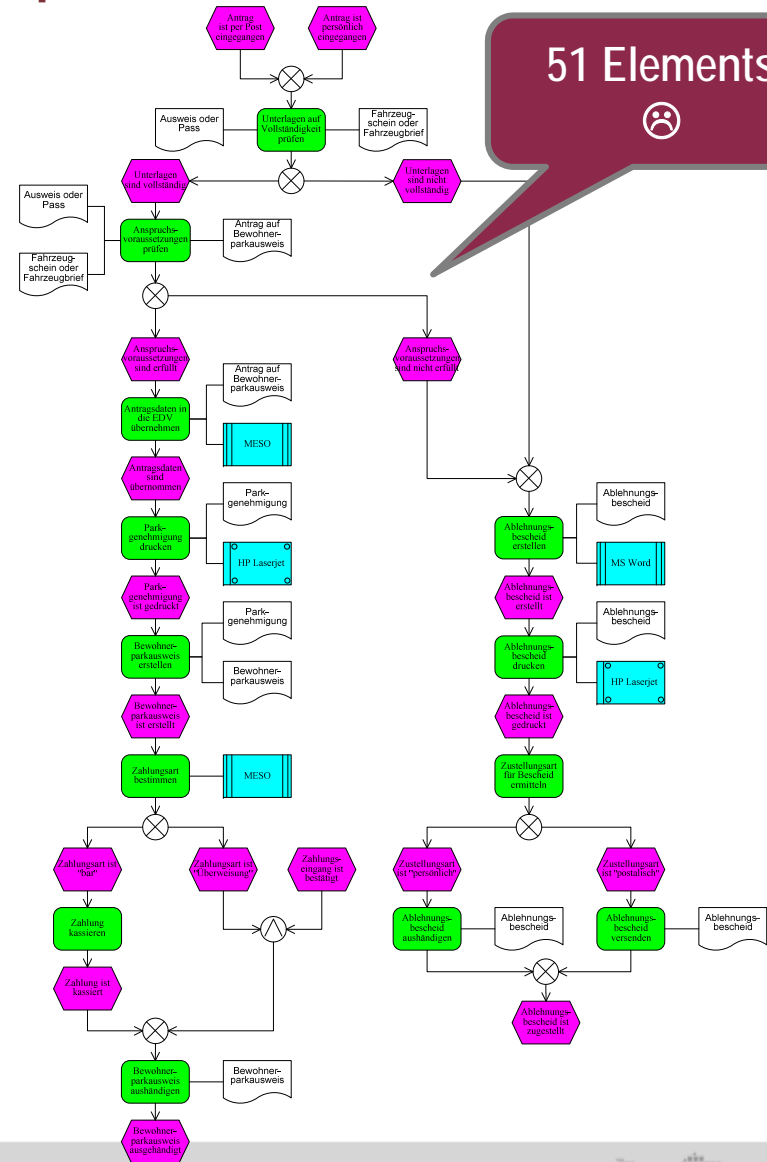
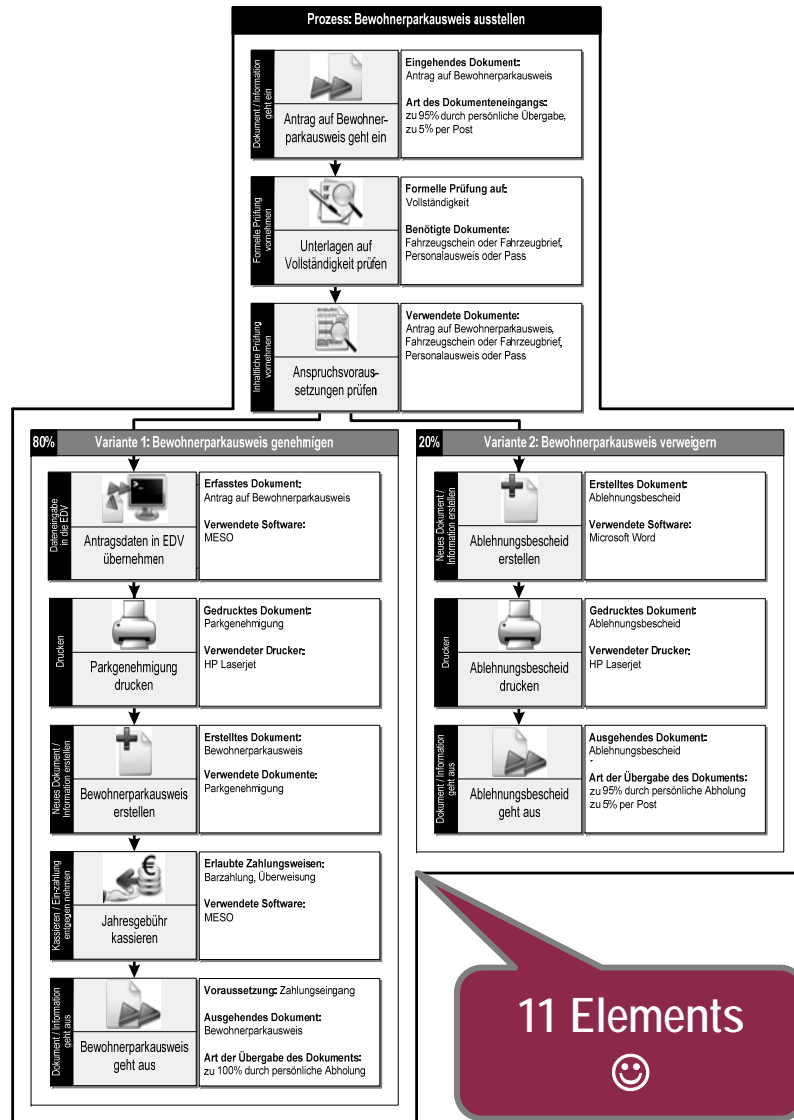
Solution: Domain-Specific Semantic BPML ■



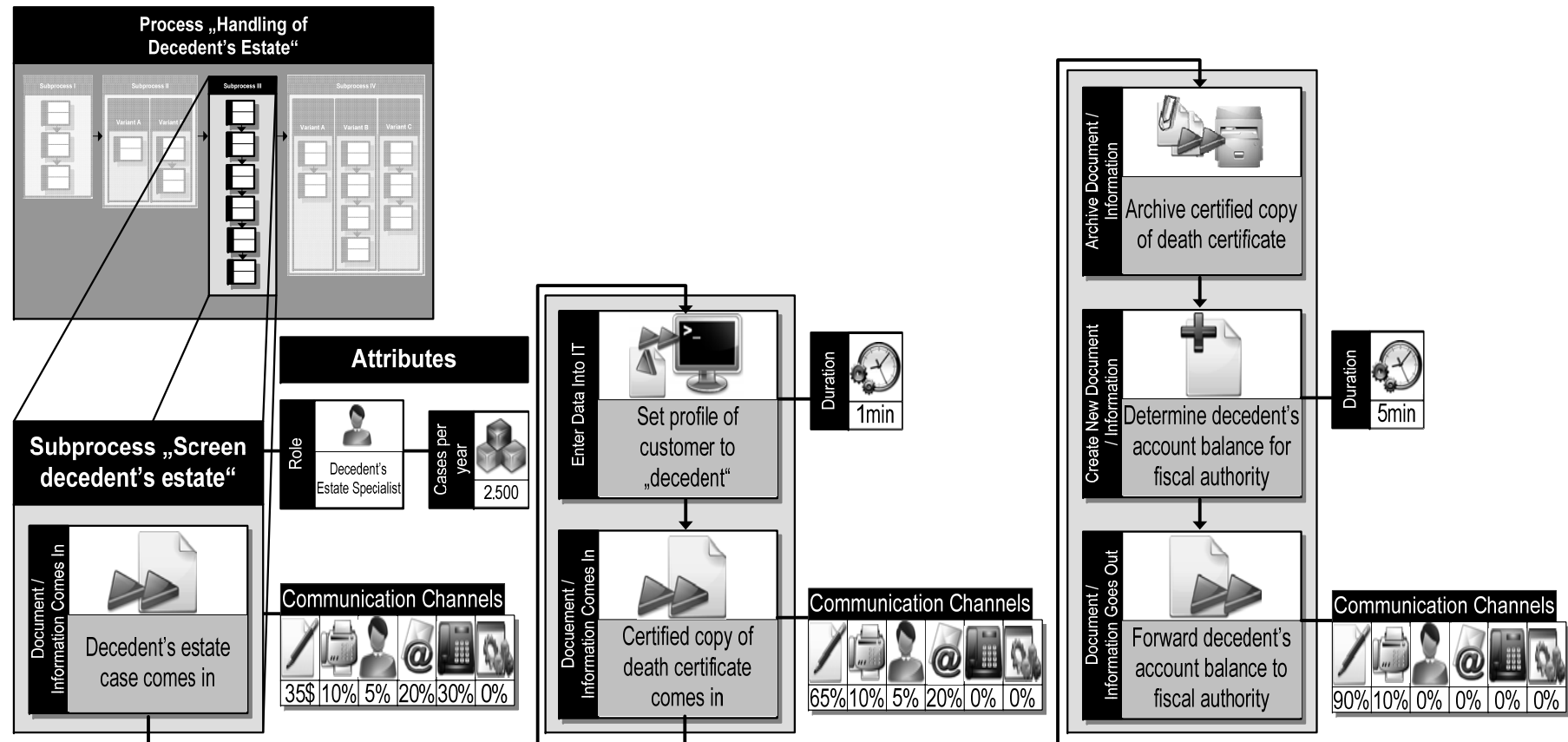
Semantic BPML

Domain-specific process building blocks for public sector which resembles banking sector in many ways

