



**FACULTY
OF INFORMATION
TECHNOLOGY
CTU IN PRAGUE**

ASSIGNMENT OF MASTER'S THESIS

Title: Law Modelling Using BPMN and DEMO
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Study Programme: Informatics
Study Branch: Web and Software Engineering
Department: Department of Software Engineering
Validity: Until the end of summer semester 2019/20

Instructions

Laws are notoriously complex and hard to read. With new bills being passed every day, they only grow complex over time so their original meaning and purpose are fading away. This problem affects not just the ordinary people, but also companies that need to comply with this law and the government institutions that need to enforce them.

In this thesis, we will discover how to apply the state-of-the-art techniques from enterprise engineering and business process management to better model, execute, and optimize laws.

Steps to take:

- Explore the state-of-the-art law modelling techniques.
- Explore how to model laws with BPMN and DEMO.
- Compare which approach is better to model the law.
- Create a case study with a bill that is modelled and supported with a BPM system.

References

Will be provided by the supervisor.

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Department of Software Engineering
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May 8, 2019

Acknowledgements

I wish to express my sincere gratitude to Ing. Marek Skotnica for being a great supervisor. I've always left our meetings feeling good and motivated. True, it didn't always last until the next day, but that is on me. You've made me believe in my work and always provided me with good advice and understanding when I struggled. Thank you.

I also wish to thank my parents. You were always there for me, trying to help, even when you didn't know what I was doing.

Lastly, thank you, Marianna, for being the one who understands.

Declaration

I hereby declare that the presented thesis is my own work and that I have cited all sources of information in accordance with the Guideline for adhering to ethical principles when elaborating an academic final thesis.

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In Prague on May 8, 2019

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Citation of this thesis

Lassaková, Martina. *Law Modelling Using BPMN and DEMO*. Master's thesis. Czech Technical University in Prague, Faculty of Information Technology, 2019.

Abstrakt

Cílem této práce je pomocí BPMN a DEMO nalézt způsoby jak lépe modelovat, vykonávat a optimalizovat zákony. Oba přístupy se prokázaly mají budoucnost v oblasti modelování zákonů. S pomocí DEMO jsem našla více než 300 chyb a nejasností v legislativním dokumentu. Modelování zákonů s pomocí DEMO a BPMN může usnadnit práci a přinést pochopení mnoha subjektům, kteří chtějí nebo potřebují právu rozumět a vylepšit je.

Klíčová slova Modelování legislativních procesů, BPM, BPMN, DEMO

Abstract

The purpose of this thesis is to discover how to better model, execute and optimise laws with the help of BPMN and DEMO. Both techniques show promise for modelling laws. With the DEMO methodology, I've discovered over 300 errors and ambiguities of the legal document. Law modelling using DEMO and BPMN could prove useful to lawyers, governments, businesses and natural persons who want or need to better understand the law and improve it.

Keywords Law modeling, BPM, BPMN, DEMO

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Introduction

Motivation

Every day new laws are being formulated and discussed while others are being reviewed for changes. They tend to be complex and ambiguous, often by design. Everyone affected by a new law, be it an individual or an organisation, has to understand their new obligations and rights, or they face sanctions and loss of opportunity.

According to a research paper from 2013[5], companies in the EU estimate that 6.2 % of their turnover is spent on compliance with regulations. The exact cost of compliance with regulations is hard to calculate. It is clear, however, that compliance costs make up a significant amount of business turnover.

If the law is presented in an easily understandable way, which can be readily implemented in the company systems, it could speed up the process of introducing the law into the business. Having a good model of the law could also make it easier to avoid mistakes, which could lead to monetary loss or affect the reputation of a company.

Even lawmakers could benefit from creating easily understandable conceptual models of law, which make them easier to analyse and read and therefore easier to improve.

One of the Priorities of the Czech Government is the digitisation of legislation. Process modelling techniques could help improve these efforts by bringing the law into a more comprehensible format.[6]

Objectives

The main objective of this thesis is to discover how to better model, execute, and optimize laws by applying enterprise engineering and business process management techniques.

The main focus is given to BPMN and Design & Engineering Methodology for Organizations (DEMO). The former is a standard, which provides a graph-

ical notation for modelling business processes. The later is a methodology for modelling transactions, and analysing and representing business processes.

These techniques have been chosen because they are both actively used for working with business processes. There are experts, who understand them and teach them in companies and at universities. If these techniques prove suitable for modelling laws, they could be used in companies, who already work with them.

This thesis tries to answer the following questions:

1. What are the state-of-the-art law modelling techniques?
2. How to model laws with BPMN and DEMO?
3. Which of the two techniques is more suitable for modelling laws?

A law will be chosen for a practical case study to explore the possibilities of modelling law provided by these techniques. Finally, the law will be supported by a BPM system.

Thesis Structure

This thesis is divided into four chapters, each focusing on one of its objectives.

First, in chapter 1, I explore the state of the art of law modelling. I briefly introduce law and legal documents, their relationship to businesses, and their computer representation. Then I explore techniques, which may be used to model laws.

In chapter 2 I take a closer look at BPMN and DEMO and their capabilities to capture laws in a model.

In chapter 3 I compare these two techniques and their suitability for modelling laws.

Finally, chapter 4 is focused on the case study. I introduce the selected bill, create its model, and support it with a BPM system.

State-of-the-Art of Law Modelling

In this chapter, I examine the current state of the art of Law Modelling. Before I introduce the modelling techniques, I first focus on the law itself.

I begin section 1.1 by examining the definitions of law, then move on to explaining some of its basic concepts. Since analysing legal documents is an import part of this thesis, I take a look at legislation and how to understand it. Later on, I focus on compliance and the relationship between law and business management. Finally, I examine ways to represent legal documents digitally.

The second part of this chapter is dedicated to law modelling techniques. In section 1.2 I examine several works, whose authors attempted to capture law in a model, either by developing a new modelling notation or using an established one.

1.1 Object of Study: Law

There is virtually no part of our lives untouched by law. From the moment of our birth, through childhood, becoming an adult, being a parent, to our death and even beyond, we are surrounded by regulations. Even our food has to meet rigorous standards before we can buy it.

Law is described as a binding custom or practice of a community, or a whole body of such customs. Law is also the control arising from the existence or enforcement of such law. It is always important to take into account the context. In natural science, law refers to a statement of an order or relation of phenomena, which is believed to be invariable under given conditions.[7]

This thesis takes the view of law as a normative legal system. It regulates human actions by defining rules of social conduct as well as the penalty for not complying with them.

Table 1.1: Jural Correlatives

Correlatives	Right	Liberty	Power	Immunity
	Duty	No-Right	Liability	Disability

Table 1.2: Jural Opposites

Opposites	Right	Liberty	Power	Immunity
	No-Right	Duty	Disability	Liability

1.1.1 Concepts of Law

It is possible to classify law as **Substantive or Procedural**. There is some debate, however, whether the two categories are clearly distinct, overlapping or indistinguishable.

According to J. Salmond[8], “Substantive law is concerned with the ends which the administration of justice seeks; procedural law deals with the means and instruments by which these ends are to be attained.” Procedural law is the law of action. Everything else falls into the category of substantive law.

Is it not clear, however, if the two can be separated. The orthodox view is that there is a clear distinction between substance and procedure. A different view is that the sharp separation exists in theory. In practice, however, many procedural and substantial rules are partially or wholly equivalent. According to another view, there is no distinction between substance and procedure at all. One other view adds a third category. Next to the clearly distinct substance and procedure, there is the “Twilight Zone”, which may be either substance or procedure, depending on the end to be attained.[8]

Substantive and procedural law are tightly linked. Substantive law creates, defines and regulates rights and obligations of individuals and collective bodies. Procedural law regulates the form, manner, and order of steps taken in conducting a lawsuit. It governs the process, which determines the rights of parties.[9]

Right and Duty are important legal concepts, whose significance must be understood.

We tend to associate Right with justice or ethical correctness. In the legal sense, Right represents “a power, liberty, demand, or claim possessed by a particular person by virtue of law”.[9]

An individual’s legal right always corresponds to a legal duty of another. Duty represents “a legal obligation that entails mandatory conduct or performance”.[9]

W. Hohfeld further split these concepts into four entitlements and four burdens, based on the context, in which they are used. He then groups them into pairs and defines their relationships. There are two kinds of relationships. Table 1.1 shows pairs of Jural Correlatives, concepts which must exist

together. Table 1.2 shows pairs of Jural Opposites, concepts which cannot exist together.[10]

Hohfeld didn't offer a direct definition of any of his concepts. Instead, he provided their meaning through their relationships.

Right: When X has paid Y to deliver him goods, then X has a right to have Y deliver him goods, while Y has a duty to deliver goods to X. X having a right against Y means that he is legally protected from interference by Y or that Y can't withhold assistance concerning this right. The person having a right always must be able to pinpoint another person, who has the correlative duty.[10]

Liberty: Liberty is the absence of duty. It is a weaker form of right and correlates with no-claim. A smoker has a liberty to smoke outside, as long as there are no legal prohibitions. A person, who feels bothered by the smoking, has no-right to stop the smoker from doing so. However, they are at liberty themselves (within the constraints of the smoker's rights), to impede their smoking, for example by encouraging others to complain about the smoking as well.[10]

Power Power gives a person the ability to alter legal (or moral) relations. It correlates with liability to have legal relations altered. When X steals a car, they have a power to sell it to someone. However, they are not at liberty to do so, because they have a legal duty not to sell it.[10]

Immunity: Person X having immunity against Y prevents Y from changing X's legal position concerning any entitlements covered by the immunity. It correlates with disability. Important immunities are often defined with relation to the state, limiting their power. When the state has the power to impose a duty on a person, they have an immunity in that regard, while the state has a disability.[10]

1.1.2 Understanding Legislation

Legislation refers to the exercise of the power and function of making legal rules.[7] Its purpose is to protect an individual's rights. For legislation to be effective, it is necessary for people to understand that living in accordance with all of the rules is to their benefit. It's also necessary that they know and understand these rules, which requires legislation to be accessible.

Legal documents need to be accessible not only in the sense of being available but also in the sense of being understandable. An essential role in reaching this goal has the structure of the document.

Traditionally, legal documents share a common structure, which helps the reader quickly find the relevant information. According to [11], the usual structure of legal documents in the Commonwealth is the following:

1. Preliminary provisions, which contain short and necessary provisions, e.g. Title or Definitions.

1. STATE-OF-THE-ART OF LAW MODELLING

2. Principal provisions, which carry a prime message.
3. Miscellaneous.
4. Final provisions, which contain all the other provisions.

It is up to the drafter whether they stick to the traditional technique of structuring the document, or choose a more modern method. The drafter also has to decide how to divide each provision into smaller sets of provisions.[11]

The decisions of the drafter have a direct impact on the reader's ability to access the information in the text. It is possible, that some provisions get placed into the wrong section (erroneous division) or that some parts get to be divided too much in a way that the purpose of the provision is lost (over-division).[11]

It is necessary, for the legislation to be structured in a logical manner with respect to the targeted audience. The drafter has to identify, who is going to read the legislation, which generally includes persons who are burdened by the law or benefit from it and those who administer the law.

1.1.3 Legal Compliance and Businesses

Every business has its goals and objectives. The stakeholders specify business goals and design their processes in a way that meets these goals. However, they don't have complete freedom in how they achieve them. Apart from the requirement specified by the stakeholders, businesses have to fulfil the requirements specified by the law.

The law defines norms and regulations which protect its people. They give them certain rights companies cannot break, even if it conflicts with their needs and objectives. The goal of an e-shop is to sell products. It is against its best interests to let the customer return something they bought and demand refund. However, the law gives the customer the right to return the product within 14 days of purchasing, and the e-shop has a duty to accept it and return the money.

Laws may conflict with the stakeholder's needs and objectives for the business, effectively breaking their strategies.[1]

Sometimes companies asses that following the law is to their disadvantage and break the law on purpose. In September 2015, the German car manufacturer Volkswagen confessed to manipulating with the software of their cars to meet the US emission standards. This lead to the break of customer trust in the company and diesel-powered cars altogether. At the beginning of 2019, German news server Der Spiegel[12] reported about 50.000 active lawsuits against the car manufacturer.

1.1.4 Machine Representation of Law

As previously stated, legal documents have to be accessible. They are written in natural language, which makes it relatively easy for humans to understand. However, it's not suitable to be processed by a computer. For legal documents to be considered accessible, they have to be machine-readable. This means describing and classifying them in a uniform and organised way, which can be read and understood by software applications.

I have found three notations, which specify in representing legal documents in a machine-readable format.

1.1.4.1 MetaLex

CEN MetaLex provides a standard for representing sources of law and references to such sources using eXtensible Markup Language (XML) It was developed by the CEN Workshop on an Open XML Interchange Format for Legal and Legislative Resources. It is focused on information exchange and interoperability in the context of software development.[13]

Metalex provides public administration with the means to link legal information from different authorities, countries and languages. It provides support for companies which actively use legal knowledge systems to use legal content in their applications. For citizens and businesses, Metalex provides improved transparency and accessibility of legal content.[13]

According to the MetaLex homepage[13], the bibliographic identifiers identified by the CEN MetaLex recommendation are being used by the UK legislation, and all Dutch regulations have been converted into CEN MetaLex documents.

Unfortunately, the MetaLex Document Server¹, where all Dutch regulations are supposed to be published as CEN MetaLex and RDF Linked Data, is not available at the time of writing this thesis. The document, which defines the latest version of MetaLex standard, has been published in 2010.[13]

1.1.4.2 LKIF: The Legal Knowledge Interchange Format

The Legal Knowledge Interchange Format (LKIF) is a Semantic Web-based language for representing legal knowledge, which has been developed under the EU project ESTRELLA[14]. Its goal is to support the modelling of legal domains and to make the interchange between legal knowledge-based systems easier. Under the project, the LKIF-Core Ontology has been developed as an answer to the need for a standard vocabulary of basic legal terms. It defines approximately 200 concepts.

LKIF supports the representation of three types of legal knowledge: terminological knowledge, legal rules and normative statements.[14]

¹<http://doc.metalex.eu/>

The support of terminological knowledge is provided through the Web Ontology Language (OWL), one of the standards recommended for Semantic Web. It allows for the explicit and formal representation of the meaning of terms and their relationships with each another.[14]

There wasn't any recommended Semantic Web standard, which would be able to represent legal rules. SWRL has been considered; however, its expressiveness wasn't sufficient. LKIF rules have been developed instead, as an extension of SWRL with support for negation and defeasible reasoning. LKIF rules provide a language expressive enough to reflect the structure of the rules in legislation. It provides support to rules with exceptions, assumptions, and exclusionary conditions.[14]

Normative Statements are supported through the Norm module included in LKIF-Core ontology. This module contains minimally restricted definitions of deontic concepts and properties. It is possible to map the normative statements into OWL representation.

1.1.4.3 Akamo Ntoso

Akamo Ntoso defines a set of simple electronic representations of parliamentary, legislative and judiciary documents. It's technology-neutral and provides a framework for the effective exchange of machine-readable legal documents such as legislation, debate record, judgements, etc. The structure and syntax of the documents are defined using the XML standard. The official schema has been approved as Oasis standard on 29. August 2018.[15]

Akamo Ntoso provides standardised representations of data and metadata in the parliamentary and judiciary domain as well as a mechanism, which allows citations and cross-referencing of legal documents. Its primary purpose is to develop a number of connected standards, languages and guidelines for legal documents. It specifically aims to define[15]:

- a common document format,
- a common model for document interchange,
- a common data schema,
- a common metadata schema and ontology,
- a common schema for citation and cross referencing.

Akoma Ntoso aims to capture and describe the similarities between legal documents, regardless of their country of origin. At the same time, it takes into consideration the differences created by the different legislative culture of each country and by using a specific language. It provides support for exceptions and extensions, which allows it to capture all individual characteristics of legal documents of different cultures and countries.

1.2 Law Modelling Techniques

For any form of communication to be successful, it is necessary to establish a common ground between the participants. Communication in the legal domain is characterized by a legal professional jargon (legalese), which may lead to misunderstanding between legal experts and legal laypersons. Conceptual models are (mostly graphic) representations of a specific domain. They provide the communication partners with items they can refer to, helping them establish the common ground.

Recognising the potential of conceptual modelling to enhance the comprehensibility of legal documents has led to a notable research on the topic of visualisation of law and legal principles.

In the section, I review several approaches to Law modelling based on requirements engineering and business process modelling.

1.2.1 Nòmos

Nòmos is a modelling framework developed at the University of Trento, Italy. It was first introduced by Alberto Siena in his PhD thesis[1]. Nòmos attempts to solve the problem of law compliance of software requirements by extending goal-oriented techniques to argue about compliance.

Goal-oriented requirements engineering (GORE) is focused on goals that the developed system should support and requirements derived from these goals. However, goals do not necessarily address legal requirements. The team behind Nòmos framework proposes to solve this problem by finding actor goals such that if all of them are fulfilled, the legal requirements are also fulfilled.[1]

The modelling process with Nòmos starts from a model of legal requirements, which is then used to incrementally build a model of goals without breaking the alignment with the legal prescriptions. This approach determines which specific strategic elements are required or allowed to exist or not exist.

Figure 1.1 represents the normative propositions defined in the U.S. Health Insurance Portability and Accountability Act (HIPAA), Articles §164.502 and §164.314.

In his PhD thesis[1], Alberto Siena mentions a modelling tool developed for automating some parts of his modelling work. However, it has never reached enough stability and maturity to be used by external users, and its development has been discontinued.[16]

The last publication on Nòmos was released in the year 2016. No further research has been conducted because the EU project funding it has terminated.[16]

Nòmos is focused on obtaining rules embedded in a law and deriving its goals. It is not meant for modelling procedures.

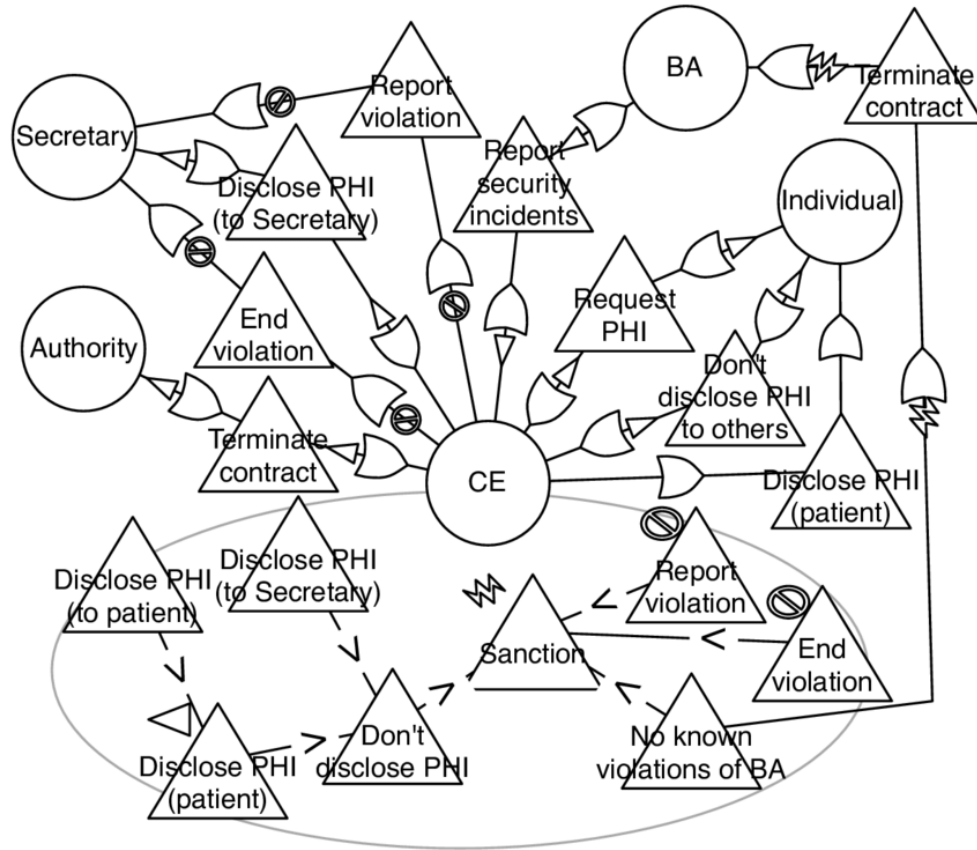


Figure 1.1: A Nòmos model of a Health Insurance Law[1]

1.2.2 VLPM 2.0

Visual Law Process Modeler (VLPM) is a law modelling framework, which aims to support the law-making process and improve understanding of legal documents. It provides people without a jurisprudence background with means to comprehend the law and potentially participate in the editing of regulations. It also supports the process of making changes to the law and keeps track of the dependencies between legal documents and models.[17]

The framework has been developed specifically with the focus on documents, which define, regulate or in some way define processes. Legal documents contain procedures as well as high level principles and rules, which regulate and motivate legal processes.[17]

VLPM 2.0 supports these two aspects of law by combining the following approaches[17]:

- VLPM semi-automatically extracts processes from a legal text marked with XML tags and creates their model using Unified Modeling Lan-

guage (UML). Actors, entities and activities are identified in the document and organized in a hierarchical structure. VLPM maintains the traceability between the original text and the model elements.

