

DIGITAL EXPERIENCES IN CREATING DIGITAL SERVICES: CASE WORK FOR THE RIGHTS OF THE CHILD¹

H. A. LÓPEZ^{a, b}

^aCopenhagen University, 41 Sigurdsgade, Copenhagen 2200, Denmark

^bDCR Solutions A/S, 76 Njalsgade, Copenhagen 2300, Denmark

The digitalization process in the public sector has brought different benefits to states and their citizens, but it has also brought several challenges. In particular, digitalization processes require close collaboration with legal practitioners, managers and IT professionals, and failure to engage all participants means to come up with digital systems that do not comply with requirements, especially those related to laws. Currently, compliance is done in an after-the-fact fashion: a digital system is implemented, and legislators audit whether it abides legal constraints. The problem with this approach is the cost: in case of non-compliance, systems need to be re-implemented, and this will be most likely the case since laws are always changing. In this work we report experiences in *compliant-by-design case work* (CbDCW). In CbDCW, legal considerations are involved before the system is implemented, making compliance checking a task that can be automated. Moreover, the impact of a law change in implementation can be identified without needing to program a new solution. This paper reports our experiences in the application of CbDCW in the Danish public sector, as well as to propose a research agenda derived from these experiences. Overall we identified that there are key socio-technical differences between legal practitioners and process or IT developers, and that ensuring compliance requires these types of stakeholders to have a common understanding, which can be supported by hybrid-modeling techniques proper from business process management.

Keywords: rights-by-design; digitalization of the public sector; regulatory compliance; compliant-by-design case work.

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ОПЫТ СОЗДАНИЯ ЦИФРОВЫХ УСЛУГ: ПРАКТИКА В ОБЛАСТИ ЗАЩИТЫ ПРАВ РЕБЕНКА

Х. А. ЛОПЕС^{1), 2)}

¹⁾Копенгагенский университет, ул. Сигурдсгаде, 41, 2200, г. Копенгаген, Дания

²⁾DCR Solutions A/S, ул. Ньялсгаде, 76, 2300, г. Копенгаген, Дания

Процесс цифровизации в государственном секторе приносит как различные выгоды, так и проблемы для государств и их граждан. В частности, цифровизация требует тесного сотрудничества юристов, менеджеров и IT-специалистов, а неспособность привлечь всех участников влечет создание цифровых систем, которые не соответствуют требованиям, особенно в части законодательства. В настоящее время проверка на соответствие осуществляется постфактум: сначала

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Автор:

Хьюго-Андрес Лопес – доцент кафедры компьютерных наук отдела программного обеспечения, данных, населения и общества кафедры компьютерных наук.

Author:

Hugo-Andrés López, assistant professor in computer science at the software, data, people and society section, department of computer science.
lopez@di.ku.dk
hual@dcrsolutions.net

внедряется цифровая система, а затем законодатели проверяют, соответствует ли она правовым требованиям. Проблемой подобного подхода являются возникающие издержки: в случае несоответствия системы внедряются повторно. Чаще всего происходит именно так, поскольку законы постоянно меняются. В данном исследовании описывается опыт работы именно с проектами, соответствующими нормам по умолчанию. В таких проектах перед внедрением цифровой системы учитываются правовые аспекты, что делает проверку соответствия автоматизированным процессом. Более того, влияние изменений в законодательстве может быть выявлено без необходимости программирования нового решения. Рассматривается опыт применения исследуемых проектов в государственном секторе Дании, а также приводится программа исследований, основанная на этом опыте. По итогам работы определены ключевые социально-технические различия между юристами и разработчиками процессов или IT-разработчиками. Также выявлено, что для обеспечения соответствия необходимо взаимное понимание причастных сторон, которое можно поддерживать методами гибридного моделирования, соответствующими выбранным схемам управления бизнес-процессами.

Ключевые слова: безусловные права; цифровизация в государственном секторе; нормативно-правовое соответствие; соответствие нормам по умолчанию.

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Introduction

The emergence of information technologies, big data and machine learning has brought a revolution on the way we conceive, operate and take decisions, as well as on to how processes are automated. In particular, the move from paper-based cases to digital ones allows caseworkers to identify trends, and base their decisions in historic data. Not surprisingly, such an interest has spawned questions regarding the transparency in decision making based on digital systems. How are decisions considering the legal framework for each case, and how can we ensure that citizens are guaranteed the rights given in legislation, when processes move from paper to digital?

