

Compliance in BPM today - an insight into experts' views and industry challenges

Monika Kochanowski¹, Christoph Fehling², Falko Koetter³, Frank Leymann²,
Anette Weisbecker¹

¹ Fraunhofer Institute for Industrial Engineering
70569 Stuttgart, Germany
firstname.lastname@iao.fraunhofer.de

² Institute of Architecture of Application Systems
University of Stuttgart, 70569 Stuttgart, Germany
lastname@iaas.uni-stuttgart.de

³ Institute for Human Factors and Technology Management
University of Stuttgart, 70569 Stuttgart, Germany
falko.koetter@iat.uni-stuttgart.de

Abstract: Compliance has evolved into a mature research topic in business process management (BPM). However, most companies and BPM tool providers do not incorporate advanced methods from scientific research into their everyday life. This work gives an insight on the state in the industry based on expert interviews in companies and BPM tool provider companies. Based on this, the findings are condensed in challenges and research questions, showing the need for additional studies.

1 Introduction

Compliance is a current research topic in business process management (BPM). Examples include frameworks for overall compliance management in the complete lifecycle [TZH⁺12], methods for solving single issues with certain design time checks [SFG⁺11] [SLSW10], as well as monitoring for compliance exceptions [SLS10].

However, the state of the practice shows a different picture. Companies often have a heterogeneous environment and deal with compliance issues on distributed levels. First of all, IT compliance is managed by the IT department. Secondly, compliance to certain laws is ensured by lawyers, situated in the departments law, revision, or controlling. Thirdly, compliance in business processes is focused on risk management and internal control systems, which is required from recent legislation and a feature that BPM tools offer.

In earlier work [KKR⁺13], the details of the unification of compliance in various departments have been tackled from a technical view point. The compliance descriptor concept was introduced, which interlinks necessary artifacts on several levels - IT, business process, and law. However, this has not included details on experts' opinions and methodological derivations.

In this work, related work on the topic compliance and BPM is reviewed with a focus on industry studies in Germany. The main contributions are expert interviews in the industry in different departments and telephone interviews with BPM tool providers. Finally, a conclusion and an outlook are given.

2 Related work

The related work is structured it in (1) overall compliance management BPM concepts, (2) compliance in certain application areas like IT or certain types of processes, and (3) empirical research on the needs of compliance based on the finance industry in Germany.

2.1 Compliance management in BPM

In a model of a business process one verified aspect often considered for compliance is termination of the process and reachability of modeled activities [GB13]. More specific, compliance may be described as requirements that either have to be checked or state how activities have to be done [SAL⁺10]. Requirements may already be expressed as verifiable rules to ensure a well-structured and compliant data-flow and control-flow [SGL⁺11]. One approach to guide the implementation of reoccurring compliance requirements in business processes is the use of process fragments [SLM⁺10]. In order to maintain a manageable overview of such modeled processes and especially the included compliance aspects, user-specific views on processes may be defined [SLS10]. During runtime, the monitoring of such business process models may be ensured using the a priori defined rules [LRMKD11]. For the verification of compliance in business processes, many approaches rely on formal models to which the business process and described compliance rules are translated for a formal evaluation. In [AKM09], Reo - a channel-based coordination language - is used for compliance verification. [GV06] uses temporal deontic logic focusing on permission associated with activities of a business process, [Gov13] provides an abstract framework to model deontic notions. Temporal logic and model checking are used for compliance verification in [MMJ98], [ADW08], and [SFG⁺11]. The work [AJKL06] describes how the usage of workflow management systems and middleware can support compliance enforcement. Specific compliance functionalities across the entire BPM lifecycle are described in [CRRC11], whereas the problem how different interpretations of rules can be dealt with has been partly tackled in an technical approach [CRRC12].

2.2 Compliance in specific application areas

Aside from the generic compliance management in BPM, further approaches have been developed for specific application domains. If compliance shall be ensured for business processes modeled in BPMN, [GK07] and [SLSW10] propose suitable frameworks

		Disciplines			
		Compliance	IT provisioning	BPM	
Maturity	Fully automated	Model checking, CEP, ..	Model-driven approaches	Flexibility, Cross-company, ..	← State of research
	IT-supported	RMS, IT security, ..	SOA-based approaches	Workflow systems	← State of industry
	Manual	Audits, Reports, ..	Legacy systems	Manual processes	← State of industry

Figure 1: Compliance in research and industry

and BPMN modeling language extensions focusing on compliance. [LMX07] elaborates model checking techniques used for compliance verification in business processes expressed in BPEL. Regarding specific application domains, approaches can be found for handling compliance in service-oriented architectures (SOA) [DCD⁺09] and Cloud Computing [SLSW10] [BDA⁺10]. An overall model-driven approach for SOA is presented in [TZH⁺12].