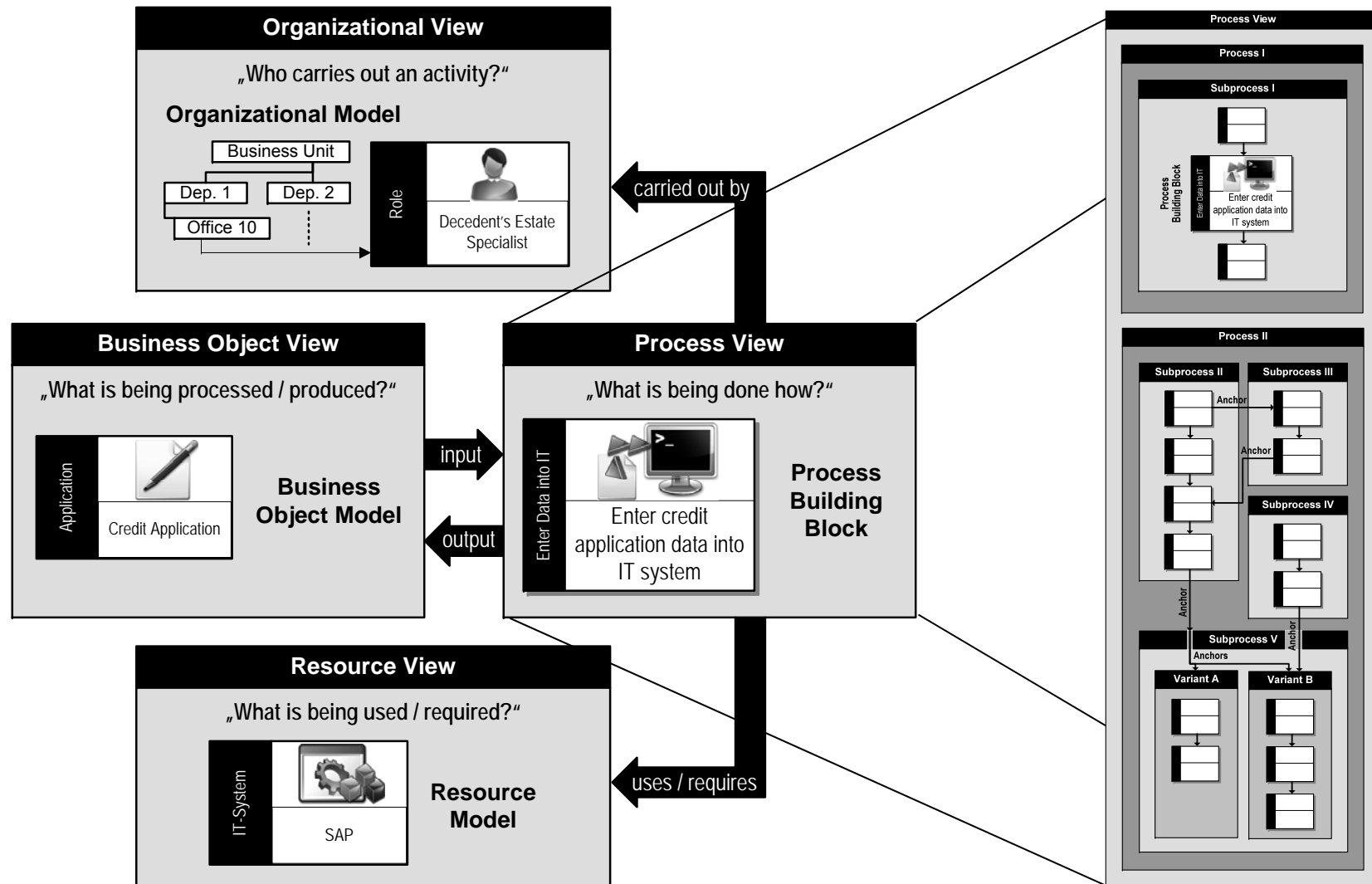
Comparison of SBPML and EPC



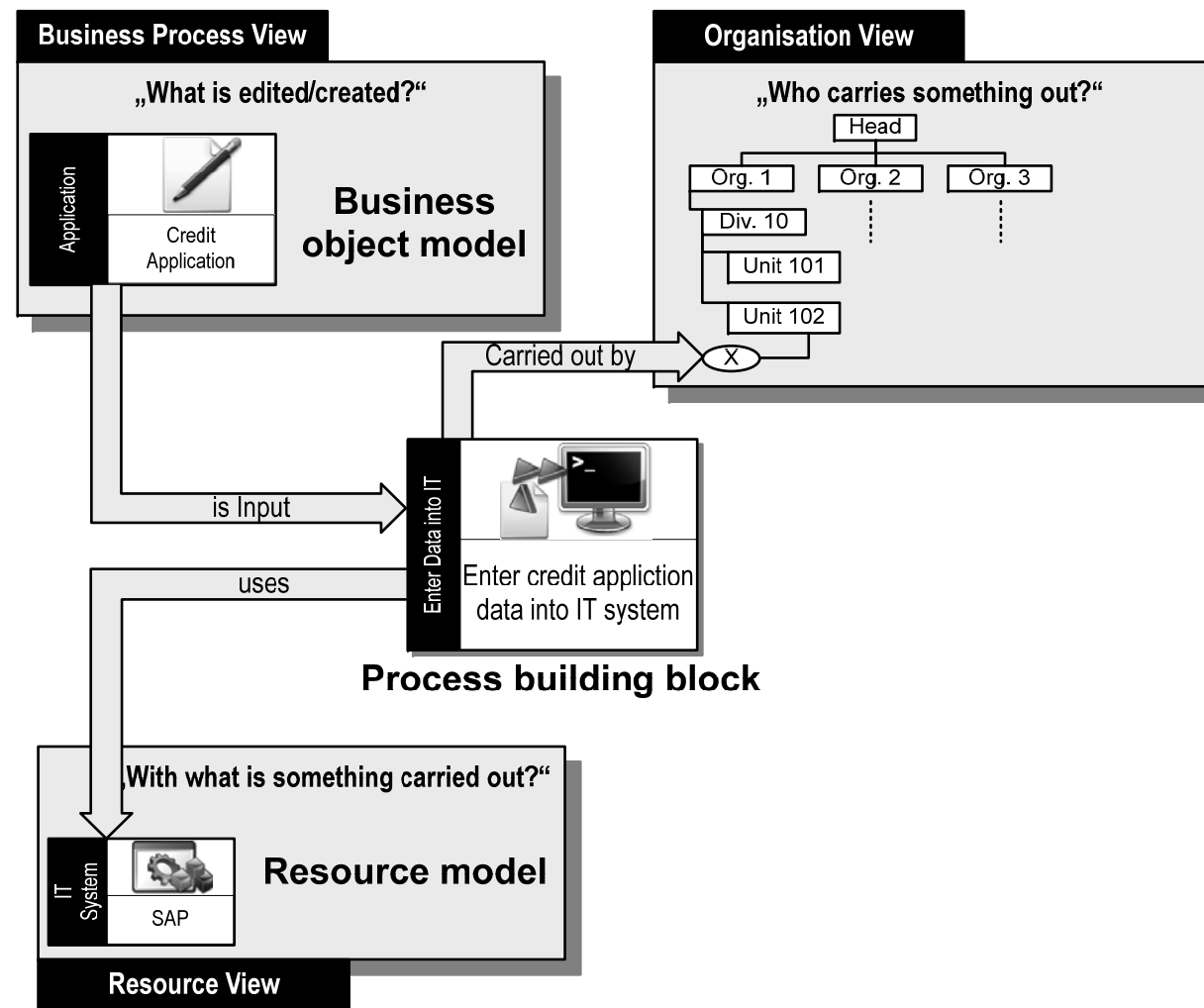
Sample Process from a Bank Using SBPML Method ■



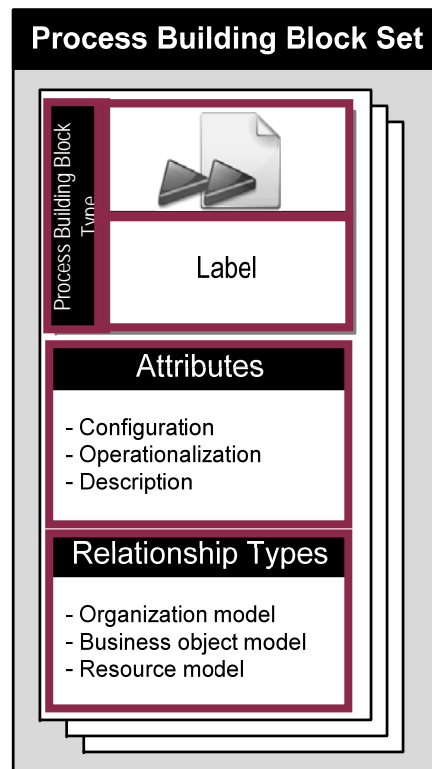
Views of the SBPML Method ■



Modeling Using Views of the SBPML Method ■



Concept of a Process Building Block ■



■ Type

- Define amount of types (building block set)
- Evaluable semantic
- Association of a definite symbol

■ Free short name

- Free vocabulary / higher readability
- Open meaning

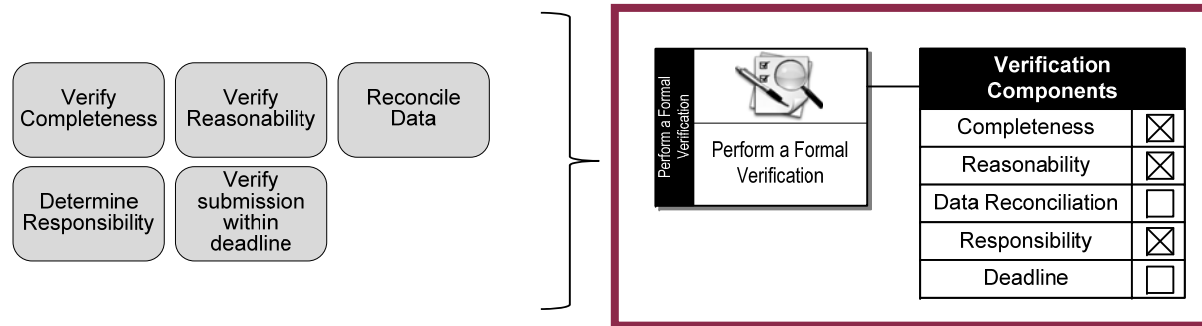
■ Attribute types

- Configurative attributes
 - Definite semantic / details of the building blocks
- Operational attributes
 - Evaluability / measurement of model evidence
- Descriptive attributes
 - Free additions like comments and notes

■ Relationship types

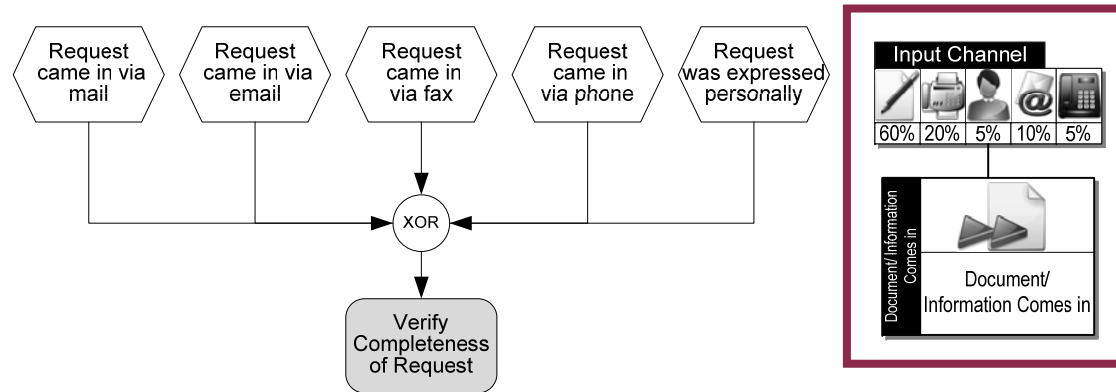
- Organisation (internal/external)
- Business objects
- Resources

Introduction of Configurative Attributes ■



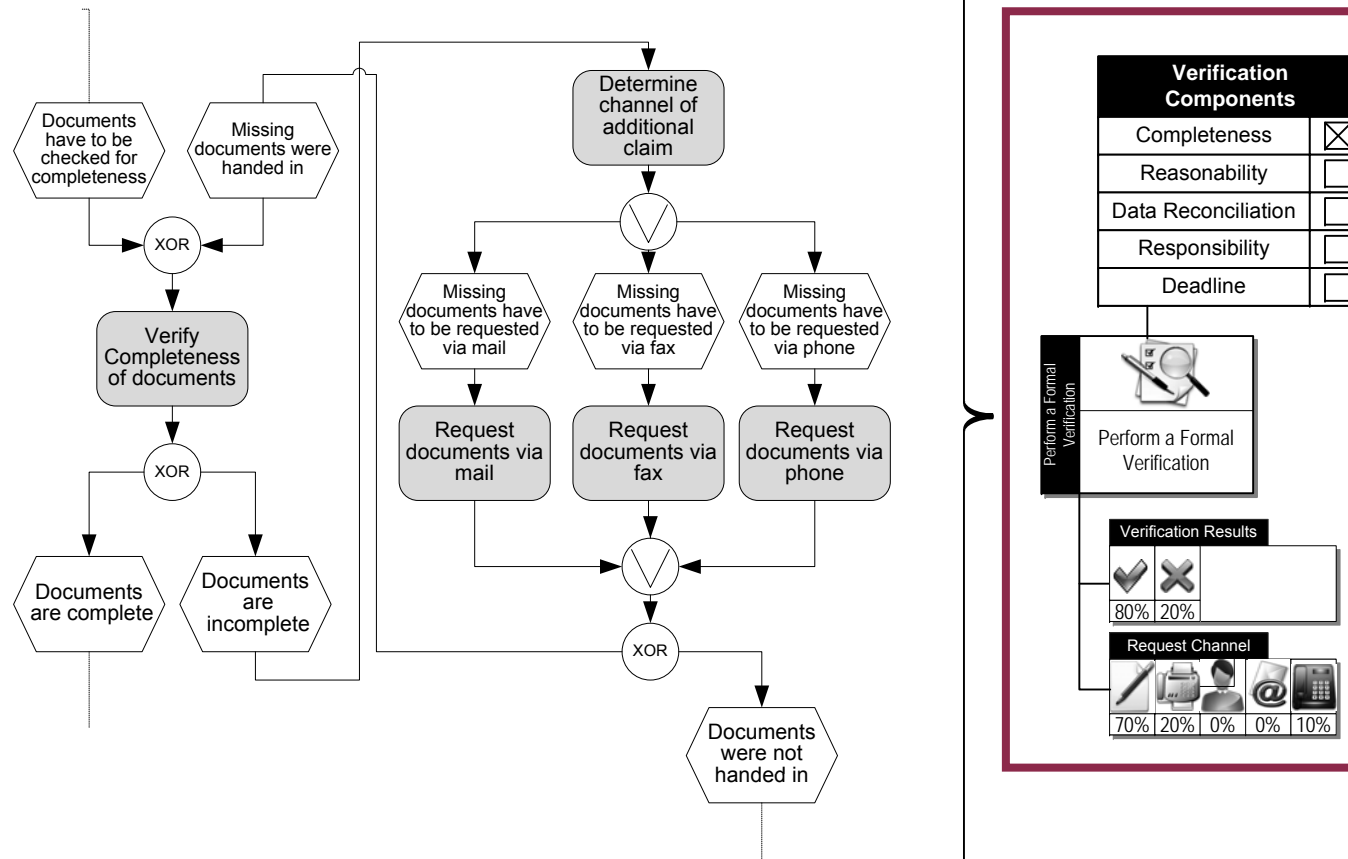
- **Precise description of activities with regards to content**
- **Reduction of the number of process building blocks**
- **Unchanged analyzability**
 - E.g. „Where in the present process does the integrity check take place?“

Introduction of Operational Attributes ■



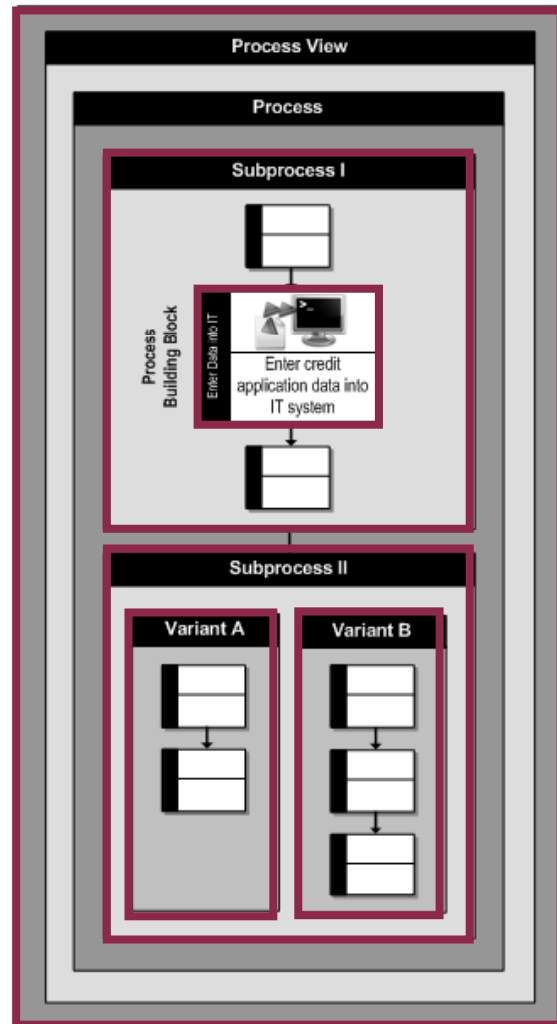
- **Facilitation of the evaluation of process elements**
- **Allowance of complex analysis across multiple processes**
 - E.g. comparison of input- and output channels in different organisational units
- **Dependent on the modeling objective modifications are needed**
 - E.g. capturing of time or of information about the degree of utilisation
 - It has to be checked if it is possible to capture data in advance

Integration of Information about the Control Flow by the Use of Attributes



Element Types in the Process View ■

Core Elements of the PICTURE Process View and their Relationships



■ Process

- ❑ **Atomic** (entirely or not at all) utilised by the client
- ❑ Basis: product documentations of the organization
- ❑ Concerning inner (support processes) and outer tasks (core processes)

■ Sub-process

- ❑ Specific for a process (no reutilisation)
- ❑ Basically within one organisational unit (e.g. one functional area)

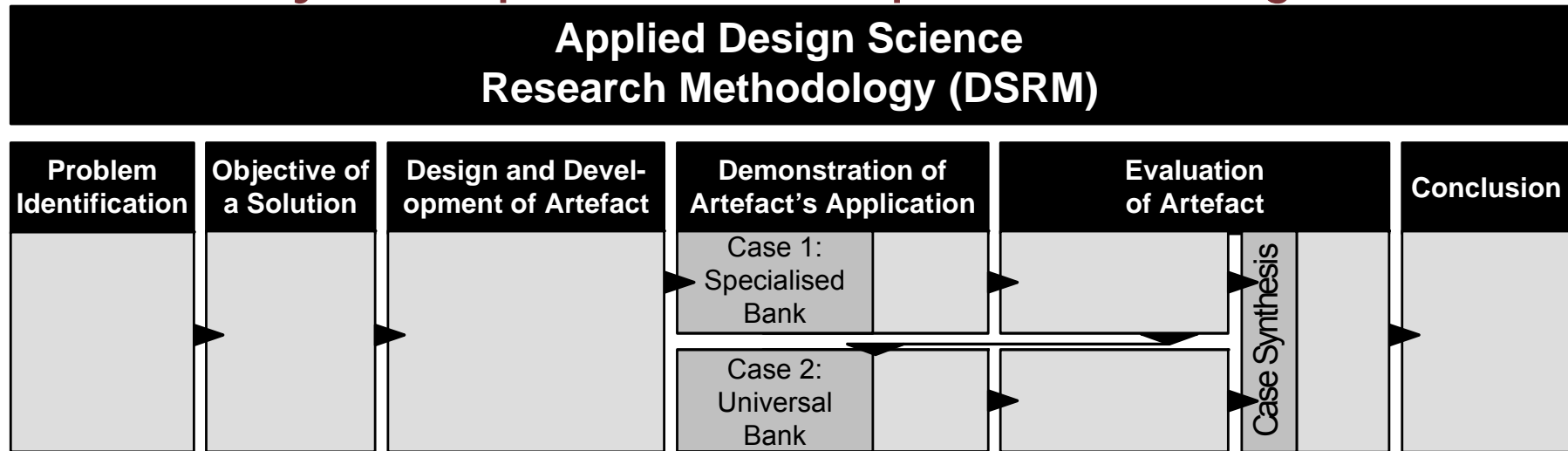
■ Alternative sub-process

- ❑ **Relevant** differences in the used building blocks with valuable amount of occurrences

