MODELING AND VISUALIZATION IN LAW: PAST, PRESENT AND FUTURE

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Keywords: ***Future Trends, Conceptual Modeling, Visualization, Legal Design, Contract Design, Delphi Study, Literature Review***

Abstract: *Communication between legal experts and laypersons takes place in many contexts related to law: contracts, for example. Visualization can support the communication and mitigate its barriers. In the field of legal visualization different approaches have been discussed, but a common language and standards are missing. This paper aims to identify the status quo of existing approaches and determine directions for the future. It is based on a literature review on IRIS proceedings (1998–2016) to identify the trajectory of the field and a Delphi study to derive trends for research and practice.*

1. Introduction

Conceptual models and visualizations aim to support the creation of a common ground for communication [Kung/Solvberg 1986]. Law, in particular, needs a common ground because the meaning of law should be accessible to those who use it or are impacted by it [Curtotti 2016]. Thus, the interest in visual elements such as diagrams and icons has increased [Berger-Walliser/Barton/Haapio 2017]. Nowadays, visualizations can be found in places where they did not exist a few years ago, such as textbooks, deal documents and legal education materials. However, sets of consistent diagram constructs (e.g. symbols) and guidelines (e.g. how to use them) are still missing [Conboy 2014]. The multidisciplinarity in the field of modeling and visualizing law or contracts is challenging. It is affected by different disciplines such as information systems, information design and, of course, law [Curtotti 2016]. *This paper aims to identify (a) the status quo of existing approaches as well as (b) further directions for this field*. The findings can be used by researchers and practitioners to, for example, position their research, derive new research questions and improve approaches.

Our paper is structured as follows: In section 2, we outline our research approach, which consists of a literature review (status quo) and a Delphi study (future). In section 3, we review the IRIS proceedings (1998–2016) to identify the status quo of modeling and visualization in law. In section 4, we cover questions which were evaluated by up to 26 experts in a Delphi study with two rounds. In section 5, we conclude with our findings.

2. Research Method

Literature review. To identify and classify the status quo of modeling and visualization in law we conducted a literature review. An important factor is the rigor of the search process. Therefore, researchers have to document findings, the selection of keywords and the evaluation of the results. Due to the methodological

rigor of literature reviews, we followed [vom Brocke/et al. 2009]: definition of review scope (section 1), conceptualization of topic (section 3.1), literature search, analysis and synthesis (section 4.1.).

Delphi study. A Delphi study is a survey-approach with experts to derive implications for future trends. It aims to move the study participants towards a consensus or a saturation of new findings. A series of linked questionnaires can be employed in successive rounds. A Delphi study is mostly applied in interdisciplinary research fields if future predictions are difficult to derive (e.g. [Delbecq/Van de Ven/Gustafson 1975]).

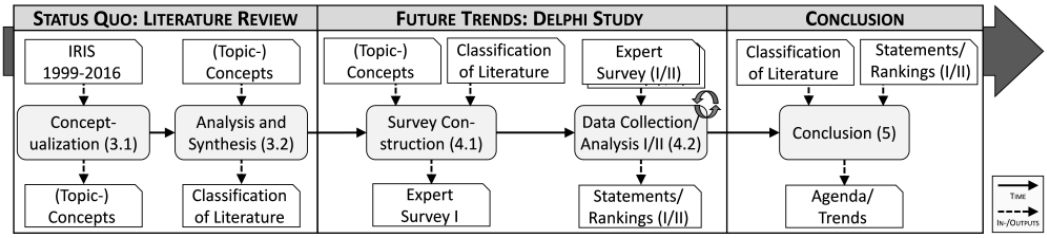


Figure 1: Research process and methods

3. Literature Review

3.1. Conceptualization

To classify the literature and provide evaluation criteria to assess the relevance of the articles, domain-specific concepts are required. Based on [Knackstedt/Heddier/Becker 2014] we determined the following concepts:

Development of methods and tools (I). The first sector deals with the development of visualization/modeling techniques and supporting software tools. For example, *method engineering (1.1)* to develop and extend modeling methods to support the creation and application of law or contracts; *meta modeling (1.2)* to design and adapt modeling techniques to support the creation and application of law or contracts;

Construction of models (II). Secondly, approaches that can support the construction. For example, *multi-perspective modeling (2.1)* to design model variants of law or contracts and provide views for different stakeholders; *modeling software (2.2)* to support the process of the design and creation of law or contracts.