2.3 Empirical studies on the state of compliance in industry

In the industry several companies, especially consulting companies, already conducted surveys on compliance. One is [Bea12], which discusses compliance management as an increasing challenge for insurance companies. Main findings include that process design will be part of the compliance task - products, services, processes, etc. have to be coordinated between compliance departments and operating departments. Main areas with focus on compliance are purchasing, law, and IT. Very interesting is that 93% of the participants mentioned that their compliance activities are not or only partly supported by IT. The authors follow that one of the main challenges in the future is to handle the multiple different compliance sources (international and national laws, code of conducts, etc.) and provide IT support thereof. It is seen as a challenge to monitor compliance in the process aspect as well. The authors state that control activities have to be automated in the future.

Another study discusses the compliance organization in insurance companies [BDO10]. One interesting aspect is that most reporting is done ad-hoc with 31%. One surprising aspect is that 53% state that the compliance functionality is not involved in any other company processes, which shows a lack of integration and communication between company departments. Only 11% state that other processes are involved, like risk management, and only 3% mention IT processes. The study states that compliance needs to be better integrated into business processes. The new edition of the survey in 2012 [BDO13] shows a very small improvement in the integration of compliance in the business processes. Additional potentials lie in a higher process efficiency and consolidation of compliance reports. The study [KPM13] shows that compliance management is seen as very important, not



Figure 2: Layers of compliance (similar to [Bea12])

only by large companies, but also by medium sized companies. The integration of business partners is also seen as a main topic.

Figure 1 gives a view on the maturity of compliance management and the underlying layers - IT and BPM - in industry and in state of research. Whereas companies - especially in insurance industry - still perform compliance management mostly manually and do not have overall workflow systems in place, the state of research is much more sophisticated.

3 Expert interviews: compliance in companies

The three conducted expert interviews were targeted at three different peer groups in the industry: compliance departments, IT departments, and BPM departments. This matches the compliance layers (see Figure 2). Compliance is a cross-department issue, and depending on the company organization, the goals of the different department do not have to match completely. In preparation of the three interviews, an interview guide has been created which has been applied in all three interviews in order structure the answers, containing 10 questions on compliance and 2 specifically targeted on unification and adaptation. Additionally, the event *compliance compact* in the finance industry has been visited to grasp the topics discussed there. The findings are then summarized at the end of this section.

3.1 Expert interview on compliance within an IT department

The interview took place in an IT department in a company (more than 1000 employees). The company acts as a service provider for other branches in the Finance industry in Germany. The software architecture decision is to provide a private cloud - departments can host services in the company's IT department. Because of the importance of the IT applications and the IT positioning of the company in the finance industry, several audits take place every year, checking for IT compliance. To ensure the success of these audits, the governance framework COBIT 4 [IT 07]. The employed method is pragmatic: based on a main auditor, COBIT is applied and checked. When other auditors are involved, the result of the compliance check based on this framework is presented. If different requirements persist, they are discussed with the main auditor and incorporated into the application of the governance framework.

Considering compliance in business processes, the challenge is to begin with the documentation of processes across the departments. Currently the documentation is done using

standard office software. One person in each department is responsible for compliance. In the future, a centralized BPM is the goal of the company. As long as no input is given from the operating departments, the IT department cannot support BPM compliance within the company. This is currently perceived as a bottom-up approach from the IT department for ensuring compliance in BPM.

The current main issues are the identification of the matching and valid compliance regulations. To change, search, and find such regulations is a challenge. Compliance is not strictly defined - the most important issue is to extract measurable metrics from laws and rules. Documentation of compliance is not clearly defined. However, the interview partner's opinion is that automated reporting functionality is necessary in the future. Compliance of partners should be monitored by the operating departments, which is difficult to fulfill when considering the complexity of ensuring compliance requirements from business processes to IT.

3.2 Expert interview on compliance within a BPM department

The interview took place in a BPM department in one of the largest German insurance companies. The company also operates in parts of Europe and has over 10.000 employees. The company employs the six sigma methodology [BMK00] for BPM. Currently, process controlling is done by sample analysis of single files which document the process outcome. The process management is decentralized. One important topic within process management is the risk management and internal control system within financial reporting. Because of the size of the company a risk landscape has evolved, which is adapted according to the size of the company. Basically, every decision in the process is perceived as a risk.