- Nòmos, introduced in the previous section, captures the high-level principles defined in the legal document. It serves to model those aspects of a law, which do not describe procedure.

The process of modelling with VLPM 2.0 starts with a Markup phase, where a legal document in Akoma Ntoso XML format is marked with tags representing actors, activities, artifacts and events. In the following Transformation phase, the objects are represented in a modelling notation (e.g. BPMN) while maintaining the links to the original text fragments. Next is the Modeling phase, where the analysts work with the models obtained during transformation. The final phase is Change Management, where changes to the models are identified and compared to the original version.[17]

The VLPM project home page was last updated in August 2008². There hasn't been any new publications on the framework after VLPM 2.0 has been introduced in 2010.[17]

1.2.3 UML

UML is an Object Management Group (OMG) standard used to specify, visualize, and document models of software systems, their structure and design. While it is primarily used for software systems, it is also commonly used for business modelling.[18]

There are thirteen diagram types defined by UML, which are divided into three categories[18]:

- Structure Diagrams represent static application structure and include the Class Diagram, Object Diagram, Component Diagram, Composite Structure Diagram, Package Diagram, and Deployment Diagram.
- Behaviour Diagrams represent general types of behaviours. They include the Use Case Diagram, Activity Diagram, and State Machine Diagram.
- Interaction Diagrams represent interactions derived from the Behaviour Diagram. They include the Sequence Diagram, Communication Diagram, Timing Diagram, and Interaction Overview Diagram.

1.2.3.1 Using State Machines for Law Modelling

The idea behind the work of V. Strahonja[19] on modelling laws using UML was to capture the domain knowledge procedural legislation using a commonly understandable standard. He takes advantage of the UML capabilities

²<http://ed.fbk.eu/vlpm/overview.html>

to capture the dynamic part of a domain (states, transitions, activities, sequences etc.). The State Machine Diagrams provide a notation for describing the time-dependent behaviour of a legal system and allow to better understand the legal domain. They also support validation and verification of legal regulation and its models.

State Machine Diagrams use visual modelling for intuitive description of system behaviour. They are relatively easy to read and be understood by human readers, while also being less ambiguous than natural languages.[19]

1.2.3.2 Luxembourg's Income Tax Law

A more recent work[20] defines a visual and at the same time semantically-precise UML-based methodology for modelling procedural legal rules. The methodology doesn't apply to declarative legal rules such as permissions, obligations and prohibitions. The authors have chosen UML because it's widely used and provides extension mechanism to the standard.

The researchers conducted a field study with the participation of legal experts, where they analyzed several legal statutes. They identified the information needs and complexity sources in the documents and developed a methodology for modelling legal rules, which uses a customization of UML Activity Diagrams as their core component. The resulting models are then transformed into Object Constraint Language (OCL) in an automated process. This approach is then applied to Luxembourg's Income Tax Law as a case study.[20]

The authors concluded that their approach is expressive enough to capture the complexity of legal rules in the case study. The legal experts involved in the study provided a positive feedback to the research and while further user studies need to be conducted, the authors have deemed their work worthwhile and useful to the large majority of taxpayers.[20]

1.2.4 BPMN

BPMN is one of the most commonly used graphical notations for modelling business processes. It provides a standard notation, which captures the complex process semantics for technical users, but is at the same time comprehensible to business users. The notation allows the process diagrams to be translated into software process components.[21]

BPMN aims to provide a bridge between the business process design and its implementation. It is easily understandable to analysts, who work on the initial draft of the process, the developers, who implement the technology performing the processes and also to the business people responsible for monitoring and managing the processes.[21]

In my research, I have come across two works, whose authors chose this very standard to analyze a legal process. There's also been an attempt to

extend BPMN meta-model in order to make it more suitable for modelling laws and legal requirements.

1.2.4.1 Public Procurement Process

In the article [22] from Bulgaria, the authors use BPMN to model the process of Public Procurement. Their goal is to identify the critical elements in the model, which affect Time, Quality and Cost at Organization, Process execution and System levels. The sources for their case study are National media, the Agency for public procurement and customer's interviews.

The authors identified several management problems with the process, which can cause misunderstandings, mistakes in decision making or prolonging the execution time of the process.[22]

To define and manage the problems in the process, the authors have decided to use BPMN. It allowed them to prepare a ready to analyze process flow, review how time delays can be reduced and analyze the impact of changes to the model and the involvement of the human factor.[22]

1.2.4.2 Law-making Process

The article [23] from the Netherlands looks on the process of Law making from the business process view. The authors have observed, that the law making process can be considered a typical business process.

The authors chose BPMN, because it's the de facto standard for business process modelling, it makes the information flows in the process visible and it can show how processes are integrated with each other.[23]

During the analysis, the authors created two models of the law-making process. First was based on the legal documents prescribing how the process should be executed. The second model was based on interviews and represented the process as it being executed in praxis.[23]

Even this analysis discovered problems with the process. There were differences between the described way for the process and the way it was actually executed in praxis. Some parts of the process have been left out, different formats has been used and there were some inconsistencies in the division of text. Other problems were discovered in the coordination of the process, where several agencies worked in parallel on the same problem, but didn't communicate with one another.[23]

The main discovery of the authors was that the law-making process itself is an obstruction to its improvement. The rules can be hard to understand and may end up ignored in praxis.[23]

The authors also proved their assumption that the law-making process can be treated as any other business process. BPMN helped them discover constraints and bottlenecks in the process. The weak point of the law-making process proved to be the same as with other business processes.[23]

1.2.5 DEMO

Design & Engineering Methodology for Organizations (DEMO) is the leading methodology of Enterprise Engineering (EE), which helps to provide insight and overview of an organisation. It's based on the idea that the key to understanding the operation of an organisation lies in the communication between people who constitute the organisation. Without people, there would be no organisation. Design & Engineering Methodology for Organizations (DEMO) describes the world by modeling transactions. Each has a specific initiator and executor, producing a single specific result.[4]

DEMO aims to capture the essence of an organisation, focusing on what they do and want to achieve rather than how to do it. The essential model represents the enterprise without functions, structures or specific persons. The initiators and executors of transactions are represented with actor roles, which demonstrate the needed responsibilities and authorities.[24]

1.2.5.1 DEMO Model of GDPR

General Data Protection Regulation (GDPR) is a European Union Regulation, which came into effect in May 2018. The primary aim of this law is to give individuals control over their personal data and to unify the regulation within the EU. Data subjects now have better insight into which data and for what purpose are being collected about them. They can give and remove consent for processing the data as well as require for them to be changed or erased. Entities outside EU also have to comply to the regulation whenever they handle personal data about persons who are in the EU, or offer goods, services or monitor behaviour in the EU.[25]

In their paper[25], D. Gouveia and D. Aveiro have analysed and modelled GDPR using DEMO. They tested the ability of the methodology to model the system described by the GDPR, and to reduce the complexity of the regulation. Another aim of their research was to identify the parts of GDPR which are hard or challenging to model with DEMO.

The authors have identified 48 transactions in the regulation. Most of these transactions do not connect to other transactions, which makes the final model harder to understand. The Actor Transaction Diagram (ATD) they created fits an A3 paper, which is a significant reduction to the complexity of the original text. Unfortunately, they did not provide the transaction results and the final model is therefore difficult to understand without the knowledge of the original text.[25]

The authors found DEMO to be an adequate technique for modelling the GDPR and reducing its complexity. However, the regulation posed a few challenges for the methodology. The authors believe that DEMO doesn't handle well transactions where the execution is handled by two or more participants, because each transaction is allowed only one executor actor role.[25]

Another challenge was created by the nature of transactions appearing in the GDPR. Typically, only ontological transactions are included in DEMO diagrams. However, this regulation mostly contains datalogical transactions. To create a comprehensive model, the authors decided to include the datalogical transactions.[25]

Exploring BPMN and DEMO for Law Modelling

In this chapter, I consider the modelling capabilities of BPMN and DEMO for modelling law. I explore their basic concepts, which I'll later use in my case study. In the case of BPMN, I also mention an existing extension tailored specifically for modelling laws. There is no such extension for DEMO.

Both of these techniques are well established for modelling business processes. Compared to the other law modelling techniques mentioned in Chapter 1, they have the best chance of finding use in practice, should they prove sufficient for modelling laws.

2.1 BPMN

Business Process Model And Notation (BPMN) was first released to the public in May 2004. The primary goal of this standard is to provide all business users with an understandable notation for modelling processes. It provides a simple mechanism for creating business process models, while at the same time can handle the complexity of a business process.[26]

The standard is maintained by the OMG. The latest version, BPMN 2.0.2 has been released in 2014.[27]

2.1.1 Notation Overview

In BPMN, the business process model is realised as a Business Process Diagram (BPD), which is based on a flowcharting technique. A BPD consists of a set of graphical elements, which were chosen in a way that makes them easily distinguishable from each other and familiar to most modellers. There are four element types[26]:

- Flow Objects

2. EXPLORING BPMN AND DEMO FOR LAW MODELLING

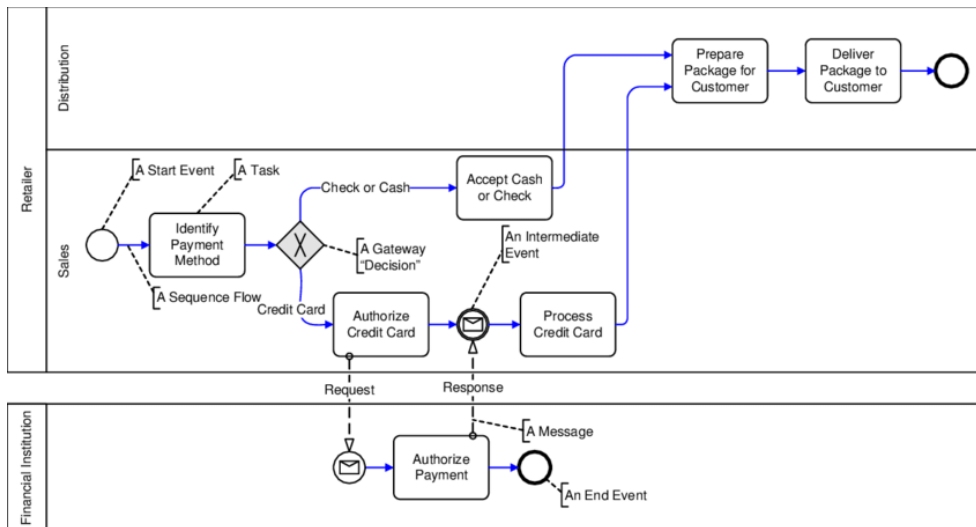


Figure 2.1: BPMN example of a “Payment process”[2]

- Connecting Objects
- Swimlanes
- Artifacts

An example of a BPMN model of a Payment process with an explanation of the basic elements is shown in fig. 2.1

The **Flow Objects** are the core elements of BPD. They are Event, Activity and Gateway.[26]

An *Event* represents something that “happens” during the process. They usually have a trigger and a result. The Events are represented by a circle, which may include internal markers in the centre to indicate different triggers or results. There are three types of Events based on when they appear in the process: Start, Intermediate, and End.[26]

An *Activity* is work that the company performs. It is represented by a rounded-corner rectangle. There are two types: Task and Sub-Process. The Sub-Process is indicated by a small plus sign in the bottom centre. An Activity can be atomic or compound.[26]

A *Gateway* represents decisions, as well as forking, merging and joining of paths in the process. It is represented by a diamond, with an internal marker indicating the type of behaviour control.[26]

The **Connecting Objects** serve to connect the Flow Objects of the process. They are the following: Sequence Flow, Message Flow, and an Association.[26]

A *Sequence Flow* shows the order, in which the activities of the process will be performed. It is represented by a solid line with a solid arrowhead.[26]

A *Message Flow* shows the flow of messages between particular Process Participants (business roles or business entities).[26]

An *Association* links data, text, and other Artifacts with Flow Objects. It is represented by a dotted line with a line arrowhead.[26]

Swimlanes help organise activities into separate visual categories, illustrating different functional capabilities or responsibilities. There are two kinds of Swimlane objects in BPMN: Pools and Lanes.[26]

A *Pool* represents a Participant in a Process. They are usually used when a diagram contains separate business entities. All activities within the Pool are associated with a specific Participant and are considered self-contained processes. Sequence Flows are not allowed to cross the boundary of a Pool. The communication between participants of the process is shown using Message Flows.[26]

A *Lane* is a sub-partition of a Pool. It usually serves to separate activities associated with a specific company function or role. The activities of different Lanes may be connected by a Sequence Flow. However, Message Flow may not be used for communication within the same Pool.[26]

Artifacts provide modellers with the ability to include additional context in their diagrams. They offer some flexibility in extending the basic notation. The notation offers three pre-defined Artifacts: Data Object, Group and Annotation. Modellers can create their own types of Artifacts.[26]

Data Object represents data required or produced by activities, to which they are connected through Associations.[26]

A *Group* may serve for documentation or analysis purposes. It is represented by a rounded corner rectangle drawn with a dashed line and does not affect the Sequence Flow.[26]

An *Annotation* provides additional text information to the reader of the diagram.[26]

2.1.2 General uses of BPMN

There are two basic types of processes, which can be modelled using BPDs: Collaborative Business-to-Business (B2B) Processes and Internal Business Processes.[26]

Collaborative B2B Processes are used to model public processes, where two or more business entities interact with each other. These processes are also called abstract. They show activities, which are visible to the public. The actual (internal) processes behind them usually include more activities and detail.[26]

Internal Processes usually take into account only the processes within a single organization. They may include interactions with external participants. However, they define activities, which are private and therefore not visible to the public.[26]

2. EXPLORING BPMN AND DEMO FOR LAW MODELLING

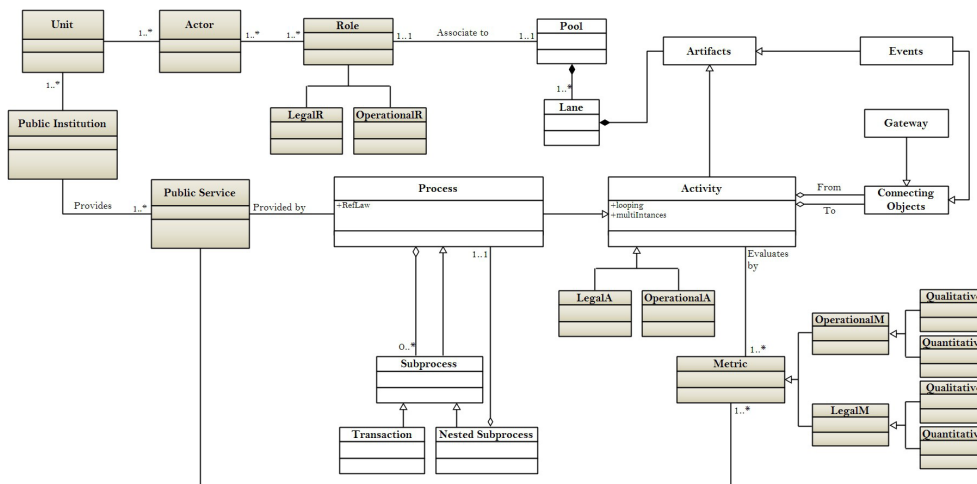


Figure 2.2: The extended Meta-model of BPMN (suggested extension marked by a dark background).[3]

2.1.3 User Complains

In a study conducted by Recker, J.[2], it was revealed that some aspects of BPMN may complicate modelling of a process.

BPMN doesn't adequately support the articulation of business rules. Process modellers have to use workarounds, usually by also using additional tools, to include business rules in their processes. This problem could be solved by adding a new element.

Another problem is caused by the vague definition of Swimlanes. In practice, various contexts are assigned to both Pools and Lanes. For example, Lanes can represent roles, organizational units or business areas, based on the needs of the specific process. The suggested solution would be to label Swimlanes with a symbol to represent a specific use of the elements.

The authors of the study have also found out, that there are too many symbols and element types. Several elements, such as "Compensation", "Conditional Flow" or "Intermediate Cancel" are seldom used and mostly unnecessary. Users also have problems distinguishing individual types of Events, which decreases the ease of use of the notation.

BPMN also lacks a way to evaluate a modelled process, which would make it easier to improve the processes.[3]

2.1.4 A BPMN Extension for Modelling Law

A. Cherouanaet et al.[3] attempted to make BPMN more suitable for modelling laws by suggesting an extension to the notation meta-model, as seen in the figure 2.2. Original elements are white, and the suggested new elements are dark.

There are four categories of the extension elements: organisational aspect, service aspect, process aspect, and process evaluation aspect.

Organizational Aspect consists of Public Institution, Unit, Actor, Role and individual Role types. It identifies all participants in the process. Each actor is assigned one or more Roles. Each role is represented by a Pool or a Lane with a special symbol indicating if it's a Legal Role, Organizational Unit or a Public Institution.

Service Aspect contains only the element Public Service. It represents the final output as a result of the execution of a process. This component describes the Service. It must state the type of service and the beneficiary social entity.

Process Aspect contains the extensions of Activity element, namely Legal Activity and Operational Activity.

Parts of a process may be subject to changes. Based on the frequency of these changes, we talk about stable/unstable parts. Legal Activities in the meta-model describe the stable parts of the process, while Operational Activities describe the unstable parts, which may frequently be changing.

Evaluation Aspect consists of the Metric elements, which are meant to be used for evaluation. The authors define to families of Metrics, Legal Metrics and Operational Metrics. Both can be Qualitative or Quantitative.

The Organisational and Service Aspects of the metamodel introduce elements, which improve BPMN capacity to model legal processes. However, I have an issue with the definition of the Process Aspect, which defines Legal and Operational Activity based on how likely they are to change. The authors didn't explain how to assign to which category the identified activity belongs. This Aspect, in my opinion, isn't sufficiently defined to enhance the basic BPMN.

2.2 DEMO

Enterprise engineer approaches the design and construction of an organisation the same way a civil engineer would approach building a bridge. DEMO allows them to untangle the complex structure of an organisation and fix the constructional mistakes.[24]

An enterprise usually consists of three components: Business, Organisation and IT. Each of these components is managed by their own experts and usually regarded as a separate entity. Enterprise Engineering (EE) provides a holistic view on the enterprise and guaranteed cohesion in these different enterprise components during a transformation.[24]

The main benefit of DEMO is that it brings forth the essence of an organisation, without depending on the realisation and implementation. It produces very compact models, which usually fit only several A4 papers.[24]

This section is dedicated to Design & Engineering Methodology for Organizations (DEMO) with focus on those methods, which are suitable for modelling laws.

DEMO is currently the only EE methodology.