This paper reports experiences in the digitalization of administrative processes in municipal administration situated in Denmark. Such processes are governed by a reference framework that defines rights, duties and responsibilities between citizens and municipal governments. The aim is to provide a process-aware information system (PAIS) where municipalities process and monitor citizen cases. The implementation of governmental processes needs to preserve the intent of the law, and allow caseworkers for flexibility and discretion in their decision making. The last aspect is important as each case is different, and the information required in order to take a decision in each case varies according to their context. Such systems are not uncommon in public administration [1]. However, the question about transparency still remains: legal practitioners are normally not trained in IT and IT specialists are not trained in the law, and lack of understanding between each group poses at risk the compliance in the implementation of a case management system. Currently, legal compliance is performed in an after-

the-fact fashion: a prototypical implementation is released, and auditors confirm whether the system lives up to the rights inscribed in the law. Such an approach is extremely expensive: first, the mapping between legal rights and code is not straightforward. Second, the impact of regulations and their changes in an implementation is unknown.

This work aims at building the capability of public workers to develop novel socio-technical solutions for the public sector (for instance, citizen portals and case-management processes in local governments), paying considerations for the respect of the legal framework in the design of digital solutions in which such solutions operate. Ultimately, we would aim at providing a compliance-by-design framework that allows public workers and computer scientists to speak a common language, which will improve the understandability of case-management implementations, validate compliance earlier, and adapt changes in the regulations in an easier way than existing systems.

The paper is structured as follows: in the following section we describe our application case: the distribution of social benefits in the municipality of Syddjurs, in Denmark. Section 3 describes the intended compliance framework, as well as the technology stack developed for this project. Section 4 describes the adoption considerations report on lessons learned so far, proposing a research agenda derived from these experiences. Finally, section 5 concludes. To the most extent, this paper represents a compilation of several research works in the “Effective co-created and compliant adaptive case management systems for knowledge workers” (Ecodknow) project², and focuses on the parts that where the first author has been involved.

Case: social benefit case work in Danish municipalities

Denmark ranks 4th out of 29 EU member states in the digital economy and society index (DESI) in 2019,

being the lead member in dimensions such as connectivity, use of internet services, digital public services for

²Effective co-created & compliant adaptive case management for knowledge workers [Electronic resource]. URL: <https://ecodknow.org/> (date of access: 23.04.2020).

business and medical data exchange [2]. A common agreement between central and local governments has been instrumental in these positions. In March 2019, the central, regional and the local governments released a novel “Digitisation pact” to enable a seamless digital delivery and service collaboration across administrations in the public sector [3]. The goal is to accelerate public sector digitalisation efforts and to contribute to a better and more coherent welfare state by making sure that more people benefit from new digital possibilities and technology. The goal is to be achieved via three main objectives.

First, improved the usability, speed and overall quality of the digital services and digital welfare solutions. Second, to reduce the administrative burden on the business community by providing automatic business reporting solutions. Finally, the pact will build digital competences of citizens and of businesses, and improve information security in the public sector.

Digital services offered by municipalities are regulated by a set of laws, and quality considerations need also to consider compliance considerations. How are digital services observing the rights framed by the law? Moreover, compliance is rarely a one-shot activity, as laws constantly change: in April 2020, the Danish legal think tank “Justitia” examined the scope and change frequency of the Consolidation act of social services (CASS) [4]. CASS is a complex law with strong conse-

quences for the life of families (e. g.: separation and re-integration of families, and monetary benefits among others). In its most recent revision, the 84 pages of the CASS contains 198 articles defining the circumstances under which local and national institutions are obligated to provide assistance to citizens, as well as the duties of citizens towards the state. The size and complexity of the law is not the only consideration: “Justitia’s” report showed that CASS adopted 725 changes between 1 January 2007 and 1 July 2019. This corresponds to a rough estimate of more than two changes per each of the articles in the law, with some of the sections having a top of 13 changes per year [5]. Both the size of the laws and the number of changes affect compliance: digital services need to be in constant update according to the last legislation, and sometimes the changes of an article span across different components of the digital service. Complexity and change frequency make provision of compliant service a difficult task. Caseworkers need to get constantly updated as to how to identify the relevant legislation. In addition, citizens are less certain about whether their cases have been processed correctly. Each Danish municipality processed on average 9 337.33 cases related to CASS in the last three years [6]. Many of these cases were later revisited (e.g., on appeal): just in the first semester of 2018, 9.5% of the cases were revised, and 5.1% of the decisions needed to be reversed [7].

Technological and human challenges in process compliance

The quest for automated models for process compliance is not new to the digitalization era, with the first works dating back to the 1980’s when Sergot attempted to make a digital representation of the British naturalization act [8]. However, while a great body of work has been developed since then, there are certain major challenges, both human and technological. At its core, the notion of compliance can be reduced to a question of alignment between processes and the intent of the laws. This alignment is continuous and it must be repeated when regulations or processes change. Moreover, such an alignment needs to consider the fundamental differences between laws and processes. These are, according to [9]:

- goal: business processes are designed and optimised for the achievement of a business goal, in contrast to regulations that are formulated by legal authorities to protect societal interests, ensure social welfare, and regulate citizen’s lives;
- scope: business processes describe the interactions between one or multiple organisations, while laws typically regulate activities at a national, regional or local level;
- granularity: typically laws are high level documents that abstract from implementation details,

while business processes describe in great detail the different flows of activities in an organization;

- focus: the main focus of business processes is to describe the sequences of actions that lead to the achievement of a goal, in contrast to laws, that has a focus on the effects of such actions.