The goal in BPM is to have complete process documentation in near future. The compliance department is responsible for defining how certain processes have to be done, the revision department is involved in the coordination. A BPM tool is employed for modelling business processes and risks. However, adaptations according to law changes are done manually. In the future this is perceived as a challenge, as changes are becoming more frequent and compliance requirements are manifold. Automation is seen as a possible solution.

Main issues for BPM and compliance are the acceptance of the users and resources within the company. Currently it is difficult to prove the main benefits of how controls actually support the company business processes.

3.3 Expert interview on compliance within a compliance and law department

The interview took place in a compliance and law department in a large German insurance company with above 10.000 employees. The software architecture is legacy software. Compliance management concepts are subdivided into three levels: (1) conceptual, (2)

matching the requirements, and (3) checking the results of compliance management. Currently the company is stated on level (2). One open question is where compliance actually starts and ends - beginning from risk management, as well as ensuring compliance not only in main processes but also in support processes like the food processing within the insurance company.

The organization of compliance management is done within a compliance management circle in a taskforce across several insurance companies. Law monitoring is also done in this way - the insurance circle informs the participants about relevant future legislation. In compliance management, all business processes are included - especially bonds processes, but also credit and real estate processes. It is interesting that the regulation Solvency II [Ric09] has been postponed to take effect twice in the last year, showing how difficult ensuring compliance is and how the industry struggles with regulation.

The main issue from a compliance perspective is that many different regulations have to be considered. Additionally, it is difficult to check the compliance of several processes, especially in marketing and sales departments, when performed on an operating level. Many changes in laws also pose additional challenges, because the compliance documentation has to be kept up to date and adapted manually. New products cause many process changes, with an increase in the last years. It is difficult to extract measurable metrics for compliance. Automation will be needed - by the increase in laws and changes a manual handling is not possible anymore in the future.

3.4 Findings in talks at a compliance conference in the finance industry

Additionally an event called *compliance compact* was visited, where insurance, banks, and the finance industry in general meet to discuss current compliance issues, with about 40 participants. Several talks were held by stakeholders from the industries and their service providers. Topics relevant to BPM and compliance are listed below.

Compliance and sustainability: The topic of corporate sustainability and social responsibility was discussed. In Germany, sustainability is seen as part of process management and governance. The German sustainability codex [Rat14] offers regulations and metrics for measuring that. It is interesting that this is a mixture of compliance requirements - a traditional documentation issue - as well as monitoring requirements of ecological key performance indicators.

FATCA: The foreign account tax compliance act (FATCA) [Int] is an American law which basically forces international banks to check if their customers have to pay taxes in the United States. This poses a challenge for institutes all over the world. A special system for mining and classifying customer data can be employed to solve this task. Here it is shown how data mining and BPM compliance requirements interleave.

Sales codex for insurances [GDV]: Insurance companies work together with agents, which distribute insurances of different insurers. Checking compliance is difficult in both ways: On the one side, each insurance company would have to check all their agents for compliance to the sales codex. On the other hand, all agents have to be compliant to all applicable

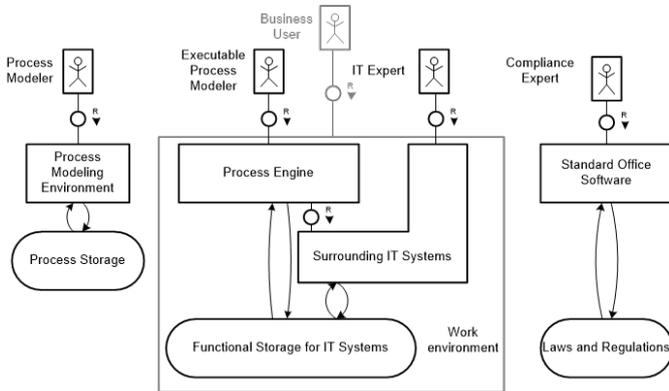


Figure 3: Current state of the architecture from experts' interviews

national and international laws and regulations as well as to the individual interpretations thereof.

Compliance software: Special compliance software can be used for managing regulations, document workflows, the quality management handbook, and process documentation in a revision safe way. The risk relevant decisions are documented. Altogether, compliance is basically brought together with document management processes.