Application of models (III). Thirdly, the use of models. For example, *model based reference modeling (3.1)* to provide guidelines (e.g. design pattern) and to reuse best practices for creating and designing law or contracts; *version control (3.2)* to manage different versions (e.g. historical overview) of law and contracts as well as to support the reconstruction of relevant versions; *argumentation-based modeling (3.3)* to support collaborative creation and interpretation of law or contracts (integrating reasons for specific elements); *transformation (3.4)* to create law and contracts based on models or create models based on law and contracts.

Evaluation of models (IV). Fourthly, *evaluation (4)* of existing or new approaches to indicate which are practical and applicable. For example, identifying whether an efficient and effective construction of a model is given (e.g. costs and time) or if it is «easy to read and understand» (e.g. comprehensive and traceable).

3.2. Analysis und Synthesis

Literature Search. Based on the conceptualization, we identified relevant articles which contribute to our research purpose («Rechtsvisualisierung» in particular). If an article met one or more of the concepts, we integrated it into our analysis. We analyzed the entire IRIS proceedings (1998–2016). Before the symposium got titled IRIS it was named «Internationales Rechtsinformatik Kolloquium» (1998–1999) and «Salzburger Rechtsinformatik Gespräche» (2000–2001). The track «Rechtsvisualisierung» exists since 2005 (2002–2004

as «Visualisierung»; later also including «Multisensory Law»). We checked the literature systematically by evaluating titles, keywords and abstracts as well as – afterwards – full texts. The analysis included articles of the entire proceedings (all tracks).

Results. In total, we identified 180 relevant articles. After collecting the articles, we classified them according to the conceptualization to represent the status quo (Table 1). We distinguished between: «motivation» (does the article argue that this concept is important?), «development» (does the article develop this concept?) and «application» (does the article apply this concept?). We included papers which (a) analyze how a model or visualization can be created, (b) analyze how it should look like or (c) use schematic representations.

Concepts	Concept use in IRIS		
Method engineering (1.1)	Motivation (48)	Development (12)	Application (80)
Model/visualization type (1.1)	Process (42)	Other (83)	Comic (11)
Meta modeling (1.2)	Motivation (4)	Construction (1)	Application (4)
Multiperspective modeling (2.1)	Motivation (0)	Development (0)	Application (0)
Modeling software (2.2)	Motivation (8)	Development (5)	Application (6)
Reference modeling (3.1)	Motivation (12)	Development (6)	Application (0)
Version control (3.2)	Motivation (0)	Development (0)	Application (0)
Argumentation-based modeling (3.3)	Motivation (0)	Development (0)	Application (0)
Transformation (3.4)	Motivation (4)	Development (3)	Application (0)
Evaluation (4)	Motivation (8)	Development (2)	Application (8)
	1-5	6-10	11-50	>50

Table 1: Results of literature analysis

As Table 1 indicates, a number of the selected articles deal with *modeling or visualizing law, legal documents or contracts*. About 42 of them focused on representing processes, for example, by using common notations such as Business Process Management Notation (e.g. [Niemand/Speck 2016]) or Event Driven Process Chains. This can be related to prior IRIS tracks which included topics such as process- and knowledge management. Further visualization techniques deal with comics (e.g. [Walser Kessel 2013]) mind maps (e.g. [Sauerwald 2007]), decision diagrams (e.g. [Kahlig 2011]) or ontologies for semantic analysis or knowledge representation (e.g. [Izumo 2013]). A few *software prototypes* such as the «Contract Design Pattern Library» [Haapio/Hagan 2016] and *reference modeling* approaches (e.g. [Brüggemeier/Dovifat 2005]) were present. Only a limited number of articles addressed aspects of *meta modeling* (e. g [Fill/Haiden 2016]), *model transformation* (e.g. [Off/Horn/Lenk 2006]) or *evaluation* of techniques, models or visualizations (e.g. [Brunschwig 2002] [Heddier/Knackstedt 2013]).