The differences do not stop there: cognitive and educational aspects play a big role. Humans only have a very limited working memory and this can easily be pushed to the limits of their cognitive processing capacity when analysing complex information, such as the contents of law or the flows in an administrative process. Moreover, legislators and computer scientists are trained with diametrically different backgrounds, each of them extremely complex to understand for the other. That means that the methods and artifacts used for making sense and understanding communicate information between one discipline (laws and other legislative provision process models or programs in computer science) differ across disciplines [10]. Even using natural language (such as English) as a communication artifact becomes trickier: legal texts can be written at different levels of complexity [11], and legal information, primarily written in a prescriptive manner, not always match process representations, that are closer to imperative writing styles [12].

Making case work compliant with laws

A collaboration between the municipal government of Syddjurs, universities and software vendors was created with the objective of improving the municipality capability to manage and process cases involving services and benefits offered to young persons

with special needs, as part of the Ecoknow project. In this section we will describe the problem of regulatory compliance of casework, pose forward some of the main challenges, and mention some of the most notable approaches in the literature.

What is digital regulatory compliance?

We take regulatory compliance as the “act/process to ensure that business operations, processes, and practices are in accordance with prescriptive (often legal) documents” [13]. While regulatory compliance can be applied to public organisations, private individuals, and private companies alike, it is in the former that compliance is crucially important. The latter two might decide to risk the non-compliance of a given law (risking fines and other punishments).

Public sector institutions do not have the same possibility, as the impact of noncompliance will have repercussions in the restrictions of rights by their citizens.

We discuss our contributions in three steps: first, the formalisation of fragments of laws for digital processing. Second, the definition of a methodology that reconciles laws and processes in the public sector, and third, the empirical evaluation of the approach.

A formal account of laws

Our first premise was that if a digital process needs to comply with regulation, then there should be a link between the activities that the process does, and what is permitted or required in the law. Such a link must be formal, maintainable and understandable. On formality: it is not sufficient to determine that a given part of the process corresponds to a legal text, but it should be possible to demonstrate that the semantics of the legal text is preserved by the actions in the process. A typical example is an interplay between rights and obligations. A legal paragraph might prescribe that if a citizen fulfils criteria for the distribution of social benefits, then the municipality shall disburse such benefits to the patient. A formal interpretation allows us to encode the above paragraph in a mathematical formula, and prove that for all executions of the administrative process, such benefits will eventually be disbursed. On maintainability: the alignments between laws and text need to be editable every time either laws or processes change. On understandability: the notations used should be amenable for comprehension for both the legal practitioner (not versed in IT jargon) and the computer scientist. Improving this factor is key in order to benefit from the legal practitioner’s domain knowledge, and increase its confidence in the implemented solution.

The three principles outlined above were integrated in the construction of a dual-coding tool. First, laws describing organizational processes in the municipal government are described in terms of process models. They are graphical representations of the activities, roles and constraints present in the achievement of a goal. Such constraints allow the descriptions of the dynamic nature of permissions, obligations and defeasible conditions that might occur in a law. Process models are not only a graphical notation that is amenable for domain specialists, but also a formal notation with

a rigorous semantics that describes the multiple ways different activities can be arranged in the achievement of a goal [14]. The notation needs to be able to describe a flexible orchestration of activities, representing in this way the discretionary nature of case work. As an example, consider an excerpt of section 42 in CASS (SASS 42):

“§1. *The municipal council shall pay compensation for loss of earnings to persons maintaining a child under 18 in the home whose physical or mental function is substantially and permanently impaired, or who is suffering from a serious, chronic or long-term illness. Compensation shall be subject to the condition that the child is cared for at home as a necessary consequence of the impaired function, and that it is most expedient for the mother or father to care for the child.*

§2. *The requirement in §1 above that the child shall be cared for at home shall not apply to any child mentioned in paragraph §1 who has been placed in care under section 52(3)(vii) in connection with the child’s hospital visit. It is a condition that the presence of the mother or father at the hospital is a necessary consequence of the child’s functional impairment and that such presence is most expedient for the child”.*

Figure 1 represents the law paragraphs in CASS 42 using the core graphical notation of DCR graphs [15]. The notation has distinctions on events (think of activities in the process, or the achievement of a right in law) and constraint between events. With a condition constraint we describe permissions: an event will not be enabled unless its conditions are fulfilled. In the mentioned figure, the payment of compensation is only enabled once all the other events linked with condition arrows are either achieved or excluded. A response constraint describes a duty: once an event has been executed, then it spans an obligation for an action that must happen. In this case, if the person documents

a child's physical or mental function, then this set an obligation to the municipal council to pay compensation of benefits. Defeasible conditions are described by exclusion relations. Exclusions take events out of the active context (e. g.: if the person documents that the child is care at home, there is no need to document that he is cared in the hospital, and viceversa). Final-

ly, the inclusion constraint acts as the converse of the defeasible constraint: it includes events for possible execution (e.g.: there will be an additional set of documents that the municipal council needs to collect if the children is cared at a hospital). Finally, these relations can be composed, allowing for a dynamic interplay between events, rights and obligations.