2.2.1 Methodology Overview

Every methodology defines three components. The Way of modelling (WoM) represents the collection models produced by the methodology. The Way of working (WoW) represents the specific methods, which are used to create such models. Both of them are rooted in the theories represented by the Way of thinking (WoT).[28]

There are eleven EE theories, which create the basis for the methods used for improving enterprises. Eight of them comprise the WoT of DEMO. The WoM consists of four models: Construction Model, Process Model, State Model and Action Model. The WoW is represented by the Organisational Essence Revealing (OER) method.[28]

2.2.2 Transaction

The core concept of DEMO is a transaction. Every transaction consists of three phases: the Order phase, the Execution phase and the Result phase.[4]

The Order phase begins with an *initiator*, who creates a *proposition* by *requesting* (*rq*) a *product* from an *executor*. When the initiator can deliver the product, they respond with a *promise* (*pm*) to do so. Otherwise they *decline* (*dc*) the proposition, after which the initiator either requests a new proposition, or *quits* (*qt*) the transaction. For example, the customer (initiator) orders (*rq*) a pizza (product). The cashier (executor) gives a promise (*pm*) to deliver it.[4]

During the Execution phase, the executor produces the product. This phase often involves the initiation of other transactions. For example, the cashier (initiator) requests (*rq*) the baker (executor) to prepare the pizza (product).[4]

The resulting phase begins when the product is created. The executor *states* (*st*) that the product is created, thus making it the *result* of the transaction. The initiator may now *accept* (*ac*) or *reject* (*rj*) the product. For example, the cashier presents (*st*) the pizza (product) to the customer. However, the customer ordered the pizza without pepperoni, so they reject (*rj*) it.[4]

The following four steps are present in every transaction and represent the happy flow: request, promise, state, accept. Each of these steps can be *revoked* (*rv*) anytime during the transaction. The other party can either *allow* (*al*) this, or *refuse* (*rf*) it. For example, the cashier has promised (*pm*) the

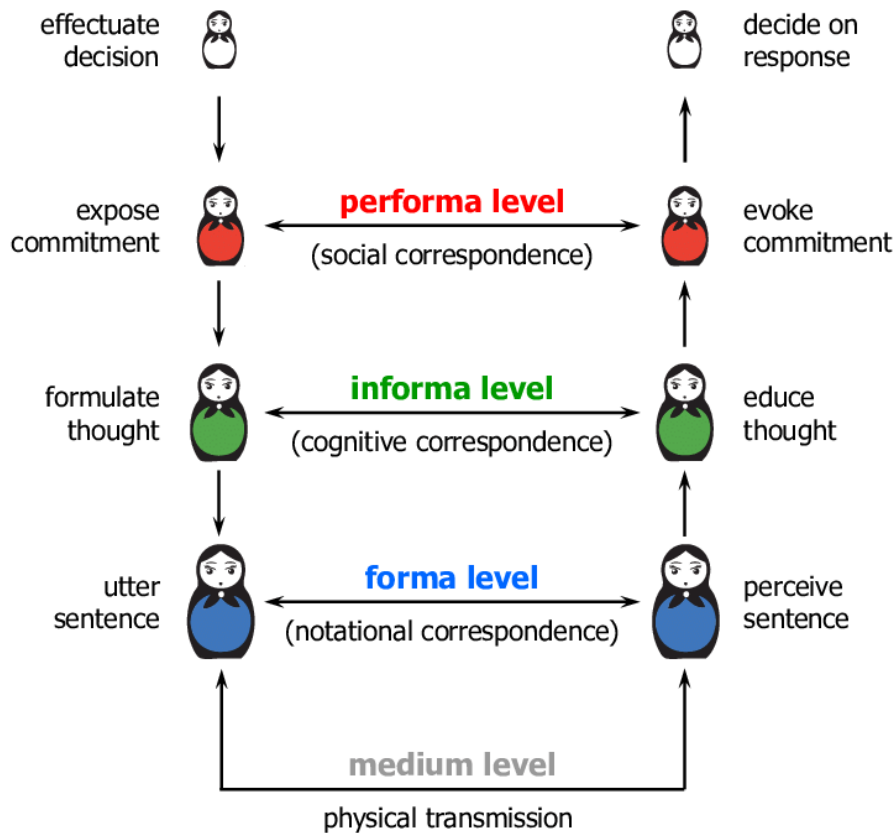


Figure 2.3: The process of a communication act[4]

customer to deliver them pizza. However, they find out that an ingredient is missing, and take back the promise (rv pm).[4]

2.2.3 Communication Levels

We can distinguish three human abilities involved in a coordination: performa, informa, and forma. These abilities form three levels of correspondence in the communication between subjects, as shown in fig. 2.3 using Russian dolls. For a communication to be successful, each level has to be satisfied. There are two more levels involved in a communication, which fall outside the scope of EE.[28]

The inner self level is where a person's wisdom and love reside. They are the basis for their decisions. This level falls outside the scope of EE. On the picture, it's represented by a blank doll.[28]

At the performa level, the intersubjective or social meaning of the message is considered. The performa ability is used to expose commitment and to evoke commitment. Understanding at this level reaches social correspondence. On

the picture, this level is represented by a red doll. This is the level where original production acts are performed such as manufacturing, transporting, observing, deciding or judging. Original production is the only one, which creates facts.[4]

At the informa level, only the content of the message is considered. The informa ability is used to formulate thought and to interpret thought. Understanding at this level reaches cognitive correspondence. On the picture, this level is represented by a green doll. This is the level where informational production acts are performed such as remembering and recalling facts or deriving facts from existing ones. Informational production never creates facts. It may provide different views on the world, but it is the same world.[4]

At the forma level, only the form of the message is considered. The forma ability is used to utter sentences and to perceive sentences. Understanding at this level reaches notational correspondence. On the picture, this level is represented by a blue doll. This is the level where documental production acts are performed such as archiving or providing.[4]

Based on the three levels of production, there are three aspect organisations distinguished in every organisation: the B-organisation (B for business, based on original production), the I-organisation (I for information, based on informational production) and the D-organisation (D for data, based on datalogical production). The three aspect organisations are represented by Fig 2.4.

2.2.4 Actor Roles

The initiator and executor of a transaction are not represented by specific persons. Instead, they are represented by actor roles, with specific authority and responsibility. Only employees who have the required competencies can be assigned an actor role.[28]

2.2.5 DEMO models

Using DEMO to analyse business processes yields the essential model of an organisation. It describes the construction and operation of the organisation, while completely abstracting from implementation and realisation. Informational aspects, such as remembering or sharing, and documental aspects such as storing or retrieving, are not included.[24]

There are four aspects of essential model[24]:

- Construction Model serves to identify transactions and actor roles, their authority, competence and responsibility,
- Process Model serves to reveal the structure of business processes,
- Fact Model serves to identify core business objects and facts and how they are connected with the transactions,

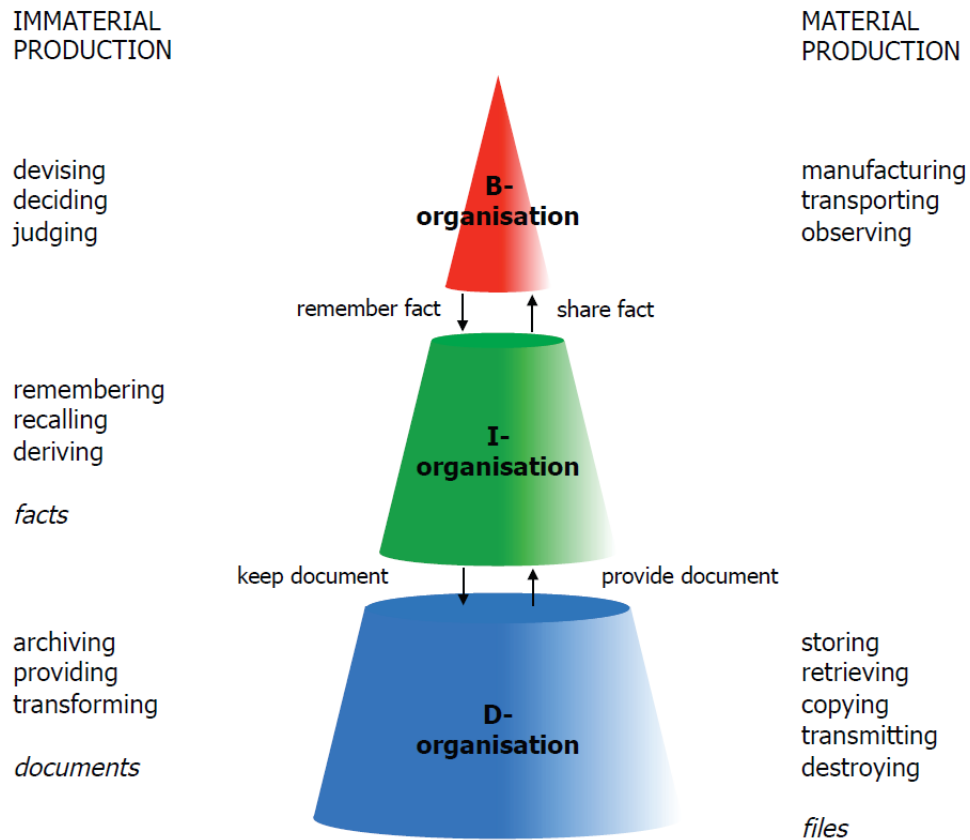


Figure 2.4: The three aspect organisations[4]

- Action Model serves to define the identification and specification of business rules and the work instructions.

2.2.6 OER Method

The Way of working in DEMO is called the OER method. It stands for Organisational Essence Revealing, but at the same time means “primal” in Dutch. The method is used to discover the “original shape” of an organisation, removing all the applied communication and information technology. Remembering and computing of facts is considered only mentally.

The OER Method consists of three steps:

1. Identifying the B-organisation coordination acts/facts and production acts/facts
2. Identifying the transaction kinds in which these acts/facts occur
3. Identifying the three structures in which these kinds occur

If it's possible to interview every person within the Scope of interest, then they should be asked the following questions: "What kind(s) of original facts do you produce?", "Who is requesting you to do this?", and "Who do you request to produce original facts for you?" The answers to the first two questions identify the transactions, in which the person serves the Executor role, their production kinds and their initiator. The answer to the third question serves to confirm the information collected so far.

This approach is not always possible. The second best way is to analyse written documents, which describe the business processes in as much detail as possible.

Comparing BPMN and DEMO for Law Modelling

Both BPMN and DEMO are actively used in business environment. Both techniques have proven to be useful for modelling business processes. Wijk and col.[23] have concluded that the Law-making process can be treated as a business process. Nonetheless, several aspects unique to legal documents should be considered before modelling them.

3.1 Legal Ambiguity

Business processes have specific instructions, and if an instruction is ambiguous, it should be revisited and clearly specified. Ambiguity is an anomaly which has to be corrected.

Legal instructions, on the other hand, are often ambiguous on purpose. There are centuries old laws still in power. They were written with the future in mind without knowing what the future might bring. The authors intentionally write laws in a way that leaves space for interpretation, based on the circumstances of their use. This intentional ambiguity makes it difficult to fully formalise law.[29]

Both business processes and laws serve a purpose and create specific products, be it a car or the transfer of rights. Even ambiguous laws serve a purpose, which shouldn't change with interpretation or implementation. The important details, such as the definition of tasks to be performed, should not depend on the circumstances of their use. Both BPMN and DEMO should be capable of capturing the process even with some ambiguity in the source material.

3.2 References

Several authors[1][29][17] have mentioned the importance of maintaining links between legal documents. Laws indeed frequently reference one another. It becomes necessary to keep the references to laws which influence the modelled law or which are influenced by the modelled law. These references are important for the process of changing a law, or when something isn't clearly defined, it might be found in the referenced text.

Conceptual models use symbols to represent the content of the source material. The exact formulation of legal texts is often necessary to properly understand the meaning. Maintaining links between the model elements and the source text would improve the understanding of the final model. The advantage of legal documents is their structure. Every paragraph is clearly identified and can be therefore easily referenced.

Neither BPMN or DEMO offer any concept of references. This, however, seems like the matter of modelling tools rather than modelling methodologies. It should be considered when designing modelling tools rather than during modelling itself.

3.3 Responsibilities

Every process requires participants, who carry out its execution. Someone is always responsible for the proper execution of tasks in a process. In law especially, it is important that only authorised person performs a task.

As shown by the extension metamodel[3], BPMN lacks necessary expressiveness when it comes to defining the process actors. Swimlanes and Pools are the elements traditionally used to represent the executor of tasks defined by the process. These elements have proven to be confusing and used for several different purposes, even within the same organisation[2].

Each DEMO transaction defines actor roles, who initiate and execute the transaction. These roles are defined by their purpose in the process rather than a specific organisational role or specific people. A subject (specific person) may be assigned to a role when they meet the competence for that role. This makes it more accurate than naming actors by their functions in the company. One person may act in several roles in a process, and several people may act in the same role.

DEMO is the better option for capturing the responsibilities of subjects in a process. The methodology also makes it easy to find missing definitions of actors, because it forces the modeller to find both the initiator and the executor. However, the actor roles defined by the methodology are not necessarily called by the same name as in the source material. It is, therefore, necessary to keep track of their relationships.

3.4 Detail and Precision

When dealing with the legal documents, it is important not to leave out essential information or confuse the meaning of the original text.

BPMN provides the modeller with a large number of elements, which gives them the opportunity to capture a lot of detail. The element meaning and usage is not always fixed and might lead to some confusion, as is the case of Pools and Lanes.[2] The models are heavily influenced by the modeller. It is possible to create two different yet equally correct models of the same process. There is no “right way” to model the process.

The depth of detail is not specified and depends on the modeller and the purpose of the model. A task represents work[27], which can consist of a single action or several of them. Sometimes going into too much detail would make the model unclear and defeat the purpose of creating the model in the first place.

DEMO places emphasis on objectivity. Two modellers with the same assignment will always produce the same result. They take into account all the communication happening between the actors but focus only on the ontological transactions which result in an original production fact. The depth of detail doesn't depend on the modeller. All concepts are well defined. Essential models contain everything that has been objectively established to be necessary.

Law, in general, is not objective. Two lawyers may interpret the written law in two different ways. The focus of this thesis is the procedural law, which provides exact descriptions of how to proceed in the process. There should be little room for creativity.

The expressiveness of BPMN allows for the process to be modelled in great detail. However, it depends on the modeller how much detail they include in their model.

I believe the law can benefit from the objective approach of DEMO, which leaves no place for unintentional ambiguity. It helps identify parts of the text, which are not clear or fully defined. Modelling with BPMN gives the modeller some freedom, which could simplify some tasks in order to tailor the model for the target audience. Unfortunately, it provides more room to overlook important steps in the process.

3.5 Comprehensibility

Legal documents contain too much information, which could make it difficult for the reader to find what they are looking for. Conceptual models provide a means to make sense of the source material and focus only on what is necessary. In my case, it is the processes concealed beneath the legal words.

3. COMPARING BPMN AND DEMO FOR LAW MODELLING

Conceptual models replace words by concepts, which may not be as comprehensible as the natural language would be. It is necessary to consider if reducing the complexity isn't paid by comprehensibility.

BPMN is generally considered a well understood notation, even by people without training. I've tested the claim in my bachelor thesis[30]. I've come to the conclusion that the models are generally well comprehensible. However, the comprehensibility also depends on the size of the model and the number of different elements used. The fewer concepts are used in creating the model, the better is its comprehensibility. The advantage of BPMN is that there's only one model which captures everything necessary to understand the process.

DEMO uses several models, each focused on a different aspect of the communication between actors of a process. At first, they may be difficult to comprehend. DEMO uses only a few concepts in each model. Once the reader understands these basic concepts, they can understand the whole model, no matter how large it is and who modelled it. The aspects of the process are split into several models, and all are necessary to fully comprehend the essential model.

If we consider a reader, who has no knowledge of conceptual modelling, then BPMN seems to be the more comprehensible notation. However, the difficulty of the model depends on the modeller. DEMO on the other hand, requires some background knowledge to be understood and all the models to have the whole overview of the process. Its comprehensibility is not linked to the modeller, which makes all models virtually equal concerning their comprehensibility.

It is not clear which technique would create the more comprehensible models of the law. It depends on the situation and people involved in making and reading the models.

Case Study

To test the capabilities of BPMN and DEMO, I have conducted a case study in which I modelled an official legal document and supported it with a BPM system.

I've considered laws of the Czech Republic and the European Union. Unfortunately, most Czech laws don't have a public translation into English, so my choices there were limited. Laws of the European Union often describe what should be achieved, but leave the specifics of implementation including the procedure to the member states.

I've chosen the *Arbitration Rules of the International Arbitration Court of the Czech Commodity Exchange*[31] for my case study. This law is currently in the final stages of being published, so it is not yet publicly available. It is a practical example with a suitable length of 40 pages in the official English version.

Any references to the Rules or Arbitration Rules shall mean references to the Arbitration Rules of the International Arbitration Court of the Czech Commodity Exchange.

4.1 Overview of the Arbitration Rules

The Arbitration Rules of the International Arbitration Court of the Czech Commodity Exchange has two official language versions, Czech and English. The Rules define the procedure of conducting the Arbitral Proceedings and all the actors involved.

Arbitral Proceedings are an alternative to the classical court proceedings. They are decided by one or more Arbitrators, who are experts on the topic of the dispute. The Proceedings lead to the rendering of the Arbitral Award, a legally binding final decision on the dispute.[32]

The International Arbitration Court of the Czech Commodity Exchange hears and decides all property disputes related to the commodities traded on the exchange.[32]

4.2 Transaction Analysis of the Arbitration Rules

My first step was to analyse the law using the OER method. I have marked the transactions in the text, using red for ontological transactions, green for infological and blue for datalogical. Then I've identified which parts of the transaction the text represents and wrote it down into the extended Transaction Result Table (TRT). Table 4.4 contains a sample of the TRT.

4.2.1 Example of an Analysed Paragraph

The following text is Article 7, paragraph 3 of the Rules[31]. It is part of the process of Challenging an Arbitrator discussed in Article 7. I've coloured the text according to the previous paragraph. I've also highlighted the subjects taking part in the transactions using yellow. The text is also marked with the identification of the transaction and the corresponding part of the transaction (e.g. [T25,rq]).

If the **challenged arbitrator**, having been informed of the challenge^[T25,rq], considers the challenge groundless and does not resign from his or her office^[T25,dc], **the Presidium of the Arbitration Court** is authorised to decide on the challenge^[T26]. **The Presidium of the Arbitration Court** assesses the admissibility of the challenge in terms of paragraphs (1) and (2), and if the **Presidium** concludes that the challenge was made properly and in time^[T26,dc], the **Presidium** decides on the merits of the challenge^[T26,st]. **The Presidium of the Arbitration Court** provides the challenged arbitrator, the remaining members of the arbitral tribunal and the other party or parties with an opportunity to comment on the challenge^{[T27][T28]} before any decision is made thereon. Any and all of the above-mentioned statements will be communicated to all parties and arbitrators. **The Presidium of the Arbitration Court** may decide that the parties shall not have access to a statement^[T29] and/or a part thereof provided by any arbitrator if it contains inside information regarding the actions of the arbitral tribunal relating to the proceedings and the factual and legal assessment of the case.

The first transaction of the process is not included in the excerpt, because it is described in Article 7, paragraph 1 and 2. The transaction is T24, Challenging an Arbitrator. Table 4.1 shows its record in the extended TRT. It begins with Arbitrator Challenger (any of the parties) filing the Challenge (rq). The Challenge is disregarded if it wasn't filed in time or doesn't follow the criteria for filing the Challenge (dc). Promise (pm) or accept (ac) are not described in the text. Therefore I've marked them to be tacit. The product of

the transaction is a Challenge resolved (st). The executor of the transaction is marked as Challenge Completer. However, it is not clear who is eligible to perform as the actor.

The first transaction in this excerpt is T25, Resignation of an Arbitrator. Table 4.2 shows its record in the extended TRT. This transaction begins with the Challenged Arbitrator being informed by the Challenge Completer (The Presidium of the Arbitration Court) that a challenge has been filed against them. I consider this part to be a request (rq), because it's an instruction to resign. The Challenged Arbitrator may decline (dc) the request by refusing to resign. If the transaction isn't declined, then it is successfully completed, and the Challenged Arbitrator has resigned (st). This part is not explicitly written in the text, but it follows from [T25,dc]. The promise (pm) and accept (ac) part of the transaction are not mentioned. Therefore they are marked as tacit in the extended Transaction Result Table.

The next transaction is T26, Deciding on the merits of a Challenge. Table 4.3 shows its record in the extended TRT. The request (rq) or promise (pm) are not specified in this case. There is written, under which conditions the Presidium decides on the Challenge. I've considered failing these conditions to be Challenge Decider (Presidium) declining (dc) the Challenge. The product of the transaction is the Decision made (st) by the Challenge Decider.

Transactions T27 and T28 are Commenting on the Challenge. I've decided to make two transactions in this case, because there are two types of executors. Party Commenters (other party or parties) are the executors outside the scope of interest, while Arbitrator Commenters (the remaining members of the arbitral tribunal) are actors inside the scope of interest.

Transaction T29 is mentioned only in one sentence. It is initiated and executed by the Challenge Decider (Presidium). The transaction result is the limited access of the parties to a statement (st). No other parts of the transaction are described.

