Jonathan Grundmann

Decoding Bureaucracy:
Towards a Process Mining Method for Public Administration

Master's Thesis

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Supervisor: Dr. Michael Räckers
Tutor: Sandro Franzoi, M.Sc.

Presented by: Jonathan Grundmann
Õismäe tee 175, 13517 Tallinn, Estonia
jonathan.grundmann(at)mail de

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Abstract

Purpose This thesis addresses the research and practice gap concerning the limited knowledge on and lack of process mining use in public administration. Findings from the literature and this thesis indicate that there are substantial benefits for public authorities to be derived from implementing process mining. However, these remain largely unrealised.

Methodology To bridge this gap, a design science research methodology is applied with the aim of developing a suitable and useful solution artefact. The artefact was evaluated multiple times through interviews and a quantitative survey with an expert panel.

Findings The thesis presents a problem statement grounded in empirical findings and literature, from which design objectives for a method are derived. Building on this foundation, the *PIPPA* method is built, introduced and prototyped as a web application. PIPPA aims at enabling public authorities to identify, assess, realize and scale potential PM value within their organisation. The evaluations show that PIPPA largely fulfils the defined design objectives. However, it is not a *one-size-fits-all* solution, and rather a first, initial proposal for such a method that aims to invite researchers and practitioners alike to further engage with process mining in public administration.

Originality This thesis represents an initial exploration of the organisational and managerial implications of process mining in public administration and is, to date, the only work to present concrete, practice-oriented recommendations for practitioners in this domain.

Keywords: process mining, process intelligence, public administration, government, method

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Abbreviations

API	Application Programming Interface
BPI	Business Process Improvement
BPM	Business Process Management
BPMN	Business Process Model and Notation
BPR	Business Process Reengineering
CoE	Center of Excellence
CSV	Comma-Separated Values
DMS	Document Management System
DO	Design Objective
DSR	Design Science Research
ERP	Enterprise Resource Planning
ETL	Extract, Transform, Load (Database operations)
FTE	Full Time Equivalent
KPI	Key Performance Indicator
MAPPER	Portfolio Management Method for Process Mining-Enabled Business Process Improvement Projects
PA	Public Administration
PIPPA	Process Mining for Public Administration (*Method name*)
PM	Process Mining
RPA	Robotic Process Automation
SLR	Systematic Literature Review
SME	Situational Method Engineering
SQL	Structured Query Language
WoS	Clarivate Web of Science
XES	Extensible Event Stream
XÖV	XML in Public Administration (Germany)

Symbols

a	Stakeholder acceptance score
f	Technical feasibility score
i	Index i ranges from 1 to n
l	Legal barriers score
M	Evaluation matrix for the processes p_i of a unit, [$a\ f\ l\ v$], $M \in N^{n \times 4}$
n	Total number of processes in an organisational unit
p_i	Individual process i, belonging to an organisational unit
v	Value case relevance score

1 Introduction

Public administrations (PA) in Europe are under pressure to deliver their services more efficiently, effectively and digitally, thereby contributing to *good governance* and creating *public value* (Androniceanu & Georgescu, 2023; Mergel et al., 2019; Panagiotopoulos et al., 2019). Public services are provided by public authorities and are an outcome of their internal processes. Well-functioning processes within public authorities are therefore essential to ensure citizen-centred, efficient and accessible public services (Stefanovic et al., 2022; Syed et al., 2018). Over the past two decades, this has led to the professionalisation of Business Process Management (BPM) in PA and to an increasing research interest in it (Becker et al., 2012; Kregel et al., 2022). Methods and techniques from the private sector have been adapted, and domain-specific methods have been developed, such as PICTURE, a process method and modelling language (Becker et al., 2007; Takagi et al., 2024).

In the private sector, process mining (PM), a data science-based approach, has established itself as a prominent component of BPM (Dakic et al., 2018). PM refers to the algorithmic analysis, i.e. the *mining*, of event logs and other digital trace data from IT systems to better understand the actual execution of business processes. This approach enables the objective analysis of processes and the derivation of data-driven insights and business process improvements (BPIs). PM provides a deeper understanding of process performance, compliance, and bottlenecks that are often inaccessible through traditional modelling or manual observation. This can enhance operational efficiency, resulting in substantial savings in both cost and processing time (van der Aalst, 2011a). Consequentially, PM is being adopted by an increasing number of companies, is receiving substantial scientific attention and has emerged as a valuable method among practitioners as well as in research (Reinkemeyer, 2020; Zerbino et al., 2021).