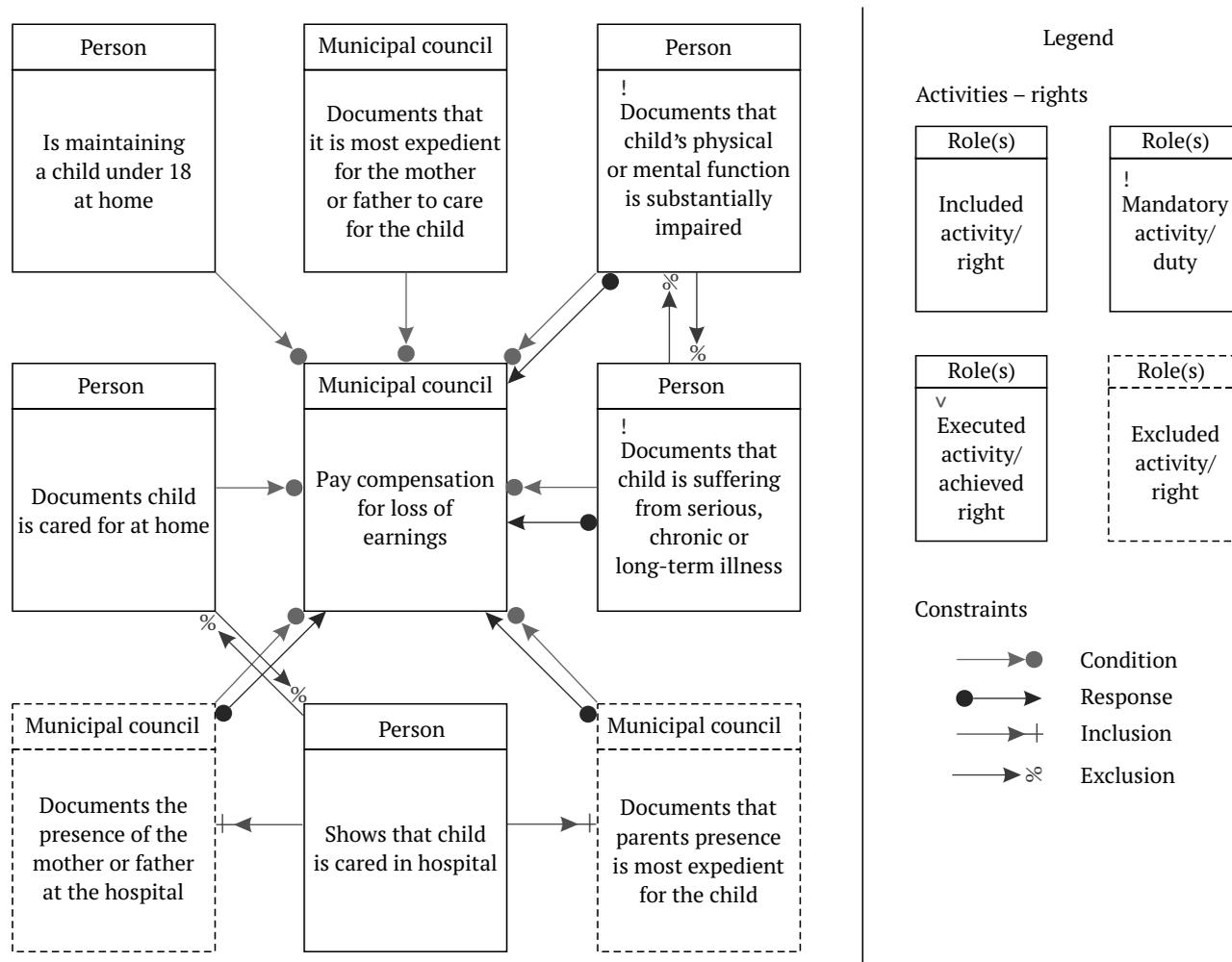


Fig. 1. Process model of CASS 42

Figure 1 illustrates how legal paragraphs can be represented via a declarative process notation such as DCR graphs, yet the notation is far from standard understanding of legal personnel, that are more used to legal documents. In a second phase, we built a tool that reconciles laws and digital processes. The process highlighter [16] implements Paivio's dual code theory [17]: while process models are visual representations with a defined execution semantics, they lack in many ways the context (e. g.: why is this task needed?) and are not natural to the law practitioner. Adding the legal information in its original form (legal text) information allows to include the context on why certain activities are necessary. Moreover, visual and verbal information are linked together: elements in the process model can be traced back to their requirements

in the law by looking at their highlights. The process highlighter is used to generate process models representing laws, as well as for auditing whether existing processes in a municipality are compliant with laws. Figure 2 shows the alignments between laws and processes for the example above.