There is one infological transaction in the excerpt marked green. It serves to inform all parties and arbitrators on all the statements in the proceedings. It does not create any original production facts, and it is not an instruction to create any original production facts.

4.2.2 Transaction Definitions

Transactions in the document were not easy to find. The document isn't ordered chronologically. Filing of Statement of Claim (transaction T2) is described in Article 23 (there are 57 Articles). The conditions for handing the Files over to Arbitrators are described in Article 29. One of the conditions is that all Arbitrators have been Appointed. The Respondent takes part in appointing the Arbitrators, yet they aren't part of the Proceedings until they've been asked to answer the Statement of Claim, which is first mentioned in Article 31.

4. CASE STUDY

Table 4.1: Transaction Result Table Example: T24 - Challenging an Arbitrator

Basic information		Source
ID of transaction:	T24	
Name of transaction:	Challenging an Arbitrator	§7
Initiator	Arbitrator Challenger	
Executor	Challenge Completer	
Order Phase		
Request	Filing Challenge of Arbitrator	§7/2
Revoke request		
Promise	tacit	
Revoke promise		
Decline	Not admitting the Challenge	§7/2
Quit		
Result Phase		
State	Challenge resolved	
Revoke state		
Accept	tacit	
Revoke accept		
Reject		

Some transactions or a group of related transactions span across several articles. The starting transaction, T2, Arbitral Proceedings, is mostly defined in Article 23, while its revoke request is defined in Article 28. The transactions of appointing the arbitrators are defined in Articles 6, 24 and 31.

There are paragraphs with no ontological transactions while other paragraphs contain several of them.

I've identified 128 ontological transactions. None of them was fully defined. Transactions in DEMO have four compulsory parts: request, promise, state, accept.

Request (rq) is tacit in about 1/3 of cases. The request is not defined when the Initiator and Executor are the same. It is also not always defined when both Initiator and Executor are actors within the Scope of Interest.

Usually, requesting something results in the executor either providing it or declining the request. In case of the transactions in this document, the Initiator doesn't request the product they want directly. Parties don't request for an Arbitrator to be removed from Office. They request a Decision on

Table 4.2: Extended TRT Example: T25 - Resignation of an Arbitrator

Basic information		Source
ID of transaction:	T25	
Name of transaction:	Resignation of an Arbitrator	§7
Initiator	Challenge Completer	
Executor	Challenged Arbitrator	
Order Phase		
Request	Informing the Arbitrator of the Challenge	§7/3
Revoke request		
Promise	tacit	
Revoke promise		
Decline	Refusing to resign	§7/3
Quit		
Result Phase		
State	Arbitrator resigned	
Revoke state		
Accept	tacit	
Revoke accept		
Reject		

removing an Arbitrator from office to be made. The transaction is successfully finished whether the Arbitrator is removed from office or not.

Promise is absent from almost every transaction. The only other kind of promise is Receiving a Statement or a Request. The Arbitral Proceedings, for example, begins the moment the Statement of Claim is delivered to the Arbitration Court.

State is the only compulsory part present in every transaction.

Accept is missing from every transaction. All decisions of the Arbitration Court are final and there's no option of an appeal unless specified otherwise.

The optional parts of transactions are mostly undefined as well. A few requests may be declined if they don't follow the criteria for accepting the request. The Statement of Claim may be withdrawn (revoke request). The only other revokes may happen in case an Arbitrator has been replaced, and the new Arbitrator decided to rehear the case. I haven't included this revoke promise in the extended TRT, because I wasn't clear which transactions are part of the Hearing.

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Table 4.3: Extended TRT Example: T26 - Deciding on the merits of a Challenge

Basic information		Source
ID of transaction:	T26	
Name of transaction:	Deciding on the merits of a Challenge	§7/3
Initiator	Challenge Completer	
Executor	Challenge Decider	
Order Phase		
Request	tacit	
Revoke request		
Promise	tacit	
Revoke promise		
Decline	Not admitting the Challenge	§7/3
Quit		
Result Phase		
State	Decision made	
Revoke state		
Accept	tacit	
Revoke accept		
Reject		

Every transaction requires an Initiator and an Executor. Some transactions, however, are missing the latter. As mentioned before, the transaction T24 doesn't specify who is executing the transaction. There are more transactions like that. As an example, we can look at Article 14, paragraph 3 of the Rules[31].

The arbitrators may, at their discretion, determine that the parties shall send any and all of their submissions, including all documentary evidence and/or any and all other communication concerning particular proceedings in such a manner that allows for proof of delivery directly to the other party or, as applicable, through the party's counsel, if the party has any. The sender is in such case obliged to **prove upon request** to that the document or the communication sent as indicated above was properly delivered.

The words "prove upon request" specify the transaction T85, Proving a Document has been properly delivered. The sender is requested to prove the

delivery, and they provide the proof. The text doesn't say who may request the proof. Given the rest of the paragraph, it would seem like Arbitrators should be the Executing subject. However, it would also make sense for the President of the Arbitration Court or the Secretary General to request the proof of delivery.

A few transactions have their subjects defined, but not clearly. The following sentence is taken from Article 1, paragraph 11 of the Rules[31].

If **the parties to a dispute** plead the incompatibility of the two language versions and claim the existence of an impact thereof on the case at hand, the arbitral tribunal shall decide which version shall apply for the purposes of the particular proceedings.

There are two ways how to interpret the sentence. The way it is written, it seems like the parties have to plead the incompatibility together. It could also be that any of the parties may plead the incompatibility. The second case seems more likely, yet the first one is truer to the words used in the text.

Most transactions in the Arbitral Proceedings are ontological. Actors within the Scope of Interest mostly pass decisions or request original production facts. The passing of documents is mostly not mentioned unless it has ontological meaning. When Arbitrators inform, it is usually a request. Informing the Respondent of the Statement of Claim is actually a request to provide an answer.

There are instances of document transfer to share the information between all the participants of the proceedings. They don't serve as a directive to do something. They are meant to be understood by their recipients and inform them of their content, so I consider them infological.

It is possible that some infological transactions are in fact ontological. The following text concerning the Arbitrators comes from Article 5, paragraph 2 of the Rules[31].

Together with the acceptance of the appointment, each arbitrator is obliged to sign a declaration of independence and impartiality and disclose any and all circumstances that could give rise to legitimate doubt as to the arbitrator's independence and impartiality and which could lead to the disqualification of the arbitrator. This declaration is part of the case file and is accessible to the parties. **Furthermore, each arbitrator shall promptly inform the parties and the Secretariat of the Arbitration Court in writing of any and all of the above-mentioned circumstances that have occurred or that the arbitrator has become aware of during the arbitral proceedings.**

The bold text is on the border of infological and ontological transaction. Logically, an Arbitrator informing the other participants of the proceedings

that they are no longer fit to perform their function should be understood as a request to be taken off the case. However, nowhere in the Rules is it written. The text only states that the participants have to be informed. Since there is no followup to this transaction, I've categorized it as infological.

Another infological transaction would be the calculation of the Value of Dispute, which is either part of the Statement of Claim or calculated by the Secretary General based on the information provided.

4.2.3 Actors

The Rules[31] define 5 subjects on the side of Arbitration Court: Secretary General, President of Arbitration Court, Presidium, Arbitral Tribunal, and Individual Arbitrator. I have also included a subject called Unclear, because the subjects of several transactions couldn't be identified.

Each of these subjects has a specific role in the Proceedings, but during the process, they fill 21 actor roles. Table 4.5 maps these subjects to their actor roles. The names of the actor roles are not included due to space constraints. They can be found in the Appendix, in table A.2.

The Rules[31] define 4 subjects outside of the Arbitration Court: Claimant, Respondent, Third Party (Intervening Party) and Expert Witness. The last two could be merged together, but a Third Party has different rights and obligations in the Proceedings. I haven't mapped many transactions to the Third Party, because those rights and obligations weren't clear to me. The Rules[31], Article 20, paragraph 2 state the following:

The intervenor has the same rights and obligations in the proceedings as a party, except for the right to appoint an arbitrator.

From this text, the Third Party can act as the Claimant or Respondent in all transactions except appointing of Arbitrators. While most transactions are performed by a "party", some transactions require specifically the Claimant or Respondent. Others imply that there are only two parties to the proceedings. Following text is Article 42, paragraph 2 of the Rules[31].

Any party has the right to petition the arbitrators at any time during the proceedings and demand that the arbitrators request **the other party** to produce documents in the latter's possession, provided that the said documents are relevant for the factual and legal assessment of the case and are not publicly available. Before the arbitrators make a decision on any such request, the party who is requested to produce the documents will be provided with an opportunity to comment.

Because I wasn't sure about what rights and obligations the Third party has in the proceedings, I included them only in the transactions, where they were specifically mentioned.

Most actor roles outside the Scope of Interest are filled by the Claimant or Respondent. There are 38 composite actor roles outside the Scope. Table 4.6 maps the subjects to their actor roles. The names of the actor roles are not included due to space constraints. They can be found in the Appendix, in table A.2.

I've used four types of marks in the Actor mapping tables:

- X** Subjects who may perform the role. If the cell is merged, then both subjects perform the task as one executor.
- XX** Subjects who perform the role. The transaction has to be performed with each of these subjects as an executor.
- X?** Subjects who may perform the role. It is not clear, if each subject can act on their own or if they have to act together.
- ?** Subject is unknown.

4.3 Organization Construction Diagram

Once the ontological transactions have been found, I have used them to create the Organization Construction Diagram (OCD). The Rules[31] contained too many transactions to fit them on one page. I have split the model into 4 parts into Figures 4.1, 4.2, 4.3, 4.4.

There are many ontological transactions in the process of Arbitration Proceedings, but only a few are compulsory to finish it. I have marked these transactions in the model with red connections if the transaction has to be completed, and with orange connections if one transaction in a group has to be completed.

The process consists of 4 main parts:

1. Preparation of the Proceedings, in Figure 4.1,
2. Hearing of Dispute, in Figures 4.2, 4.3 and 4.4,
3. Rendering the Arbitral Award, in Figure 4.4,
4. Actions after Rendering the Arbitral Award, in Figure Figure 4.4.

Preparation of the Proceedings begins when a Statement of Claim is filed by the Claimant (T2). From the side of the Arbitration Court, this part is handled by the Proceedings Completer. After the Arbitration Fee has been paid (T3), the Respondent is informed and requested to provide the Statement of Claim (T6). Afterwards, the Arbitrators are appointed. If the dispute should be decided by a Sole Arbitrator, both parties appoint them together

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Table 4.4: Transaction Result Table Sample

TID	Transaction name	Product
T24	Challenging an Arbitrator	Challenge resolved
T25	Resignation of an Arbitrator	Arbitrator resigned
T26	Deciding on the merits of a Challenge	Decision made
T27	Parties Commenting on Challenge	Comment provided
T28	Arbitrators Commenting on Challenge	Comment provided
T29	Limiting access to a Statement	Access to Statement limited
T30	Appointing new Arbitrator	New Arbitrator Appointed
T31	Objecting to Arbitrator's Misconduct	Objection resolved
. . .		
T65	Compilation of a Checklist of issues	Checklist of issues compiled
T66	Proposals, Recommendations, Suggestions	Proposals, Recommendations, Suggestions made
T67	Settlement	Proposition resolved
T68	Requesting Security of Costs	Request addressed
T69	Ordering Security of Costs	Security of Costs ordered
T70	Reviewing Decision on Security of Costs	Decision reviewed
T71	Final Decision on Security of Costs	Final Decision on Security of Costs issued
T72	Paying Security of Costs	Payment resolved
. . .		
T119	Scrutiny of Arbitral Award	Consent with the Form of the Arbitral Award given
T120	Scrutiny of Termination Decision	Consent with the Form of the Termination Decision given
T121	Serving a Written Copy of the Arbitral Award without Pronouncement	Decision to serve the Arbitral Award as a Written Copy passed
T122	Supplementation of Arbitral Award	Supplementing Award made
T123	Adopting Measures to supplement the Arbitral Award	Measures to supplement the Arbitral Award adopted
T124	Correction of Arbitral Award	Arbitral Award corrected
T125	Reviewing the Arbitral Award	Arbitral Award Reviewed

(T14). If the dispute is to be decided by more Arbitrators, then each party appoints one (T15), and the Arbitrators then Appoint a Presiding Arbitrator(T18). When this is completed, the Proceedings Completer hands over the Files to the Proceedings Decider (T21).

The other transactions, like Remedying Defects of the Statement of Claim (T5), filing Counterclaim (T126) may not be necessary. Transactions on the right side of the model do not concern the Proceedings Decider. Transactions T47, Stay of Proceedings, and T50, Permission to perform what Party failed to perform, may happen in other parts of the Proceedings as well.

Once the Files are handed over to the Proceedings Decider, the Hearing begins. Transactions in Figure 4.2 may be part of the Proceedings. This part consists of mostly small processes such as complaints and suggestions. One of

4.3. Organization Construction Diagram

Table 4.5: Actor mapping table, Composite actors

ID	Claimant	Respondent	Arbitral Tribunal	Third Party	Expert Witness
CA-1	X				
CA-2		X			
CA-3	X	X			
CA-4	XX	XX			
CA-5		X			
CA-6	X	X			
CA-7	X	X			
CA-8	XX	XX			
CA-9	X	X	X		
CA-10	X?	X?			
CA-11	X	X			
CA-12	X	X			
CA-13	X	X			
CA-14	X	X			
CA-15	X	X			
CA-16	X	X			
CA-17				X	
CA-18	X	X			
CA-19	X	X	X		
CA-20	X	X			
CA-21		X			
CA-22	X	X			
CA-23	X	X			
CA-24	X	X			
CA-39	X	X			
CA-25	X	X			
CA-26	X	X	X		
CA-27	X	X			
CA-28	X	X			
CA-29	X	X			
CA-30	X	X	X		
CA-31	X	X			
CA-32	X	X			
CA-33	X	X			
CA-34				X	
CA-35					X
CA-36	X	X	X		
CA-37	X	X	X		
CA-38		X			

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Table 4.6: Actor mapping table, Arbitration Court Actors

ID	Secretary General	Arbitral Tribunal	President of A. Court	Presidium	Individual Arbitrator	Unclear
A-1	X					
A-2		X				
A-21						?
A-3			X			
A-4			X			
A-5		X				
A-6			X			
A-7		X				
A-8						?
A-9					X	
A-10				X		
A-11					XX	
A-12				X		
A-13						?
A-14				X		
A-15		X	X			
A-16		X	X			
A-17				X		
A-18						?
A-19						
A-20						?

these processes may result in the Termination of Proceedings. The process of Objecting to the Jurisdiction of the Arbitration Court begins in transaction T60. If the Arbitrators decide that the Court doesn't have Jurisdiction, then they terminate the proceedings.

The third part of the model, in Figure 4.3 contains the transactions dealing with the actual Oral Hearing and examination of Evidence. The Oral hearing (T73) is a compulsory part of the Proceedings unless the parties agree on conducting the Proceedings in writing only (T82). Even in this case, the Proceedings Decider may order the Oral Hearing.

The first transactions of figure 4.4 deal with the examination of Witnesses. When all evidence and witnesses have been examined, the Proceedings Decider closes the Proceedings (T115).

I haven't marked many transactions between the Handover of Files (T21) and the Closing of Proceedings (T115) as compulsory. It is not clear, which of these transactions actually have to happen or if it's possible to somehow conclude the Proceedings without written Evidence and Witnesses.

After the conclusion, the Proceedings Decider make a final decision and render the Arbitral Award (T116). Before the Award or the decision to termi-

nate the Proceedings can come into effect, it has to go through the Scrutiny (T119, T120) of the Result Scrutiniser, who may return it for corrections before they sign it and make the result official. This concludes the Proceedings.

After receiving the Result (Arbitration Award or the decision to terminate the Proceedings), the Adjustments Requester have 30 days to request the Supplementation of the Award (T122), if not all claims were addressed. In that case, the Arbitrators may reopen the Proceedings and adopt Measures to supplement the Award (T123). At any time they may also request the correction of errors in the Award (T124).

The decision of the Arbitration Court is final and cannot be appealed. However, the parties may request the Review of the Arbitral Award by other Arbitrators (T125).

4.4 Other DEMO models

There are three more models defined by the DEMO methodology. Object Fact Model, Action Model and Process Model. They are not included in this thesis due to the time and extent constraints for writing it.

The number of discovered transactions in the relatively short document (40 pages) exceeds my expectations. The main reason for such a large number of transactions is missing information. None of the transactions is fully defined with request, promise, state and accept. Modelling the other DEMO models with this little information would result in incomplete models.

The proper course of action would be to meet with the lawyers and fill in the missing information wherever possible before moving on to modelling the remaining models.

The process model makes use of the extended TRT. More than half of the information required is missing. The biggest challenge for the Process model would be “Measures”. Article 41 of the Rules[31] deals with the subject of evidence. Paragraph 3 states the following.

To this end, the arbitrators are primarily entitled to (i) (...) (v) adopt any other procedural measures that the arbitrators deem appropriate.

There are several mentions of adopting measures within the process. They are mostly unspecified actions resulting in unspecified results. Sometimes there are suggestions to what form the measures may take, but there are never any restrictions. In a way, this could represent all the information missing from the transactions.

The Rules[31] define many conditions and rules, which could be used to create the Action model. This requires a very careful analysis to uncover all the relations between objects and conditions for actions to be taken.

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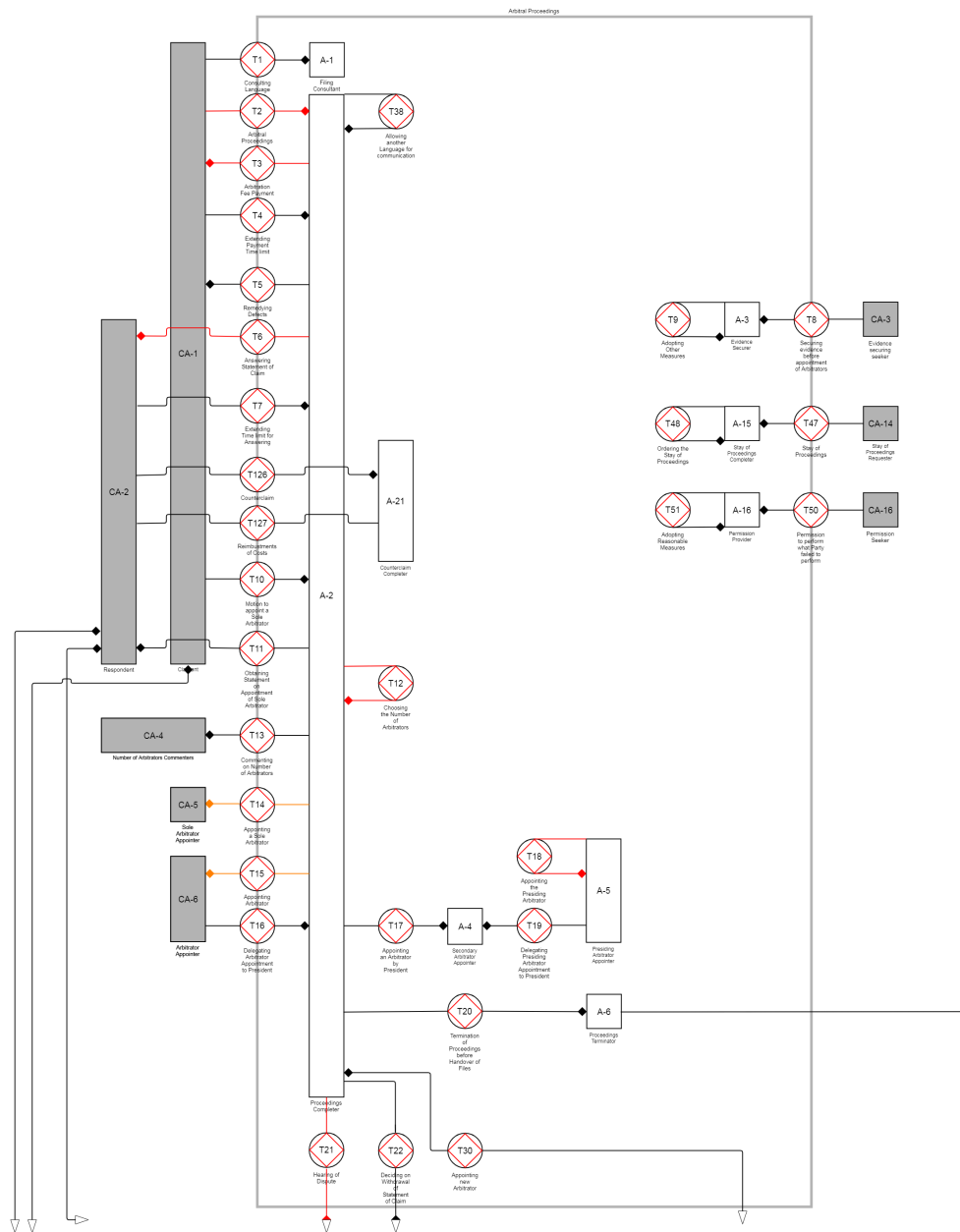