4. Delphi Study

4.1. Study Settings

Hypothesis development. First of all – based on the findings of the literature review – we derived implications and hypotheses of topics which could be considered «in the future». The most suitable ones were selected.

Expert selection. Secondly, we determined different expert groups which, here, are related to the fields of information design, contract design, conceptual modeling/information systems and (general) law.

Data collection (I). Thirdly, we conducted an online survey. The concepts (section 3.1) were introduced and presented for ranking (1 not agree to 5 strong agree). Furthermore, we asked for chronological prioritization of the concepts. We distinguished between «short-term» (<=1 years), «medium-term» (about 1–5 years) and «long-term» (> 5 years) to determine which concepts should be considered first. The participants could assign a total of 100 points (100 = important). (Figure 2). Finally, we asked: «What else could be helpful? What do you suggest?» Afterwards, we invited experts from the determined fields to participate in the study.

Data collection (II). In round 2, we presented the results to the experts involved in round 1 to confirm them.

Analysis. Finally, the answers were analyzed in a descriptive and quantitative manner (section 4.2).

#	Survey (Questions and Concepts)
1.1	*Developing visual techniques* – Visual techniques support the creation of diagrams (e. g. flow-charts or process models) by providing guidelines, how and which elements can be used in a specific diagram. For example, a process technique describes which icons can be used to create a process diagram or flow-chart. Do you think we need to extend or develop (new) techniques for visualizing law or contracts?
1.2	*Developing rules for diagrams* – Rules describe fundamental linguistic constructs and their relationships as well as the visual representation of language constructs by assigning a set of symbols. These rules aim to achieve consistent visualizations. For example, rules that describe the main concepts of a process diagram (e. g. tasks and events) and the manner of using them in order to create a new diagram. Do you think that specifying rules can be helpful for visualizing law or contracts?
2.1	*Distinguishing between role-specific variants of diagrams* – People with different roles (e. g. man-agers, laypersons, software engineers or lawyers) often use a law or contract for different purposes. Although all of these stakeholders have different views on laws or contracts, the fundamental source of information remains the same. For example, process model variants which describe an employment-contract-content for (a) employees and (b) employers - two models. Do you think role-specific variants are helpful for visualizing law or contracts?
2.2	*Using software for create diagrams* – Software can support the creation of law or contracts, for example, by providing predefined elements. For example, flow-chart elements such as activities, roles, events and icons which can be applied to create a flow-chart. Do you think that there are (acceptance-)barriers in the use of software to create diagrams of contracts or law?
3.1	*Applying reusable building blocks* – Reusable and universally applicable building blocks (e. g. diagram parts) usually describe best practice structures or concepts of specific domains which can be adapted and used in further contexts. For example, contract templates, visual contract blocks or diagram sections that can be reused in new visualizations. Do you think that the specification of reusable building blocks is important for visualizing contracts or law?
3.2	*Managing the history of diagrams* – Different versions of law or contracts play important roles in the legal domain. For example, documenting reasons which led to a change of a diagram (e. g. a flow-chart). Do you think that the history (versions and releases) of diagrams should be managed to improve the traceability of law or contracts?
3.3	*Documenting the chain of reasoning of diagrams* – It is important for a legislator, contract designer or law-interpreting person to know the rationale behind a certain norm, contract or law. For example, Person A documents why a flow-chart of a specific work-sequence (contract) has changed by adding relevant reasons to the diagram. Thus, Person B can trace why it has changed. Do you think that the integration of the chain of reasoning into diagrams supports the understanding?
3.4	*Transforming diagrams to diagrams* – Transformation describes rules which can be applied to trans-form a specific type of a diagram into another type. For example, an (automatically) transformation from a flow-chart to a comic or a comic to a flow-chart. Do you think that a transformation would be helpful for the visualization of law or contracts?
4	*Evaluating diagrams* – Evaluation verifies the effectiveness and efficiency of creating and understanding diagrams. For example, is it easier to create a contract as a flow-chart than a comic? Or, is it easier to understand a flow-chart than a comic? Do you think that the evaluation of existing approaches for visualizing contracts or law is important?

