Proposal for an in-house legal process mining case*

Steven Knoblich[1,*,†], Jan Mendling[1] and Larissa Sonja Böhme

[1]Humboldt-Universität zu Berlin, Rudower Chaussee 25, 12489 Berlin-Adlershof, Germany

Abstract

In-house legal processes, especially contract negotiation, play a critical role in corporate organizations, especially in the B2B sector where transactions often involve high-value goods and services with associated risks. This paper explores the application of process mining to improve the efficiency of contract negotiation by leveraging metadata collected during the negotiation process in state-of-the-art legal tools. Our proposal focuses on the critical success criterion of time, as protracted negotiations can significantly impact labor costs and delay the implementation of goods and services and their value creation. Our proposal uniquely quantifies the lost revenue resulting from delays in the introduction of new goods or services, providing a comprehensive understanding of the financial impact of negotiation inefficiencies at the clause level. We offer professional legal organizations a new way to monitor the progress of contract negotiations and indicate where additional rounds of negotiations are not only costing time and effort, but also hindering value creation, giving them the information they need to potentially accept an abstract risk.

Keywords

Legal Process, Process Mining, Value Creation

1. Introduction

In-house legal processes, particularly those involving contract negotiations, are critical components in corporate organizations, especially in the B2B sector, where transactions often involve high-value goods and services accompanied by significant risks. Despite the growing importance of legal operations within these organizations [1, 2, 3], the application of process mining—a powerful tool traditionally used to improve business process efficiencies—remains largely unexplored in the legal domain. While process mining has been extensively studied and applied in operational contexts such as healthcare and manufacturing, its potential in legal processes, particularly in enhancing the efficiency of contract negotiations, has not been adequately addressed in the literature [4].

Process mining research primarily concentrates on developing and refining algorithms to visualize, analyze, and predict the performance of business processes. Although this field has significantly influenced organizations in multiple ways [5], recent studies highlight the need for greater attention on the managerial implications and the practical application of process mining in organizational settings [6, 7, 8, 9, 10]. Zerbino et al. reviewed the adoption of process mining in organizations, highlighting that most of the use cases are in operations, especially in the healthcare sector. They did not identify any use case in the area of legal [4]. Previous research identified success factors of process mining, such as a structured process and data quality, among others [11]. Mamudu et al. built a framework of impacts of process mining on organizations by categorizing it into impacts on process, customer innovation and learning, and finance [12]. In finance, they focus on cost savings but ignore the revenue impact.

Building on this context, the aim of this paper is to propose a novel approach to leveraging process mining to enhance the efficiency of contract negotiation processes in corporate legal departments. By focusing on time as a critical success factor, we aim to quantify the lost revenue resulting from delays at the clause level and offer a framework for legal professionals to monitor negotiation progress more

PLC - Processes, Laws and Compliance workshop, in conjunction with ICPM 2024, October 14, 2024, Lyngby, Denmark

*Corresponding author.

†These authors contributed equally.

knoblich.steven@googlemail.com (S. Knoblich); jan.mendling@hu-berlin.de (J. Mendling); lara.boehme@gmail.com (L. S. Böhme)

0009-0002-8509-7042 (S. Knoblich); 0000-0002-7260-524X (J. Mendling)

effectively. This approach not only highlights where additional rounds of negotiations may be costing time and effort but also provides insights into when accepting certain risks may be financially justified.

The remainder of this paper is structured as follows, section 2 presents the research background against which we position our work. Section 3 introduces our concept for a use case to apply process mining in the context of contract negotiation. Section 4 concludes this paper with a discussion.

2. Background

In this section, we introduce the topics of process mining, legal processes, operation, technology and data, as their development over the past decades build the basis for this paper.