Summarizing the above points, it shows that compliance in special application areas is discussed most, followed by the integration in IT and integrating partners. In individual discussions it showed that especially current law changes are most urgent. Depending on the stakeholder, the view is limited on their operating departments and their current problem. It is difficult to maintain and report compliance as well as to generate a documentation, as it has to be redone for every law / regulation. As many departments work isolated on some topics, coordination is difficult.

3.5 Summary of expert interviews in companies

According to the findings in the sections above, the current state of compliance management is segregated for each of the participating roles shown in Figure 3. The process modelers work mostly on their own, within a process modeling environment and a process storage depicted on the left of Figure 3. The compliance experts also work with their separate tools, mostly standard office software, generating compliance reports based on internal audits and single case analysis as seen on the right of Figure 3. Finally, the business user works within his work environment depending on functional IT systems, which can be enhanced by a process engine in some cases. The challenges from the interviews are summarized in Table 1.

A *unification concept* for bridging the gaps between different functions and IT systems within the company is not given. Further on, apart from round-trip BPM a *round-trip com-*

Table 1: Insights: Challenges in expert interviews, legend: ✓ mentioned

Expert interview	IT department	BPM department	Compliance department	Compliance conference
Communication and co-ordination across departments	✓	✓		✓ and partners
Increasing number of requirements and manual effort	✓		✓	✓
Identification of relevant laws and definition of measurable metrics	✓		✓	
Increasing number of changes and needed automation		✓	✓	✓
Other	Increasing number of audits	Acceptance of BPM in general	Compliance scope definition	Integration across systems

pliance management is needed, which interconnects the requirements and the measures taken. However, to generalize the findings, a much larger data set is needed in the future.

4 Expert interviews: compliance from a BPM tool provider point of view

4.1 Interviews with BPM tool providers on compliance

Compliance is a topic incorporated in many BPM tools. Currently, an internet research has shown that especially the topics of risk management and internal control system play an important role in the branch. Based on these findings, six BPM tool providers have been informally interviewed with an interview guideline containing seven questions in short telephone conferences in order to evaluate the importance of the topic and the willingness to give in-depth information in a further study.

Interview 1 The tool provider is very interested and sees an important topic in compliance in BPM. It is possible to design risk models and add risks to process tasks in the tools. In process execution, check tasks are triggered. However, no monitoring is included, but the tool provider counts on that development in the future. The most important industry branches for compliance are the finance and life science industry.

Interview 2 Another tool provider is focused on process execution. Compliance is ensured

by providing a business rule management framework, which works on data extracted from processes. The current process execution is not interlinked with compliance tools. The hosting of the processes is decided on a case by case basis.

Interview 3 The third tool provider claims to have a full compliance support. Included are reporting features as well as conformity to several governance frameworks and guidelines. Process lifecycle support is also given. However, the details of this statements have to be evaluated in the following.

Interview 4 The fourth tool provider has a model-driven compliance methodology. Risks and controls are mapped to process steps and can be analyzed in a list export. The documentation is based on quality criteria. The method consists of creating documentation, extracting it to workflow layer, add controls, and check these controls within control goals. Periodic assessments are done within the internal control system. Measures are extracted if the controls are not adequate or not effective. The company sees compliance and quality management as interleaved. Additionally versioning and tracking of changes are part of their solution. Compliance is seen as a lever for BPM in companies.

Interview 5 The next provider also offers a process platform, consisting of 12 single products like BPM tools, document management systems, etc. Additionally risk management and revision management is done. Internal control systems can be introduced together with the BPM tool. Risk management is focused on risk reporting for centralized management. Additionally question catalogues can be created to add risks to a process in a structured way. They are evaluated qualitatively and quantitatively. The analysis and documentation as well as measures are documented. Life science is seen as main industry, but finance industry is developing fast, especially in the field of risk management.

Interview 6 The last provider uses a workflow engine to support compliance and process management activities, but not for execution. However, internal control system activities will be in the product in the future. Risk management is included, as well as version management and revision management. Reporting is supported based on the results mentioned above. Main branches are finance and government. Quality management will be integrated. The process execution environment from a partner provider can be integrated, providing additional monitoring technology.

4.2 Summary and arising research questions for future BPM study

Preliminary insights are summarized in Table 2, but a structured BPM tool study is needed in the future. The limitations of the telephone interviews include the small sample size as well as the short interview duration. The research questions for a future study are:

What is the current understanding of *compliance* within BPM tools? Which are the current main features of compliance management supported by the tools ? How does compliance management in BPM tools integrate with document management, revision management, quality management, and IT governance? Which features will be needed by the customers in the future? How is the future development towards compliance monitoring seen by the BPM tool providers within the context of complete process lifecycle support?