Figure 4.1: OCD of Arbitral Proceedings, part 1

4.4. Other DEMO models

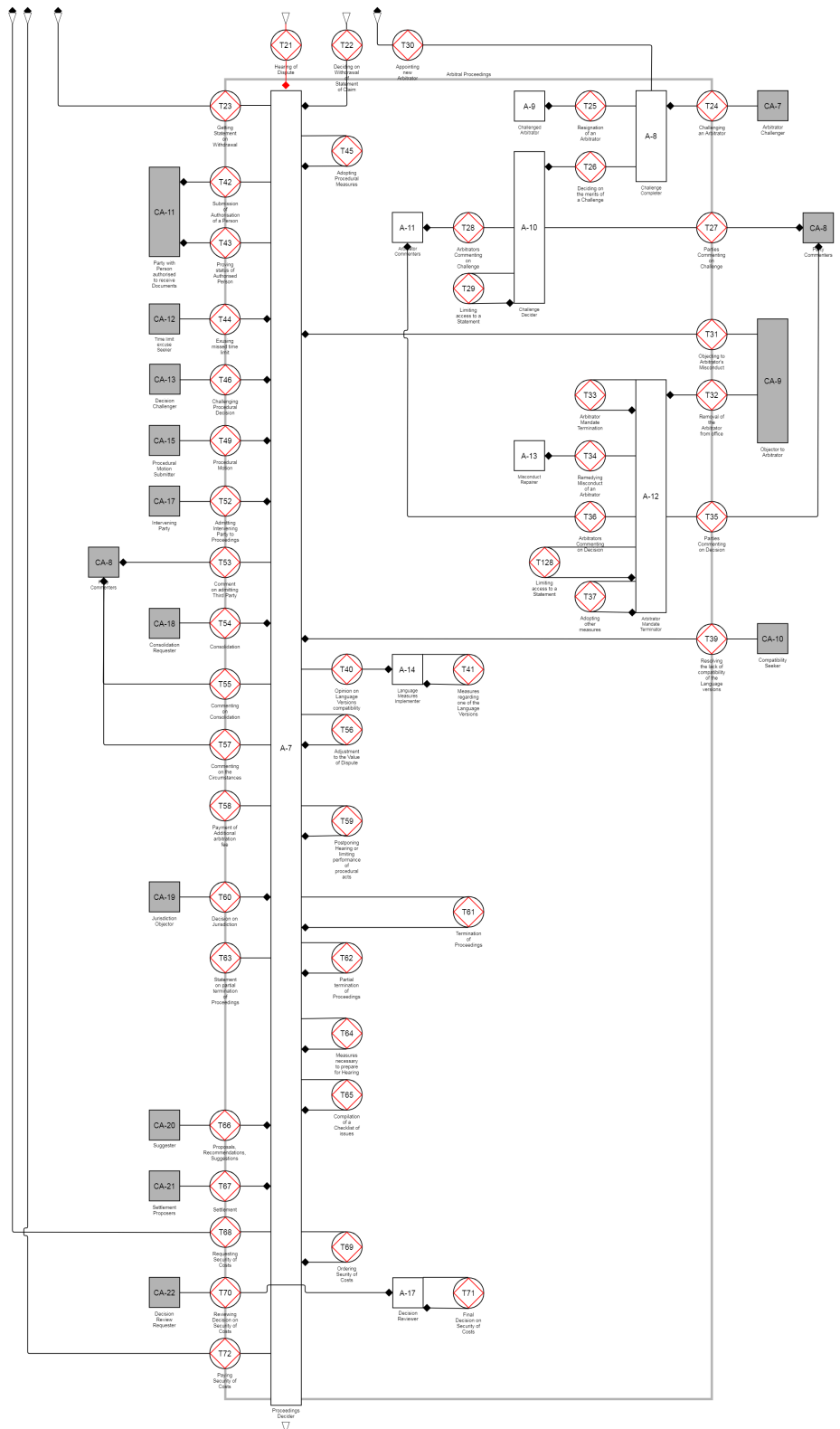


Figure 4.2: OCD of Arbitral Proceedings, part 2

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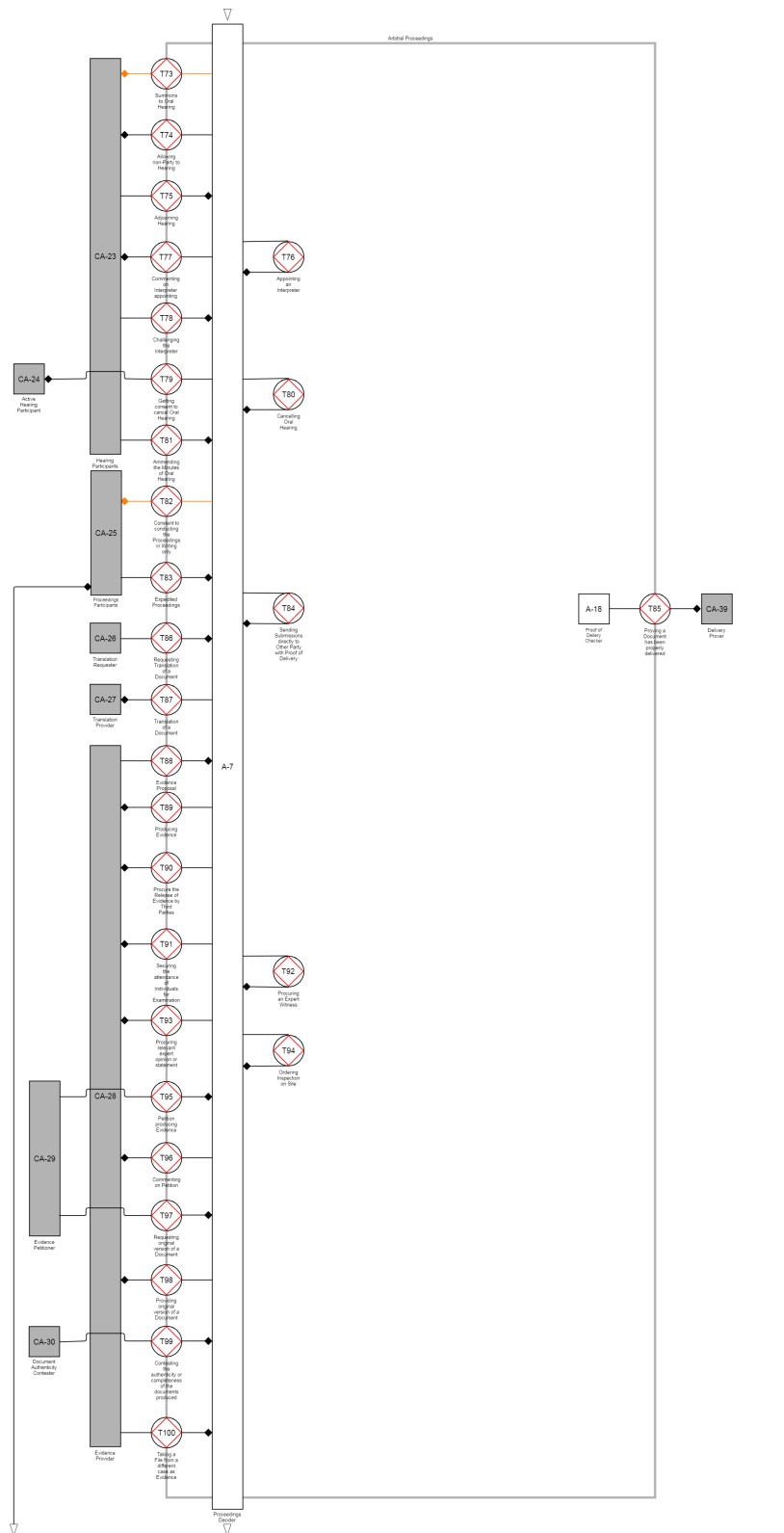


Figure 4.3: OCD of Arbitral Proceedings, part 3

4.4. Other DEMO models

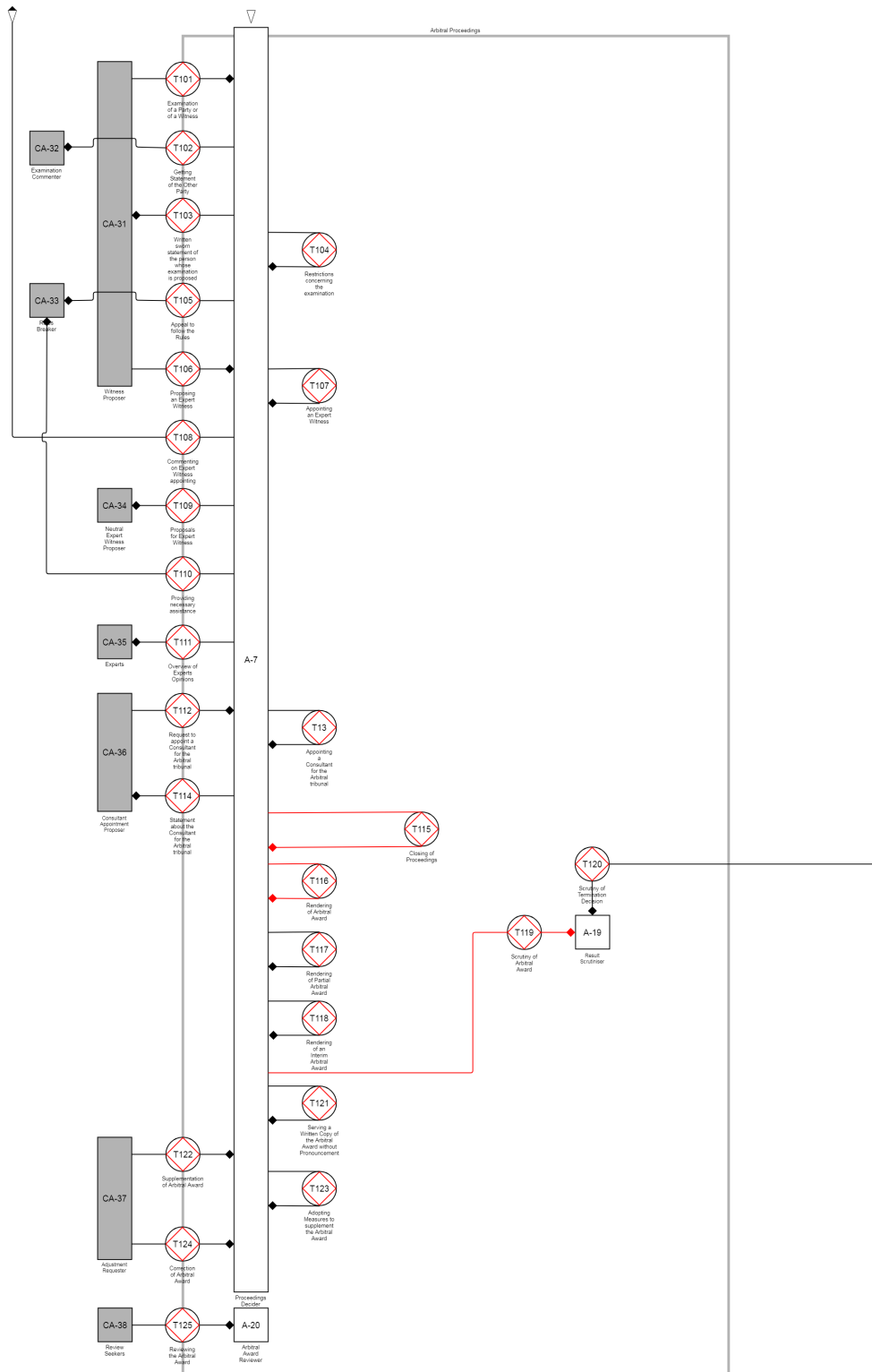


Figure 4.4: OCD of Arbitral Proceedings, part 4

Some rules may seem incomplete if only one paragraph is considered. Article 17 of the Rules[31] states that the proceedings may be stayed at the request of a party and if that party is the claimant, then it can be stayed only after the arbitration fee has been paid. This implies that the proceedings may be stayed even earlier at the request of the Respondent. However, according to Article 31, the Respondent isn't part of the proceedings until the arbitration fee has been paid and any defect to the statement of claim remedied.

4.5 DEMO Findings

The DEMO methodology is a great tool for uncovering missing information. It forces the modeller to think about all possible outcomes and look for them in the text. It also makes sure that every transaction has someone to initiate it and someone to execute it.

While working on the Organization Construction Diagram (OCD), I have noticed a kind of transactions, which is inherent to the legal procedure. Objections, challenges and proposals are not a typical part of a business process, yet they play an important role in legal proceedings.

4.5.1 Missing Information

There are unclear statements in the Rules. While they may be clear to people with a legal background, they can raise questions by a layperson. As an example, we can look at Article 31, paragraph 3.

The Secretary General shall request the respondent to submit his or her answer to the statement of claim and specify any evidence to prove the respondent's allegations **within 14 days from the delivery of the request**. The respondent is also obliged to appoint an arbitrator or, as applicable, provide his or her statement to the claimant's motion to appoint a sole arbitrator, or request that the arbitrator be appointed by the President of the Arbitration Court, all within the same time limit. The time limit for filing the answer to the statement of claim **may be extended at the respondent's request**. (...)

What happens when the respondent doesn't answer the statement of claim? There is no mention of any fine for the obstruction of proceedings in this manner.

What does the word "may" mean in this context? Does it mean that the respondent has an option to request the time extension, or does it mean that the President of the Arbitration Court may extend the time limit if requested? One possible interpretation would be that when a respondent

requests to extend the time limit, the President extends it. This interpretation could lead to an endless loop of time limit extension.

There are a few statements, which are very poorly formulated and confusing. This sentence was taken from Article 8, paragraph 5.

If the Presidium of the Arbitration Court intends to remove the arbitrator from office for neglecting and/or breaching his or her duties, the Presidium must first **notify the parties and the other arbitrators of its findings together with a request for remedy.**

As I understand it, the Presidium sends the **findings together with a request for remedy** to both the other arbitrators and the parties. I don't see a reason why the parties should be involved in implementing the remedy especially if they were the one who requested the Arbitrator to be removed from office.

The legal statements are often written in a passive voice. This makes it easy to define a transaction with a missing actor. As mentioned in the previous sections, the actors are not always clearly defined. In some cases, it is not clear if the subjects performing the role may act on their own or have to act together. In other cases, the actor is missing altogether.

“Mutatis mutandis” and “shall be governed by the Rules analogously” are two ways of lawyers saying that a transaction is the same as another yet different. According to the Meriam Webster[7], Mutatis mutandis is Latin for “things having been changed that have to be changed”. This doesn't say much to a legal layperson. It could mean just renaming the subject of the transactions, or changing some steps if they were necessary. This term has been used with relation to the Counterclaim, so I choose to interpret it as only renaming the participants, which has no effect on the DEMO models.

The phrase “shall be governed analogously”, on the other hand, is even vaguer and it is hard to say what it means. One of the instances, where it was used, relates to the Review of the Arbitral Award by other Arbitrators.

Both phrases seem to have similar meaning if not the same. I don't understand why both are used and what is their difference. The phrase Mutatis mutandis has been used only once in the whole document.

4.5.2 Objections, Challenges and Proposals

Modelling the Organization Construction Diagram (OCD) brought my attention to a kind of transactions specific to the legal field. Objections, challenges and proposals are an inherent part of the legal proceedings, yet don't have a fixed place in the process. There is a certain time window when they can be raised. Otherwise, they can be denied.

The Rules[31] don't always specifically state from when they can be raised. Mostly the Arbitrators handle them, which can only happen after the arbitral

tribunal has been appointed and the files had been handed over to them. Others may be raised even earlier, but only if the arbitration fee has been paid.

These transactions are optional and usually, don't have many followup transactions. In the OCD diagram in Figures 4.1 to 4.4, some of them lie on the right border of the Scope of Interest and are not directly connected to the main process because they tend to bypass the Arbitrators and are handled by the President of the Arbitration Court. Even though they are not always connected, they have a direct impact on the process. E.g. the process of challenging an arbitrator stays the proceedings until the challenge is concluded and potentially a new arbitrator is appointed.

4.6 BPMN Model

I have taken advantage of the TRT and the OCD when creating the BPMN process model. I have followed the DEMO model and considered every transaction for the BPMN model. I haven't directly included all of the transactions, because they would make the model too complicated and confusing. Adding all the challenges and other complaints would create too many splits in the process path.

The final model contains two subprocesses. One is embedded to properly handle the possibility of the Proceedings being terminated. The other is an external subprocess, which handles the appointment of arbitrators. It is a simple process, which I chose to hide from the main process to make it cleaner.

I've split the main model into two parts to fit the page and still be readable. The main part is in Figures 4.5 and 4.6. The subprocess Constitution of the Forum is in Figure 4.7

BPMN is a very expressive notation. It offers many different elements to use. Some of them even have the same meaning (e.g. exclusive gateway and conditional flow). It is very tempting to use a large variety of elements in one model. However, the more different elements are used within the same model, the less intuitive and understandable it is[30].

I have created several models of the same process before I have settled on the final version. I have succumbed to the temptation of using many different elements to express exactly what I wanted. Eventually, I have realised that simpler elements can achieve the same result.

The final version of the model was adjusted to meet the requirements of Camunda BPM platform. The main adjustment was merging Claimant, Respondent and Arbitration Court into one pool. In the original model, I've been using messages to communicate between the pools, which lead to some complications when testing the process. That model has also included event-based subprocess to deal with one pool creating an optional parallel path in another pool.