It is reasonable to hypothesise that, given the recognised advantages of PM, PM in PA would also be of practical and scientific interest with practitioners and within the disciplines of Information Systems and Public Administration. However, the results of the literature review in Chapter 3 indicate that there is a scarcity of research on the application of PM in PA, with existing articles being limited in scope. Furthermore, the existing literature also suggests that there is not only a **research gap** but also a **practice gap** in this area as certain factors, such as a lack of methodical knowledge, seem to inhibit

the adoption and scaling of PM in PA (Racis & Spano, 2024; Rawiro et al., 2022). This thesis operates under the assumption that advantages realised in companies through PM can in principle also be achieved in PA for BPM and other purposes, such as automation. The current literature and the findings of this thesis support this assumption (Fioretto, 2023; Racis et al., 2024).

This thesis therefore aims to address these gaps. Given that the discussed problem is one of a practical nature, it is reasonable to argue that the knowledge gained should also be applicable and useful in practice. Consequently, this thesis is structured according to the Design Science Research (DSR) paradigm, which aims to solve problems through the iterative creation of design knowledge that culminates in an artefact (vom Brocke et al., 2020).

The **research goal** of this thesis is to propose a domain-specific method which enables public authorities to realise PM potential within their organisation. Based on this research goal, this thesis aims to make the following five interrelated, hierarchical contributions, which are structured and guided by the following subordinate research questions.

Systematic Literature Review: A systematic literature review (SLR) on the managerial aspects of PM and its use in PA shows the current state of research and highlights gaps. This is the most recent review of articles on these topics and, to the best of the author's knowledge, the only one for PM in PA that does not focus exclusively on technical aspects. *(Chapter 3)*

→ *RQ1: What is the current state of the literature regarding managerial aspects of process mining and process mining in public administration?*

Problem Analysis: A problem statement is formulated based on the SLR and expert interviews. Firstly, the advantages that practitioners in PA see in the use of PM are identified. Secondly, an analysis is conducted to determine the reasons why PM is not used despite its recognised benefits. Thirdly, the problem statement demonstrates the shortcomings of existing PM methodologies. *(Chapter 5)*

→ *RQ2.1: What, if any, perceived benefits do relevant practitioners in public administration associate with process mining?*
→ *RQ2.2: Why are these benefits currently not being realised?*

Design Objectives: Based on the problem statement and the literature, the type of target artefact, i.e. a method, is justified and objectives for its design are defined. *(Chapter 6)*
→ *RQ3: What objectives should a domain-specific method pursue that aims to overcome the outlined problems?*

Design & Development of a Method: The target artefact and main contribution of this thesis is a domain-specific method called PIPPA (Process Mining for Public Administration) for PM in PA. Following its design & development, the method and the evaluation results are presented. (*Chapter 7*)

→ *RQ4: How should a method that fulfils the defined design objectives be designed?*

Demonstration & **Evaluation of Method**: For demonstration purposes, PIPPA was implemented as a prototypical web application and evaluated by experts on its usefulness and how it fulfils the design objectives. (*Chapter 8*)

→ *RQ5: How do relevant practitioners in public administration perceive and evaluate a domain-specific method for process mining?*

This research takes PA and its core processes across federal, state and municipal levels in Germany as its point of reference. Nonetheless, the findings may be wholly or partially applicable to PA in other countries. The focus on PA in Germany was determined based on three primary rationales: (1) Given the robust corpus of literature on BPM within German PA, this thesis can effectively build upon existing knowledge. (2) Many German authorities have integrated BPM into their organisational structures and established responsible roles that could serve as potential users for PM (Ahrend et al., 2013; Kregel et al., 2022; Lederer & Mahr, 2025; Rosemann, 2015). (3) Professional associations, interest groups, and authorities in Germany have signalled a growing interest in PM for PA over recent years (Bundesverwaltungsamt, 2024; Morelli et al., 2022; Würfel & Schumacher, 2020).

The iterative evaluations in particular engage practitioners in PA, their needs and attitudes, thereby allowing their perspectives to contribute to the generation of new und useful knowledge, bridging theory and practice (Van de Ven, 2007). This thesis also seeks to contribute to the expanding field of research on the organisational dimensions of PM (Kipping et al., 2022; Martin et al., 2021).

2 Research Context

This chapter introduces the relevant characteristics of the Public Administration in Germany as well as the relevant fundamentals of process mining in regard to this thesis.