Figure 2: Survey (questions and concepts)

4.2. Analysis and Results

Data collection (I). Our online-survey was available from October to November 2016. In total 31 experts participated and 26 of them finished completely – incomplete ones were not analyzed. Overview of experts:

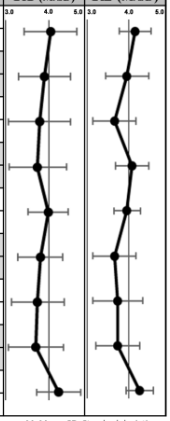
- *Sector*: Research and science (46.12%); Practice (38.46%); other (7.69%).
- *Discipline:* Information Systems (15.38%); Information Design (11.54%); Contract Design (15.38%); Law (26.92%); Other (23.08%) (e.g. knowledge management or engineering).
- *Work Experience:* <=1 (7.69%); 1–3 (3.85%); 4–7 (11.54%); 8–10 (3.85%); >=11 (65.38%).

Hence, we had a base of experts with a lot of work experience and a fair balance between different disciplines.

Data collection (II). Our second survey which aimed to confirm the results from round 1 was online during December 2016. 21 experts (round one) provided their email addresses. In total, 14 experts took part in round 2.

Rankings. In Figure 3, the results from round 1 (R1) and round 2 (R2) are presented. We distinguished: (I) *discipline* – Information Systems (IS) (n=5), Contract Design (CD) (n=4), Information Design (ID) (n=3) and Law/Jurisprudence (n=8); (II) *sector* – (P) (n=12) and research (R) (n=13); (III) total.

Concepts	Discipline (Mean, R1)				Sector (Mean, R1)		Total					
	IS	CD	ID	Law	P	R	R	Mean	Median	#	R1 (M/SD)	R2 (M/SD)
Method engineering (1.1)	4.4	4.5	4.34	3.38	4	4.31	R1	4.08	4	2		
	#2	#2	#3	#7	#2	#2	R2	4.31	4	2		
Meta modeling (1.2)	4.8	3.5	3.67	3.13	3.17	4.15	R1	3.79	4	4		
	#1	#6	#5	#9	#8	#3	R2	3.92	4	4		
Multiperspective modeling (2.1)	4.2	4.25	3	3.75	3.5	4	R1	3.56	4	6		
	#4	#4	#9	#3	#6	#5	R2	3.31	3	8		
Modeling software (2.2)	3.4	3.75	4	3.63	3.67	3.54	R1	3.48	3	7		
	#8	#5	#4	#5	#4	#9	R2	4.15	4	3		
Reference modeling (3.1)	4.2	4.75	4.37	3.5	3.91	4.01	R1	3.96	4	3		
	#4	#1	#2	#6	#3	#4	R2	3.92	4	4		
Version control (3.2)	4.2	3	3.67	3.75	3.34	4	R1	3.60	3	5		
	#4	#8	#5	#3	#7	#5	R2	3.31	3	8		
Argumentation-based modeling (3.3)	3.6	3.25	3.67	4.13	3.67	3.62	R1	3.48	4	7		
	#7	#7	#5	#1	#4	#8	R2	3.46	4	6		
Transformation (3.4)	3.4	2.25	3.67	3.38	2.84	3.85	R1	3.38	3.5	9		
	#8	#9	#5	#7	#9	#7	R2	3.46	4	6		
Evaluation (4)	4.4	4.5	5	4	4.34	4.54	R1	4.46	5	1		
	#2	#2	#1	#2	#1	#1	R2	4.54	5	1		



M=Mean; SD=Standard deviation

Figure 3: Rankings (M=Mean; SD=Standard deviation)

Best ranked concepts. Evaluation (4) was – in both rounds – ranked first (mean=4.46; 4.54). Method engineering (1.1) was ranked second and modeling software (2.2) third. In R1, reference modeling (3.1) was third (mean=3.96), but using modeling software increased from 3.48 to 4.15 in R2.

