Preventing disputes: preventive logic, law & technology
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Summary

Chapter 1 introduces *Preventive Law* as the scientific field established to prevent legal risks from becoming legal problems. Over time, it advanced in multiple directions, including *the effective management of contracts*. As part of this development, the management of legal risk was central. Up to 2015, contractual risk management was performed manually and often implicitly. By the use of Applied Logic, Data Science and Artificial Intelligence we show how it is possible to structure an explicit contract risk analysis to assist legal experts in delivering advanced legal risk analysis to non-legal experts. We do that via the introduction of the Onassis Ontology, that shows how it is possible for contractual client-to-client communications to perform optimally and securely from the perspective of contract risk management. Our investigation contributes to the theory of *Intelligent Contracts* (iContracts), currently the most advanced technology for contracting automation. The thesis investigates iContracts from multiple perspectives, with the following Problem Statement (PS).

PS: *To what extent is it possible to automate the prevention of disputes?*

The answer to the PS is provided in six follow up Chapters (Chapters 2 to 7), each of them addressing a particular Research Question (RQ). A concluding Chapter (Chapter 8) provides our answer to the PS. Finally, a Chapter of reflections (Chapter 9) shows how it is possible to apply the thesis in real-life.

Chapter 2 addresses RQ1, which reads:

RQ1: *To what extent is it possible to develop an ontology that automates contracts with communications and risk data?*

Contract automation is a challenging topic within AI and LegalTech. From digitised contracts via smart contracts, we are heading towards iContracts. Here, we will address the main challenge of iContracts: the handling of *communications* and *risk* data in contract automation. In our research we *design* and *conceptualise* an iContract ontology. Our findings validate the *conceptual expressiveness* of our ontology. A brief discussion highlights the value of the ontology design

and its application domains. The Chapter concludes by two observations: (1) the current method is innovative, and (2) further research is necessary for handling more complex use cases.

Chapter 3 addresses RQ2, which reads:

> **RQ2:** *To what extent is it possible to translate the Bow-Tie Method into a visualisation of an ontology for contract risk management without altering the bow-tie structure?*

Standing at the start of our research we propose a new *visual analysis method* of hazardous events to be used in contract risk management. Our aim is to create an extension of the Onassis Ontology to *manage*, *analyse* and *visualise* risk data. The extension of the Onassis Ontology will be used for the development of *trustworthy* iContracts. The idea is that the implemented extension allows for the creation of *explicit* data out of *implicit* contractual information and legal processes. The creation happens by performing cross-referencing analyses with other collections of data. The ontological model that results from our study will additionally help to the disambiguate the information stored in the Bow-Tie Method structure. To achieve this, we use the following methodology. (1) We visualise the Bow-Tie Method in an ontology. (2) We investigate the presence of taxonomic ambiguities or even errors in its structure. (3) The results present an enriched version of bow-tie conceptualisation of information, in which entities and relationships are translated into openly-accessible and *ready-to-use* ontological terms, whereas risk analysis becomes visible.

Chapter 4 addresses RQ3 which reads:

> **RQ3:** *To what extent is it possible to improve user trustworthiness for Intelligent Contracts via the visualisation of risk during legal question-answering?*

Our research aims to show how contractor *trustworthiness* for iContracts improves via the visualisation of risk. Traditionally, contractors relied on legal experts who conducted the analysis of risk and proposed contracting solutions. Currently, trustworthiness is still an *open question* concerning the state-of-the-art in user interfaces for contract automation. Nowadays, the available interfaces do not present much valuable information, and the question is whether it is sufficient information (or otherwise stated what are the criteria for sufficient information). To measure the impact of the trustworthiness at the end users side, we will investigate to what extent we can visualise legal risk for answering legal questions addressed to contracting parties. For this task, we developed an explorative survey that requested end users to rate in what way their trustworthiness level is different when compared (a) to an empty user interface and (b) to a legal expert who discusses legal risks with them in person. The results show that the end user reaction is on both cases almost sufficiently positive. The discussion highlights the importance of risk analysis visualisation for user trustworthiness in iContracts and provides suggestions for improvement. The conclusion is that end user trustworthiness improves with risk visualisation. Yet, further improvements are necessary.