2.1 Characteristics of Public Administration in Germany

The German PA is characterised by the federal nature of the German state. Therefore, the respective federal levels and their territorial authorities possess a high degree of autonomy within their designated areas of legal jurisdiction (Münch, 2012). Consequently, administrative organisations have substantial choice in shaping both their structural and operational organisation. German bureaucracy is characterised by clear functional specialisation, a division of labour, and hierarchical structures with well-defined responsibilities. Administrative processes are governed by strict adherence to rules, formal documentation, and written record-keeping. These characteristics significantly influence the operationalisation of BPM, as well as its governance and culture within public authorities (Ahrend et al., 2013; Kregel et al., 2022; Lederer & Mahr, 2025; Niehaves et al., 2013).

Most public administrations are organised into departments (*Abteilungen*), directorates (*Referate*), or specialised units (*Sachgebiete*) (Bogumil & Jann, 2020). In this thesis, the term *organisational unit* is used uniformly to refer to these entities. These units may be positioned hierarchically above, below, or alongside one another. An organisation within public administration, regardless of its federal level or function, is hereinafter referred to as a *public authority*.

The procedures carried out by PA in accordance with legal requirements are referred to as specialised procedures (*Fachverfahren)*. The IT systems underlying these procedures are also commonly referred to as *Fachverfahren* or *IT-Fachverfahren* (Müller & Peper, 2019). In this thesis, the term *Fachverfahren* refers specifically to the IT systems that realise these procedures. A major driver of process digitalisation in German public administration in recent years has been the Online Access Act (*Onlinezugangsgesetz*). This legislation focused primarily on digitalising the interfaces between *Fachverfahren* and citizens (Seckelmann, 2025). As the majority of public services are delivered at the municipal level, a significant share of administrative processes occurs within local authorities (Marienfeldt et al., 2024). For the digitalisation of internal administrative

processes, document management systems (DMS) are frequently used to implement electronic case files (*E-Akten*) (Steinbrecher, 2020).

Whenever PA is mentioned in this thesis, it refers specifically to PA in Germany.

2.2 Fundamentals of Process Mining

PM is the algorithmic analysis of digital trace data, particularly event log data from software systems, to draw conclusions about the actual execution of processes and work practices within an organisation, see Figure 1. These analyses typically focus on identifying sequential process steps within a given process resulting in process models and visual process representations. Furthermore, PM also enables the mining of other organisational data, such as task distributions. PM is the intersection of process science and data science (van der Aalst, 2011a).

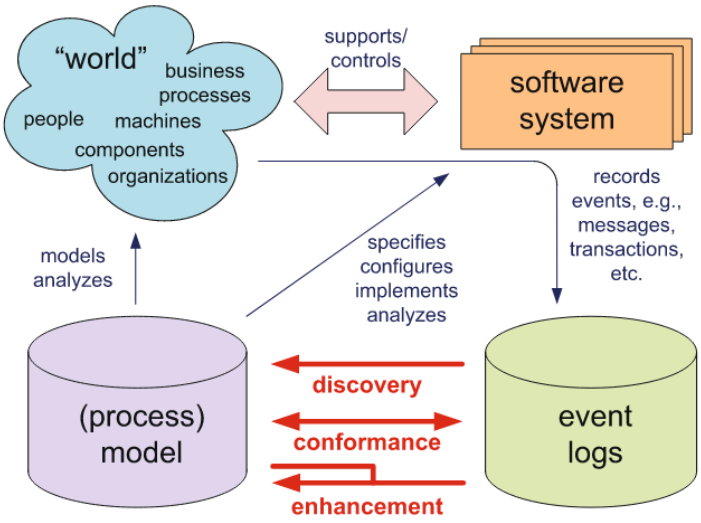

Figure 1: Context of Process Mining. Taken from van der Aalst (2011a, p. 9)

There are three fundamental PM techniques, each with distinct objectives (van der Aalst, 2011a):

Process discovery: New process models are generated from event log data without requiring any prior process knowledge.

Conformance checking: An event log is compared against a reference process model to identify deviations. This allows, among other things, the detection of rule violations.

Process enhancement: Existing process models are improved using information extracted from event logs. This may include the analysis of process performance indicators, such as throughput time.

To conduct PM, event log data sets must meet three fundamental requirements: (i) the presence of a unique case ID, (ii) clearly defined activities, and (iii) time stamps for each event record. Certain PM techniques may require additional conditions to be met (Reinkemeyer, 2020). While PM creates transparency regarding the actual execution of processes, the underlying motivation for its deployment is typically the achievement of Business Process Improvements (BPIs), thereby contributing to overall organisational efficiency (Badakhshan et al., 2022).