2.1. Process Mining

Process mining is an interdisciplinary field that combines methods and tools from data mining, business process management, machine learning and visualisation [13]. It aims to discover, monitor and improve real processes by extracting knowledge from event logs [14]. Process mining can be used to analyse various aspects of processes such as their performance, conformity, variability and compliance [15]. This technology can also provide insight into the causes and effects of process variation, bottlenecks and inefficiencies [16]. In addition, predictive analytics can be applied to predict future process states, anticipate deviations and optimise execution by integrating historical data with machine learning [17]. It requires structured source data with event logs for detailed records of individual events that occur within a system. Case IDs as identifiers to collate related events and facilitate coherent process analysis. Timestamps, which are essential for analysing temporal patterns and sequences of events [13].

2.2. Legal Processes, Operation, Technology and Data

Legal processes differ significantly between government agencies, in-house legal departments and law firms, each with unique roles and operational structures. Government legal departments focus on regulation and public law, while in-house legal teams manage internal corporate legal matters, including compliance and risk management. Law firms, on the other hand, handle a wide range of legal services across industries, often specialising in specific areas such as litigation and corporate law [18]. The Association of Corporate Council has identified process management as a key area for success [19].

Legal technology, often referred to as *legal tech*, encompasses a wide range of software and tools designed to streamline and enhance the practice of law, manage legal operations and improve the accessibility of legal services. It includes applications for document automation, legal research, case management, e-discovery and contract analysis. Legal tech is increasingly leveraging advanced technologies such as artificial intelligence (AI), machine learning, and blockchain to provide more efficient, accurate, and scalable solutions in legal operations [20, 21]. Utilizing legal technology comes with the benefit of more structured and reliable data e.g. for all iterations of contract clause negotiations. This also includes relevant data for process mining. Cevc et al. define some of these relevant data in contract negotiations from a legal point of view [22].

Legal operations have emerged as the core hub of corporate legal departments, transforming legal from a back-office function to a core business partner. Some key elements in building an in-house legal operations function include assessing the current state and aligning with short and long-term financial and operational strategies, effective use of legal technology and innovation, continuous learning, training and development of legal professionals [11, 23, 24, 25]. Recent studies show that the need to professionalise legal operations will grow in the future, supported by the rise of AI.

3. Concept of process mining in contract negotiation

This section introduces the concept of using process mining to enhance contract negotiations. Therefore it first intorduces a high level sourcing process. Second it defines the relevant information to apply this

technology. Following it proposes a method to calculate the financial value of negotiating specific clauses, balancing expected risk mitigation against the time and costs involved resulting in a decision-making framework to determine if the negotiation is financially justified.

3.1. Sourcing Process

The sourcing process in organisations starts with a clear definition of needs, including specifications, quality and quantity requirements. This step ensures that all subsequent activities are aligned with the organisation's strategic objectives. Once needs have been identified, market research is conducted to identify potential suppliers, assessing their capabilities and market conditions to create a shortlist.

The supplier evaluation stage involves a detailed cost-benefit analysis, taking into account the total cost of ownership - both direct and indirect. A critical part of this stage is the development of a business case that justifies the sourcing decision. This business case includes financial projections, risk assessments and an analysis of how well the decision aligns with the organisation's long-term strategic goals.

Once a supplier is selected, negotiations are conducted to finalise terms and conditions that reflect the assumptions of the business case. Once contracted, the supplier is integrated into the organisation's operations, with ongoing performance monitoring and relationship management to ensure that the supplier meets expectations. Throughout this process, the risk management strategies outlined in the business case are implemented to protect against potential disruption and ensure that the sourcing strategy effectively supports the organisation's objectives.