Chapter 5 addresses RQ4, which reads as follows:

RQ4: *To what extent is it possible to generate quality Proactive Control Data to improve an Intelligent Contract?*

iContracts have many challenges, among which including the quality of data used. In our research we focus on generating and including quality Proactive Control Data (PCD) to improve iContracts. It is a novel research scope in the literature. Currently, the legal system is more *reactive* than *proactive*, leading to high consequential legal costs. By shifting the focus to proactiveness, we discuss the available methodologies (the Bow-Tie Method and the Logocratic Method) and aim to improve upon them. Moreover, we examine PCD with the context of three technologies (Ontology Engineering, Software Engineering and LLMs) with the aim to arrive at a higher degree of proactiveness in iContracts. Our research direction is threefold. First, we generate PCD after the development of a prototype. Second, we show that impact of PCD on contract drafting is measurable. Third, we show how the quality of PCD can be assessed and improved. The discussion (1) highlights the feasibility of the research with available technologies and (2) shows that its implementation depends on organisational considerations and resource allocation. From the results we may conclude that it is possible to implement these new ideas successfully.

Chapter 6 addresses RQ5, which reads as follows:

RQ5: *To what extent is it possible to develop an explainable and trustworthy Preventive Legal Technology?*

Preventive Legal Technology (PLT) is a new field of Artificial Intelligence (AI) investigating the *intelligent prevention of disputes*. The concept integrates the theories of *preventive law* and *legal technology*. Our goal is to give ethics a place in the new technology. By *explaining* the decisions of PLT, we aim to achieve a higher degree of *trustworthiness* because explicit explanations are expected to improve the level of *transparency* and *accountability*. Trustworthiness is an urgent topic in the discussion on doing AI research ethically and accounting for the regulations. For this purpose, we examine the limitations of rule-based explainability for PLT. After an insightful literature review, we focus on case studies with applications. The results describe (1) the effectivity of PLT and (2) its responsibility. The discussion is challenging and multivariate, investigating deeply the relevance of PLT for LegalTech applications in light of the development of the AI Act (currently still under construction) and the work of the High-Level Expert Group (HLEG) on AI. On the ethical side, explaining AI decisions for small PLT domains is clearly possible, with direct effects on trustworthiness due to increased transparency and accountability.

Chapter 7 addresses RQ6, which reads as follows:

> **RQ6:** *To what extent is it possible to accelerate the adoption of Intelligent Contracts with Explainable Large Language Models?*

Contract automation is a field of LegalTech under AI and Law that is currently undergoing a transition from Smart to iContracts. iContracts aim to full contracting automation. Their main challenge is finding a convincing direction for market adoption. Two powerful market factors are the *advent of LLMs* and *AI Regulation*. The Chapter investigates how the two factors are able to influence the market adoption of iContracts. After a literature review our research employs three methodologies: (1) market gap analysis, (2) case study, and (3) application. The results show a clear way for iContracts to follow, based on existing market gaps. Moreover, the indicated paths validate whether the application of Explainable LLMs is actually possible. The discussion clarifies the main limitations with Explainable LLMs. Our chapter conclusion is that the two market factors are impactful for so long as the market adoption attempts to bridge the gap between innovators and early adopters.

Chapter 8 answers the PS based on the answers to the RQs provided above.

> **PS:** *To what extent is it possible to automate the prevention of disputes?*

The automated prevention of disputes is possible to the following extent: a relevant technological infrastructure is established to facilitate this type of automation. Initially, the successful prevention will be possible for use cases with a simpler scope, such as use cases with freelancing projects. Gradually, more complex case studies can be examined, with the goal of eventually automating even Foreign Direct Investment (FDI) energy project agreements. The progress from simpler to more complex case studies is possible owing to (1) the gradual increase and improvement of data and (2) the relative iterative improvement of technology. While scaling up the technology application, the categorisation of use cases is important owing to the contextual nature of disputes. The success depends on the use case itself as well as on applying specific parameters.

Finally, Chapter 9 provides five reflections which show the relevance of the thesis in real-life applications. The reflections are as follows.

Reflection 1: *The Bow-Tie Method can be used to* ***analyse*** *risk in legal cases*

Reflection 2: *The Bow-Tie Method can be used to* ***explain*** *risk in legal cases to non-legal experts*

Reflection 3: *The Bow-Tie Method can be used to* ***improve*** *legal text or speech from the perspective of legal risk*

Reflection 4: *The collection of prevention data falls under the* ***protection of sensitive data***

Reflection 5: *iContracts will* ***gradually automate*** *most parts of the legal workflow*