3 Literature Review

As DSR aims to operationalise scientific knowledge, the following insights from the literature will inform the design activities. This chapter therefore addresses *RQ1*.

The review of the literature is structured and conducted according to the recommendations of Watson and Webster (2020; 2002) and vom Brocke et al. (2015). The operationalisation and documentation of the SLR is carried out in successive steps (vom Brocke et al., 2009). This ensures the traceability of the results. Based on Cooper's (1988) taxonomy for literature reviews, the focus is on research outcomes, the goal is to depict central issues, the organisation is conceptual, the perspective is the espousal of positions, the audience are general scholars and the coverage is representative.

Figure 2 shows the steps of the SLR process. (1) The strategic scope of the review is defined and justified. (2) The topics are further conceptualised, and inclusion and exclusion criteria are defined. (3) This is operationalised by defining specific search parameters. (4) These are then used to conduct the search in Clarivate's Web of Science (WoS). (5) All articles from the results list are checked for quality and relevance by manually scanning the title, abstract and keywords and relating them to the pre-defined search criteria. (6) Relevant articles are subjected to a backward and forward search, i.e. it is checked whether they either cite other relevant papers or are cited by such. The inclusion of additional papers stops once no new relevant concepts are identified. (7) Other relevant articles that have not appeared in the search, but whose inclusion can be well justified, are included in the article pool. (8) The relevant literature is then categorised into sub-themes and literature groups are identified. As a result, a concept

matrix and concept tree of the literature groups are created. (9) Central concepts are synthesised and presented.

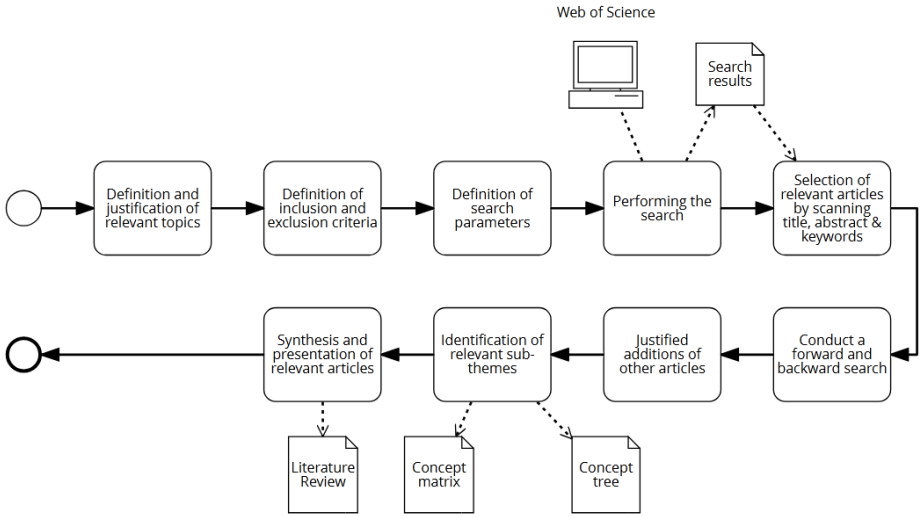

Figure 2: SLR process. Own illustration.

To ensure the academic rigor and reliability of the references cited in this study, sources were selected using Clarivate's Web of Science Core Collection. Its curated indexing, comprehensive disciplinary coverage, and standardized citation metrics provide a robust foundation for selecting high quality articles. All relevant articles have been evaluated against lists of alleged predatory journals and publishers, which, however, did not apply to any article. The considered literature consists of (a) conference papers in conference proceedings, (b) research or review articles in peer-reviewed journals, and (c) book chapters in academically edited volumes. Only English-language publications are considered. Articles with early access are also included. All searches were conducted on 14 February 2025, although some justified additions may have been made later.

Based on the research gap and supplemented by a preceding exploratory literature research, two relevant strands of literature were identified for the SLR: (I) the managerial aspects of PM and (II) PM in the public sector.

The appendix contains the overarching concept tree (Appendix B), the search results with the primary concept classification matrix (Appendix D), additional justifications and data to support the reproducibility of the search operators (Appendix C), as well as a list of the justified additions (Appendix E).

3.1 Managerial Aspects of Process Mining

The managerial aspects of PM encompass the implications of PM use on the structures, entities, roles, resources and governance of the respective organisation. The relationship between the technology and its organisational application area before and during PM use is central to this research endeavour.

Relevant articles should clearly address the managerial aspects of enabling PM in organisations. The articles should be as industry-agnostic as possible, generate theoretical knowledge and/or build and validate artefacts. In addition, only articles from the last ten years (2015–2025) will be considered in the initial search to reflect the latest state of the disciplines. Older relevant and frequently cited articles will then be included using the backward search. Table 1 presents the conceptual disjunct inclusion and exclusion criteria for the search.