Major differences between round 1 and 2. Modeling software (2.2) had the biggest difference – increased from 3.48 to 4.15 (+0.67). Version control (3.2) had differences from -0.29 and method engineering (2.1) +0.23.

Overall, each concept was rated with a mean between 3.31 and 4.54 and a median between 3 and 5. Hence, some concepts – especially evaluation (4) – were rated higher, but none of them seemed completely insignificant.

Prioritizations. Secondly, we asked for a chronological prioritization. The participants could assign a total of 100 points (100=important) to each concept and each time-category (Figure 4).

Concepts		Short-Term			Medium-Term			Long-Term			Total
		Mean	SD	R2 (M/SD)	Mean	SD	R2 (M/SD)	Mean	SD	R2 (M/SD)	Mean R2
Method engineering (1.1)	R1	32.36	22.43		23.19	27.38		15.95	21.44		
	R2	30	13.16		25	12.25		14.55	8.38		
Meta modeling (1.2)	R1	15.65	12.38		10.89	6.41		15.45	20.37		
	R2	15.45	7.52		12.54	7.15		14.55	8.11		
Multiperspective modeling (2.1)	R1	5.59	3.63		8.16	4.78		8.8	4.06		
	R2	5.17	3.65		6.17	4.81		4.92	3.15		
Modeling software (2.2)	R1	17	10.33		16.95	9.94		13.7	8.5		
	R2	15.23	9.07		17.15	10.72		16.75	10.66		
Reference modeling (3.1)	R1	11.45	6.27		11.30	4.22		9.89	3.43		
	R2	10.62	10.9		9.75	8.3		11.83	6.84		
Version control (3.2)	R1	7.11	6.24		10.33	6.87		13.22	7.15		
	R2	4.91	5.12		9	10.29		6.91	5.57		
Argumentation-based modeling (3.3)	R1	7.11	6.48		9.78	6.17		11.67	6.39		
	R2	7.73	8.33		6.91	6.39		10.27	7.22		
Transformation (3.4)	R1	5	4.35		7.82	5.95		9.95	6.9		
	R2	3	3.05		4.91	5.55		8.18	9.31		
Evaluation (4)	R1	16.26	11.81		15.1	8.82		14.35	10.53		
	R2	14.17	8.36		14.08	7.26		16.58	10.05		

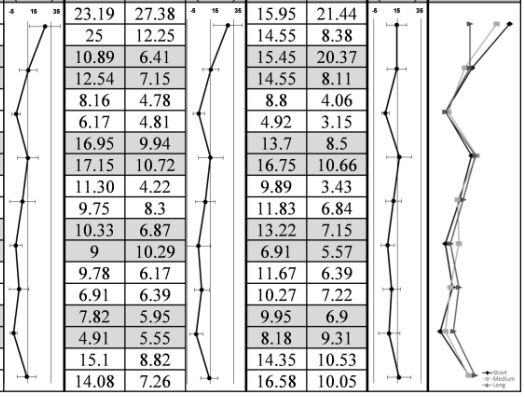


Figure 4: Prioritizations (M=Mean; SD=Standard deviation)

Best ranked concepts (short-term). The best ranked concept by far, in both rounds, was method engineering (1.1) (mean=32.36; 30). After that, modeling software (2.2), evaluation (4) and meta modeling (1.2) were approximately the same. Evaluation and modeling software were reduced in round 2.

Best ranked concepts (medium-term). Again, method engineering (1.2) took the first place, but it decreased by 5. Modeling software (2.2) was ranked second and evaluation (4) third; but, evaluation had lower SD-values than modeling software or method engineering, so the variation of answers was smaller.

Best ranked concepts (long-term). The long-term ratings were more balanced. The best ranked concepts were modeling software (2.2) evaluation (4), method engineering (1.1) and meta modeling (1.2), followed by reference modeling (3.1) (R2=11.83) and argumentation-based modeling (3.3) (R2=10.27).