Table 2: Insights: BPM tools and compliance features and industries, legend: ✓ explicitly mentioned as included, - explicitly not included, else: no information

Tool Provider	1	2	3	4	5	6
Risk management	✓	-		✓	✓	✓
Quality management				✓		
Revision management			✓	✓	✓	✓
Reporting			✓	✓	✓	✓
Internal control system	✓	-		✓	✓	✓
Finance industry focus	✓	-		✓	✓	✓
Life science industry focus	✓	-		✓	✓	-

5 Conclusion and outlook

In this paper the topic of compliance and BPM has been tackled from three different sides: (1) Literature research in related work, (2) the view on compliance management has been accessed in interviews with company employees in different departments, considering IT, business processes, and law, and (3) the view on compliance management by BPM tool providers, which have been contacted in telephone interviews. It has been shown that a gap between industry and current research persists. An important step would be to generalize the answers based on a larger data set. The small sample size of the interviews and the broad answers show that it is necessary to perform a larger survey with a structured questionnaire. In future work, a study of BPM tool providers will be conducted. It will also give an insight into the compliance needs of BPM customers in the future. The findings will serve as a basis for further developments based on recent research of the authors.

Acknowledgements

The work published in this article was funded by the Co.M.B. project of the Deutsche Forschungsgemeinschaft (DFG) under the promotional reference SP 448/27-1. The authors would like to thank all interview partners.

References

- [ADW08] Ahmed Awad, Gero Decker, and Mathias Weske. Efficient compliance checking using bpmn-q and temporal logic. In *Business Process Management*, pages 326–341. Springer, 2008.
- [AJKL06] R. Agrawal, C. Johnson, J. Kiernan, and F. Leymann. Taming Compliance with Sarbanes-Oxley Internal Controls Using Database Technology. In *22nd International*

Conference on Data Engineering (ICDE'06), pages 92–92, Atlanta, 2006. IEEE.

- [AKM09] Farhad Arbab, Natallia Kokash, and Sun Meng. Towards using reo for compliance-aware business process modeling. In *Leveraging Applications of Formal Methods, Verification and Validation*, pages 108–123. Springer, 2009.
- [BDA⁺10] Ivona Brandic, Schahram Dustdar, Tobias Anstett, David Schumm, Frank Leymann, and Ralf Konrad. Compliant cloud computing (c3): Architecture and language support for user-driven compliance management in clouds. In *Cloud Computing (CLOUD), 2010 IEEE 3rd International Conference on*, pages 244–251. IEEE, 2010.
- [BDO10] BDO AG Wirtschaftsprüfungsgesellschaft. Compliance Survey bei Versicherungen, 2010.
- [BDO13] BDO AG Wirtschaftsprüfungsgesellschaft. Compliance Studie bei Versicherungen, 2013.
- [Bea12] BearingPoint GmbH. Agenda 2015 : Compliance Management als stetig wachsende Herausforderung für Versicherungen, 2012.
- [BMK00] Bo Bergman, Kjell Magnusson, and Dag Kroslid. *Six Sigma: The Pragmatic Approach*. Studentlitteratur, Lund (Schweden), 2000.
- [CRRC11] Cristina Cabanillas, Manuel Resinas, and Antonio Ruiz-Corts. Exploring Features of a Full-Coverage Integrated Solution for Business Process Compliance. In *Advanced Information Systems Engineering Workshops*, volume 83 of *Lecture Notes in Business Information Processing*, pages 218–227. Springer Berlin Heidelberg, 2011.
- [CRRC12] Cristina Cabanillas, Manuel Resinas, and Antonio Ruiz-Corts. Introducing a Mashup-Based Approach for Design-Time Compliance Checking in Business Processes. In *Advanced Information Systems Engineering Workshops*, volume 112 of *Lecture Notes in Business Information Processing*, pages 337–350. Springer Berlin Heidelberg, 2012.
- [DCD⁺09] Florian Daniel, Fabio Casati, Vincenzo D’Andrea, Emmanuel Mulo, Uwe Zdun, Schahram Dustdar, Steve Strauch, David Schumm, Frank Leymann, Samir Sebahi, et al. Business compliance governance in service-oriented architectures. In *Advanced Information Networking and Applications, 2009. AINA’09. International Conference on*, pages 113–120. IEEE, 2009.
- [GB13] Heerko Groefsema and Doina Bucur. A survey of formal business process verification: from soundness to variability. In *Proceedings of International Symposium on Business Modeling and Software Design (BMSD)*, 2013.
- [GDV] GDV e.V. Verhaltenskodex für den Vertrieb.
- [GK07] Aditya Ghose and George Koliadis. Auditing business process compliance. In *Service-Oriented Computing–ICSOC 2007*, pages 169–180. Springer, 2007.
- [Gov13] Guido Governatori. Business Process Compliance: An Abstract Normative Framework. *it - Information Technology*, 55(6):231–238, 2013.
- [GV06] Stijn Goedertier and Jan Vanthienen. Designing compliant business processes with obligations and permissions. In *Business Process Management Workshops*, pages 5–14. Springer, 2006.
- [Int] Internal Revenue Service. Foreign Account Tax Compliance Act.