Inclusion criteria	Exclusion criteria
[IC1.1] Industry agnostic	[EC1.1] Tailored to industry contexts (i.e. education, health or manufacturing)
[IC1.2] Dealing with socio-technical aspects	[EC1.2] Sole focus on technological aspects (e.g. data formats, algorithms)
[IC1.3] Theory building, reviewing or validating	[EC1.3] Descriptive case studies without theoretical reference
[IC1.4] Building or validation of an artefact	

Table 1: Inclusion and exclusion criteria for the literature search on the organisational aspects of PM.

Give the search objectives and a preliminary exploratory literature research, the following keywords were identified: *process mining, organisation, organisational, management, managerial* and *portfolio*. Together with the inclusion and exclusion criteria, the following search string was defined for the WoS database:

> *"process mining" (Title) AND (organization* OR organisation* OR "management" OR "managerial" OR "portfolio") (Topic) NOT "educational" OR health* OR "manufacturing" (Topic) and Proceeding Paper or Article or Review Article or Book Chapters or Early Access (Document Types)*

This search string resulted in 330 hits. Of these, 21 were subsequently identified as relevant and congruent with the search scope. A further six articles were added to this selection through a forward and backward search and as other justified additions, totalling in 27 papers.

Seven literature groups were identified in this distilled body of literature: (1) Capabilities [11], (2) Organisational Set-ups [2], (3) Maturity [3], (4) Methodologies [8], (5) Transparency & Awareness [3]. Each item has been assigned a primary group but may also touch on other themes. The number of related publications is indicated in square brackets.

3.1.1 Capabilities

PM capabilities refer to the use and availability of the resources required o be able to apply PM to processes within an organisation. They are a prerequisite for initiating and operating PM projects. The configuration and provision of these resources depend on the respective organisational setup, the predefined strategic objectives and the overarching organisational commitment to PM. The set of available capabilities and their capacities determine the scalability of PM activities on the overall organisation and its operations. In the following, a distinct set of capability dimensions from the literature is identified and presented: personnel resources, methodological knowledge, technical knowledge and technological resources. (Grisold et al., 2020; Kipping et al., 2022; vom Brocke et al., 2021).

Personnel resources are a central element of organisational PM capabilities. Their relationship to PM in the organisation is defined by their role. This role results in tasks and skills that the person fulfilling the role has to perform or acquire. Tasks and skills can be PM-related in a narrower sense, e.g. data extraction and data literacy, or in a broader sense, e.g. project management and communication skills (Kipping et al., 2022). The orchestration of all PM-related roles should be based on thorough, consistent stakeholder management (Saito, 2019).

The organisational availability of methodological and technical knowledge is crucial for building PM-related competencies and skills (Zerbato et al., 2022). Methodological knowledge sets out how PM can be carried out systematically, according to a predefined scheme. It describes individual steps and recommendations for activities. PM methods also outline different techniques for the alignment of business operations and the IT setup for PM purposes and the fit into the broader organisational BPM (Martin et al., 2021; van Eck et al., 2015). Existing business methods that are already widely used in other areas can also be utilised here, for example design thinking.

In contrast, technical knowledge describes the necessary understanding of the IT systems used and required to operate PM. Among other things, this means how data can be extracted from systems or how a PM tool is operated. This knowledge is a necessary condition for PM to be carried out and to achieve reliable results. It concerns the provision of data availability and quality as well as the ability to operate a PM tool in the organisation's respective IT environment and technology stack (Kipping et al., 2022; Zuidema-Tempel et al., 2022).

Various technological resources are required to carry out PM. A software environment, like an Enterprise Resource Planning System (ERP), which is able to export standardised event logs is essential. This may require other technologies such as Structured Query Language (SQL), Python Application Programming Interfaces (APIs). The varying technical conditions also determine what other technical skills, knowledge and role definitions are necessary for PM. Other tools such as process modelling tools may also be relevant in order to interpret and use PM results (Kipping et al., 2022; Thiede et al., 2018).