■ Process building blocks

- ❑ Encapsulates the type of activity
- ❑ Charged with several attributes
- ❑ Basically sequential chain

Evolutionary Development of Bank-Specific Modelling Notation ■



Specialized Bank:

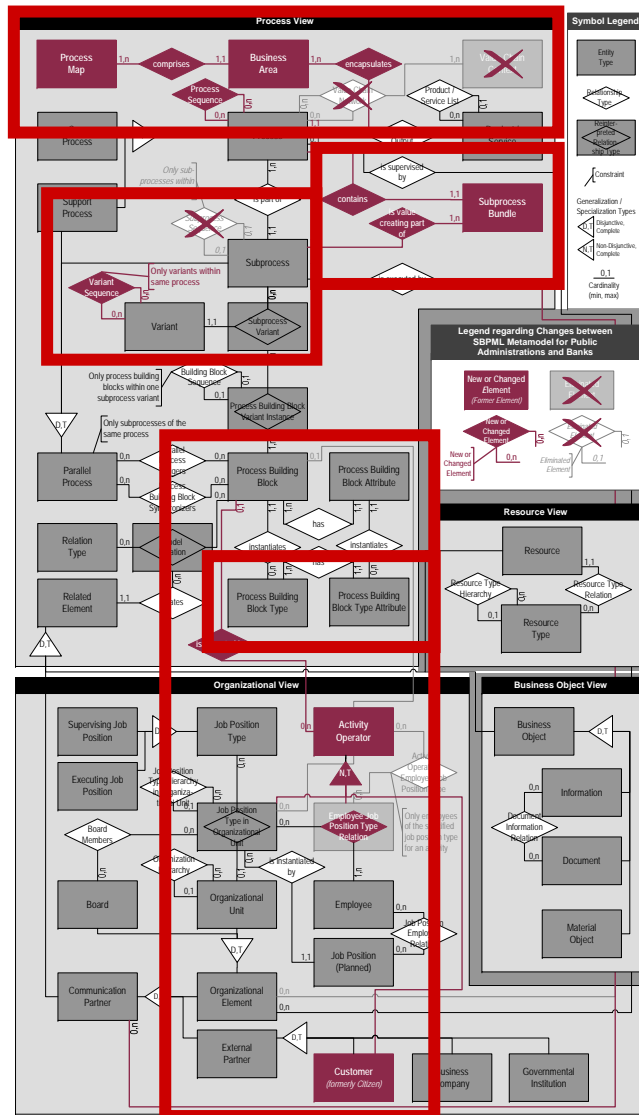
- 34 banking processes with
- 84 subprocesses,
- 258 process variants and
- 693 activities in the form of PBBs
- specialised bank, focusing only on instalment credits (1product)
- bank was operating in Germany and Austria with 60 subsidiary credit shops in different cities
- it employed over 1,000 people in 2008,
- who altogether as a bank served 443,000 customers,
- totalling a credit volume of 4.9 billion euros.

Universal Bank:

- 227 process models, which comprised
- 334 subprocesses,
- 813 variants and documented
- 2,897 activities in the form of PBBs
- universal bank from Russia, offering a wide range of products, including cash services, credits, deposits, cards and payments
- banking activities spread over multiple regional branch offices
- it employed over 2,000 people in 2008 in 132 subsidiary offices in South Russia,
- who served 37,000 small and medium enterprises, had over 160,000 depositors and
- issued credits in a volume of 94.2 billion roubles

Business Process Modeling and Analysis in Banks

Transferring the PICTURE Approach to Banks



5 key changes

Necessity to model process maps / frameworks for managerial view on process landscape.

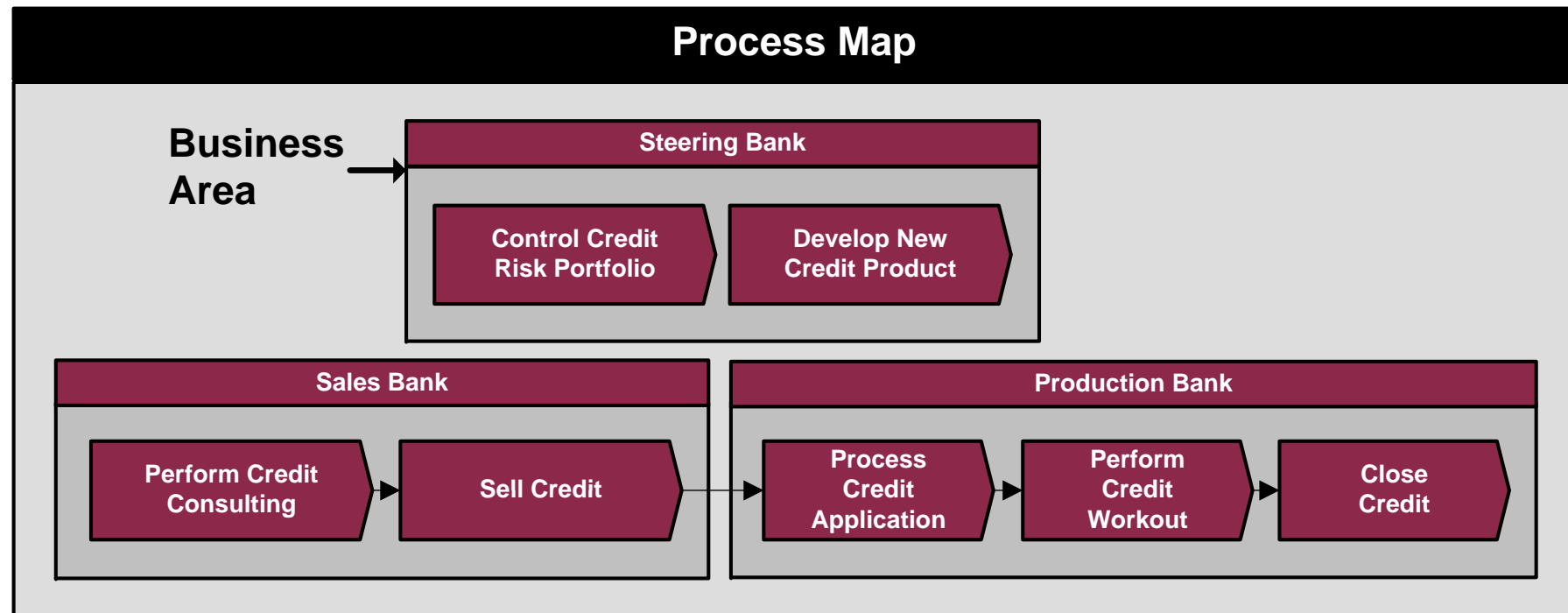
Necessity to model subprocess bundles for purpose of offering not only complete processes to external service providers (e.g. other banks), but also partial processes in terms of finegranular business services (coherent parts of processes with a well-defined economic input and output).

Necessity to enhance the original control flow concept to make all process flows not only traceable on the subprocess but variant or process building block level.

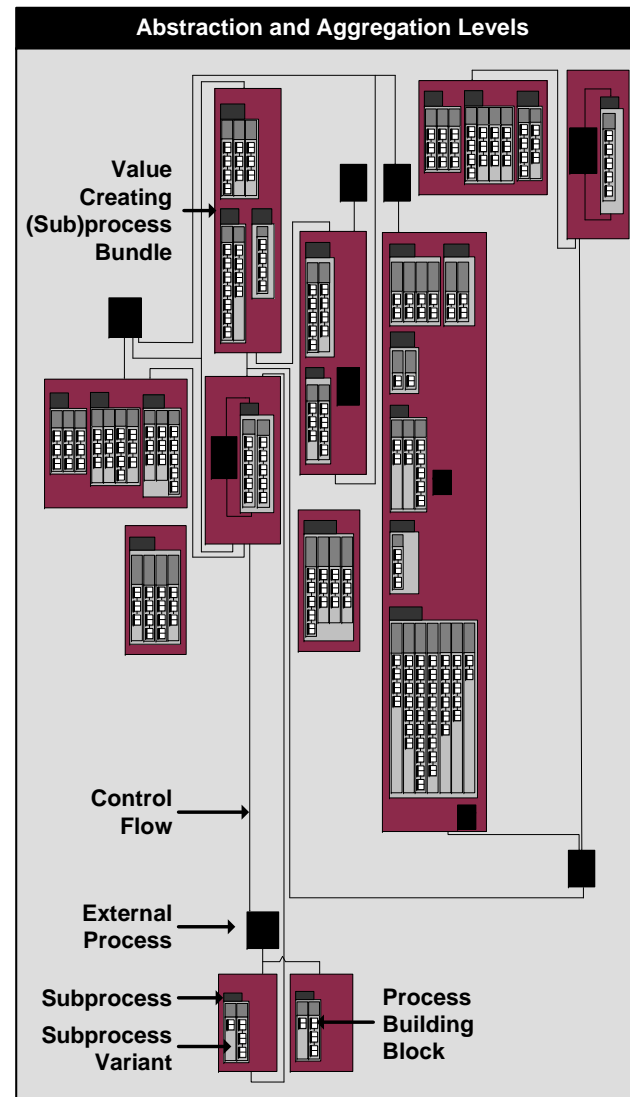
Necessity to construct domain-specific process building blocks and corresponding attributes for financial service providers including possibility to model system activities.

Necessity to be able to model customer processes.

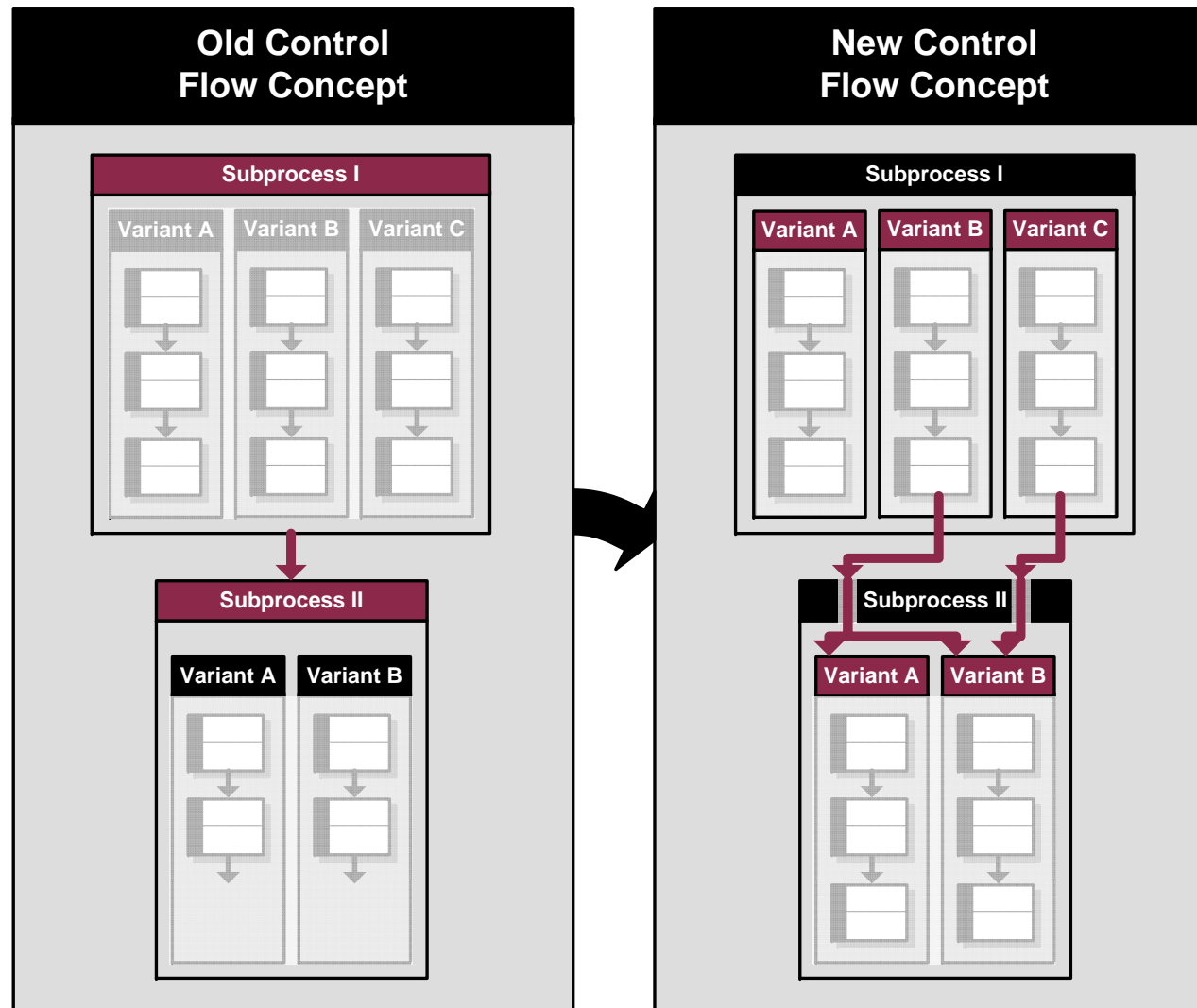
Introducing the Concept of Process Maps to SBPML ■