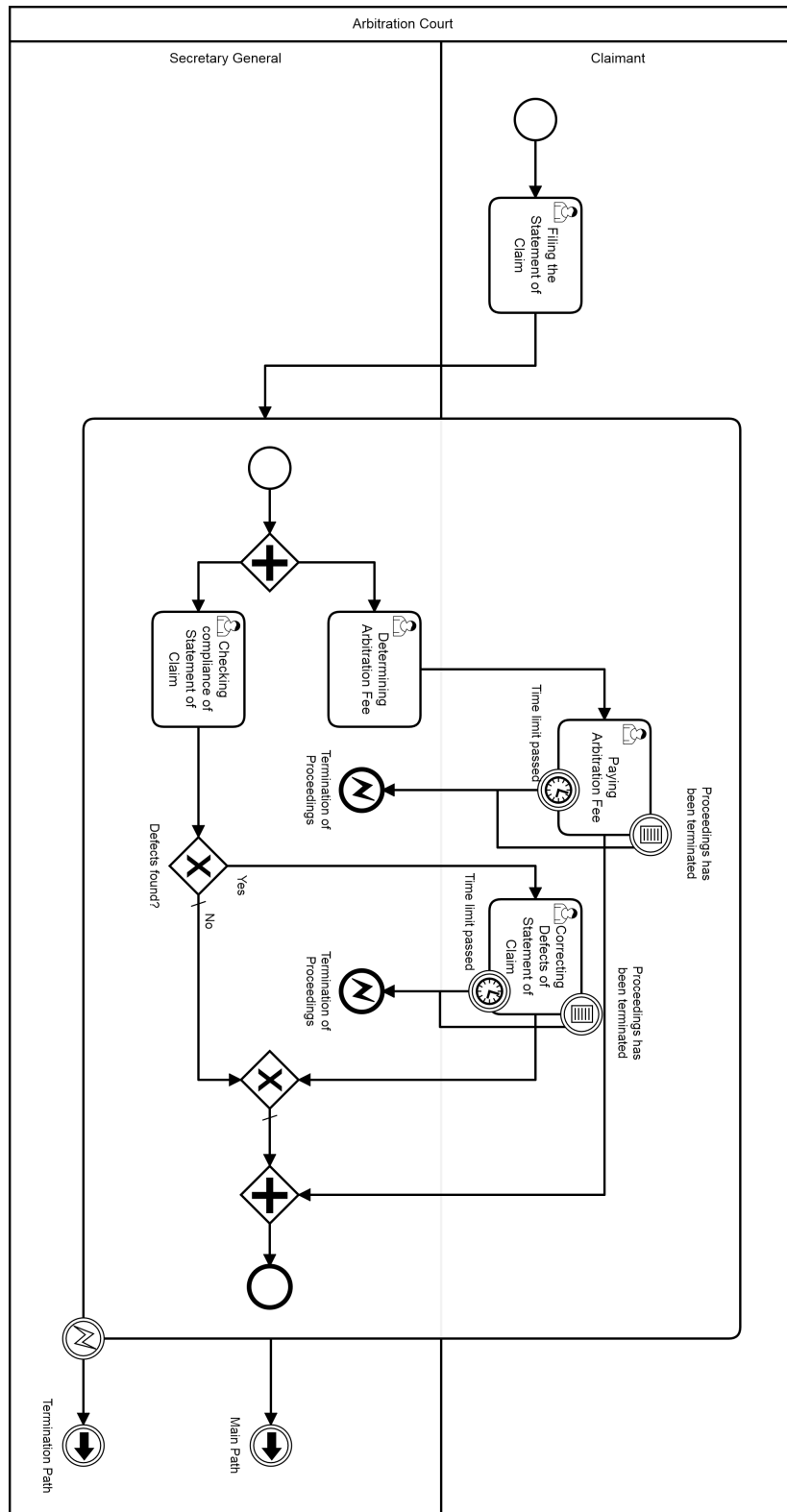


Figure 4.5: BPMN model of the main process, part 1

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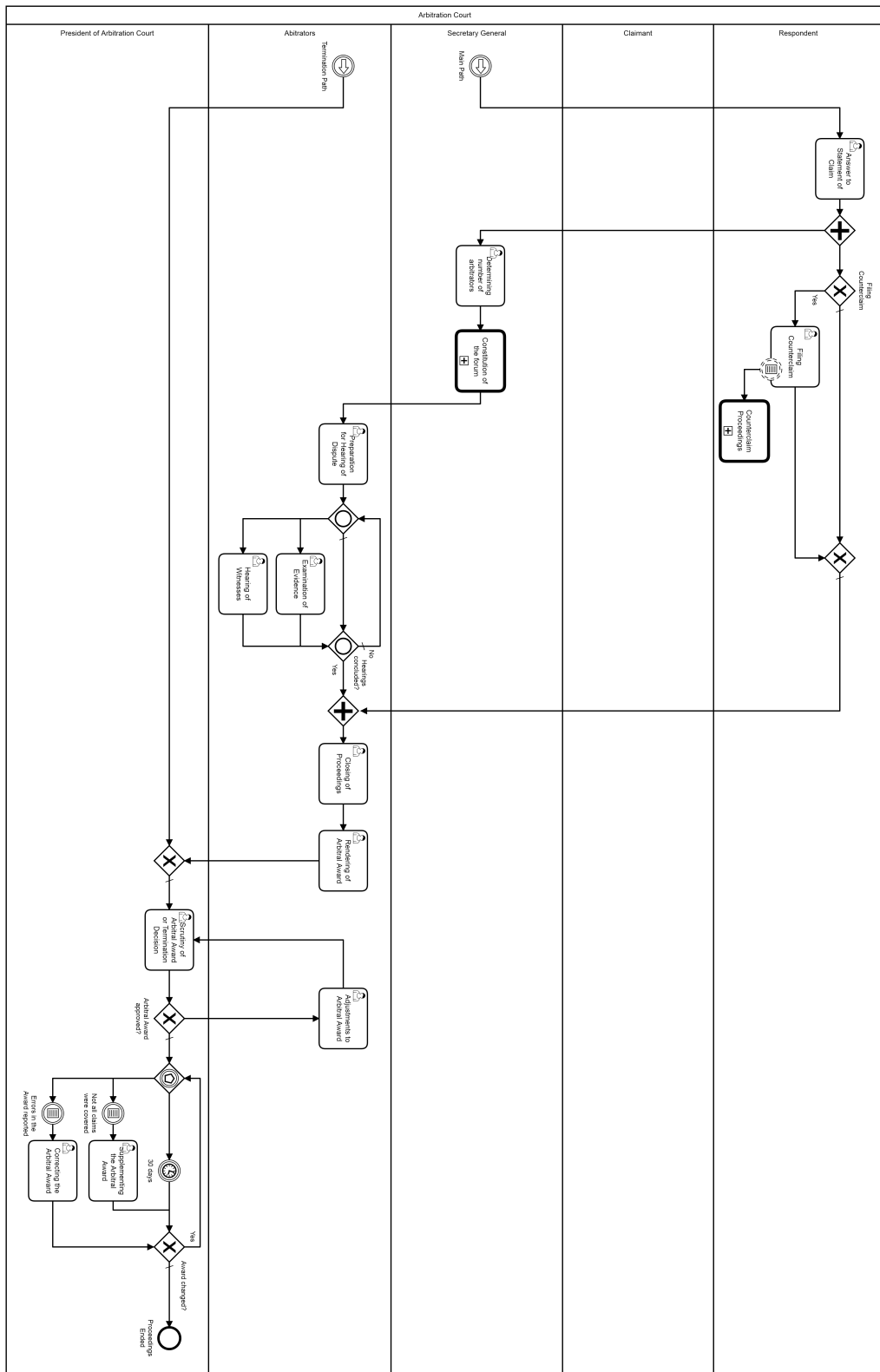


Figure 4.6: BPMN model of the main process, part 2

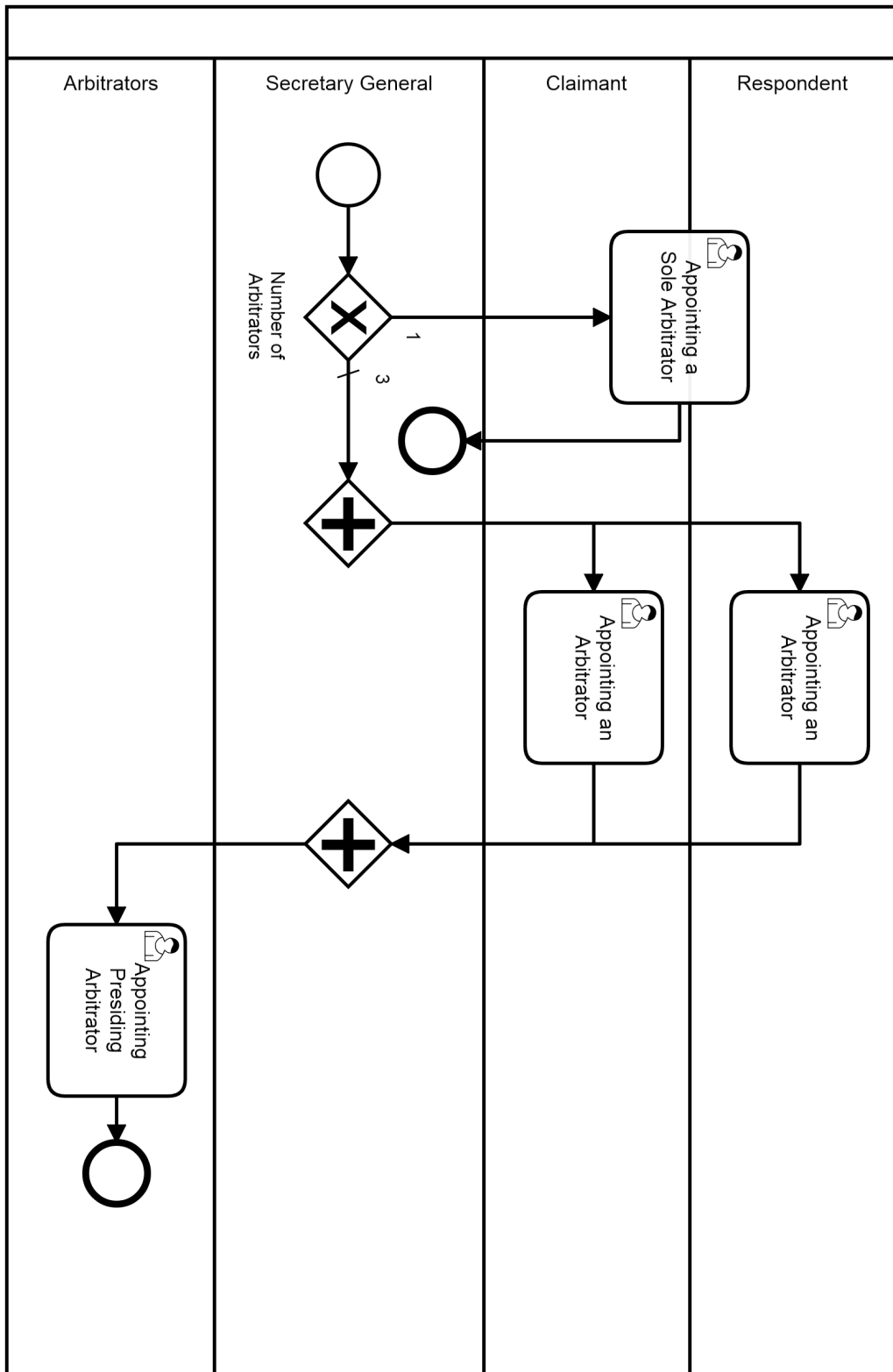


Figure 4.7: BPMN model of the subprocess “Constitution of the Forum”

4.6.1 Model Description

At the beginning of the process, in Figure 4.5, the Claimant files the Statement of Claim and enters the embedded subprocess. Within the subprocess, there are two parallel paths. The Claimant has to pay the arbitration fee, and in case any defects are found, repair them. If the claimant fails to pay the fee or doesn't correct the defects to the statement in time, the proceedings are terminated. This is handled by the timer border event of the tasks Paying Arbitration Fee and Correcting Defects of Statement of Claim. If either of those timers goes off, then the subprocess ends with an error. In the main process, the error is handled by moving to the end of the process to render the Decision of termination of proceedings. In my model, these tasks have an extra conditional border event to simulate the timer running out.

If the subprocess is finished without an error, the process continues to the Respondent's task Answer to Statement of Claim, in Figure 4.6. From now on until the closing of proceedings, the Respondent may file a Counterclaim. If the counterclaim is admitted, another instance of the main process is initiated.

The main path follows to the Choosing Number of Arbitrators and the subprocess of Constituting the Forum, in Figure 4.7, where all the Arbitrators are appointed. Each of the appointing tasks should have a timer and in the Arbitrator isn't appointed in time, the appointment is delegated to the President of Arbitration Court. I chose not to model this delegation and instead the delegation is considered a part of the task.

Once all arbitrators are appointed, they prepare for the hearing. Afterwards, they enter a loop of Examining Evidence and Hearing of Witnesses. Once all evidence is examined, and all witnesses are heard, the Arbitrators Close the Proceedings and continue to Rendering the Arbitration Award and pass it to the President for Scrutiny. If the President doesn't agree to the form of the Award, they return it to Arbitrators for adjustments. Once they give consent, the Award is made official. During the following 30 days, the parties may request Supplementing of the Arbitral Award or Correcting of Errors. After 30 Days, the process ends.

I haven't included the process of requesting a Review of Arbitration Award, because the process would never end. According to the Rules, the parties may agree to request a review of the Award at any time after the proceedings have been concluded.

4.7 BPM System

After I've modelled the BPMN process using the Camunda Modeller[?], I have filled in all the necessary information in the Properties Panel and deployed the models using the Camunda BPM Platform and tested the process. I have created 10 screenshots of the process walkthrough.

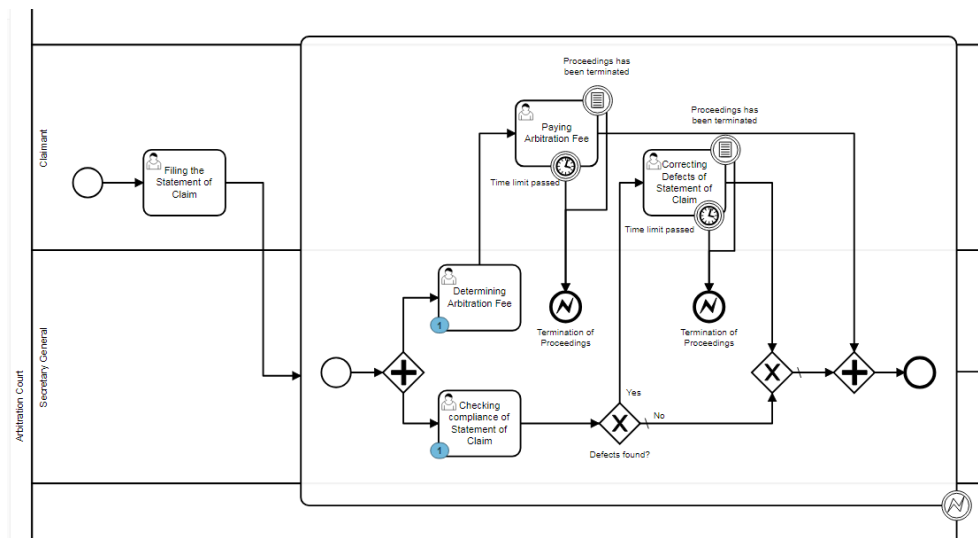


Figure 4.8: BPM system simulation, part 1

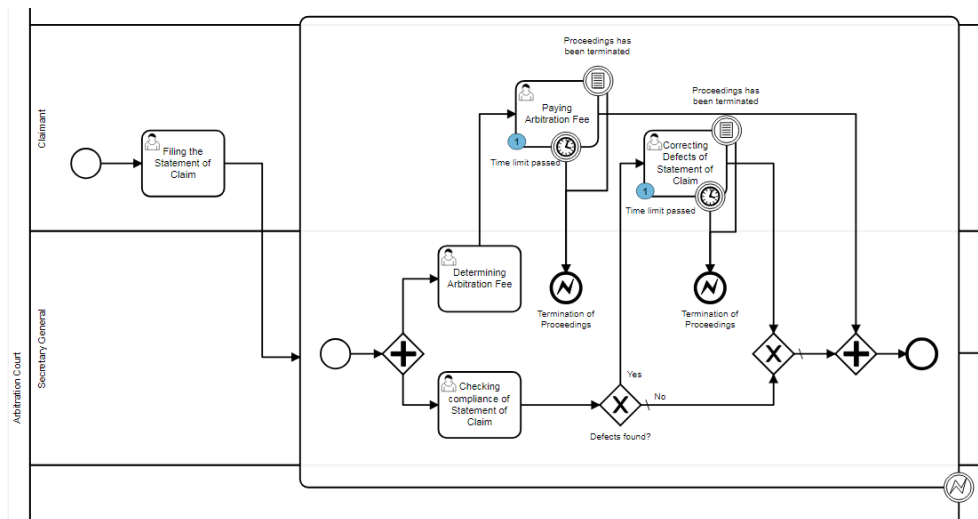


Figure 4.9: BPM system simulation, part 2

Figure 4.8 shows the beginning of the process. The Statement of Claim has been filed, and the token has entered the subprocess where it split into two paths. One token is now on the task Determining Arbitration Fee, where the Value of Arbitration fee is calculated and the time limit for paying it is decided. This limit can't be shorter than 14 days. The other token is in task Checking compliance of Statement of Claim, where the Claim is checked for defects and the time limit for correcting them is set. If any are found, they are sent to the Claimant to correct.

Figure 4.9 shows the state of the process after the tasks Determining Ar-

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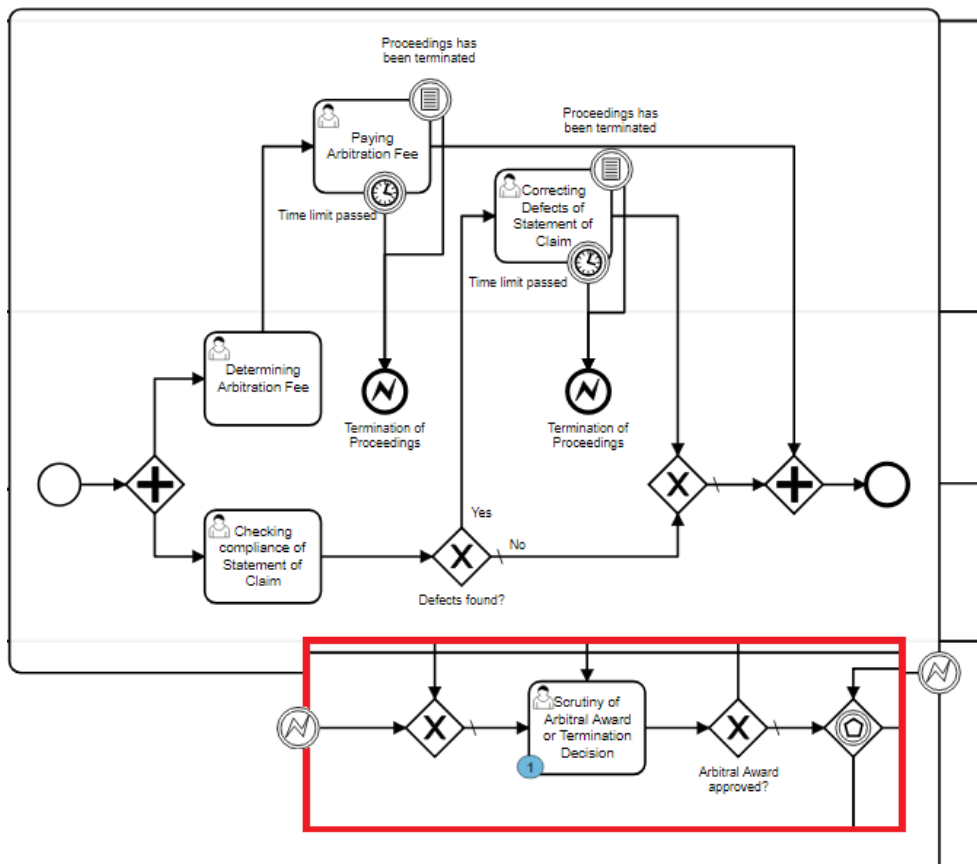


Figure 4.10: BPM system simulation, part 3

bitration Fee and Checking compliance of Statement of Claim have finished. Some defects to the Statement of Claim have been found. Therefore the exclusive gateway has sent the token to the task Correcting Defects of Statement of Claim. The other token has passed to the Paying of Arbitration Fee. Both of these tasks have a timer. If either of the timers goes off without the task completing, the subprocess is ended with an error. I couldn't test the timer going off. Therefore I've added a condition that if any of the tasks terminate, it ends the subprocess with an error. Each of these tasks can set a boolean variable, which is evaluated in the conditional event.