Role	Tasks	Technologies	Skills
Head of PM	• Communication with departments • Coordination and team leadership	• PM tool	• Communication skills • Data science skills
Process Analyst	• Data preparation and analysis	• PM tool • Cloud	• Data preprocessing • Project management
Data engineer	• ETL operations	• Cloud • SQL	• Programming • Problem solving mindset

Table 2: Exemplary distribution of selected skills based on roles. Adapted from Kipping et al. (2022, p.43)

The bundling of personnel resources, methodological and technical knowledge and technological resources constitutes PM capabilities. Table 2 demonstrates the distribution of some selected skills and responsibilities for knowledge and technology based on roles. Their characteristics depend on the configuration of the PM dimensions in a company. Pfahlsberger et al. (2021) subdivide this configuration into five dimensions: (1) field of

application, (2) perspective, (3) usage type, (4) online vs. offline, and (5) context. These dimensions determine the scope in which PM capabilities are utilised.

Khurshid et al. (2024) argue that these capabilities should be centrally anchored in a Center of Excellence (CoE) for PM. The requirements for these capabilities change during the conceptualisation and implementation of PM initiatives. This can be roughly divided into four different phases: (a) planning and business case calculation, (b) process selection, (c) implementation, and (d) process mining use (Grisold et al., 2020).

3.1.2 Organisational Set-ups

The organisational set-up describes the roles of people and entities, their responsibilities and activities as well as the general organisational positioning of PM capabilities on the basis of different organisational dimensions (Marcus et al., 2024). For this purpose, an organisation can be viewed and partitioned from different perspectives, e.g. horizontally, vertically, process-oriented, systems-oriented or management-oriented (Thiede et al., 2018, p. 905). The dimensions or layers represent various managerial aspects of the aligned use of information systems in organisations.

Marcus et al. (2024) identify four layers for the characterisation of an organisational PM set-up: (1) Governance and structure, (2) Operationalization and scope, (3) Funding and planning, and (4) Roles and responsibilities. As can be seen in Table 3, each layer has several (sub-)dimensions that define specific manifestations of the respective aspects.

Layer	Dimension
Governance and structure	• Degree of centralization • Anchoring • Institutionalization
Operationalization and scope	• Key activities • Prioritization of projects
Funding and planning	• Internal cost management • Budgeting
Roles and responsibilities	• Role allocation • Internal leadership • External support • Data ownership

	• Tool ownership

Table 3: Allocation of layers and respective dimensions. Taxonomy adapted from Marcus et al. (2024, p.10)

Marcus et al. (2024) further developed a taxonomy to categorise and describe organisational PM setups. They find that each dimension can be characterised as centralised, decentralised or hybrid. This determines how the respective layer and dimension are shaped, e.g. whether PM is institutionalised in a dedicated department or within an existing IT division. This configuration represents the overall organisational PM setup and varies depending on the company. The authors identify the following decisive factors, which determine how an organisational setup of a company might be shaped: (a) experience with PM (time), (b) number of processes analysed, (c) number of active PM users, (d) revenue, and (e) number of employees.

The responsibilities and competencies for PM usually extend across different teams and departments. For instance, IT and finance departments can be significantly involved in PM activities. The bundling of these responsibilities based on PM usage forms the *PM unit*, an entity within the organisation. The actual form of the *PM unit* is determined by the needs and structure of the organisation. The *PM unit* enables the organisation to use PM tools, has personnel capacities and provides knowledge and necessary skills. Therefore, it can be distributed across several areas and teams (Khurshid et al., 2024; Kipping et al., 2022; Marcus et al., 2024, p. 3).

A typical form of *PM unit* that is often found in companies is a Centre of Excellence (CoE). The *PM unit* can be a part of the CoE or be the entire entity. The CoE assumes an important hinge function between the strategic objectives of the organisation and the translation of these into operational PM activities. In this way, it acts bidirectionally upwards to the leadership level and downwards to the individual departments. CoEs often use standardised technological platforms, e.g. SAP Signavio, as leverage for their PM and possibly BPM initiatives. In terms of personnel, the CoE often consists of a centralised core team that devotes its resources entirely to the CoE and decentralised individuals who are based in the departments and perform respective PM tasks there (Ammann et al., 2025; Khurshid et al., 2024; Marcus et al., 2024).

The specific understanding of roles in relation to PM within the organisational setup varies for each organisation. A person can have one or more (formal) roles. Frequently observed roles can be roughly categorised into three buckets: (i) strategic, (ii) operational

and (iii) technical. People in strategic roles characterise the fundamental orientation of PM and the alignment of it with the overarching corporate strategy. Operational roles are usually found in the various company departments and are related to process analysis, specialised topics and embedding and contextualising PM activities in day-to-day operations. Technical roles are responsible for the provision of all technical resources and skills. They often work in a department-agnostic manner and ensure that data is available in the appropriate quality. Examples of the respective roles are (i) the Head of PM, (ii) the Process Analyst and (iii) the Data Analyst (Ammann et al., 2025; Grisold et al., 2020; Kipping et al., 2022).