Creating a process of law requires us to process an entire law: identify its main actors, events, rights, obligations, and constraints between them. This is a major task, and its manual processing might introduce ambiguities and further errors. To help caseworkers streamlining their model elicitation activities, the original process highlighter was extended with AI techniques based on natural language processing (NLP) [18]. Here a rule-based approach was explored: most information required in the models of law corresponds to a specific

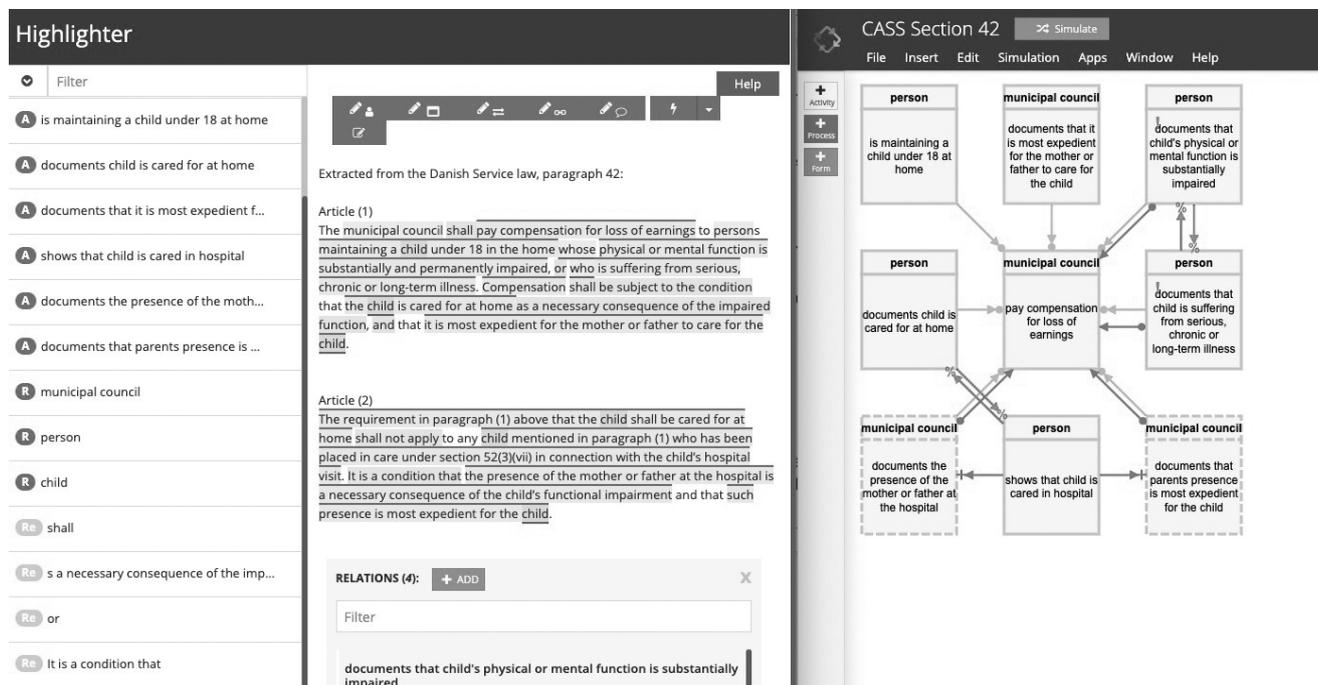


Fig. 2. Law-process alignments: excerpts of the process highlighter

set of grammatical patterns that occur in the legal text, and standard natural language processing (NLP) techniques such as named-entity recognition and part-of-

speech tagging help retrieving candidates to the caseworker, that can use them to complete the model, or filter them out in case of ambiguity.

Efficient compliance checking

While a graphical notation is useful for understanding of the implications in the law, the real benefit of such representation comes on the flexibility that the model allows. The process to achieve a right might differ from person to person, in the same way that a caseworker will be autonomous to execute one or other activity depending on the case. The formal semantics of DCR graphs permits to link the notation with a set of simulations. The simulation engine implements the formal semantics of the notation, allowing caseworkers to create scenarios from existing cases that are desirable, or that should be violated. The scenarios can map legal precedents or caseworker's best practice. Figure 3 represents some of the scenarios derived from the model of CASS 22.