Introducing the Concept of Value Creating Subprocess Bundles ■

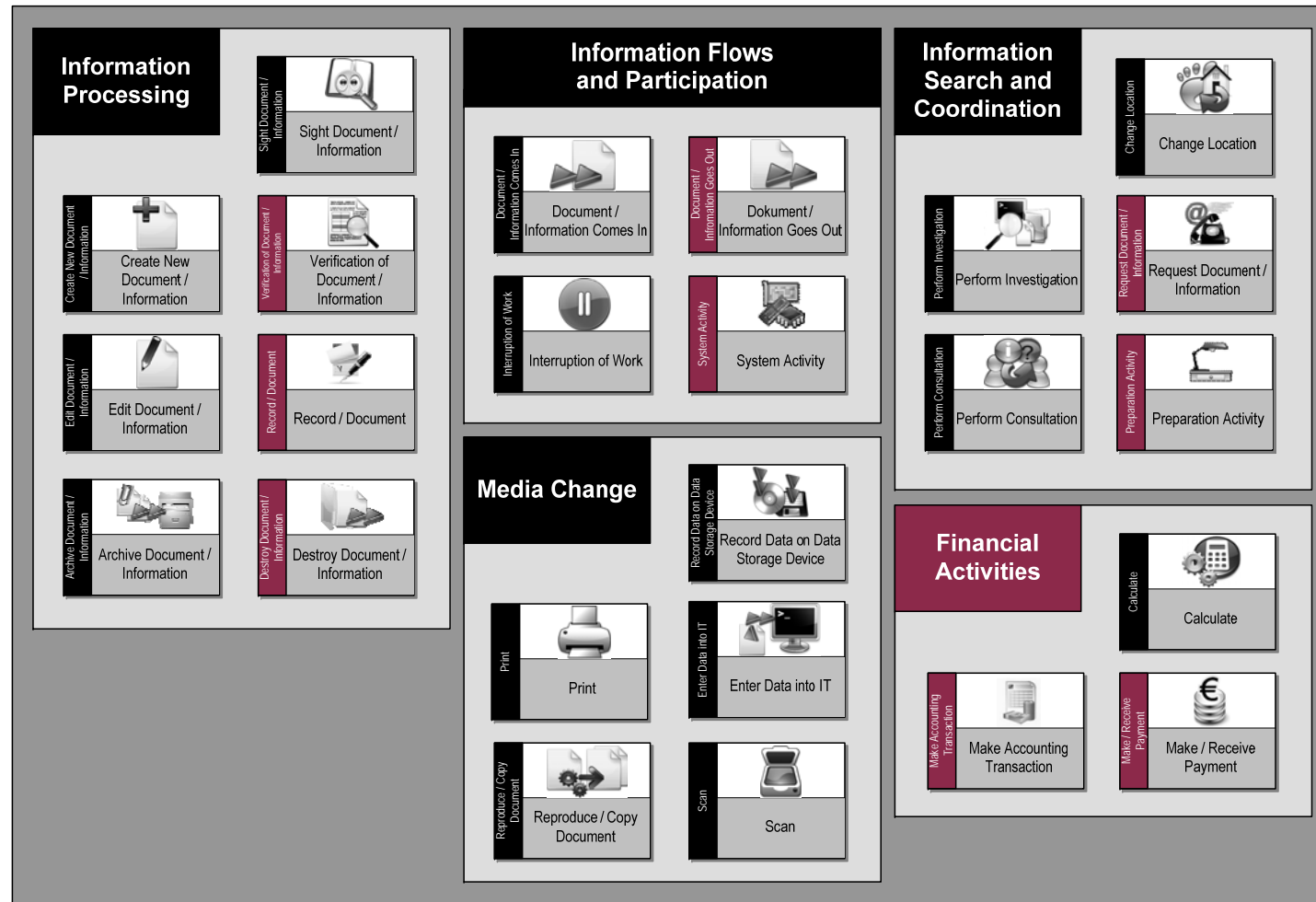


Introducing the Extended Control Flow Concept ■

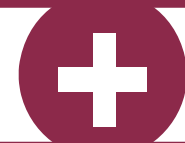


Introducing New Semantics to SBPML ■

SBPML Process Building Blocks and their Sets for Banks



From originally 24 PBBs from public administration sector 8 were merged into 4 PBBs, 1 PBB was eliminated (as it was not used in banks) and 5 PBBs were added (as these described frequent activities in banks).



Original PICTURE specification included 163 attributes. In new SBPML specification 11 attributes were changed, 17 attributes (specific to public administrations) were removed and 149 attributes were added. This resulted in 304 analyzable attributes.

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Potential Process-Based Weakness Identification? ■



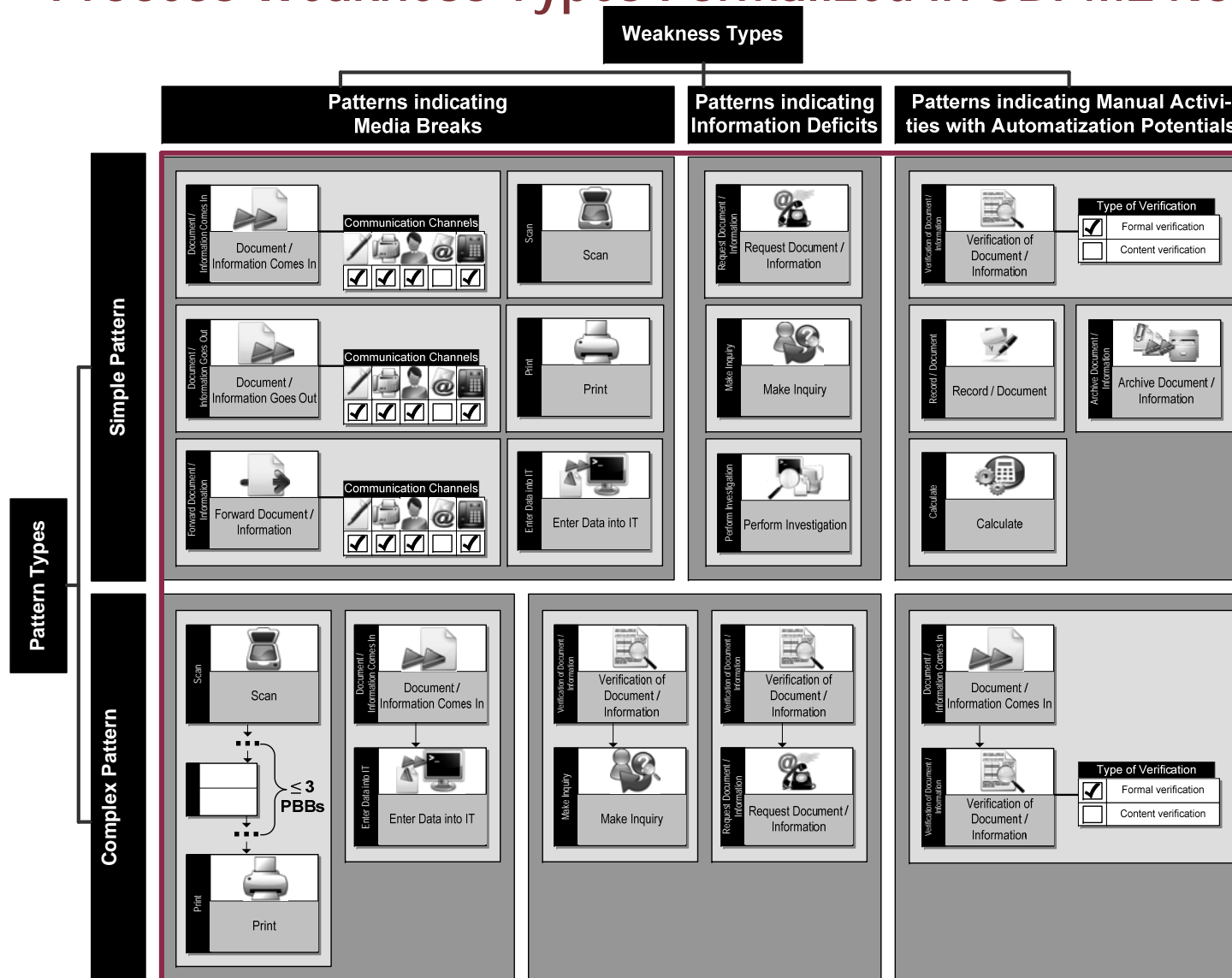
How can potential process weaknesses be detected in an automatic way?

First idea: by systematically analyzing well-structured information that business process models contain – esp. those that are semantically enriched

Typical Process Weaknesses in Banks ■

| Process Weaknesses | Description |
|---|--|
| Media break | Change in medium or channel, e.g. from electronic format to paper |
| Redundant use of documents | Creation of various copies of a document |
| Lack of standard templates | Availability of different templates for same document |
| Unclear storage location for documents | Place for storage of original document is not defined and leads to increased search time |
| Inefficient output channels | Transport of documents e.g. via postal services may result in long transport times and media breaks |
| Inefficient input channels | Incoming documents and information come in through inefficient channels such as postal mail |
| Lack of integration of different channels | Incoming and outgoing channels are not integrated. As a result, documents get lost or media breaks occur |
| Lack of transparency and traceability | Process progress is not transparent. Too much time is spent on waiting times, etc. |
| Redundant use of IT | Different IT systems are used for the same process by different departments/people |
| Lack of system integration | The usage of many systems that are badly integrated leads to inconsistent data, outdated information, etc. |
| Redundant data sets | Unclear specification of competency in master data management can lead e.g. to an overwriting of data |
| Multiple formats | The same information is stored on multiple formats/media |
| Needless checks and signatures | Many checks and document signatures are there for historic reasons but do not have a function anymore |

Process Weakness Types Formalized in SBPML Notation ■



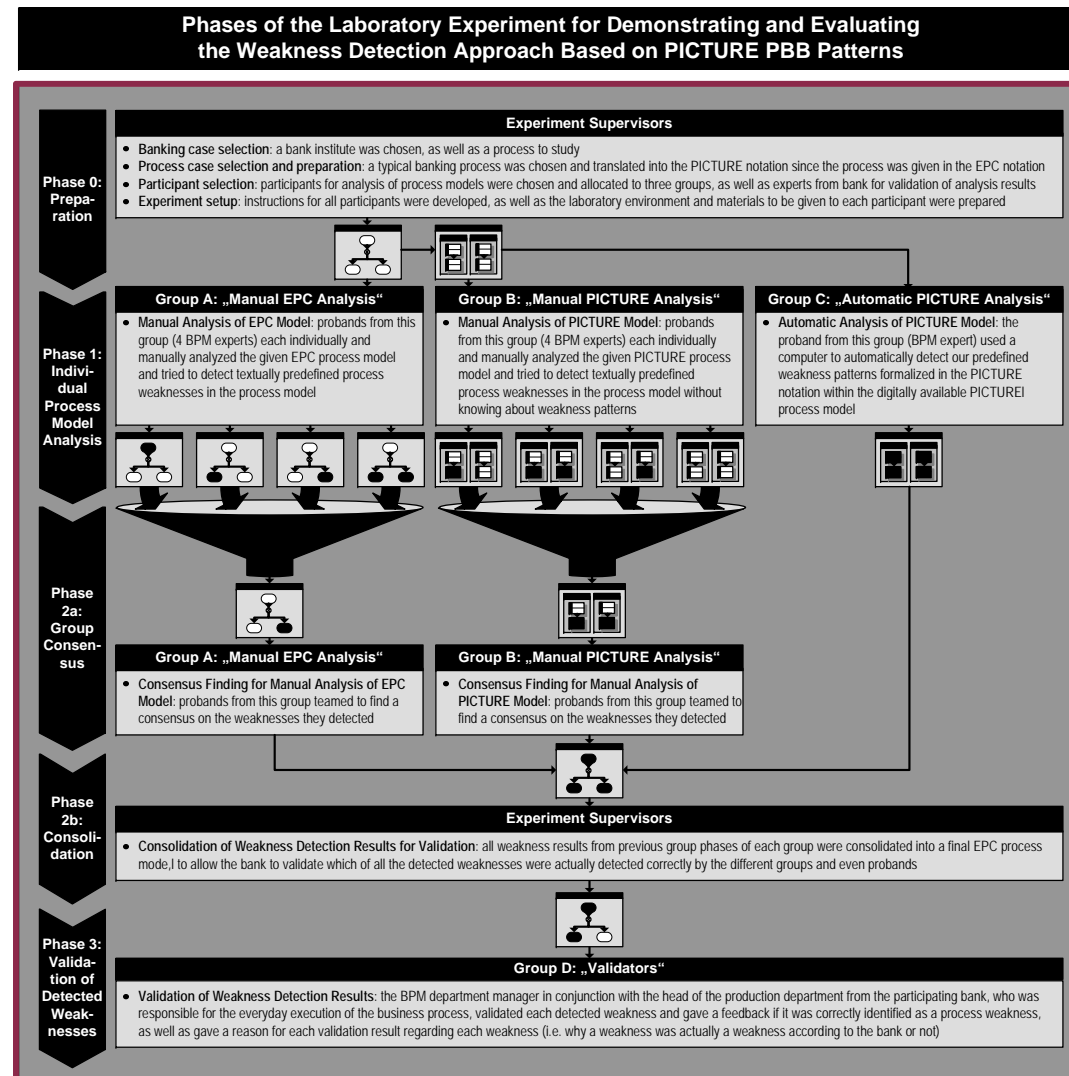
Lab Experiment Design for Automating Process Analysis ■

Goal of Lab Experiment:

Demonstrate that process weakness analysis is easy using SBPML

and

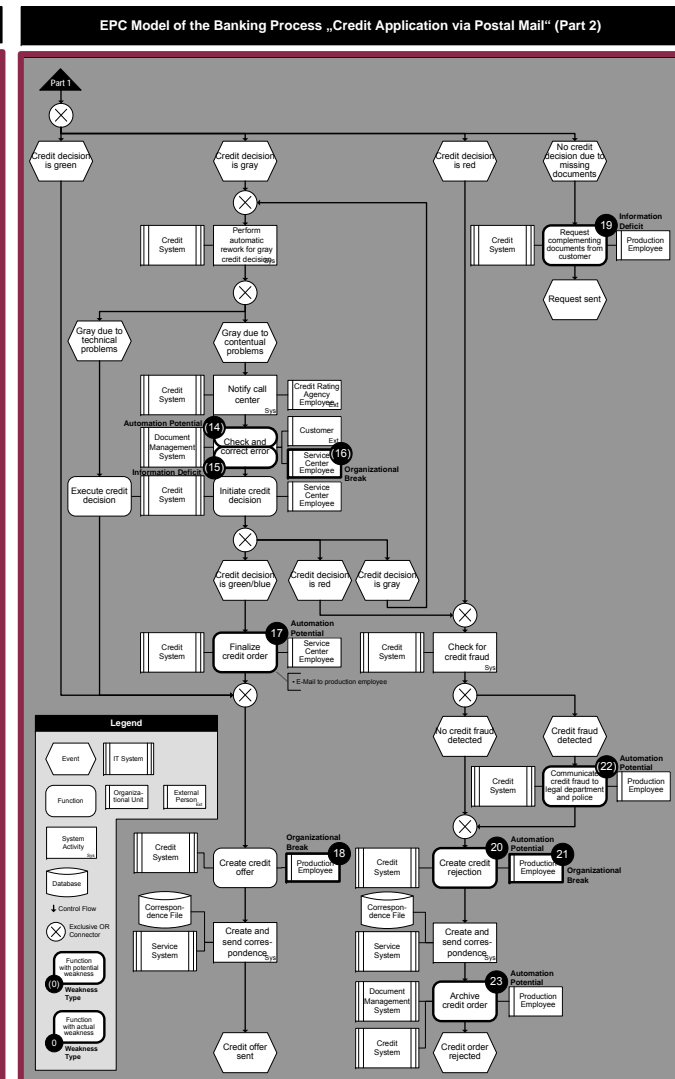
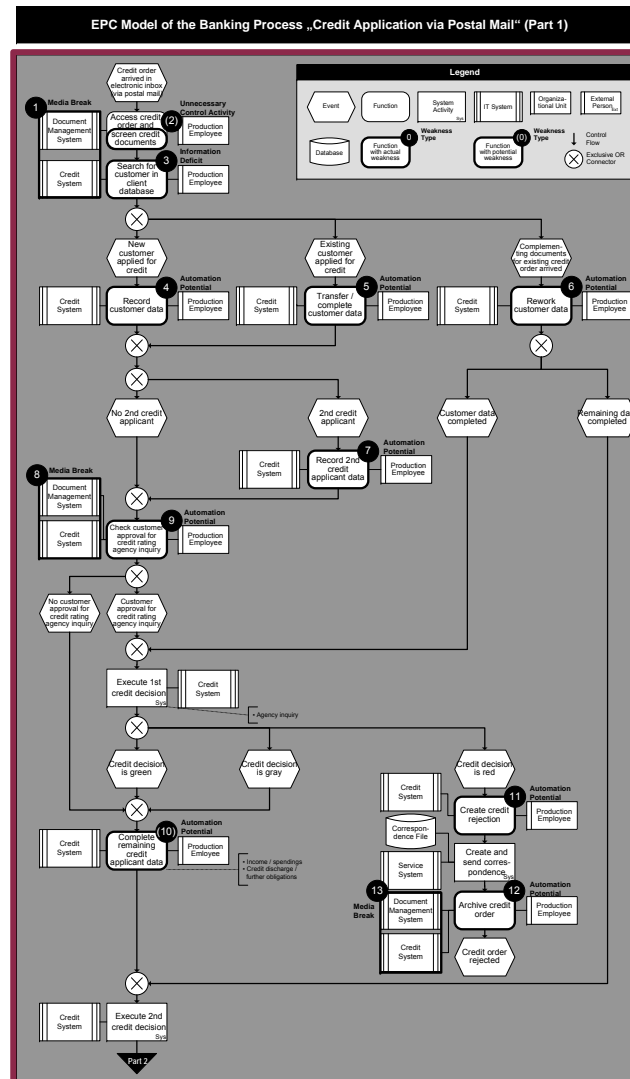
Gather data as proof for effectivity and efficiency