In contrast to roles in relation to the organisational setup, Ammann et al. (2025) identify four deviating user types based on observed attitudes when using PM: (A) PM influencers, (B) Power users, (C) Process participants and (D) Strategic users. They describe these types on the basis of observed user behaviour, cognition and affect. This categorisation is independent of formal roles in the organisation. PM influencers take care of the strategic direction of PM, power users are heavily and frequently involved in many different PM activities, process participants use PM mainly at irregular intervals for performance monitoring and strategic users use PM irregularly to make decisions for the organisation.

3.1.3 Maturity

PM maturity refers to the level of capabilities that an organisation has and can utilize to execute PM projects. A beginner organisation, for example, would be characterised by little knowledge, unclear goals and an insufficient data basis, and would therefore have low maturity. In contrast, an advanced organisation would have already institutionalised these areas and knows how to call on which capabilities. This is referred to specifically as PM readiness and can have several dimensions. Particular attention is paid to the extent to which PM can be integrated into organisation-wide BPM and improve it. Formalised PM maturity is a framework for analyzing the gap between PM goals as well as potentials and the actual value gained through its usage (Brock et al., 2024; Hijriani & Comuzzi, 2024).

Brock et al. (2024) have developed a comprehensive maturity model for PM called *P3M*. The resulting *P3M* model outlines five relevant maturity factors: (1) *Organisation*

describes how an organisation enables PM, (2) *Data Foundation* explores how the environment enables PM, (3) *People's Knowledge* indicates how people understand PM, (4) *Scope of PM activity* describes the extent to which PM is used holistically, and (5) *Governance* describes the guidelines that exist for PM. These five categories are further described and defined in 23 additional subordinate elements. These elements are assessed in isolation according to their degree of maturity on an ascending five-level scale: (i) Initial, (ii) Rudimentary, (iii) Standalone, (iv) Systematic and (v) Optimising. Furthermore, the authors present a method for determining the current overall PM maturity level of the organisation and deriving activities for improvement. To this end, members of the organisation are surveyed, and qualitative workshops are then held to record the as-is maturity and the to-be target state. The authors propose a number of possible recommendations for action for each of the five categories in order to achieve higher maturity levels.

Hirjrani and Commuzzi (2024) propose an alternating PM maturity model called *β-P3M*. It is not related to the findings of Brock et al. (2024). Their method views PM as an analytical facility that enables a better understanding of an organisation through data science methods. This model draws closer to the technical realities of PM. It outlines seven different focus areas for PM maturity: (I) *Technology*, (II) *Pipeline*, meaning the state of the PM workflows, (III) *Data*, (IV) *People*, (V) *Culture*, (VI) *Governance*, and (vii) Strategic alignment. These focus areas each define a main capability and various sub-dimensions of it. The maturity level of the technology dimension is divided into four levels: descriptive, diagnostic, predictive, and prescriptive. The maturity levels for all other dimensions are: initial, managed, defined, quantitatively managed, and optimized.

PM maturity models shift the focus of PM capabilities away from a purely static view to a dynamic one and further provide a framework for recommendations as well as concrete steps for action to develop necessary capabilities. In addition, they help to classify an organisation's PM resources and identify which PM activities are possible to what extent, grounded in the current status quo. Based on the literature, five foundational areas for PM maturity can be identified: People (3; IV), Technology (2; I; II), Governance (5; VI), Environment (1; V), Scope and shape (4; VIII)

3.1.4 Methodologies

PM methodologies typically describe sequential steps that project team should follow to initiate, execute and utilise PM projects. A PM project refers to a specific use case with a clear scope and analyses one or more processes within a defined area, such as a department or a business function. These projects can be divided into sequential phases in which different stakeholders, tools, process data and other capabilities are involved at different times and with varying degrees of intensity (Zuidema-Tempel et al., 2022).

Early methodologies such as van der Aalst's (2011) L* lifecycle model or Bozkaya et al.'s (2009) Process Diagnostics Method (PDM) are still very closely aligned to the technical execution of PM and primarily describe the movement, transformation and analysis of log data. While key performance indicators (KPIs) and business goals are taken into account, organisational aspects are largely neglected. In addition, they are linearly designed, have clear start and end points, and are only partially geared towards an iterative operationalisation. In summary, they focus on technical implementation, while through PM activities derived business recommendations play a subordinate role.