Figure 4.10 represents the case, where the proceedings have been terminated, and the subprocess ended with an error. Both tokens within the subprocess have disappeared, and only one token has been passed to the task for Scrutinising the Arbitral award or Decision on termination, which is at the end of the process. I've put two parts of the process into this Figure to show that all the tokens in the subprocess have finished and only one has been passed through the border error event. Before I contained this part of the model in

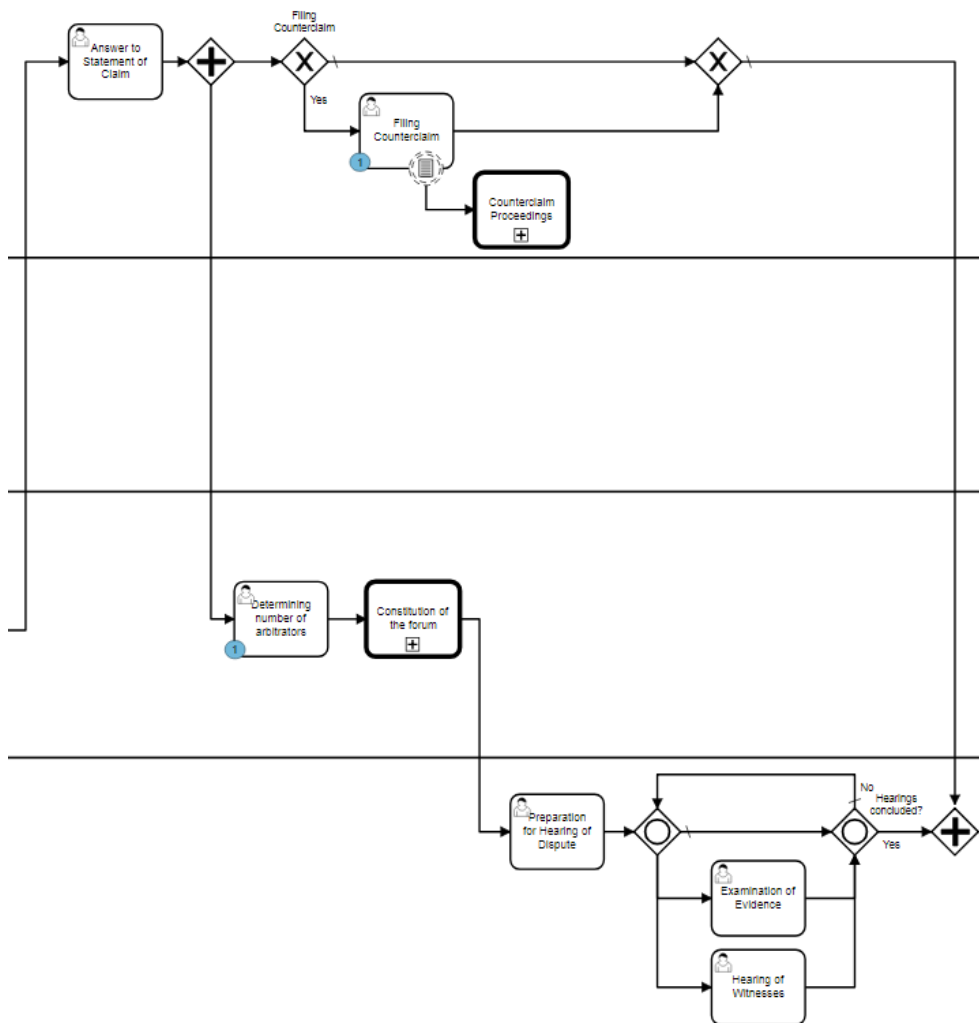


Figure 4.11: BPM system simulation, part 4

a subprocess, the Termination of Proceedings couldn't be properly handled. This path is no longer followed in the walkthrough.

Figure 4.11 shows the other path after the subprocess. When the Arbitration Fee has been paid and all defects to the Statement of Claim has been remedied, the tokens join at the parallel gate and leave the subprocess as one. The figure shows the state after the Statement of Claim has been answered by the respondent. From now on until the Closing of Proceedings, the respondent may file a Counterclaim, which they did, as indicated in the top branch. At the same time, the Secretary General determines the number of Arbitrators to decide on the dispute.

Figure 4.12 shows the next steps in both parallel paths. In the top branch, the Arbitrators have decided that the Counterclaim is lawful and a new Arbi-

4. CASE STUDY

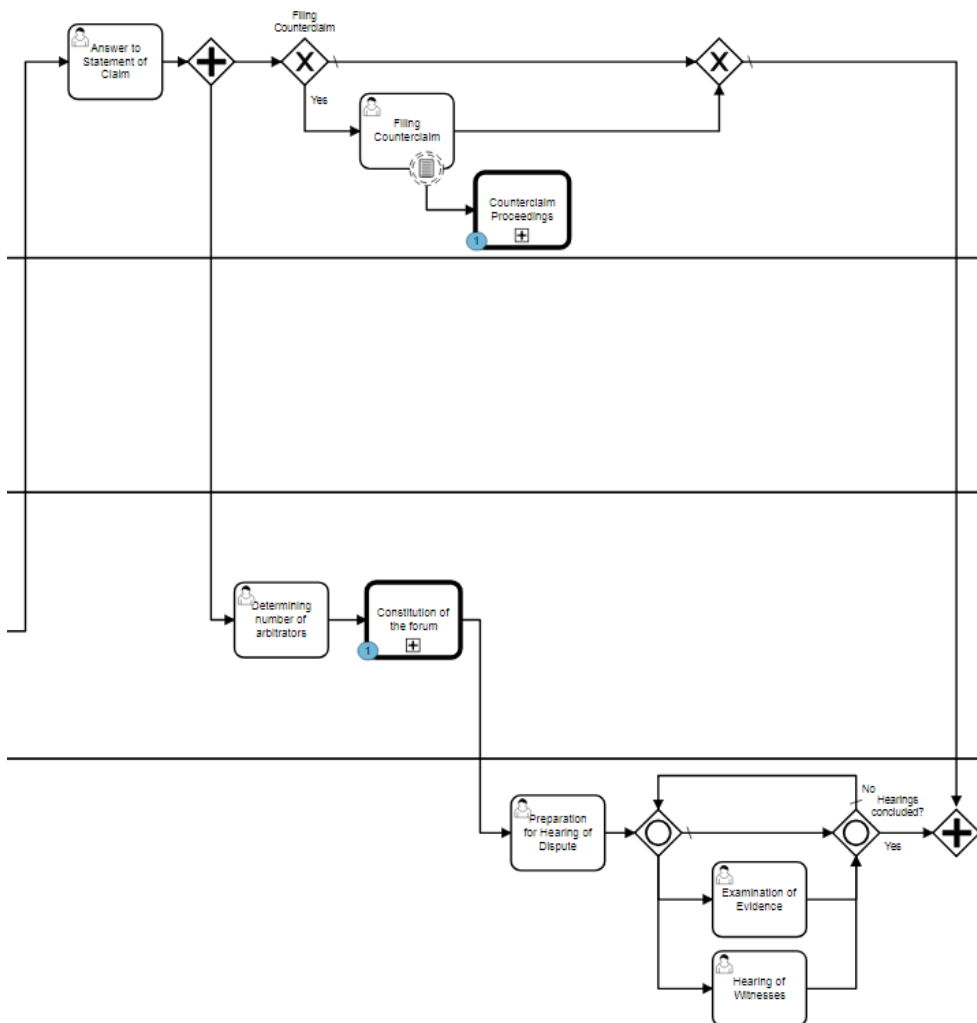


Figure 4.12: BPM system simulation, part 5

tral Proceedings has been started for the Counterclaim. In the bottom path, the token has entered the called subprocess of Constitution of the Forum.

Figure 4.13 shows the subprocess Constitution of the Forum. There are two options based on the number of arbitrators chosen in the main process. In this case, the dispute is to be decided by a Sole Arbitrator, which means the Claimant and the Respondent select one together.

Figure 4.14 shows the Hearing of Dispute. After the token left the subprocess and passed the Preparation for the Hearing of Dispute, it enters the loop representing the Hearing, during which Evidence is examined, and Witnesses are heard. I have used an inclusive gateway, which at the beginning evaluates all the paths and enters all of them, which evaluate as True. In this case, there is some Evidence to be examined and Witnesses to be heard. After the

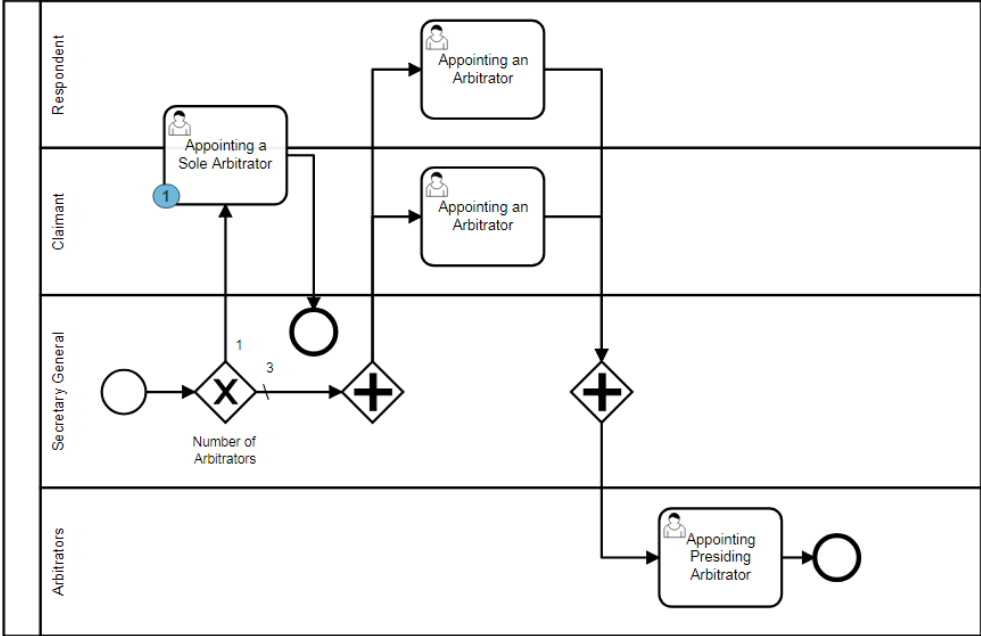


Figure 4.13: BPM system simulation, part 6

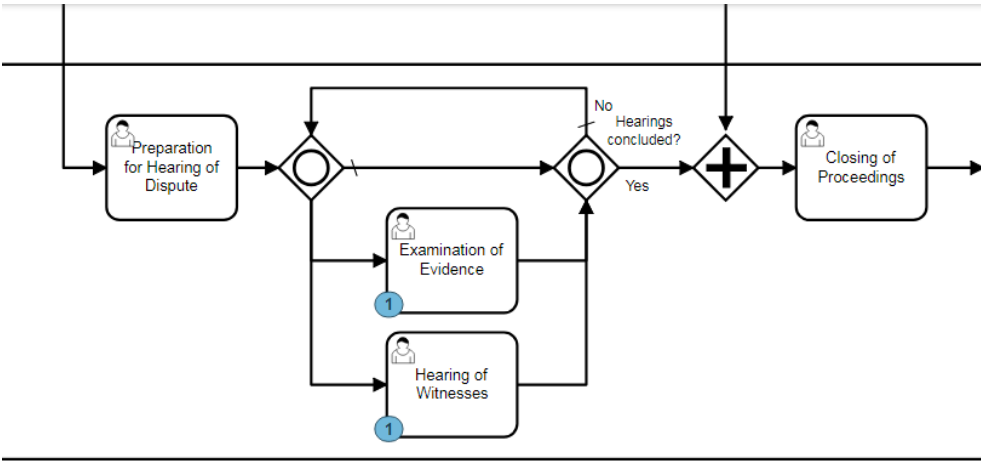


Figure 4.14: BPM system simulation, part 7

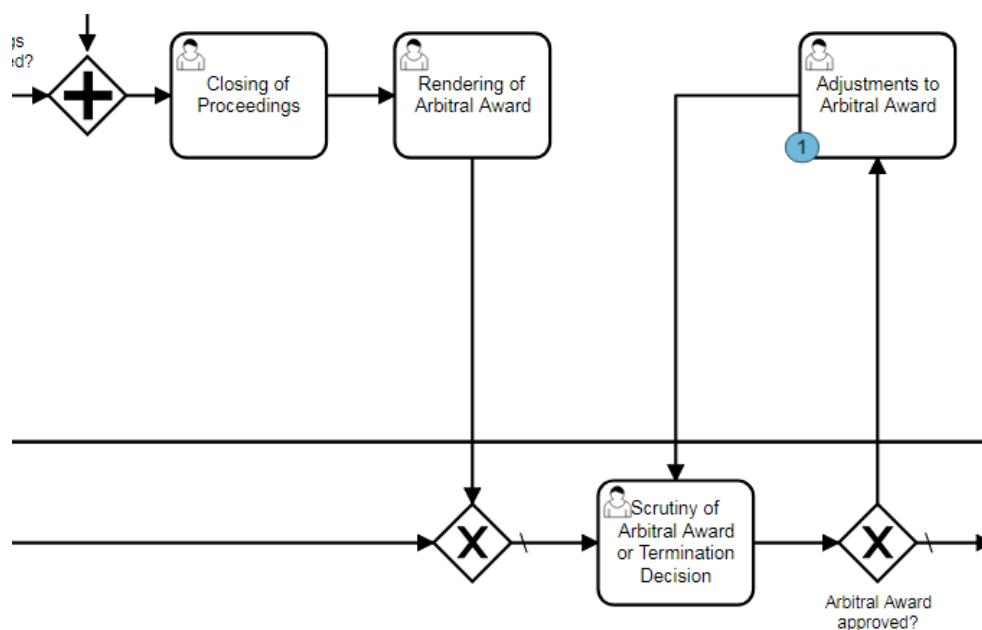


Figure 4.15: BPM system simulation, part 8

tasks finish, the gateway checks whether any examinations or hearings are to be done and if not, the token is passed on and the Proceedings are closed.

Figure 4.15 shows a case where the Arbitral Awards has been rendered and passed for Scrutiny of the President of the Arbitration Court. The President has found some errors in the Award and passed back to the Arbitrators to correct it, which is where the token is waiting.

Figure 4.16 shows the state where the award has been signed by the President and passed to the final stage of the Proceedings. This part isn't very well modelled. The Award can be Supplemented withing 30 Days of being sent to the parties. If there are any errors to the Award, they can be remedied during this time as well, but also any time after. Same applies to the Review of the Award. It can be filed any time after the Award has been announced. I haven't included this task in the model, because I know very little about it. From the Rules[31] it seems like the Review of the Arbitral Award is same as the process Arbitral Proceedings.

Figure 4.17 shows the state of the BPM system after the Arbitral Proceedings process has ended. The Counterclaim filed in step 5 is still pending as it's meant to be. A counterclaim is a new Claim, which can only be filed from a different instance of the Proceedings. After is it filed, it no longer depends on its parent process. There are two tokens in the model. The Counterclaim token is the remnant of the Arbitral Proceedings process, which has finished. The Filing of the Statement of Claim token is its child. Once the second token

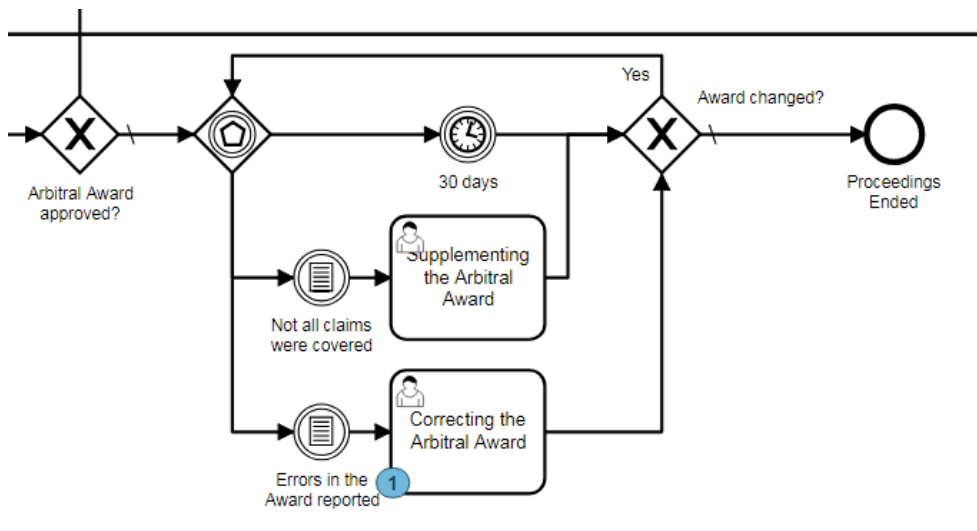


Figure 4.16: BPM system simulation, part 9

reaches the end, the Counterclaim gets concluded as well, and no tokens from the original process will remain.

4.8 BPMN Findings

The biggest obstacle in modelling with BPMN was the freedom provided by the notation. I could have created 10 versions of the model, and all would be equally correct. It leads to modelling almost perfect solutions because there are many options, which makes finding the right solution difficult.

BPMN doesn't define how detailed the model should be. I've used this aspect of the notation to hide some difficult detail. The loop of examining evidence and hearing of witnesses is a very simplified solution. In the DEMO model, most transactions correspond to this part of the process. From the point of view of a legal expert, this should be sufficient, because they know what hearing of witnesses and examination of evidence comprises of.

The BPMN model is focused on the happy path, where no challenges or objections are filed. These concepts are not easy to implement in the process. The best would be to model them as event-based subprocesses with a message start event. Since I've chosen to include only one pool in the process, the messages can't be used. The best alternative would be to use the conditional event.

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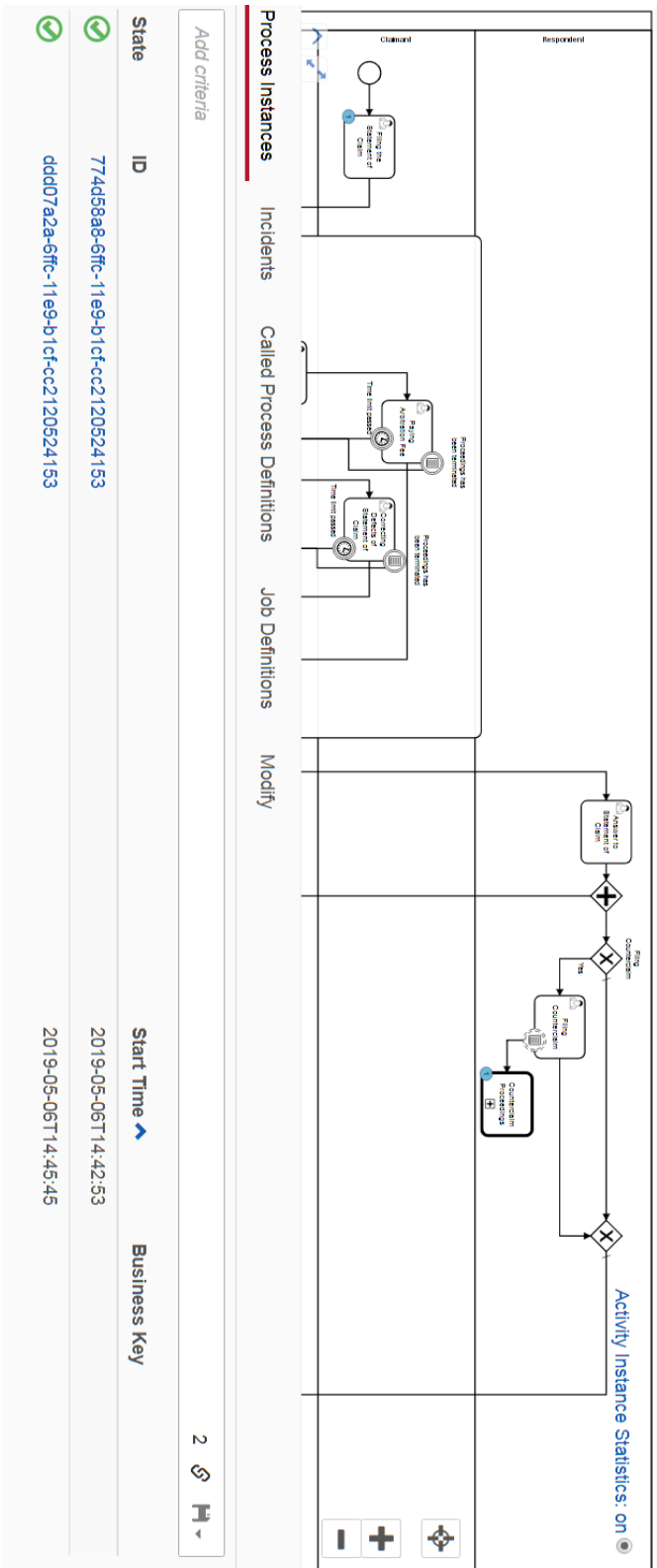


Figure 4.17: BPM system simulation, part 10, Claim finished, Counterclaim still pending

4.9 Comparison

In chapter 3 I have compared BPMN and DEMO for modelling certain aspects of legal documents. I revisit this comparison to compare my case study findings with expectations.

4.9.1 Legal Ambiguity

I didn't expect much legal ambiguity in procedural law, yet I was surprised by how many missing and unclear information I have encountered. I don't think that what I found is the legal ambiguity other authors have been referring to. Most of the information isn't ambiguous; it is missing. I believe that the legal experts have no problem filling this missing information in their minds without too many original interpretations. However, for a legal layperson or someone tasked with digitising the law, the provided information is insufficient.

Some statements are ambiguous, and I believe it's not on purpose. All the question marks in the actor mapping tables 4.5 and 4.6 shouldn't be acceptable. When modelling with DEMO, it is easy to partially bypass the issue in the OCD model by naming the actor by their role in the process. Still, the issue shows in the Actor mapping table.