Demonstration: Results of Lab Experiment – EPC

Intermediate results of Lab Experiment:

Process weakness analysis with EPCs is manually possible but time-consuming

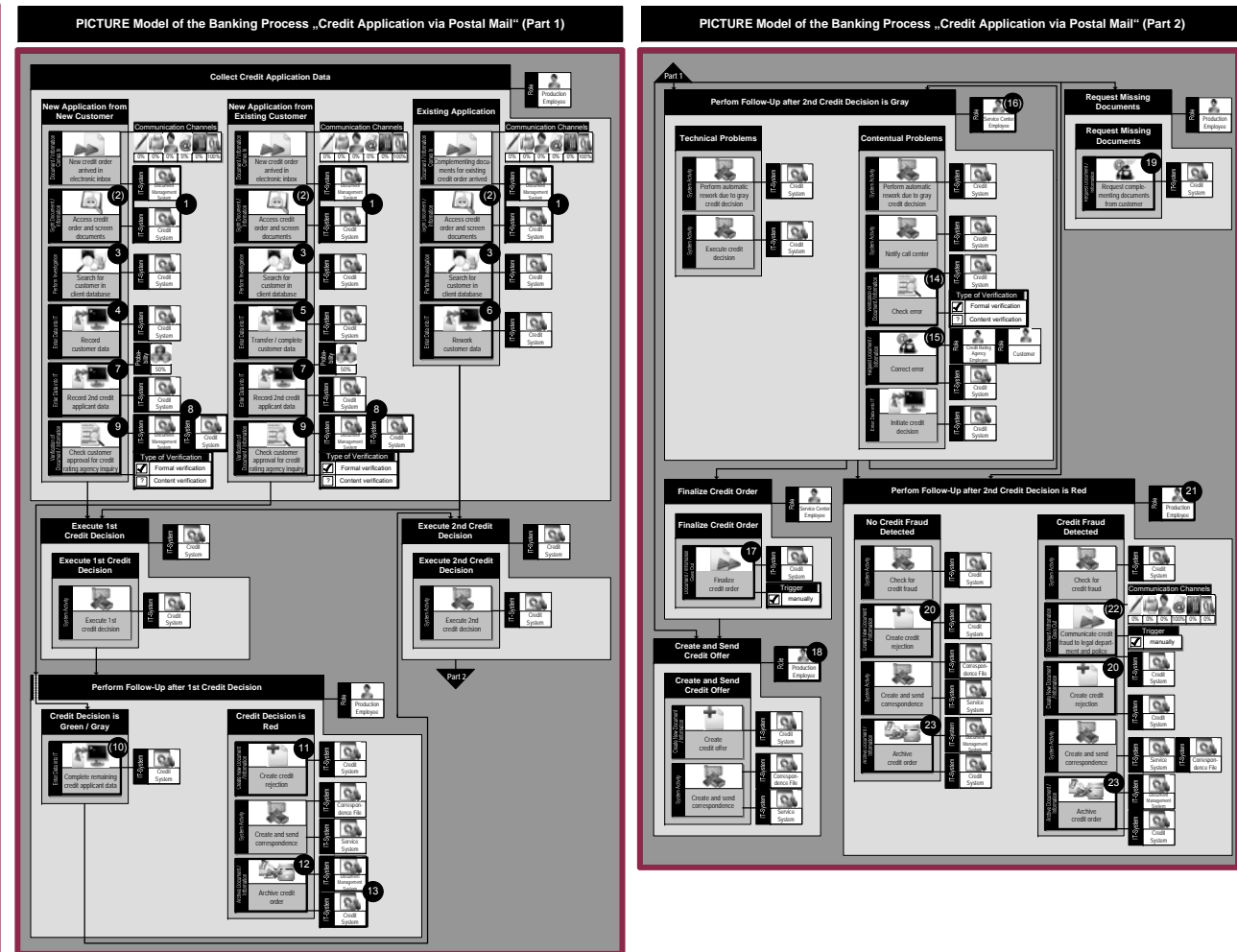


Business Process Modeling and Analysis in Banks

Demonstration: Results of Lab Experiment – Semantic BPML

Intermediate results of
Lab Experiment:

Process weakness analysis
with Semantic BPML is
manually and automatically
possible and less
time-consuming



Evaluation: Effectivity of Process Weakness Analysis

| Effectivity | | | Group A: “Manual EPC Analysis” | | | Group B: “Manual Semantic BPML Analysis” | | | Group C: “Automatic Semantic BPML Analysis” | | |
|--|--------------------------------|---|---------------------------------------|------------------|-------------------|--|------------------|-------------------|---|------------------|-------------------|
| Pattern Types | Weakness Types | Weakness Patterns | Detected “Potential” Weaknesses | Correct- ness | Complete- ness | Detected “Potential” Weaknesses | Correct- ness | Complete- ness | Detected “Potential” Weaknesses | Correct- ness | Complete- ness |
| Simple Patterns | Information Deficit | Request Document / Information | (15),19 | 50% | 100% | (15),19 | 50% | 100% | (15),19 | 50% | 100% |
| | | Perform Investigation | 3 | 100% | 100% | 3 | 100% | 100% | 3 | 100% | 100% |
| | Unnecessary Control Activities | Sight Document / Information | - | 100% | 100% | - | 100% | 100% | (2) | 0% | 100% |
| | | Enter Data into IT | (10) | 0% | 0% | 4,5,6,7,(10) | 80% | 100% | 4,5,6,7,(10) | 80% | 100% |
| | Automation Potential | Formal Verification of Document / Information | - | 100% | 0% | 9,(14) | 50% | 100% | 9,(14) | 50% | 100% |
| | | Archive Document / Information | 12/13,23 | 100% | 100% | 12/13,23 | 100% | 100% | 12/13,23 | 100% | 100% |
| | | Create New Document / Information | 11,20 | 100% | 100% | 11,20 | 100% | 100% | 11,20 | 100% | 100% |
| | | Document / Information Goes Out (triggered manually) | - | 100% | 100% | (22) | 0% | 100% | (22) | 0% | 100% |
| | | Document / Information Goes Out (not 100% electronically) | 17 | 100% | 100% | 17 | 100% | 100% | 17 | 100% | 100% |
| Complex Patterns | Organizational Breaks | Change in Executing Organizational Unit for Process | - | 100% | 0% | (16),18,21 | 67% | 100% | (16),18,21 | 67% | 100% |
| | Media Breaks | Two different IT systems in a process flow | 8 | 100% | 50% | 1 | 100% | 50% | 1,8 | 100% | 100% |
| Sum for Simple and Complex Patterns | | | 11= 9+(2) | 82% | 53% | 21= 17+(5) | 76% | 94% | 23= 17+(6) | 74% | 100% |
| Correctly + (Incorrectly) Detected Weaknesses for Simple Patterns | | | 10= 8+(2) | 80% | 62% | 17= 13+(4) | 76% | 100% | 17= 13+(4) | 76% | 100% |
| Correctly + (Incorrectly) Detected Weaknesses for Complex Patterns | | | 1= 1 | 100% | 25% | 4= 3+(1) | 75% | 75% | 6= 4+(2) | 67% | 100% |

Correctness: % of correctly identified weaknesses of detected “potential” weaknesses

Completeness: % of all “actual” weaknesses that were also detected

Detected “Potential” Weaknesses: The numbers correspond to the numbers from the potential weaknesses (results from phase 2a of the laboratory experiment) as depicted in the process models in Figures 6,7,8 and 9. Numbers in parentheses indicate detected weaknesses, which the bank did not see as actual weaknesses. Numbers without parentheses indicate detected weaknesses, which the bank did see as actual weaknesses.

Evaluation: Efficiency of Process Weakness Analysis ■

| Efficiency | | Phase 1: Individual Process Model Analysis | Average | Phase 2a: Group Consensus | Sum (of Phase 1 and Phase 2a) | Phase 3: Validation of Detected Weaknesses |
|--|---|--|-------------|---------------------------------|-------------------------------------|---|
| Group A: “Manual EPC Analysis” | Proband A (BPM Student) | 20:22 Min. | 20:29 Min. | 24:25 Min. | 44:54 Min. | |
| | Proband B (BPM Student) | 11:53 Min. | | | | |
| | Proband C (BPM Student) | 29:34 Min. | | | | |
| | Proband D (BPM Student) | 20:05 Min. | | | | |
| Group B: “Manual PICTURE Analysis” | Proband E (BPM Student) | 25:00 Min. | 26:20 Min. | 17:05 Min. | 43:25 Min. | |
| | Proband F (BPM Student) | 26:06 Min. | | | | |
| | Proband G (BPM Student) | 35:45 Min. | | | | |
| | Proband H (BPM Student) | 18:30 Min. | | | | |
| Group C: “Automatic PICTURE Analysis” | Proband I (BPM Research Assistant) | ~ 0:10 Min. | ~ 0:10 Min. | | ~ 0:10 Min. | |
| Group D: “Validators” | Proband J (Head of BPM Department of Bank) | | | | | ~ 60:00 Min. |
| | Proband K (Head of Production Department of Bank) | | | | | ~ 20:00 Min. |

Evaluation: Findings & Limitations ■

Evaluation:

Modeling:

- Identification of a stable set of building blocks for core banking processes
- Simple modeling due to the limited set of building block alternatives
- Fast modeling compared to traditional modeling

Analysis:

- Process models useful for analyzing IT investment decisions, for process comparisons, and for IT implementation analyses (esp. for WFMS and DMS because building blocks focus on information and document flows).
- Automatically identifying weaknesses in business processes possible

Limitations:

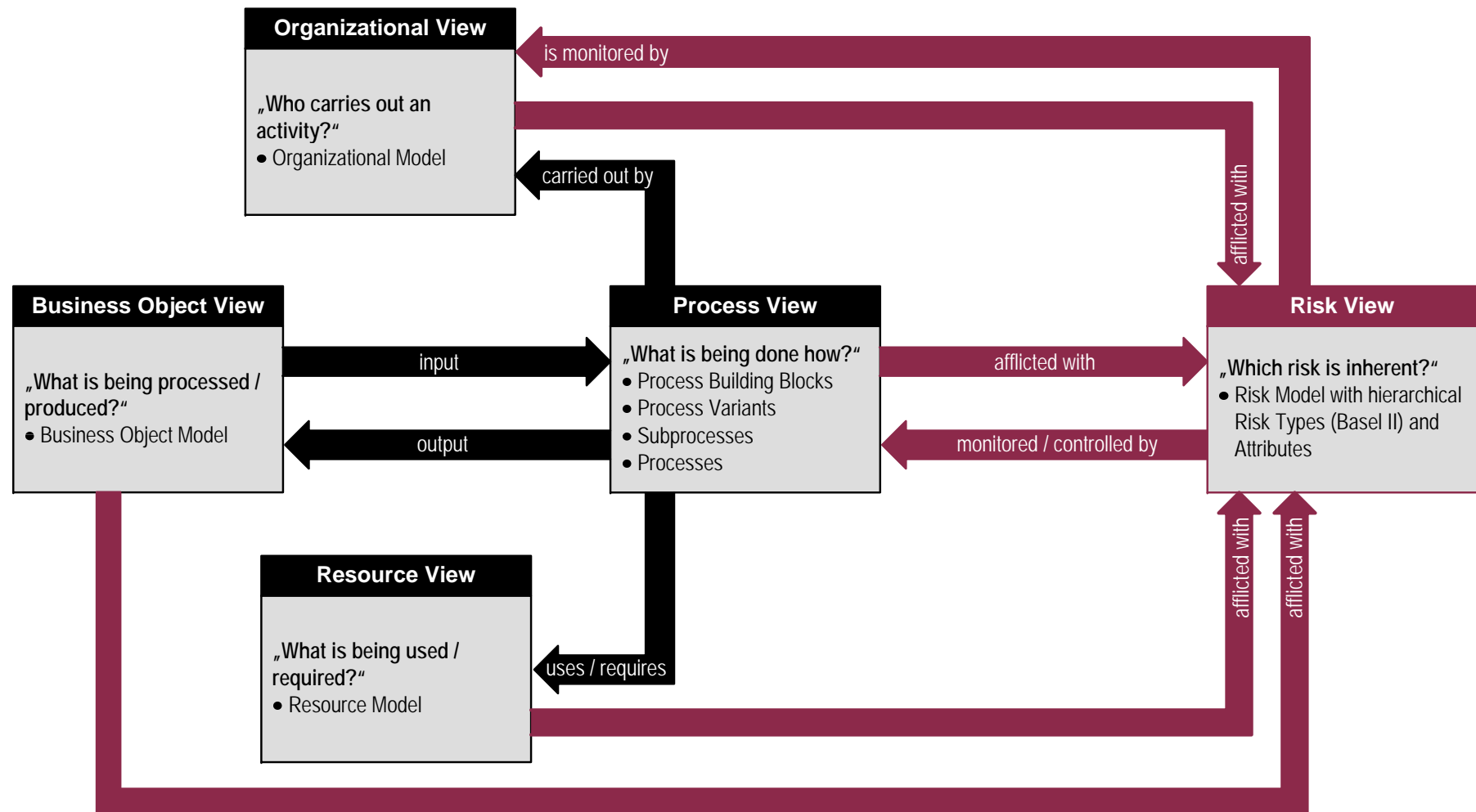
- SBPML method focuses on core banking processes (mainly “production banks”). Not yet proven in “sales banks” (upcoming case study this year) or “steering banks”.
- Typical (domain-neutral) supporting processes like HR, accounting, IT department etc. not tested for modeling