Furthermore, the validation stage mentioned above needs to be complemented with a verification step. This stage will filter out logical errors derived from the composition of activities. Such errors might lead to models that are not executable, or where dependencies between activities and decisions it is impossible to attain a right or fulfil an obligation. Such terms are known as deadlocks (e. g. "nobody can take a decision, since everyone is waiting from someone else to do something") and livelocks (e. g.: "you can do only useless work, and not the work that solves the problem"). Both deadlock and livelock properties need to be taken into consideration before using models of law to compliance checking real processes. As models

of law might involve multiple a large number of decisions, it is recommended that such analysis is done via automated tools for deadlock and livelock analysis, including those presented in [19].

Recalling the technological and human challenges described in the previous section, it is important to be able to merge process and legal information. We consider a clear separation on models of laws, and process models describing administrative work. Process models represent the work carried out in an organization, and that might differ from place to place. This variability is not found in laws: the implementation of the same digital service in different municipalities should be compliant to the same law. In [14], we proposed a compliance framework that allow caseworkers to reuse of formal models of laws, and check whether the implementation in each municipality is behaving in accordance to the legal model. The second advantage is modularity: changes in a law might impact the compliance against the existing process. Such an impact can be analysed at design level, allowing possible modifications of the process model before implementation. An important aspect in this step is the computational complexity: by aligning models of laws and administrative processes that are both specified in DCR graphs, we can consider process models as a refinement of models of law. In short, refinement allows us to say that all the ways activities in can be composed in the administrative processes are a subset

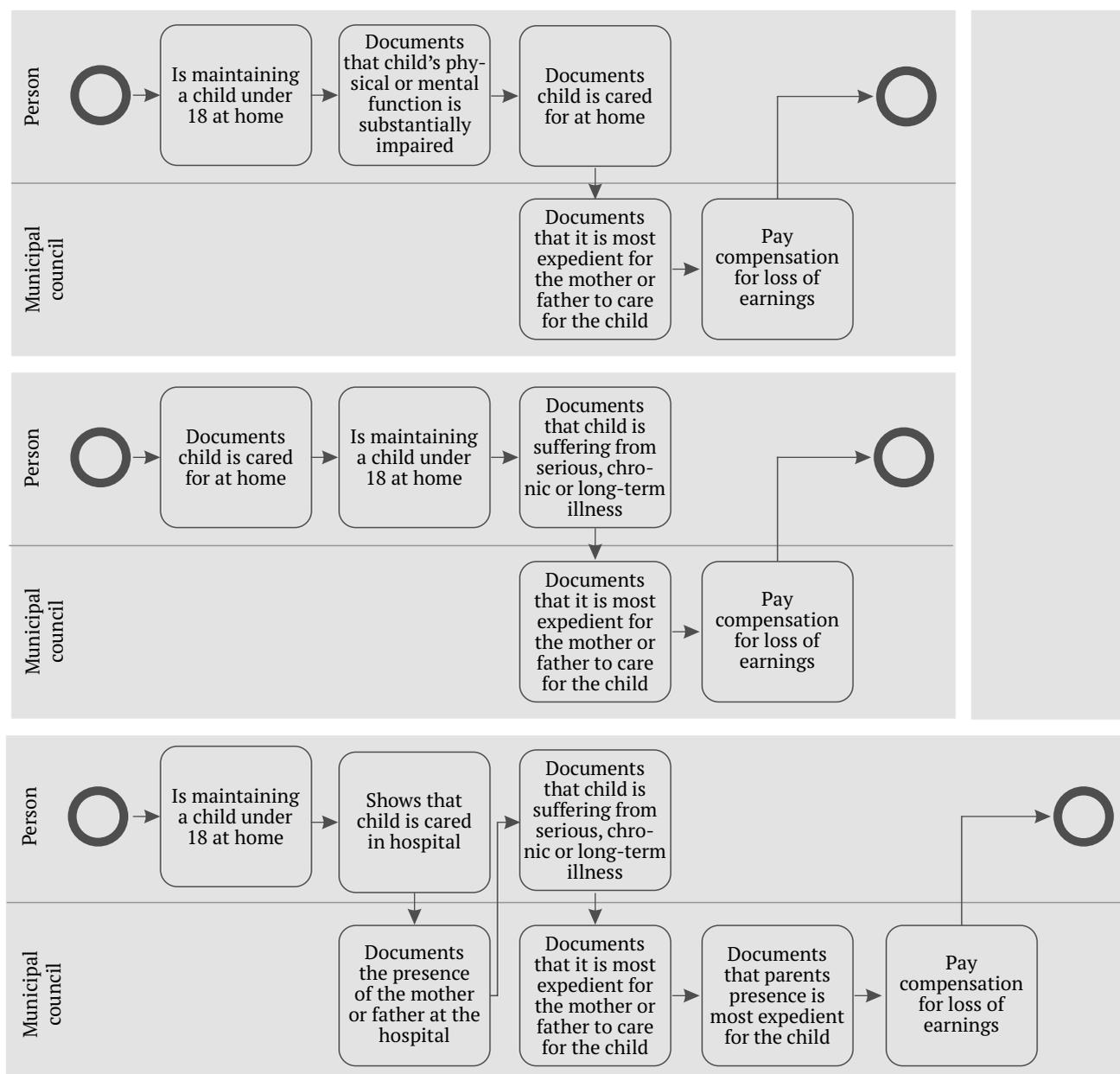


Fig. 3. Some scenarios derived from the model of CASS 42

of the possibilities considered in the process model representing a law, and that only compositions that fulfil the obligations according to the law will be ac-