Standard deviation (SD). Although meta modeling (1.2) and evaluation (4) had higher means, they also had low SDs which indicates that the answers were more consolidated.

Major differences between round 1 and 2. The SD of method engineering (1.1) was reduced by 15.13 in the medium-term and by 13.06 in the long-term with constant means. Meta modeling's (1.2) long-term SD changed by -12.26 and version control's (3.2) mean by +6.31. Overall, R2 helps to consolidate the ratings.

Qualitative data. The expert statements («further concepts») were categorized. We identified different topics:

- *Visualization*: «[…] contract element and various visual tools»; «define interfaces – (…) techniques with the aid of legal modeling language»; using «multimedia»
- *Evaluation*: «How do we make sure that explanatory pictures, text (human readable) and computer code (machine readable) all say the same thing?»; «integrate visual into computer code»; «a computer program (…) be able to interpret the modelled rules? (…) interpretability of the same (…) for machines.»
- *Tools:* «[…] to create a visualization should have more tools available.»; «[…] devices used for the generation and visualization […] (e.g. Google Glasses)»
- *User Centred Design:* «[…] developing them together with the users (…) studying how the users feel.»
- *Standards vs. No-Standards:* «[…] visualization of contracts is most important – establish a standard and then the rest can be implemented subsequently»; «Standard clauses and symbols»; «Conceptualizing contracts as data.»; «The use of open, *not standardized* visualization like sketching.»
- *Role-specific understanding*: «[…] specifically cultural differences in understanding.»
- *Modeling techniques:* «Mind maps […]»; «Interactive Flowcharts may create more accurate depictions»
- *Design literacy:* «Visual is not intrinsically better than text. So it is important that the creators of tools as well as the users (…) still know what they are doing.»

5. Conclusion

5.1. Research Agenda

Different implications can be derived from our literature review and Delphi study, for example:

Evaluating approaches. *Evaluation* aims at demonstrating the utility, quality and efficacy of an artefact [Hevner et al. 2004]. In general, evaluation frameworks distinguish between a development (build) and an interpretation (read) perspective on both the process and the product (e.g. [Schalles 2013]). Although evaluation is the most important concept for the future (expert survey, median: 5), only very few articles in IRIS proceedings evaluate their artefacts (see 3.2). Thus, we recommend to conduct more evaluation-studies to investigate which visualization types or genres (e.g. comics) are suited for which audiences.

Developing modeling techniques. A number of experts – especially designers and IS-researchers – argued that the development or extension of modeling techniques for the representation of law or contracts is important for the future. According to the results (e.g. «standard clauses and symbols» [Expert 15] vs. «open, not standardized» [Expert 26]) two different types of visualizations are discussed: (I) not-standardized images and representations (e.g. comics) and (II) standardized techniques with a predefined set of symbols and shapes

(e.g. process modeling techniques such as BPMN); but, are they totally different? Further development of techniques could try to link both worlds and investigate which potential this link might have. Thereby, techniques should consider, for example, deontic logic or time dependencies. IS-research provides *method engineering approaches* which could structure the development process [Knackstedt/Heddier/Becker 2014].

Connecting disciplines. Due to the fact that visualizing law or contracts is an interdisciplinary field, a common ground for the disciplines involved should be provided. However, the implementation and the analysis of our study indicate some issues which need further research, for example, (a) inconsistent understandings of concepts, (b) partly inconsistent wording of concepts (e.g. diagram vs. conceptual model) and (c) heterogeneous assessments of relevance, especially by legal experts (Figure 3). So, joint projects would be helpful.

Transferring knowledge between practice and research. In addition, a proper mix of researchers and practitioners is required because of result variance, for example, *meta modeling* (practice: 3.1; research 4.15) or *model transformation* (practice: 2.8; research 3.8) (Figure 3). This might indicate that some of these concepts were not commonly known and need further transfer to practice or research. For example, *meta modeling* supports describing building blocks of a modeling technique including (a) fundamental linguistic constructs and their relations and (b) the process of creating a certain model. This contributes to the experts who argued that «standard clauses and symbols» are required [Expert 15, R1]. Moreover, it can be used to (c) develop new tools which support creation. This adds to the need of tools «to create a visualization.'[Expert 4, R1].