Business Process Modeling and Analysis

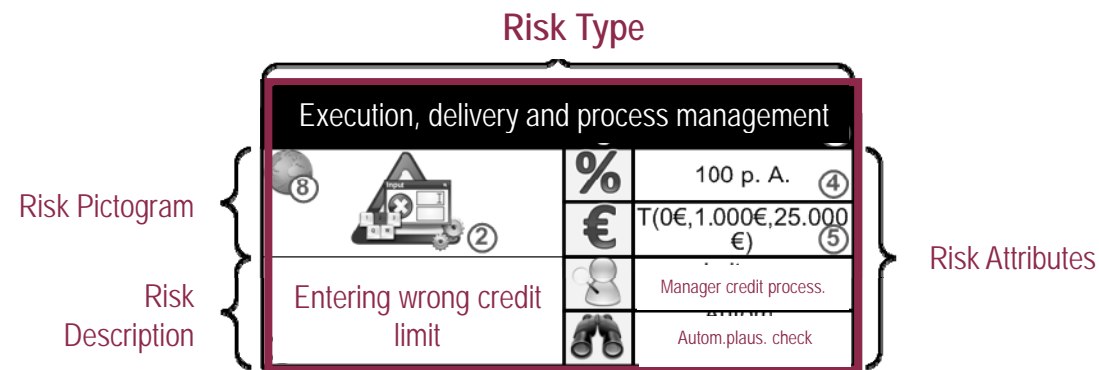
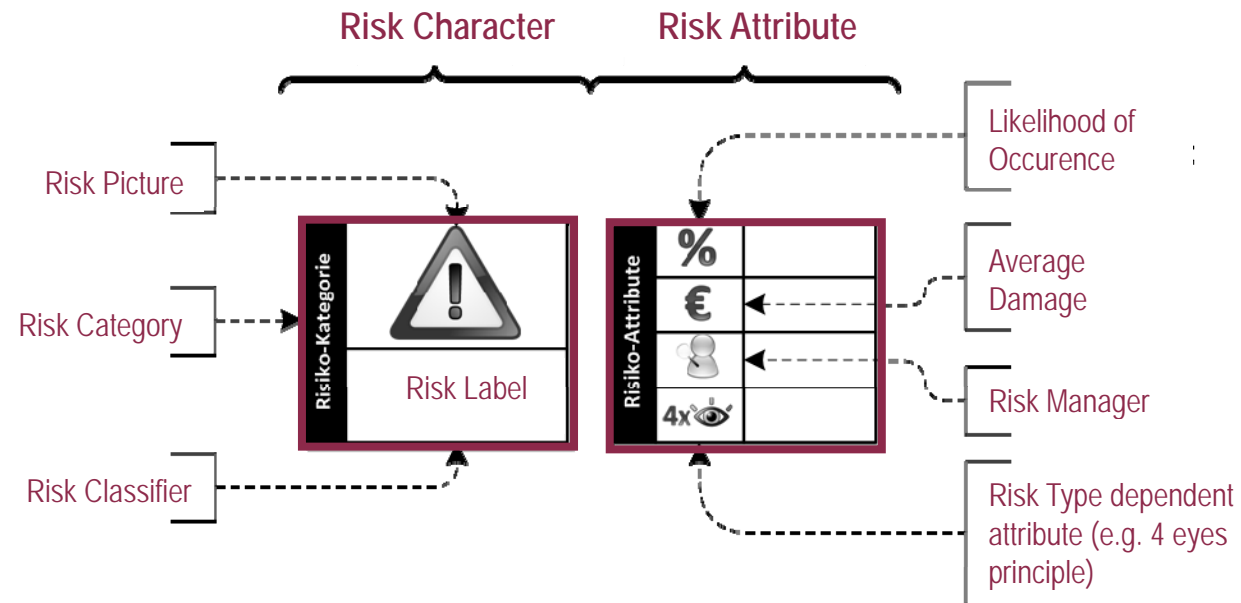
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6. Outlook



Integrating a Risk View into SBPML ■



Operational Risks Building Blocks and Attributes



Risk Type Annotation Related to Basel II Risk Categories ■

External fraudulent actions



Business objects (e.g. document falsification), activities, sub processes, processes, process landscapes

Internal fraudulent actions



Resources (job positions), activities, sub processes, processes, process landscapes

Business interruptions/ system failures



Resources (Systems: IT and communication), activities, sub processes, processes

| Level 1 Risk Type | Level 2 Risk Type |
|---|--|
| Internal Fraud | Unauthorized Activity |
| External Fraud | Theft and Fraud |
| | Systems Security |
| Employment Practices and Workplace Safety | Employee Relations |
| | Safe Environment |
| | Diversity & Discrimination |
| Clients, Products & Business Practices | Suitability, Disclosure & Fiduciary |
| | Improper Business or Market Practices |
| | Product Flaws |
| | Selection, Sponsorship & Exposure |
| | Advisory Activities |
| Damage to Physical Assets | Disasters and other Events |
| Business Disruption and System Failures | Systems |
| Execution, Delivery & Process Management | Transaction Capture, Execution & Maintenance |
| | Monitoring and Reporting |
| | Customer Intake and Documentation |
| | Customer / Client Account Management |
| | Trade Counterparties |
| | Vendors & Suppliers |

Safety in the workplace



Resources (job positions), activities, sub processes, processes, process landscapes

Material damage



Resources (systems, assets), activities, sub processes, processes, process landscapes

Customers, products, business conventions



Resources (job positions), process output, activities, external stakeholders (customers)

Execution, delivery, process management

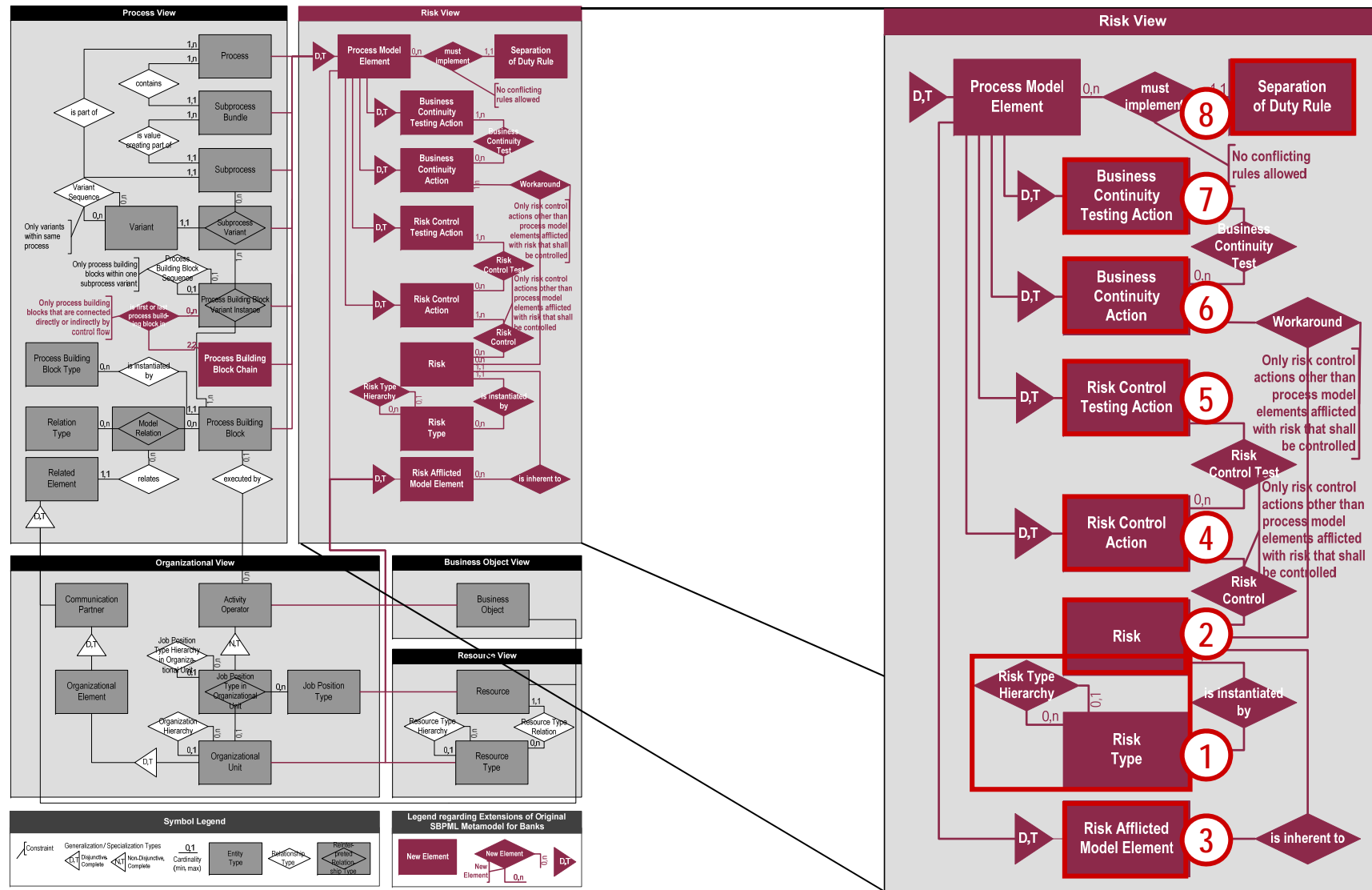


Activities, sub processes, processes, process landscapes, external stakeholders (suppliers, customers)

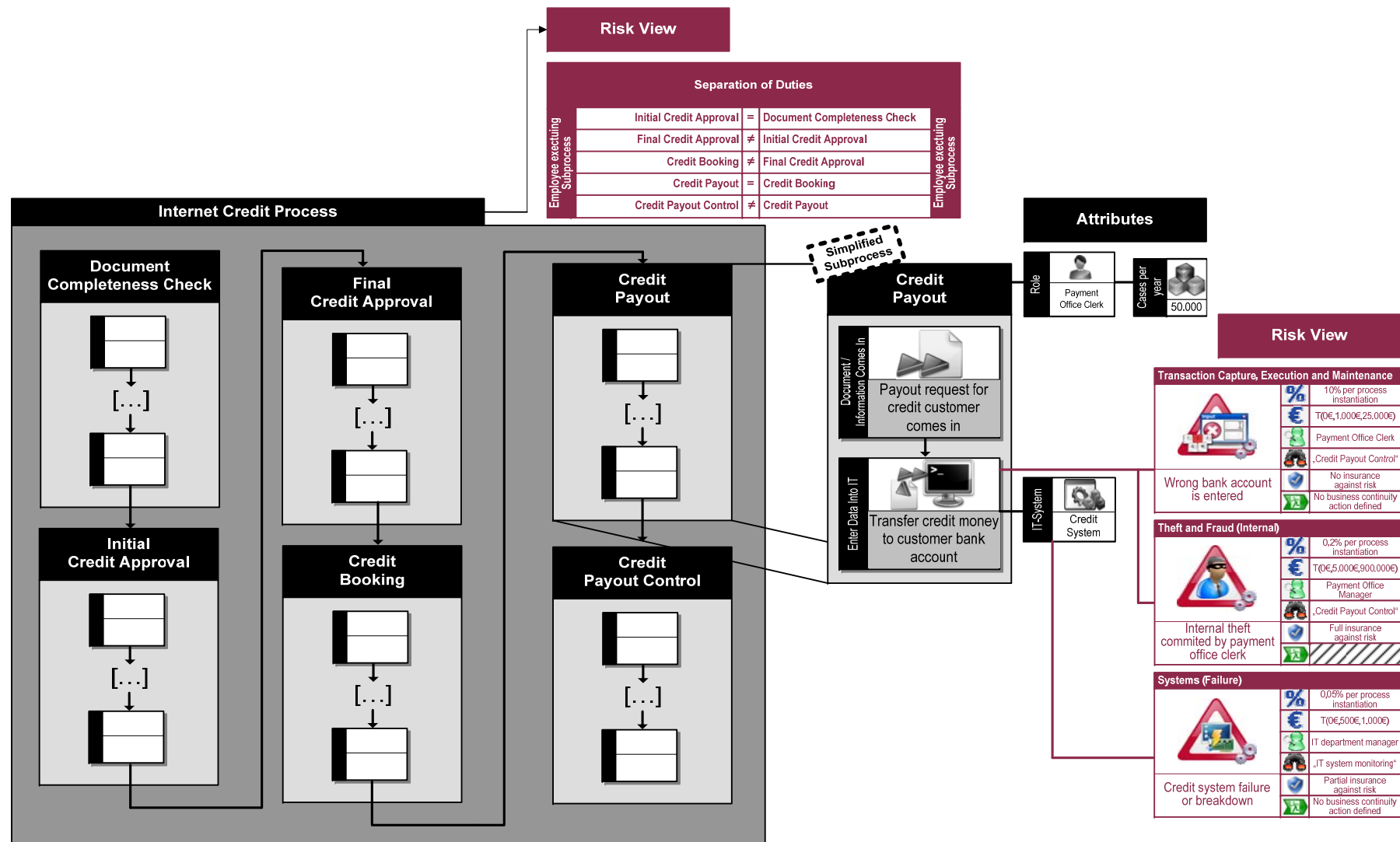
Relating Risk Types to SBPML Constructs

[illegible]