cepted. These considerations are key, as they allow us to us efficient algorithms such as those described in sources [20].

Making sense of the approach

The theory and tooling developed has become part of the commercial offering of DCR Solutions process portal (www.dcrgraphs.net). The portal and technologies here presented are available for free for non-commercial users, and they are regularly used by a multi-sector user base, including caseworkers, process consultants and university students. To test whether the technologies developed have served its purpose, the approach has been used in different municipalities, including Syddjurs, Aalborg and Gentofte municipalities in Denmark. In particular, our collaboration

with Syddjurs municipality has been instrumental in the development and improvement of different versions of the process highlighter. In order to validate whether the approach here supported caseworkers in creation and maintenance of graphs, we analysed their interaction in the process of creation of compliance models of laws. In [21] we followed a qualitative research approach addressing two main research questions:

1. How do users engage with the modelling tasks using legal and process dimensions?

2. How does the reconciliation between dimensions improve the quality of the generated models?

The results of the analysis showed that most participants used the highlighter in the identification of events, activities and roles coming from the texts, moving to the graphical modelling framework to manually ensure that models behave according to the intent of the laws or processes. The justifications for this sort of workflow are associated with the facility to identify events from the text and the implied cognitive support obtained when doing so. The alignment between relations coming from the text and the semantic rules in DCR graphs was preferred to be done via the graphical framework, and participants justified this choice arguing an implicit complexity in the interpretation of some

the constraints in the process or legal text, which made the automatic mapping to DCR relations not straightforward activity. Regarding the quality of the generated process models, the insights gathered from the participants showed the potential benefits associated with the use of the highlighter. According to them, the highlighter can support transparency in the implementations of laws. The traceability that linking processes to laws provides gives a justification of the activities in an administrative process. Moreover, the linking mechanism provided by the highlighter gives a better alignment between the process model and the corresponding process description. Finally, the use of the highlighter can help to document process models which in turn facilitate their coverage and maintainability.

Executable laws

As mentioned in the previous section, the alignment between laws and processes can help to understand laws, and to verify how compliant are administrative processes with respect to the laws. An equally important use pertains to the generation of executable, compliant processes. Process models are not only graphical abstractions that serve to communicate ideas; supported by its formal semantics, a DCR process model can be executed by a process engine, that will use the model to create an instance per each case in the municipality.

This process ensures transparency as laws are not obfuscated by low-level code implementations. To complete the setup, a presentation layer that allows the interaction between the caseworker and the engine needs to be built. In the case of DCR graphs, an open-source tool⁵ has been released so municipalities can configure the presentation layer to their needs. This presentation layer can be changed, or interoperate with other case management systems, for instance, KMD Workzone.

Lesson learned and future work

The major outcome of this project has been a successful collaboration between academia, industry and the municipal sector, which has brought theoretical research to be adapted by software vendors, producing tools that are operated by the municipalities. These interactions have brought several research directions where further development is necessary. I proceed to list some of them.

AI support to case work. Our interactions with municipal governments have evidenced that, while it is important to provide ways to speed up decision making activities for caseworkers, such activities should be properly justified and explained. The digitalization of administrative processes is one of them. As we mentioned earlier, creating a digital model of laws is a complex task and represents a significant time investment for caseworkers. An opportunity that emerged was the application of AI techniques in order to speed up processing times. The set of techniques known as natural NLP can help identifying key information in the law, lower the ambiguity in some of the terms, and filter out information that is not supposed to be part of the digital process. In [18] we started embedding such techniques by adding to the process highlighter NLP capabilities that help on the identification of roles,

events or activities and relations. NLP approaches can be divided into rule-based approaches (learn from a set of heuristics, written by experts), and machine learning approaches (learn the rules using an annotated data set). In the case of legal documents, mixing together both approaches seem to both help generalization and accuracy: a rule-based system pattern-matches fragments in the law to rules describing what type of words and sentence structures correspond to elements in the digital model. Such an approach provides a quick-start, it is domain-independent and does not depend on existing data (the rules are defined in terms of grammatical structures in the language of the regulation). The tradeoff is accuracy: the lack of domain information allows ambiguities to appear, and the NLP module will not detect rules not matching the set of heuristics. Extending original rules to cover more specialised cases is also difficult: as the amount of rules increases, the sets of heuristics become more complex.