3.2. Defining Relevant Data

Process mining relies heavily on high-quality event data to uncover and analyze business processes. The key data required includes event logs, which consist of case IDs, activity names, timestamps, and additional attributes like resources or costs. Ensuring the accuracy and completeness of this data is crucial for deriving meaningful insights from process mining activities [26]. For this paper we define these three data as following:

- **Case ID:** The case is the data object that is tracked throughout its life-cycle for the contract negotiation process. Additional attributes such as the category of the contract, the amount of the expected transaction, and supplier or customer data can be linked. This additional data helps to analyze the process flow more precisely, as the first negotiation with a new partner is likely to be longer than the negotiation with an existing partner.
- **Activity names:** Activities can be defined at different levels of granularity. As contract negotiation is part of the contract life-cycle, these activities require precise definition to add value. Legal knowledge is very relevant here and the definition of activities needs to be flexible to the understanding of the law in different cultural areas. This paper recommends the definition of activities at the paragraph level. We envisage two different approaches to the technical structure of the activity. The first reflects the start and end time of the negotiation per paragraph. The second reflects a (start) timestamp per activity, splitting the start and end of the negotiation per paragraph. The second option allows for consistent documentation of all changes to the paragraph each time a new version is saved. This would provide additional opportunities for analysis, such as how often a paragraph is changed, and allow a more robust analysis of the costs associated with the specific paragraph.
- **Timestamps:** In process mining, timestamps play an indispensable role as they are the basic building blocks for analyzing and reconstructing the flow of business processes. They are particularly important for reconstructing the sequence of activities and performing time analysis, including the duration of a task or the time between tasks. In the case of transaction management, the start time of an activity can be defined as the time when a particular paragraph is created. The end time can be defined as the time when the paragraph is approved. Any change to the content can also be recorded as the time when a new version is saved.

By building a process model based on these data, the following calculation and projection can be applied.

3.3. Calculation of business value of clauses

In contract negotiations, particularly when dealing with risk mitigation clauses, it is essential to rigorously evaluate each clause's potential impact. This evaluation should be grounded in a thorough analysis of several key factors that influence both the effectiveness of the risk mitigation strategy and the financial implications for the business. Understanding these factors is crucial for determining whether the negotiation of a specific clause is financially justified.

The critical factors to consider in the negotiation of contract clauses are as follows:

- **Expected Mitigated Risk (R)**: This represents the anticipated reduction in potential losses resulting from the implementation of a risk mitigation clause. The value of R reflects the effectiveness of the clause in reducing exposure to identified risks and is a critical measure of the clause's value to the business.
- **Expected Time to Agree on Contract Clause (T)**: This refers to the time required to reach a consensus on the terms of the clause. The time factor is significant because prolonged negotiations can delay the implementation of the risk mitigation strategy and can also lead to increased costs. Therefore, T must be carefully managed to ensure timely and efficient clause finalization. Especially here the prediction capability of process mining can be of great use.
- **Business Value per Time Unit (V)**: During the negotiation period, the business continues to operate and generate value. The value of V captures the ongoing economic benefits that the business realizes over time. Prolonged negotiations may result in opportunity costs, as the time spent in negotiation could delay the realization of additional business value.
- **Personal Costs (C)**: These are the direct costs associated with the personnel involved in the negotiation process, including wages, consultancy fees, and other expenditures necessary to bring the negotiation to a conclusion. Managing C is critical to ensure that the costs incurred do not outweigh the expected benefits of the clause.

To determine whether the negotiation of a specific clause is financially justified, the relationship between these factors must be carefully considered. This relationship can be expressed through the following inequality:

$$R > T \times (V + C)$$

This inequality indicates that the *Expected Mitigated Risk* (R) should be greater than the combined costs associated with the negotiation, which include both the *Business Value per Time Unit* (V) and the *Personal Costs* (C) multiplied by the *Expected Time* (T) required to reach an agreement. In other words, the negotiation makes financial sense only if the risk mitigation achieved by the clause outweighs the lost business value and incurred personal costs during the negotiation period.