Extended Metamodel of SBPML with Operational Risk View

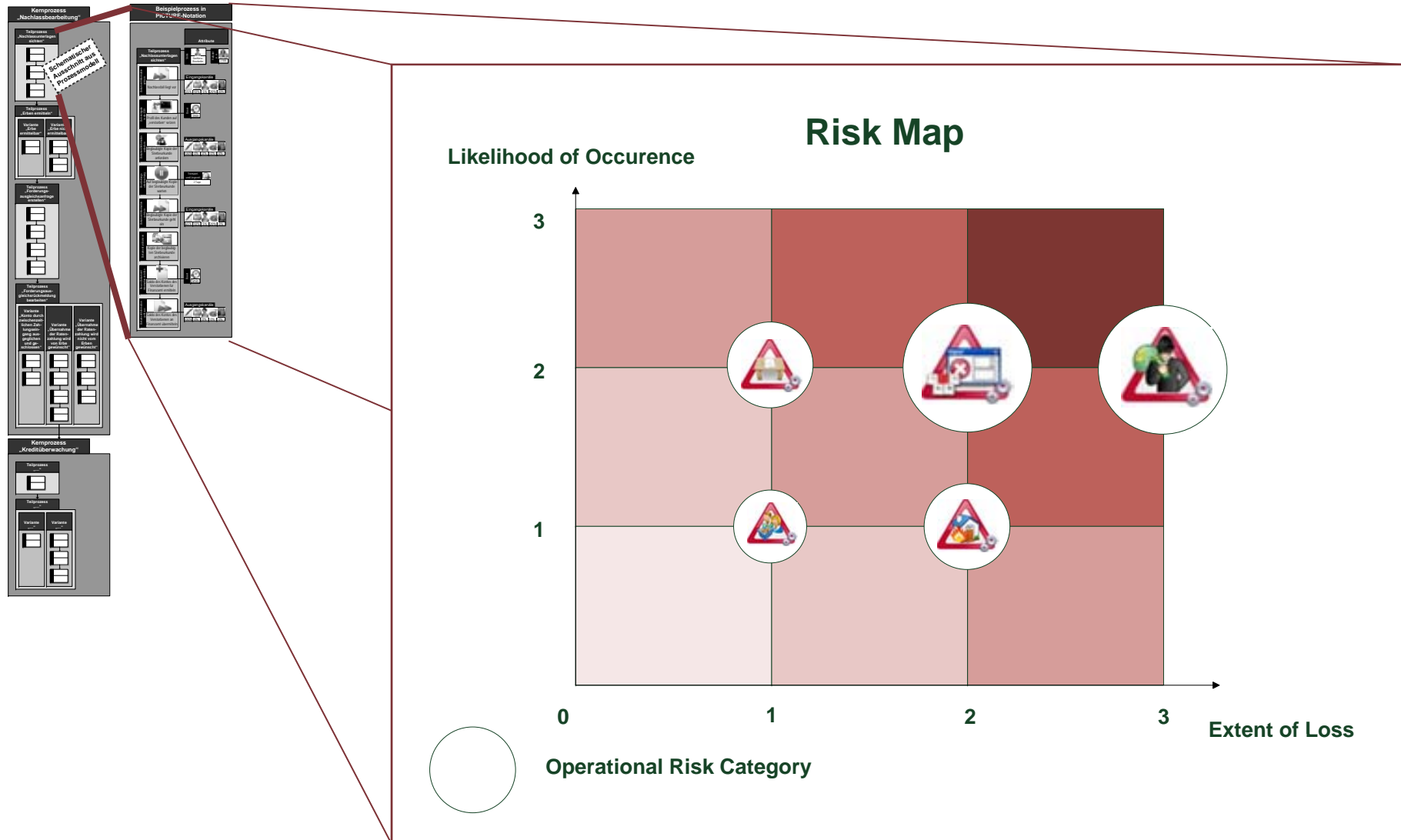


Operational Risk Modeling in Banks



Business Process Modeling and Analysis in Banks

Operational Risk Analysis in Banks ■

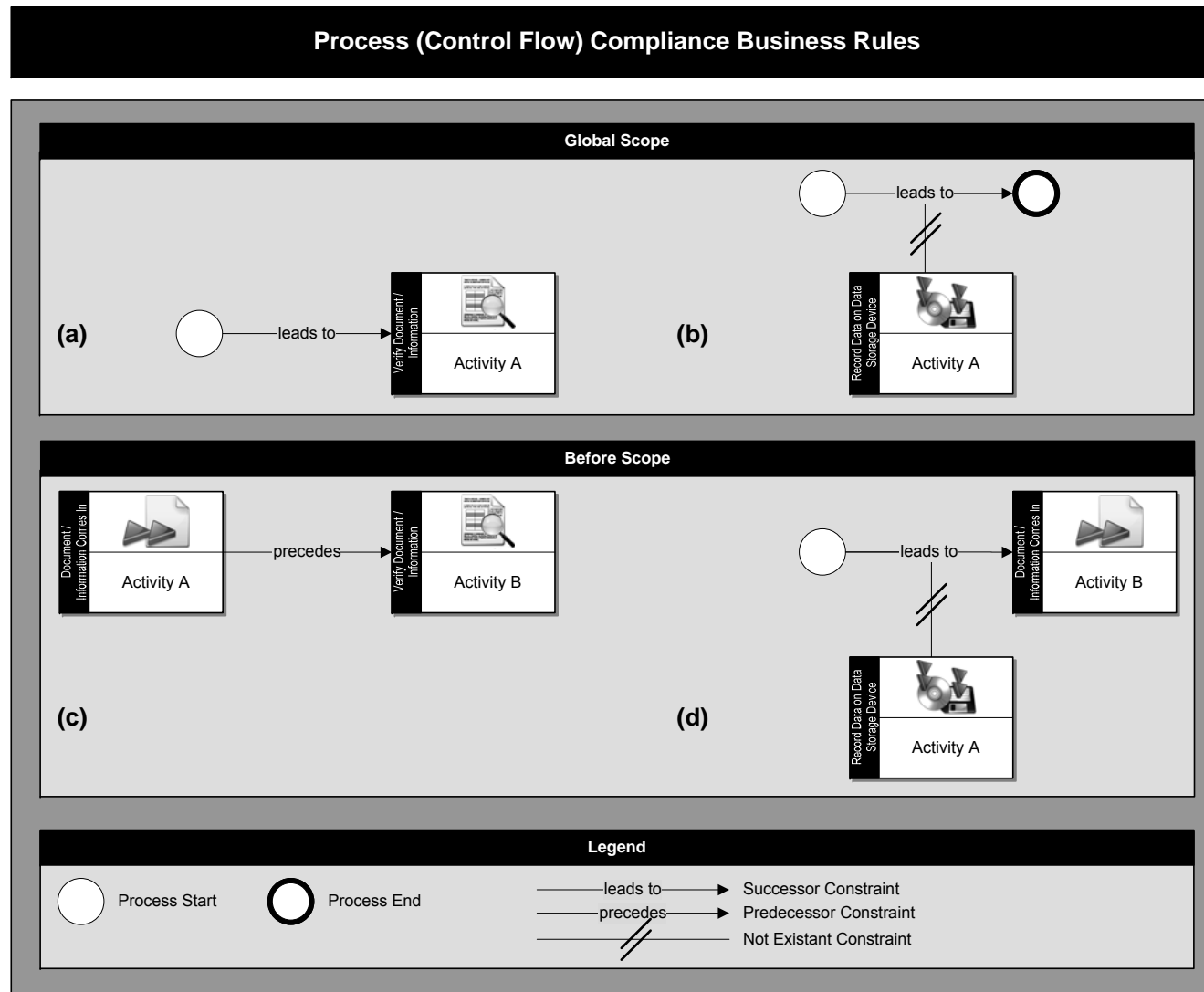


Business Process Modeling and Analysis

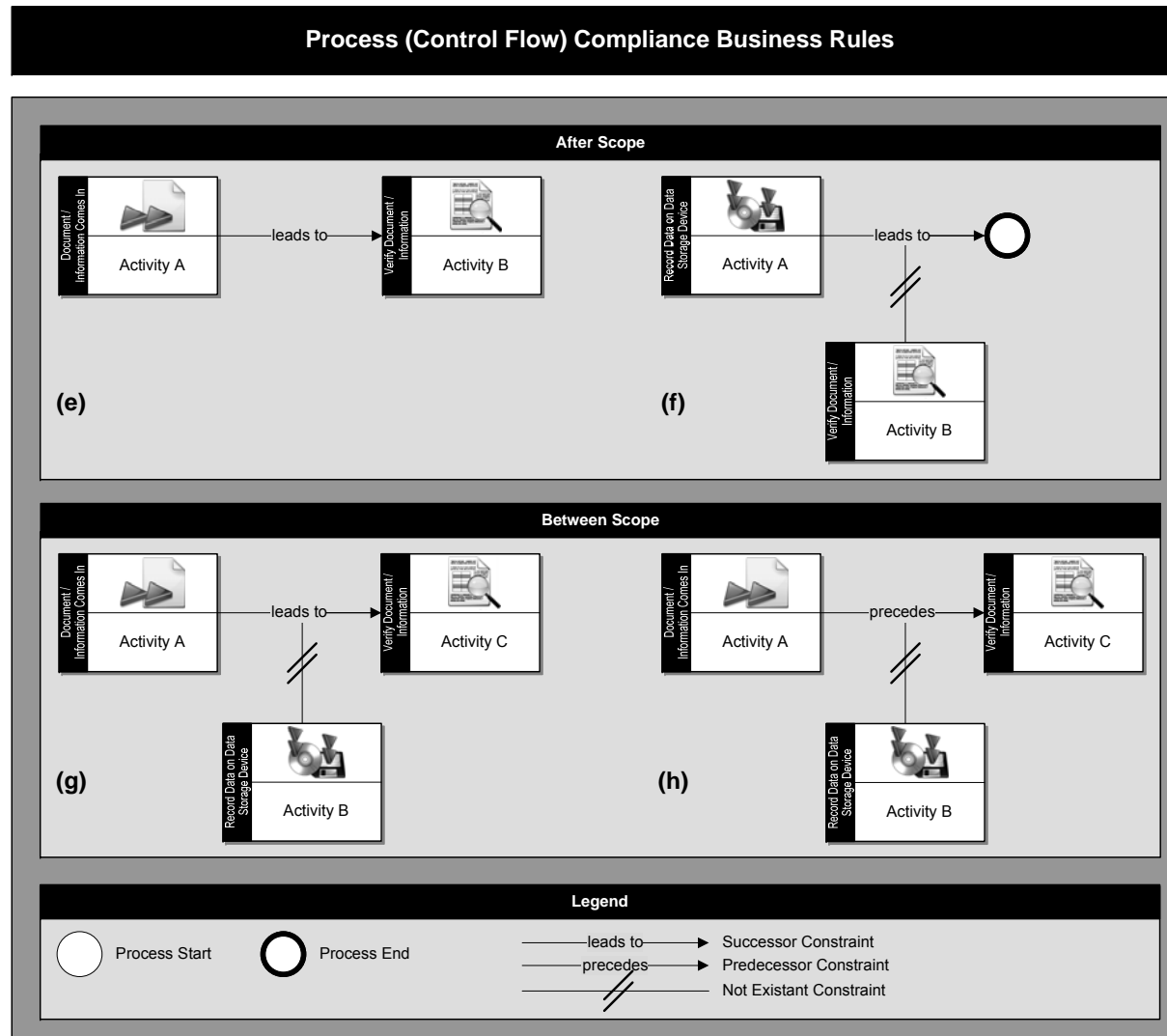
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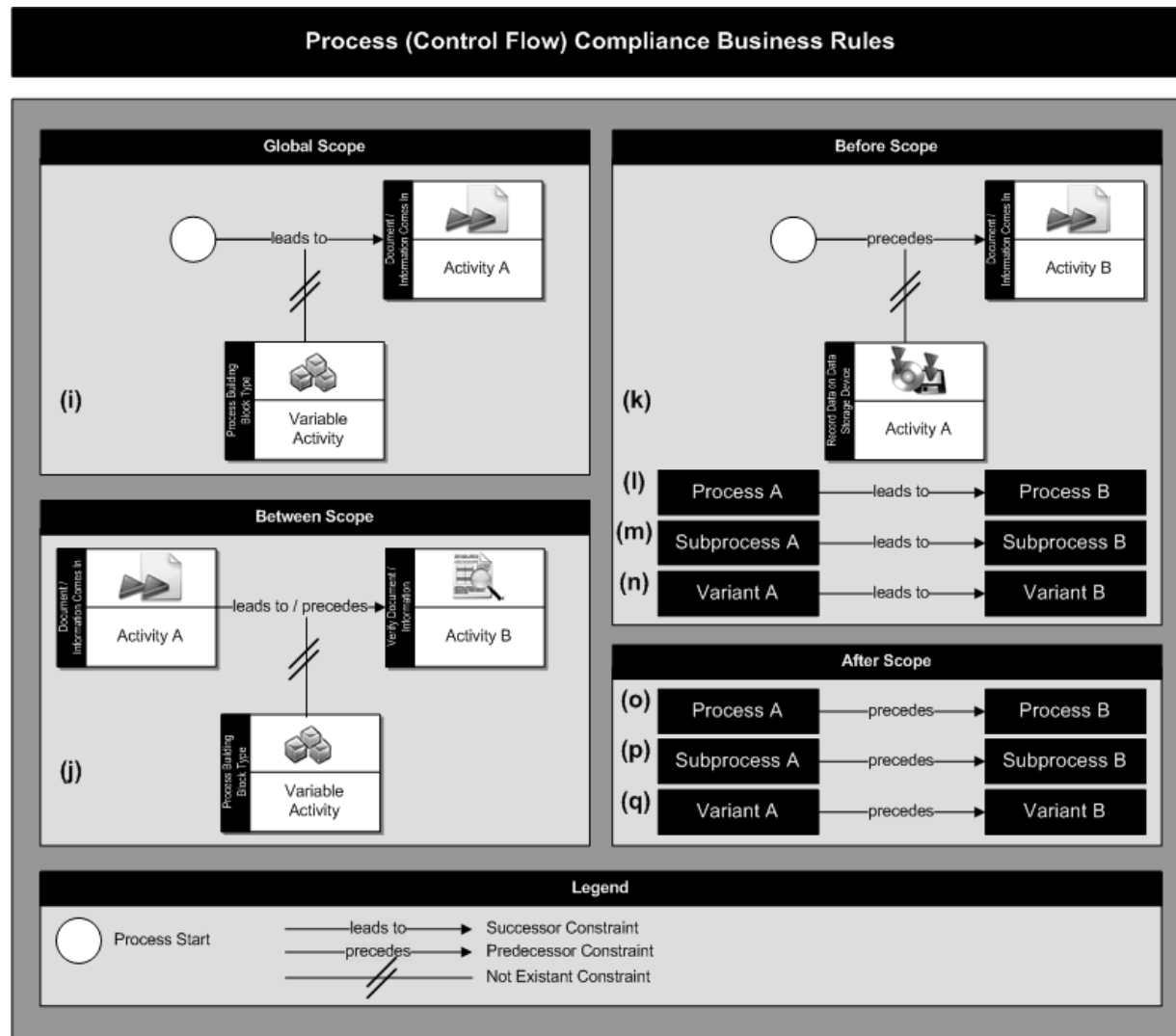
Control Flow Compliance Business Rules ■