DEMO is a good methodology for discovering legal ambiguity and missing information. It can bypass ambiguous definitions of subjects by defining actor roles. Legal ambiguity and missing information don't cause many problems for modelling Organization Construction Diagram (OCD). They might cause some problems for modelling Process Diagrams because the transactions are not fully defined. I expect the ambiguity to fully show when modelling Action Model because there are many rules in legal procedure and not all of them are well described.

BPMN is good for bypassing the legal ambiguity. It offers a lot of freedom, which can be used to hide unwanted detail in tasks.

4.9.2 References

I have encountered the need to keep track of the source material of the transactions. For my convenience, I have made the column Source in my TRT referencing the source Article and if need be the paragraph of the transaction. It has proven very useful in my work. Legal documents have a common structure, where every paragraph is clearly marked. This makes searching the document.

I propose marking the Articles and paragraphs when dealing with legal texts. Keeping references to the transaction source text when composing the TRT doesn't take much extra work but saves a lot of time.

I didn't find the need to keep references to the parent law. However, the possibility of the missing information being in the parent law should be investigated.

BPMN doesn't have much to contribute to this section. It is one model, and the elements don't necessarily correspond to a single article or paragraph.

4.9.3 Responsibilities

Again, the main benefit of using DEMO, is the easy discovery of missing information, in this case, subjects, who take part in the transaction. However, as stated before, it is easy to hide missing subjects behind actor roles.

BPMN uses Pools and Lanes, generally named after the actual subjects in the process, but it is not a rule, and the modeller may choose to define the actors in the same way as in DEMO.

I wouldn't say that either technique is better at capturing the responsibilities of the participants of the process. If both models are done well, then both perform well enough.

4.9.4 Detail and Precision

Comparing the two models, it is clear which one contains more detail. DEMO methodology is focused on capturing *all* the necessary information. It is always precise because the desired result of the models is clearly defined.

BPMN modeller is free to choose the amount of detail necessary for their model. They can group some information into one element or model other information in great detail. All within the same model. While this might lead to neglecting some part of the model, it might be an advantage of BPMN over DEMO.

I need a thorough analysis of DEMO to fully understand the process and find the missing information, but I might not need all of that information in the process model. The OCD diagram contains all the transactions related to the examination of evidence. It describes all the ways of producing evidence and how to deal with it. I might not require this information. If I hide this information from the OCD, I create an incomplete or incorrect model. In BPMN model I only include the information within one element and still have a correct model. I can also create a subprocess containing everything concerning the examination of evidence. This way it is hidden from the main process but still accessible.

I would say DEMO is the more precise way of modelling. No matter the purpose of the model, it's always done with the same precision and detail.

BPMN has an advantage over DEMO when it comes to detail because it can adjust it based on the purpose of the model. BPMN can be as detailed as the DEMO model, or perhaps even more by including elements of its imple-

mentation. It can also provide much less detail and move the focus somewhere else.

4.9.5 Comprehensibility

I can't compare the user ability to comprehend the models, because I haven't conducted the user study and I can't test them on myself, because I have created them. Instead, I am going to compare them from the modeller perspective.

I have modelled several BPMN and DEMO models before writing this thesis, but I am no expert. None of those models was this large. I had to refresh my memory to create the models.

Creating the DEMO model seemed easier. I had to keep in mind one concept at a time. The hardest part was understanding the text. That being said, I haven't modelled all DEMO models. The Object Fact Model doesn't use difficult concepts; most of the objects can be found in the TRT, so it shouldn't be too difficult to understand what to do. The Action Model is a bit more tricky, but having the TRT and Object Fact Model available makes the effort much easier. The Process diagram is more difficult to comprehend, both for the reader and the modeller.

A disadvantage to modelling with DEMO is that its names have too many meanings and it isn't easy to find help searching the internet.

While BPMN, in general, is easy to understand, not all of its elements are equally comprehensible. The fewer concepts are used in the model, the more difficult it is to model, but the more understandable it becomes.

Having the two models next to each other, the BPMN model is much more intuitive, even if it contains some difficult elements. DEMO models might not be too difficult to model, but the final result requires explanation. A disadvantage of DEMO is that it consists of several models. To properly understand the essential model, all models are necessary. BPMN model, on the other hand, contains all the information in one model, making it easier to understand.

4.9.6 Other Findings

I've encountered several other aspects of legal documents which are worth to consider.

One of these aspects is the lack of chronological order in the document. Usually, a process is described from the beginning to the end. The Rules[31] begin their process in the middle of the document and then jump back to the beginning for additional information.

Modelling with DEMO doesn't necessarily require to start at the beginning. It is possible to mark all the transactions and then reorder them to create a chronological process.

It's not as easy with BPMN, which requires all the elements to connect. The best course of action, in this case, is reading the section names and reordering them to form a process, then provide additional information from the other sections. I have benefited from first analysing the text with DEMO and only afterwards modelling with BPMN.

Another finding worth mentioning are the transactions concerning Objections, Challenges and Proposals. DEMO managed to handle them quite well, but they were seemingly unconnected to the main process. I have avoided modelling them BPMN. However, there is the event-based subprocess, which would be great for modelling them.

4.9.7 Assessment

BPMN provides a good approach to modelling laws. It offers certain freedom to include in the model as much or as little detail as necessary. In comparison, DEMO models are very precise, and it's not possible to hide small detail behind other elements.

However, DEMO provides a much better approach to analysing the text. It uncovers all the missing information. It discovers missing transaction definitions and unspecified subjects.

I believe DEMO and the OER method should be used for the initial analysis, better understanding of the source material and discovering missing information. The OCD diagram should be provided for a better understanding of the transactions. Object Fact Model and Action Model should also be included. I believe the Action model would be an important DEMO model when modelling law. I am unsure of the necessity of providing the process model as well. BPMN has proven to be able to sufficiently describe the legal process. However, I've encountered some difficulty in trying to include a task, which may happen during the end part of the process or any time after it ends.

Conclusion

New laws are passed every day. They are known for being ambiguous and hard to read by anyone, who doesn't have a legal background. The purpose of this thesis is to discover how to better model, execute and optimise laws with the help of the state-of-the-art techniques from enterprise engineering and business process management.

I have explored the state-of-the-art techniques used for modelling laws and other legal documents. Part of digitising law is providing it in a machine-readable format. I've found three XML-based notations created to support legal documents. They are MetaLex, LKIF and Akamo Ntoso. There have been a few attempts at creating a modelling language and tool specifically designed for modelling laws. The most promising ones were VLPM and Nomos. Unfortunately, these efforts have been discontinued.

I have explored BPMN and DEMO and their capabilities to model laws. At first in theory and later in the case study of The Arbitration Rules of the International Arbitration Court of the Czech Commodity Exchange. Both techniques have fared rather well. No additional concepts were necessary to create a good model. For my convenience, I have extended the Transaction Result Table (TRT) to include references to Article and if needed the paragraph of the original text. It wasn't a necessary addition to the model, but it significantly eased my work. This practice could prove useful in future research.

Comparing both approaches, I must declare that DEMO fared better. It has more to offer, even to BPMN. Beginning with text analysis, the methodology forces the modeller to think about all possibilities. This way I have discovered a large amount of missing information. There are 128 ontological transactions in the document, yet none of them contains all of request, promise, state and accept. Some transactions are missing subjects to perform them. There are unclear formulations of statements, which I believe not to be intentional.

I have discovered a law-specific kind of transactions used for objecting,

challenging and proposing. Instead of being fixed at one place in the process, they have a time window when they can be invoked and become a part of the process. They are an inherent part of legal proceedings. They are not separate processes and cannot exist without the Arbitral Proceedings.

The benefit of using BPMN lies in the possibility to hide some transactions without destroying the correctness of the model. I have used this feature when creating the BPMN model to hide the transactions behind Evidence examinations and Witness hearings.

Both techniques have their place in law modelling. DEMO has proven to be a great approach to analyse the text and find the cornerstone concepts of the document. On top of these concepts, other models can build. Even BPMN model benefits from having the DEMO analysis and models done first.

In my case study, I have taken The Arbitration Rules of the International Arbitration Court of the Czech Commodity Exchange[31] and applied the DEMO and BPMN techniques to create models of the law. I have created the Transaction Result Table (TRT) and Organization Construction Diagram (OCD). I haven't had enough time or space in the thesis to create all the DEMO models. I believe that supplying the other models, especially the Action Model, would be a good place to start further research.

Using Camunda Modeller[?], I've created the BPMN process model, which I then supported with a Camunda BPM Platform. I've tested the model and provided screenshots of a walkthrough.

DEMO turned out to be a promising notation for modelling laws. It identified over 300 problems with the legal text. The methodology could prove useful when writing new laws or revisiting the old ones. The missing information discovered by DEMO could point out unintentional mistakes or loop holes in the document, which should be remedied.

With information gained from DEMO models, BPMN models could be created and supported by BPM systems. This could speed up the legislation digitisation effort of the government[6].

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Tables

Table A.1: Transaction Result Table, all records

TID	Transaction name	Product
T1	Consulting on filing in different language	Filing in different language consulted
T2	Arbitral Proceedings	Proceedings concluded
T3	Payment of Arbitration Fee	Payment payed
T4	Extending Payment time limit	Time limit for Payment extended
T5	Remedying Defects of the Statement of Claim	Defect of the Statement of Claim remedied
T6	Answering the Statement of Claim	Answer submitted
T7	Extending the time limit for answering the Statement of Claim	Time limit extended
T8	Securing evidence before appointment of Arbitrators	Evidence secured
T9	Adopting other Measures	Measures adopted
T10	Motion to appoint a Sole Arbitrator	Motion resolved
T11	Obtaining Statement on Appointment of Sole Arbitrator	Statement provided
T12	Choosing the Number of Arbitrators	Number of Arbitrators chosen
T13	Commenting on Number of Arbitrators	Comment provided
T14	Appointing a Sole Arbitrator	Arbitrator appointed
T15	Appointing an Arbitrator	Arbitrator appointed
T16	Delegating Arbitrator Appointment to President	President instructed to appoint Arbitrator

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T17	Appointing an Arbitrator by President	Arbitrator appointed
T18	Appointing the Presiding Arbitrator	Presiding Arbitrator appointed
T19	Delegating Presiding Arbitrator Appointment to President	Presiding Arbitrator appointed
T20	Termination of Proceedings before Handover of Files	Decision to terminate Proceedings passed
T21	Hearing of Dispute	Hearing concluded
T22	Deciding on Withdrawal of Statement of Claim	Decision on Withdrawal made
T23	Getting Statement on Withdrawal	Statement provided
T24	Challenging an Arbitrator	Challenge resolved
T25	Resignation of an Arbitrator	Arbitrator resigned
T26	Deciding on the merits of a Challenge	Decision made
T27	Parties Commenting on Challenge	Comment provided
T28	Arbitrators Commenting on Challenge	Comment provided
T29	Limiting access to a Statement	Access to Statement limited
T30	Appointing new Arbitrator	New Arbitrator Appointed
T31	Objecting to Arbitrator's Misconduct	Objection resolved
T32	Removal of the Arbitrator from office	Removal of the Arbitrator from office resolved
T33	Arbitrator Mandate Termination	Arbitrator's Mandate terminated
T34	Remedying Misconduct of an Arbitrator	Misconduct Remedy resolved
T35	Parties Commenting on Decision	Comment provided
T36	Arbitrators Commenting on Decision	Comment provided
T37	Adopting other measures	Other measures adopted
T38	Allowing another Language for communication	Language allowed for communication
T39	Resolving the lack of compatibility of the Language versions	Language version chosen
T40	Opinion on Language Versions compatibility	Opinion provided
T41	Measures regarding one of the Language Versions	Measures implemented

T42	Submission of Authorisation of a Person	Authorisation submitted
T43	Proving status of Authorised Person	Proof provided
T44	Exusing missed time limit	Time limit excused
T45	Adopting Procedural Measures	Procedural Measures Adopted
T46	Challenging Procedural Decision	Challenge resolved
T47	Stay of Proceedings	Request resolved
T48	Ordering the Stay of Proceedings	Stay of Proceedings ordered
T49	Procedural Motion	Procedural Motion resolved
T50	Permission to perform what Party failed to perform	Performing what Party failed to perform allowed
T51	Adopting Reasonable Measures	Measures adopted
T52	Admitting Intervening Party to Proceedings	Decision on admitting an Intervening Party made
T53	Comment on admitting Third Party	Comment provided
T54	Consolidation	Consolidation permitted
T55	Commenting on Consolidation	Comment provided
T56	Adjustment to the Value of Dispute	Adjustment of the Value of the Dispute made
T57	Commenting on the Circumstances	Comment given
T58	Payment of Additional arbitration fee	Payment paid
T59	Postponing Hearing or limiting performance of procedural acts	Decision made
T60	Decision on Jurisdiction	Jurisdiction decided
T61	Termination of Proceedings	Proceedings terminated
T62	Partial termination of Proceedings	Proceedings partially terminated
T63	Statement on partial termination of Proceedings	Statement provided
T64	Measures necessary to prepare for Hearing	Measures adopted
T65	Compilation of a Checklist of issues	Checklist of issues compiled
T66	Proposals, Recommendations, Suggestions	Proposals, Recommendations, Suggestions made
T67	Settlement	Proposition resolved
T68	Requesting Security of Costs	Request addressed
T69	Ordering Security of Costs	Security of Costs ordered
T70	Reviewing Decision on Security of Costs	Decision reviewed

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T71	Final Decision on Security of Costs	Final Decision on Security of Costs issued
T72	Paying Security of Costs	Payment resolved
T73	Summons to Oral Hearing	Hearing summoned
T74	Allowing non-Party to Hearing	Request addressed
T75	Adjourning Hearing	Request addressed
T76	Appointing an Interpreter	Interpreter appointed
T77	Commenting on Interpreter appointing	Comment provided
T78	Challenging the Interpreter	Challenge resolved
T79	Getting consent to cancel Oral Hearing	Consent provided
T80	Cancelling Oral Hearing	Oral Hearing cancelled
T81	Ammending the Minutes of Oral Hearing	Request on Ammending the Minutes of Oral Hearing addressed
T82	Consent to conducting the Proceedings in Writing only	Obtaining Consent resolved
T83	Expedited Proceedings	Expedited Proceedings allowed
T84	Sending Submissions directly to Other Party with Proof of Delivery	Sending Submissions directly to Other Party with Proof of Delivery ordered
T85	Proving a Document has been properly delivered	Proof provided
T86	Requesting Translation of a Document	Request resolved
T87	Translation of a Document	Translation of the Document in the Language of Proceedings submitted
T88	Evidence Proposal	Evidence Proposal addressed
T89	Producing Evidence	Evidence produced
T90	Procure the Release of Evidence by Third Parties	Release of Evidence procured
T91	Securing the attendance of Individuals for Examination	Attendance secured
T92	Procuring an Expert Witness	Expert Witness procured
T93	Procuring relevant expert opinion or statement	Relevant expert opinion or statement procured
T94	Ordering Inspection on Site	Inspection on Site ordered
T95	Petition producing Evidence	Petition addressed
T96	Commenting on Petition	Comment provided
T97	Requesting original version of a Document	Request addressed

T98	Providing original version of a Document	Original version of a Document provided
T99	Contesting the authenticity or completeness of the documents produced	Contest addressed
T100	Taking a File from a different case as Evidence	Decision on Taking a File from a different case as Evidence passed
T101	Examination of a Party or of a Witness	Request for an Examination addressed
T102	Getting Statement of the Other Party	Statement provided
T103	Written sworn statement of the person whose examination is proposed	Written sworn statement produced
T104	Restrictions concerning the examination	Other restrictions stipulated
T105	Appeal to follow the Rules	The Examination conducted according to Rules
T106	Proposing an Expert Witness	Expert Witness proposed
T107	Appointing an Expert Witness	Expert Witness appointed
T108	Commenting on Expert Witness appointing	Comment provided
T109	Proposals for Expert Witness	Proposal provided
T110	Providing necessary assistance	Necessary assistance to the Expert Witness provided
T111	Overview of Experts Opinions	Experts Opinions Overview provided
T112	Request to appoint a Consultant for the Arbitral tribunal	Request addressed
T113	Appointing a Consultant for the Arbitral tribunal	Appointing a Consultant for the Arbitral tribunal completed
T114	Statement about the Consultant for the Arbitral tribunal	Statement provided
T115	Closing of Proceedings	The taking of Evidence and the Proceedings closed
T116	Rendering of Arbitral Award	Arbitral Award rendered
T117	Rendering of Partial Arbitral Award	Partial Arbitral Award rendered
T118	Rendering of an Interim Arbitral Award	Interim Arbitral Award rendered
T119	Scrutiny of Arbitral Award	Consent with the Form of the Arbitral Award given
T120	Scrutiny of Termination Decision	Consent with the Form of the Termination Decision given

A. TABLES

T121	Serving a Written Copy of the Arbitral Award without Pronouncement	Decision to serve the Arbitral Award as a Written Copy passed
T122	Supplementation of Arbitral Award	Supplementing Award made
T123	Adopting Measures to supplement the Arbitral Award	Measures to supplement the Arbitral Award adopted
T124	Correction of Arbitral Award	Arbitral Award corrected
T125	Reviewing the Arbitral Award	Arbitral Award Reviewed
T126	Counterclaim	Counterclaim concluded
T127	Reimbustments of Costs	Increased costs payed
T128	Limiting access to a Statement	Access to Statement limited

Table A.2: Actor name table, all records

Actor ID	Actor Role Name
CA-1	Claimant
A-1	Filing Consultant
A-2	Proceedings Completer
CA-2	Respondent
A-21	Counterclaim Completer
CA-3	Evidence securing Seeker
A-3	Evidence Securer
CA-4	Number of Arbitrators Commenters
CA-5	Sole Arbitrator Appointer
CA-6	Arbitrator Appointer
A-4	Secondary Arbitrator Appointer
A-5	Presiding Arbitrator Appointer
A-6	Proceedings Terminator
A-7	Proceedings Decider
CA-7	Arbitrator Challenger
A-8	Challenge Completer
A-9	Challenged Arbitrator
A-10	Challenge Decider
CA-8	Party Commenters
A-11	Arbitrator Commenters
CA-9	Objector to Arbitrator
A-12	Arbitrator Mandate Terminator
A-13	Misconduct Repairer
CA-10	Compatibility Seeker
A-14	Language Measures Implementer
CA-11	"Party with Person authorised to receive Documents"
CA-12	Time limit excuse Seeker

CA-13	Decision Challenger
CA-14	Stay of Proceedings Requester
A-15	Stay of Proceedings Completer
CA-15	Procedural Motion Submitter
CA-16	Permission Seeker
A-16	Permission Provider
CA-17	Intervening Party
CA-18	Third Party Admission Commenter
CA-19	Consolidation Requester
CA-20	Suggester
CA-21	Settlement Proposers
CA-22	Decision Review Requester
A-17	Decision Reviewer
CA-23	Hearing participants
CA-24	Active Hearing Participant
A-18	Proof of Delivery Checker
CA-39	Delivery Prover
CA-25	Proceedings Participants
CA-26	Translation Requester
CA-27	Translation Provider
CA-28	Evidence Provider
CA-29	Evidence Petitioner
CA-30	Document Authenticity Contester
CA-31	Witness Proposer
CA-32	Examination Commenter
CA-33	Rule Breaker
CA-34	Neutral Expert Witness Proposer
CA-35	Experts
CA-36	Consultant Appointer Proposer
A-19	Result Scrutiniser
CA-37	Adjustments Requester
CA-38	Review Seeker
A-20	Arbitral Award Reviewer

Acronyms

BPD Business Process Diagram.

BPMN Business Process Model And Notation.

DEMO Design & Engineering Methodology for Organizations.

EE Enterprise Engineering.

GDPR General Data Protection Regulation.

LKIF The Legal Knowledge Interchange Format.

OCD Organization Construction Diagram.

OCL Object Constraint Language.

OER Organisational Essence Revealing.

OMG Object Management Group.

OWL Web Ontology Language.

TRT Transaction Result Table.

UML Unified Modeling Language.

VLPM Visual Law Process Modeler.

WoM Way of modelling.

WoT Way of thinking.

WoW Way of working.

XML eXtensible Markup Language.

Contents of enclosed CD

	readme.txt	the file with CD contents description
	docs	the directory with diagrams and tables
	src	the directory of source codes
	thesis	the directory of L ^A T _E X source codes of the thesis
	text	the thesis text directory
	DP_Lassama1_2019.pdf	the thesis text in PDF format