- [IT 07] IT Governance Institute. *COBIT 4.1: Framework, Control Objectives, Management Guidelines, Maturity Models*. IT Governance Institute, Rolling Meadows (USA), 2007.
- [KKR⁺13] Falko Koetter, Monika Kochanowski, Thomas Renner, Christoph Fehling, and Frank Leymann. Unifying Compliance Management in Adaptive Environments through Variability Descriptors (Short Paper). In *SOCA 2013, IEEE 6th International Conference on*, pages 214–219. IEEE, December 2013.
- [KPM13] KPMG AG Wirtschaftsprüfungsgesellschaft. Analyse des aktuellen Stands der Ausgestaltung von Compliance Management- Systemen in deutschen Unternehmen, 2013.
- [LMX07] Ying Liu, Samuel Muller, and Ke Xu. A static compliance-checking framework for business process models. *IBM Systems Journal*, 46(2):335–361, 2007.
- [LRMKD11] Linh Thao Ly, Stefanie Rinderle-Ma, David Knuplesch, and Peter Dadam. Monitoring business process compliance using compliance rule graphs. In *On the Move to Meaningful Internet Systems: OTM 2011*, pages 82–99. Springer, 2011.
- [MMJ98] S Mauw, R Mateescu, and W Janssen. Verifying business processes using SPIN. In *Proceedings of the International SPIN Workshop*, pages 21–36, 1998.
- [Rat14] Rat für Nachhaltige Entwicklung. Der Deutsche Nachhaltigkeitskodex, 2014.
- [Ric09] Richtlinie Solvabilität II. Richtlinie 2009/138/EG des europäischen Parlaments und des Rates vom 25. November 2009 betreffend die Aufnahme und Ausübung der Versicherungs- und der Rückversicherungstätigkeit, 2009.
- [SAL⁺10] David Schumm, Tobias Anstett, Frank Leymann, Daniel Schleicher, and Steve Strauch. Essential Aspects of Compliance Management with Focus on Business Process Automation. In *ISSS/BPSC*, pages 127–138, 2010.
- [SFG⁺11] Daniel Schleicher, Christoph Fehling, Stefan Grohe, Frank Leymann, Alexander Nowak, Patrick Schneider, and David Schumm. Compliance domains: A means to model data-restrictions in cloud environments. In *Enterprise Distributed Object Computing Conference (EDOC), 2011 15th IEEE International*, pages 257–266. IEEE, 2011.
- [SGL⁺11] Daniel Schleicher, Stefan Grohe, Frank Leymann, Patrick Schneider, David Schumm, and Tamara Wolf. An approach to combine data-related and control-flow-related compliance rules. In *SOCA 2011, IEEE International Conference on*, pages 1–8. IEEE, 2011.
- [SLM⁺10] David Schumm, Frank Leymann, Zhilei Ma, Thorsten Scheibler, and Steve Strauch. Integrating compliance into business processes. *Multikonferenz Wirtschaftsinformatik 2010*, page 421, 2010.
- [SLS10] David Schumm, Frank Leymann, and Alexander Streule. Process views to support compliance management in business processes. In *E-Commerce and Web Technologies*, pages 131–142. Springer, 2010.
- [SLSW10] Daniel Schleicher, Frank Leymann, David Schumm, and Monika Weidmann. Compliance scopes: Extending the BPMN 2.0 meta model to specify compliance requirements. In *SOCA 2010, IEEE International Conference on*, pages 1–8. IEEE, 2010.
- [TZH⁺12] Huy Tran, Uwe Zdun, Taâid Holmes, Ernst Oberortner, Emmanuel Mulo, and Schahram Dustdar. Compliance in service-oriented architectures: A model-driven and view-based approach. *Information and Software Technology*, 54(6):531–552, 2012.