Control Flow Compliance Business Rules ■

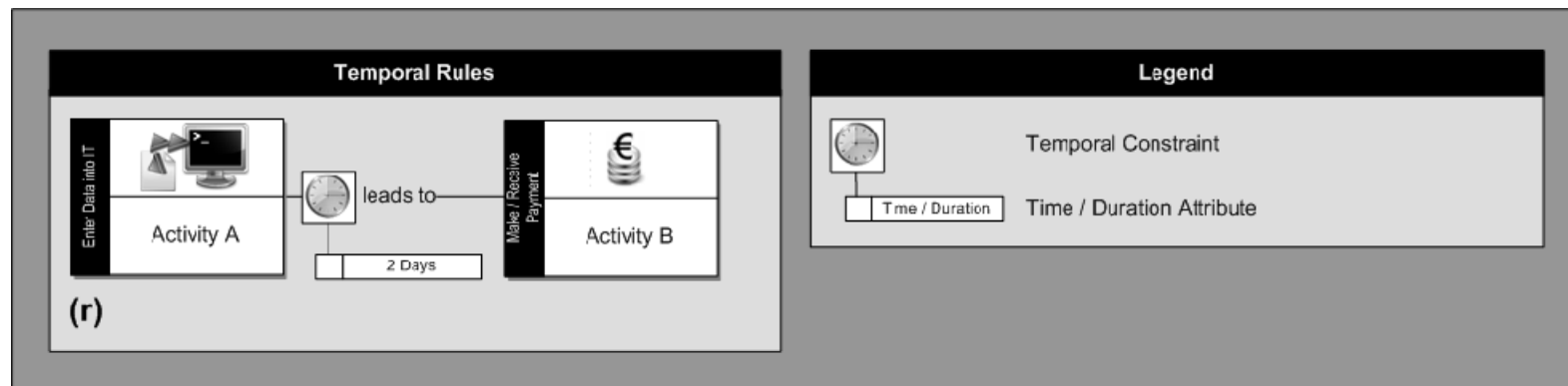


Control Flow Compliance Business Rules ■

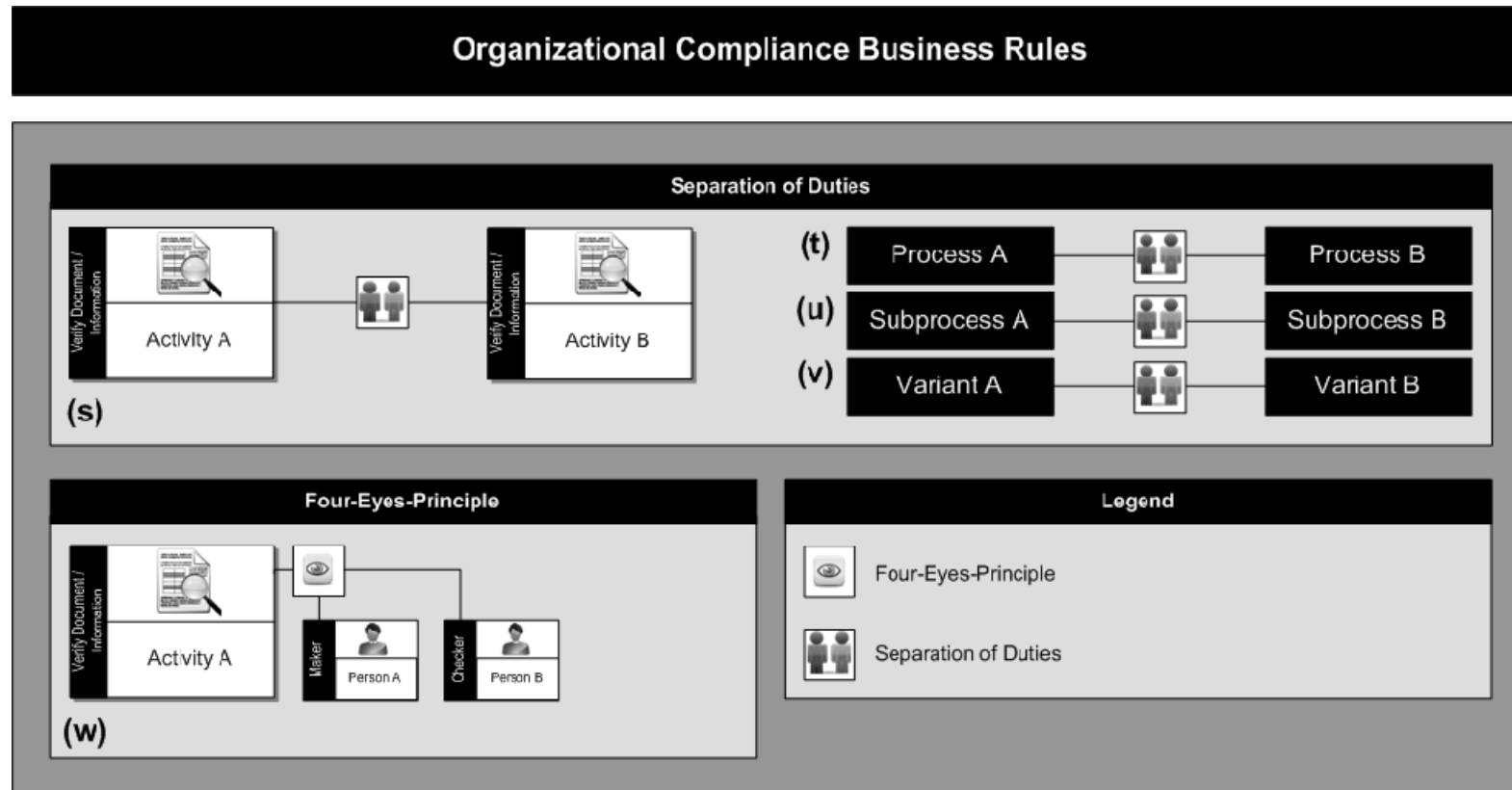


Temporal Compliance Business Rules ■

Process (Control Flow) Compliance Business Rules

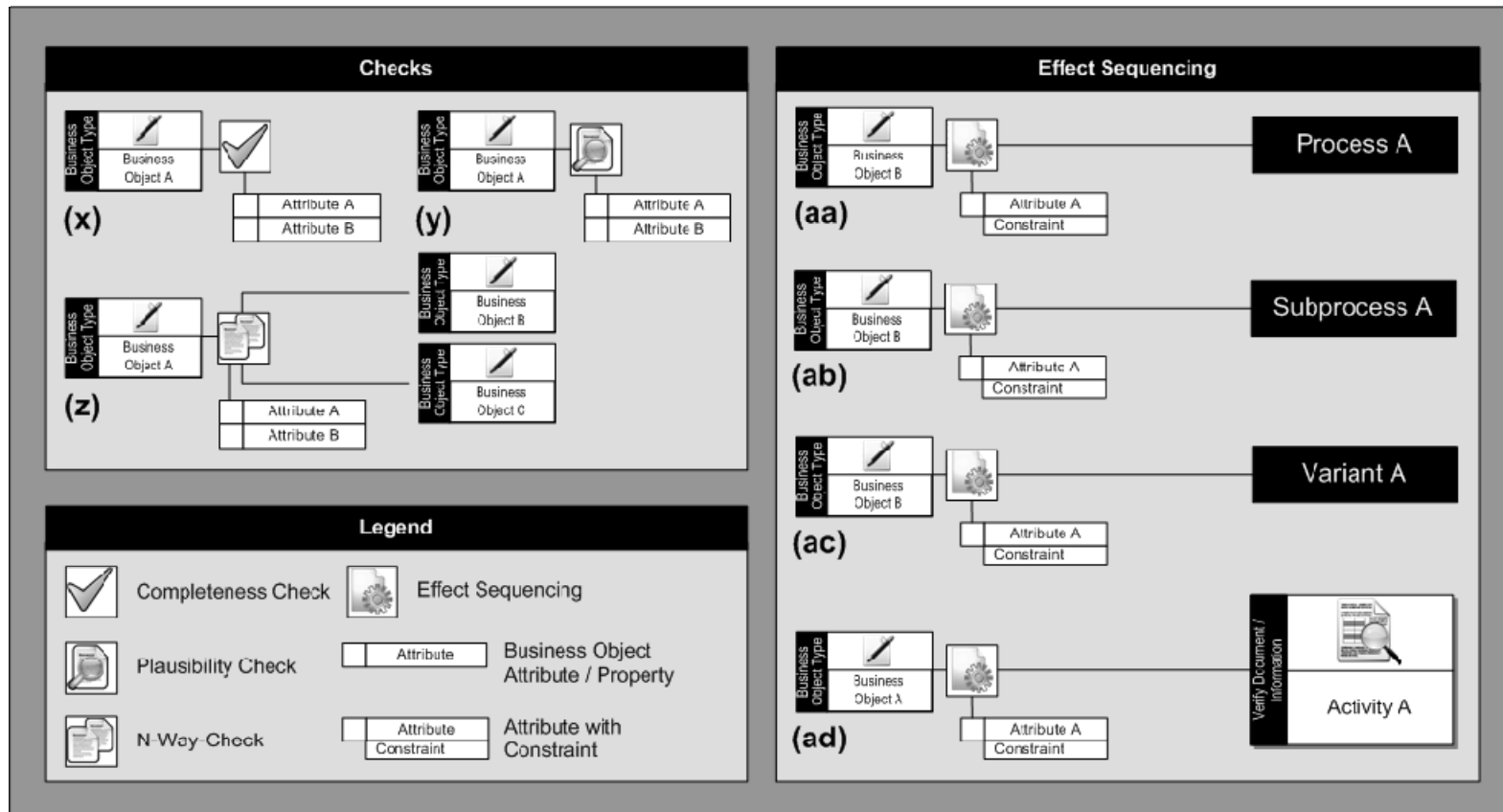


Organizational Compliance Business Rules ■

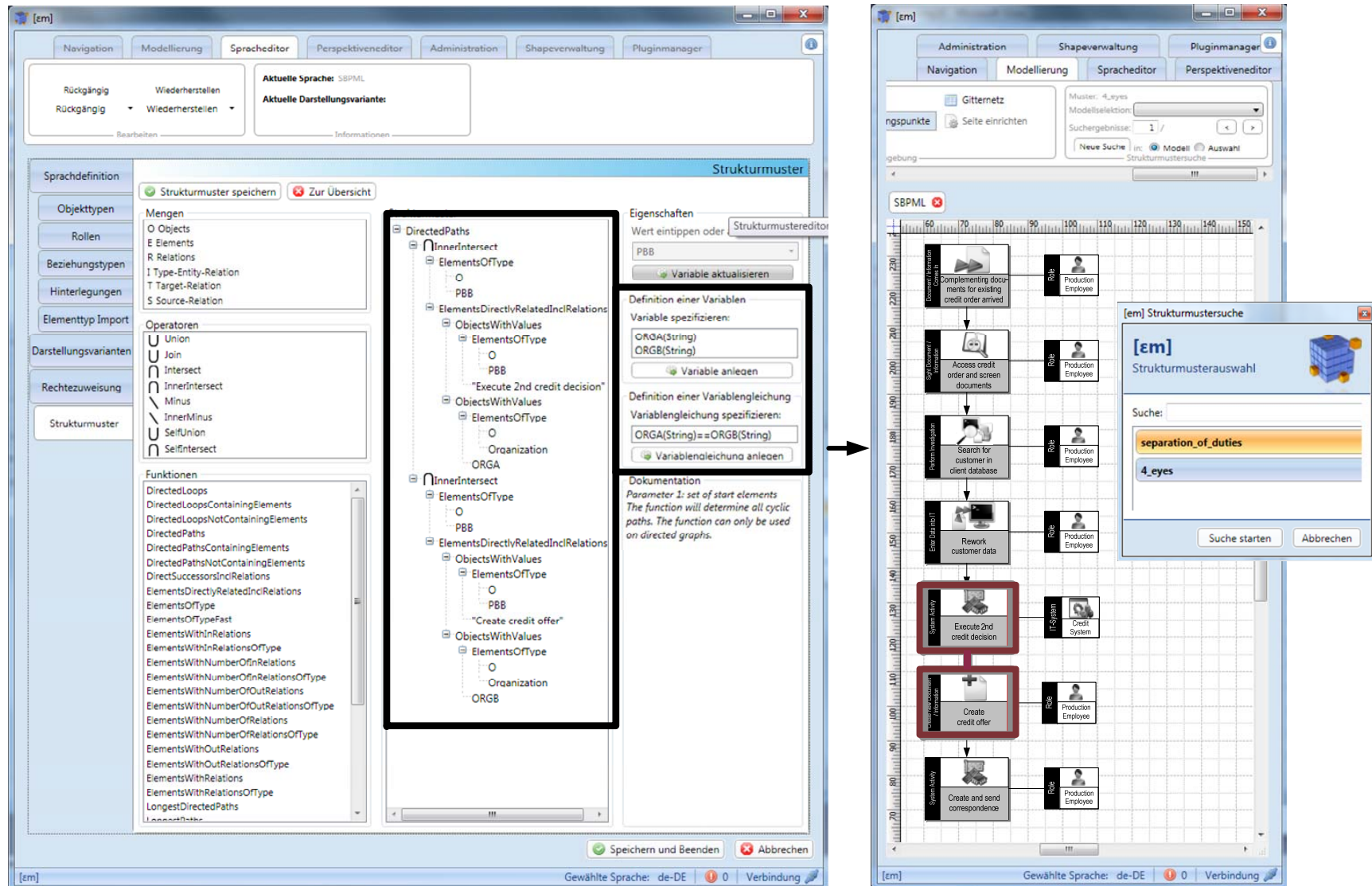


Organizational Compliance Business Rules

Business Object Compliance Business Rules



Tool-Support for Business Process Compliance Checks



Business Process Modeling and Analysis in Banks

Business Process Modeling and Analysis

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Contribution, Limitations and Outlook ■

BPM Study: contributed to research on status quo of BPM in banking sector through research study

Process Modeling: created and evaluated a purposeful semantic business process modeling language designed to the needs of the banking sector

Process Analysis: defined and evaluated a method to systematically and automatically identify process weaknesses in business process models using semantic patterns

Risk Modeling: created and evaluated a new approach to automatically analyze business process models using semantic patterns

Risk Analysis: suggested first operational risk analysis reports enabled by an integrated approach to BPM and operational risk management

Compliance Modeling: defined semantic business rules for process-oriented modeling of compliance-related business rules

Compliance Analysis: evaluated an IT artifact with regard to automatic evaluation of business process model compliance

Design Science Research Method: Validated the design science research methodology in a series of research projects to engineer purposeful artifacts for business process modeling and analysis

Contribution

Limitations & Outlook

BPM Study: limited number of banks and countries were analyzed

Process Modeling: limited types of banking processes analyzed and more financial services processes may be necessary for further refinement

Process Analysis: Semantic process weakness patterns are only first step, detailed catalogue needs to be made

Risk Modeling: approach is limited to modeling of operational risks in relation to Basel II

Risk Analysis: information need for risk analysis reports still needs to be explored

Compliance Modeling: business rules may not yet be complete and efficiency of modeling approach remains to be tested

Compliance Analysis: more processes with expert knowledge on compliance rules need to be evaluated

Engineering and Behavioural Research: Research coming from design science could inspire new theories on information modeling and analysis

Summing Up – Overview of Research Areas for Joint Research ■



Business Process Modeling and Analysis in Banks



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