Each rule has to fit in together with the entire rule-set, and as the matches get more situational, it requires more and more rules to distinctively sort the patterns from each other. In contrast, a machine-learning approach does not depend on the patterns, but on the breadth of the dataset trained on. Law paragraphs and

⁵DCRGraphsNet [Electronic resource]. URL: <https://github.com/DCRGraphsNet/DCROpenCaseManager> (date of access: 23.04.2020).

their constituents are classified. These annotations provide semantic information. For instance, an annotation can define that the word “shall” represents a constraint, that the “municipality” is an actor in the process, rather than a location, or that a given paragraph describes obligations in the law. Using a machine-learning approach has the potential of providing more accurate suggestions, as it embeds domain information, and when having enough data, the ML approach might require less effort to extend than rule-based matching, not having to engineer the ruleset by hand. The trade-off is generalizability (changing the domain in laws will require new training). In future work, we expect to be able to combine both rule-based and ML approaches: the existing rule-based approach provides human annotators with a quick-start set of suggestions that can be confirmed, rejected, or extended. Curated suggestions can then be included in the annotated dataset, that can then be used for training the ML module.

The second challenge comes with the modularization of digital models of laws. While graphical models tend to decrease the complexity in the perception of information, having a digital model of the law normally requires us to have models of multiple law paragraphs, with connections between them. For example, figure 4 shows a dependency graph between articles in excerpts of the GDPR. In order to evaluate Art. 32 (security of processing) considerations regarding three other articles (Art. 28, 30, 40) need to be considered, which in turn need to consider other articles (for instance, the other 10 dependencies for Art. 40, including Art. 32 itself). In order to have a fully compliant model,

all such dependencies need to be resolved, leading to models of great size that are difficult to understand. This is an area that could benefit from modular design, one of the pillars of modern software engineering. A complex system is decomposed into different modules, each of them with their own responsibility, and with the possibility to interact in various ways with other modules. The same modularity principles can be applied to laws. We can interpret each article in law as a module (a node in the graph) that has its specific behaviour and implicit dependencies with other articles. The assembly between different articles obeys a compositional semantics, that propagates the effects in one article to its dependencies.

Runtime monitoring. We have discussed the use of models of law as artifacts to ensure compliance in the administrative process in municipalities, with the aim to perform a verification before processes are implemented. However, both the complexity of the rules and their verification processes has limitations: rules in laws might consider different dimensions such as control, data, temporal and organisational flows, as well as combinations between them [22]. Verifying all these dimensions at compilation time is computationally expensive, and in some dimensions, even impossible. For example, the temporal dimension might describe a policy with a deadline for manual casework, but the way it has been implemented allows a caseworker to pass such a deadline. As an alternative, process models can be used as a yardstick to monitor the state of each case, suggesting a mechanism of governance and compensation for cases violating the policies.

Human aspects of process modelling

Both legal interpretation and process modelling have humans in the loop, and the successful adoption of technologies for digital rights depends on whether humans can understand the artifacts that represent laws: process models. The work of [23] showed that hybrid representations of processes combining laws and digital process models are perceived differently depending on the background of the subject. Legal practitioners will focus more on legal texts than process models, while process specialists will understand processes mostly from the models, disregarding legal text. In order to foster understandability of process models by practitioners, it is suggested that models are explained using artifacts known and understood by law personal, that is, using natural language. For this, it is suggested to em-

bed techniques of process summarization [24] that simplify the complexity of the visual notation using jargon used by lawyers, for instance, by describing the process in terms of rights and obligations. Moreover, in order to consolidate a single coherent view it is necessary to understand what are the factors that affect the understandability of process models for non-experts. These factors range from syntactic, semantic and pragmatic aspects [25], and the impact of each aspect (in isolation as well as in composition) might elucidate guidelines that, in turn, make models more understandable, thus simpler to use and communicate. Finally, these set of guidelines might identify areas that can be supported computationally, with the introduction of layout algorithms, syntax checker, or semantic verifiers.

Conclusions

This paper has reported on our experiences in the introduction of supportive technologies to support study, analysis and implementation of digital rights, and their alignment with case-management processes in municipalities in Denmark. The process

has involved a close interaction between legal practitioners and computer scientists, and it has generated a set of tools that now are supporting the administrative work of caseworkers in municipalities. Such interactions have brought theoretical and practical

considerations, that require a combination of multiple disciplines in computer science, such as formal methods, empirical software engineering and natural language processing. Our experiences in this project have pointed out that providing support, in the long

run, will require significant research efforts in supportive technologies that foster the processing of large amounts of legal texts, while at the same time decreasing the ambiguity of human-centered aspects in process modelling.

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