Considering users. To create suitable approaches, experts argued that we should develop «[…] them together with the users, experimenting and studying how the users feel about them» [Expert 14, R1]. Furthermore, «[…] cultural differences in understanding» [Expert 13, R1] should be considered. Although the concept got poor rankings, these issues can be supported by *multiperspective modeling* which aims to design and manage model variants for different stakeholders or purposes. In addition, it might suppport experts who suggested to «understand more with different views for types of contracts» [Expert 13, R17]. Besides, *argumentation-based modeling* can be applied to visualize the chain of reasoning of differences (e.g., cultural adaptions).

So, what next? First of all (short-term), *new modeling and visualization techniques (1.1)* can be developed or extended for the field of law or contracts. Moreover, *software tools* (2.2) should be provided which supports the creation and management of models and visualizations. Therefore, *meta modeling (1.2)* can be considered to describe notations in a formal way. Along with *design patterns*, they can support the development of modeling and visualization tools as well as their applicability. After developing new methods and tools (medium-term), they have to be *evaluated (4)* in order to be able to investigate which ones are efficient and effective. These findings, in return, can be used to redesign existing approaches. In the long-term, further approaches such as reference modeling (3.1) to specify reusable building blocks (e.g. contract blocks with accompanying icons or visualizations) or transformation (3.4) to enable transforming specific diagram types into other types can be addressed. Their generation can be supported by new tools, and evaluation of both remains important.

5.2. Limitations

The *Delphi study* assumes that experts are able to provide knowledge for future trends. The selection of experts and the derived trends are based on interpretations, decisions and methods which have limitations. Moreover, some experts participated only in the first round which impacts the analysis. The *literature review* is limited to IRIS proceedings. The selection of keywords and evaluation criteria is based onown decisions. We initially focused on the identified concepts (see 3.1) – other aspects could be analyzed too, for example, *model analysis* to prevent defective law design or to ensure legal compliance (e.g. [Delfmann et al. 2009]).

Acknowledgements. We would like to thank the experts who supported the study and its implementation.

6. References

Berger-Walliser, Gerlinde/Barton, Thomas D./Haapio, Helena, From visualization to legal design: A collaborative and creative process. In: American Business Law Journal, Vol. 54(2), https://ssrn.com/abstract=2841030, 2017.

Brocke, Jan vom/Simons, Alexander/Niehaves, Bjoern/Reimer, kai/Plattfaut, Ralf/Cleven, Anne, Reconstruction the Giant: On the Importance of Rigour in Documenting the Literature Search Process. In: Proceedings of the European Conference on Information Systems (ECIS) 2009, pp. 2206–2217.

Brüggemeier, Martin/Dovifat, Angela, Referenzmodelle für die Leistungserstellung in öffentlichen Leistungsnetzwerken. In: Schweighofer, Erich/Liebwald, Doris/Augeneder, Silvia (Eds.), Effizienz von e-Lösungen in Staat und Gesellschaft, Tagungsband des 8. Internationalen Rechtsinformatik Symposions IRIS 2005, Boorberg, 2005, pp. 211–214.

Brunschwig, Colette, Legal Design und Web Based Legal Training. In: Schweighofer, Erich/Menzel, Thomas/Kreuzbauer, Günther (Eds.), IT in Recht und Staat, Schriftenreihe Rechtsinformatik, Verl. Österreich Wien 2002, pp. 297–308.

Conboy, Kevin, Diagramming Transactions: Some Modest Proposals and a Few Suggested Rules. In: Transactions: Tennessee Journal of Business Law, Vol. 16, pp. 91, 2014.

Curtotti, Michael Angelo, Enhancing the Communication of Law: a cross-disciplinary investigation applying information technology, thesis of the Australian National University, 2016

Delbecq, Andre L./Van de Ven, Andrew H./Gustafson, David H., Group techniques for program planning: A guide to nominal group and Delphi processes. Scott Foresman, 1975.