In conclusion, the negotiation of individual contract clauses, particularly those aimed at mitigating risks, should be meticulously reviewed by analyzing the expected mitigated risk, the time required to reach an agreement, the ongoing business value, and the personal costs. The inequality $R > T \times (V + C)$ serves as a decision-making tool, guiding businesses in determining whether the potential benefits of a clause justify the associated costs and time investment. Additionally having the transparency of multiple negotiations in parallel will help managers to allocate specialized resources more efficiently.

4. Discussion

While the paper presents an innovative proposal for applying process mining to improve the efficiency of in-house legal processes, several critical aspects require further consideration.

First, it is important to note that this work is primarily a proposal and lacks an accompanying real-world case study. The lack of empirical validation raises questions about the practical applicability of the proposed framework in real legal environments. A case study would be essential to demonstrate the effectiveness of the process mining approach in actual contract negotiations and to highlight any unforeseen challenges that may arise during implementation.

Secondly, the paper does not address the costs associated with setting up the process mining model. Implementing such a model requires significant investment in terms of technology, data infrastructure, personnel costs to set up the model and training for legal professionals. Ignoring these costs may lead to an overly optimistic view of the potential benefits, as the initial outlay could be significant, particularly for organisations with limited resources.

Thirdly, the paper does not account for the diversity of contract types that can vary significantly in their structure, complexity, and requirements. Different types of contracts—such as service agreements, non-disclosure agreements, and licensing contracts—each have unique characteristics that may impact the process mining approach. By not addressing these variations, the paper may overlook specific adaptations or limitations necessary for applying the proposed model to a wider range of contract types, potentially limiting its relevance across different legal contexts.

Finally, the paper suggests that the expected time to mitigate risk through contract negotiation is a critical factor in the decision-making process. However, this expected time is not validated in the paper. To strengthen this aspect, it would be beneficial to support the proposed time frames with projections based on the analysis of previous contracts. This would provide a more accurate and reliable basis for assessing the financial viability of the negotiations.

In conclusion, while the proposal offers a promising approach to improving legal processes through the use of process mining, further empirical validation, cost analysis and validation of risk mitigation time frames are required to fully assess its practicality and effectiveness.

Acknowledgments

The research of Jan Mendling was supported by the Einstein Foundation Berlin under grant EPP-2019-524, by the German Federal Ministry of Education and Research under grant 16DII133, and by Deutsche Forschungsgemeinschaft under grants 496119880 (VisualMine) and 531115272 (ProImpact).

References

[1] Deloitte US, Uncovering legal operations leading practices, 2023. URL: https://www2.deloitte.com/us/en/pages/advisory/articles/legal-operations-best-practices.html.

[2] KPMG, 10 predictions: The legal department of the future, 2023. URL: https://kpmg.com/xx/en/home/insights/2023/10/legal-department-of-the-future.html.

[3] Thomson Reuters Institute, 2023 state of the corporate legal department report, 2023. URL: https://legal.thomsonreuters.com/en/insights/reports/2023-state-of-corporate-legal-department-report/form?gatedContent=%252Fcontent%252Fewp-marketing-websites%252Flegal%252Fgl%252Fen%252Finsights%252Freports%252F2023-state-of-corporate-legal-department-report.

[4] P. Zerbino, A. Stefanini, D. Aloini, Process science in action: A literature review on process mining in business management, Technological Forecasting & Social Change (2021). URL: https://doi.org/10.1016/j.techfore.2021.121021.

[5] L. Reinkemeyer, Process Mining in Action: Principles, Use Cases and Outlook, Springer Nature, 2020.

[6] J. Eggers, A. Hein, M. Böhm, H. Krcmar, No longer out of sight, no longer out of mind? how organizations engage with process mining-induced transparency to achieve increased process awareness, Business & Information Systems Engineering 63 (2021) 491–510.

[7] T. Grisold, J. Mendling, M. Otto, J. vom Brocke, Adoption, use and management of process mining in practice, Business Process Management Journal 27 (2020) 369–387.