Delfmann, Patrick/Herwig, Sebastian/Lis, Lukas/Stein, Armin, Supporting Distributed Conceptual Modelling through Naming Conventions. In: Enterprise Modelling and Information Systems Architectures, (4)1, pp. 3–20.

Fill, Hans-Georg/ Haiden, Katharina, Visuelle Modellierung für Rechtsberatende Berufe am Beispiel der gesetzlichen Erbfolge. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter/Borges, Georg (Eds.), Netzwerke, Tagungsband des 19. Internationalen Rechtsinformatik Symposions IRIS 2016, books@ocg.at, Wien 2016, pp. 349–356.

Haapio, Helena/Hagan, Margaret, Design Patterns for Contracts. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter/Borges, Georg (Eds.), Netzwerke, Tagungsband des 19. Internationalen Rechtsinformatik Symposions IRIS 2016, books@ocg.at, Wien 2016, pp. 381–386.

Heddier, Marcel/Knackstedt, Ralf, Empirische Evaluation von Rechtsvisualisierungen am Beispiel von Handyverträgen. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter (Eds.), Abstraktion und Applikation, Tagungsband des 16. Internationalen Rechtsinformatik Symposions IRIS 2013, books@ocg.at, Wien 2013, pp. 413–420.

Hevner, Alan R./March, Salvatore T./Park, Jinsoo/Ram, Sudha, Design science in information systems research. In: Management Information Systems Quarterly (MISQ), Vol. 28(1), 2004, pp. 75–105.

Izumo, Takashi, Die Anwendbarkeit von Ontologie-Editor HOZO auf die Rechtswissenschaft. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter (Eds.), Abstraktion und Applikation, Tagungsband des 16. Internationalen Rechtsinformatik Symposions IRIS 2013, books@ocg.at, Wien 2013, pp. 365–370.

Kahlig, Wolfgang, Visualisierungstypologie des Deutschen Privatrechts. In: Schweighofer, Erich/Kummer, Franz (Eds.), Europäische Projektkultur als Beitrag zur Rationalisierung des Rechts, Tagungsband des 14. Internationalen Rechtsinformatik Symposions IRIS 2011, books@ocg.at, Wien 2011, pp. 575–584.

Knackstedt, Ralf/Heddier, Marcel/Becker, Jörg, Conceptual Modeling in Law: An Interdisciplinary Research Agenda. In: Communications of the AIS (CAIS), 34(1), 2014.

Kung, C. H./Solvberg, Arne, Activity Modeling and Behaviour Modeling. In: Proceedings of the IFIP WG8.1 working conference on Information system design methodologies, North-Holland Publishing Co., 1986, pp. 145–171.

Niemand, Sven/Speck, Andreas, Prozess-Muster für den Entwurf von Rechtsnorm-basierten Prozessdiagrammen. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter/Borges, Georg (Eds.), Netzwerke, Tagungsband des 19. Internationalen Rechtsinformatik Symposions IRIS 2016, books@ocg.at, Wien 2016, pp. 595–602.

Sauerwald, Markus, Mind Mapping als Visualisierungsmethode in der juristischen Praxis. In: Schweighofer, Erich/Geist, Anton/Heindl, Gisela (Eds.), 10 Jahre IRIS: Bilanz und Ausblick, Tagungsband des 10. Internationalen Rechtsinformatik Symposions IRIS 2007, Boorberg, 2007, pp. 480–485.

Schalles, Christian, Usability evaluation of modeling languages, Gabler Verlag, Wiesbaden 2013.

Walser Kessel, Caroline, Rechtsvisualisierung im Spannungsfeld zwischen Abstraktion und Applikation – Am Beispiel des neuen schweizerischen Kindes- und Erwachsenenschutzrechts. In: Schweighofer, Erich/Kummer, Franz/Hötzendorfer, Walter (Eds.), Abstraktion und Applikation, Tagungsband des 16. Internationalen Rechtsinformatik Symposions IRIS 2013, books@ocg.at, Wien 2013, pp. 403–412.