[8] J. vom Brocke, M. Jans, J. Mendling, H. A. Reijers, A five-level framework for research on process mining, Business & Information Systems Engineering 63 (2021) 483–490.
[9] F. Zerbato, P. Soffer, B. Weber, Process mining practices: Evidence from interviews, in: International Conference on Business Process Management, Springer, 2022, pp. 268–285.
[10] N. Martin, D. A. Fischer, G. D. Kerpedzhiev, K. Goel, S. J. Leemans, M. Röglin, W. M. van der Aalst, M. Dumas, M. L. Rosa, M. Wynn, Opportunities and challenges for process mining in organizations: Results of a delphi study, Business & Information Systems Engineering 63 (2021) 511–527.
[11] M. Mason, Legal operations on a global scale, McKinsey Company (2021). URL: https://www.mckinsey.com/featured-insights/in-the-balance/legal-operations-on-a-global-scale.
[12] A. Mamudu, G. Mansingh, K.-M. Osei-Bryson, A process mining impacts framework, ResearchGate (2023). URL: https://www.researchgate.net/publication/368841575_A_process_mining_impacts_framework.
[13] W. van der Aalst, Process Mining: Discovery, Conformance and Enhancement of Business Processes, Springer Science and Business Media, 2011.
[14] W. van der Aalst, A. Adriansyah, B. van Dongen, Process mining: The next step in business process management, in: Business Process Management, Springer, Cham, 2016, pp. 1–28.
[15] J. Carmona, B. van Dongen, A. Solti, M. Weidlich, Conformance Checking: Relating Processes and Models, Springer, 2018.
[16] R. P. J. C. Bose, W. van der Aalst, Process diagnostics using trace alignment: Opportunities, issues, and challenges, Information Systems 83 (2019) 110–147.
[17] E. Rojas, M. Weidlich, H. Leopold, J. Mendling, Predictive business process monitoring with lstm neural networks, Business & Information Systems Engineering 61 (2019) 37–52. doi:10.1007/s12599-018-0550-5.
[18] K. Jacob, D. Schindler, R. Strathausen (Eds.), Liquid Legal: Transforming Legal into a Business Savvy, Information Enabled and Performance Driven Industry, Springer, 2016.
[19] Association of Corporate Counsel (ACC), Maturity Model 2.0, 2024. URL: https://www.acc.com/sites/default/files/resources/upload/MM2.0-Booklet-DIGITAL%20Final.pdf, accessed: 2024-08-21.
[20] R. Susskind, Tomorrow's Lawyers: An Introduction to Your Future, Oxford University Press, 2017.
[21] J. O. McGinnis, R. G. Pearce, The great disruption: How machine intelligence will transform the role of lawyers in the delivery of legal services, Fordham Law Review 82 (2014) 3041–3066.
[22] B. Cevc, M. Ebersoll, K. Gresbrand, S. Marks, K. Jacob, J. Löwe, D. Geidel, Contract metadata from a legal perspective, 2023. URL: https://liquid-legal-institute.com/wp-content/uploads/2024/02/LLI_contract_metadata_from_a_legal_perspective_ebook_2023-1.pdf.
[23] Bryter, What is legal operations? a complete guide to legal ops, Bryter (2023). URL: https://www.bryter.com/what-is-legal-operations-guide.
[24] C. C. Staff, The evolving role of legal operations, Wolters Kluwer (2023). URL: https://www.wolterskluwer.com/en/expert-insights/the-evolving-role-of-legal-operations.
[25] C. Brenton, S. R. Lambreth, Running Legal Like a Business: The Fundamentals of Legal Operations for Law Departments, Practising Law Institute, 2021. URL: https://www.pli.edu/catalog/publications/treatise/running-legal-like-a-business-the-fundamentals-of-legal-operations-for-law-departments.
[26] M. T. Wynn, S. Sadiq, Responsible process mining - a data quality perspective, in: SpringerLink, 2024. URL: https://doi.org/10.1007/978-3-662-49851-4.