With PM² (Process Mining Project Management), van Eck et al. (2015) introduce a more comprehensive PM project methodology that links the various project phases with the PM capabilities of the respective organisation. They outline six distinct stages, associated inputs, outputs and role definitions. The first stage is Planning, where research questions for the project are defined, suitable business processes are selected, and the project team is put together. In the second stage, Extraction, the scope for the extraction of event data is defined, then extracted and contextualised and interpreted in the tacit business knowledge context. The third stage, Data processing, consists of defining cases, aggregating events, and enriching and filtering logs. This enables PM techniques in the fourth stage: discovery, conformance checking, enhancement and analytics. The fifth stage, Evaluation, forms the basis for deriving process improvements with the activities diagnose, verify and validate. The sixth stage, Process Improvements & Results, then refers to the actual improvement of processes and supporting operations. Stages three to five are explicitly presented for execution in iterations. The methodology also provides recommendations for stakeholder involvement in all steps, e.g. when deriving recommendations for action. In addition, four clear roles are defined for persons directly involved in the project: business experts, who are familiar with the specifics of the

business model and operations; process analysts, who have methodological but often subject-agnostic process knowledge; system experts, who are familiar with the underlying IT systems; and business owners, who are responsible for the business processes. Close cooperation between business and process experts is essential for successfully addressing the posed research questions.

In contrast, Aguirre et al. (2017) propose an alternative methodology that implements more concrete intermediate steps but ignores further organisational capability dimensions. This methodology is divided into four different consecutive phases: project definition, data preparation, process analysis and process redesign. The authors present reference processes modelled in BPMN for all four steps. However, these are linear in design and do not provide for an iterative approach as default execution mode. In particular, this methodology proposal places greater emphasis on the initial project definition, with Aguirre et al. (2017, p. 106) suggesting upstream process modelling, a performance gap analysis and a resulting target goal definition. In addition, various process improvement alternatives are to be tested using PM as part of the final process redesign phase.

There are furthermore proposals to integrate PM project steps, identified in the literature, into the Six Sigma methodology for incremental process improvement. This is based on assigning the various PM project steps from PM², such as extraction or evaluation, to the matching elements of Six Sigma DMAIC (Define, Measure, Analyse, Improve, Control). PM can thus provide methodological support for Six Sigma projects and thereby contribute to process improvements (Graafmans et al., 2021; Kregel et al., 2021).

In summary, the methodologies presented so far focus on the implementation of individual, independent PM projects, but neglect the interdependence and possible interaction of several PM projects within an organisation. In addition, the initialisation and planning phase is considered in isolation for each potential project and not placed in the context of overall organisational strategic objectives. Furthermore, value creation is considered and calculated separately for each individual PM initiative. The Portfolio Management Method for Process Mining-Enabled Business Process Improvement Projects (MAPPER) addresses this gap and describes a method for describing portfolios of multiple PM projects in different states within an organisation. It supports the structured management and scaling of PM project portfolios. Fundamental to MAPPER

is the definition of so-called value cases, which refers to the realisation of potential process improvements triggered by process mining insights. Each value case thus represents a project, and the entirety of all projects constitutes the portfolio (Fischer et al., 2024).

The method outlines five consecutive phases. In the first phase, Strategize, the strategic focus of the portfolio is aligned, KPIs for evaluation are defined and resources are allocated. This is followed by the Identify phase, where value cases are identified and collected across the organisation. Next, in Select, the value cases are analysed, and the portfolio is compiled. In the fourth phase, Implement, PM is carried out, actions are derived from the analysis results, and these are implemented. In the final and continuous phase, Monitor, the value cases in the portfolio are further examined and checked to evaluate whether the assumed value is being achieved through PM and resulting process improvements. MAPPER links techniques, tools, roles and outputs to be utilized with each phase. The methodology also allows the current status of value cases to be classified into five different statuses, ranging from backlog to insight and action to value. To measure and classify these, the as-is and to-be states are compared within the framework of the set KPIs, and value hypotheses are validated. MAPPER thus takes into account the particular nature of data-driven BPM projects. (Fischer et al., 2024).

All phases of PM methodologies identified in the literature can be divided into four higher-level phase types. In initialisation phases, projects are defined, strategically aligned and success factors are determined, usually through KPI measurement. This is followed by execution, i.e. the actual implementation of PM projects, such as the extraction, preparation and analysis of data. Subsequently, the interpretation of the mining results and the derivation of business process improvements takes place. Table 4 illustrates and maps the identified steps of PM methodologies to the phase types.

Methodology	Initialization	Execution	Interpretation	Actions
L* lifecycle (van der Aalst, 2009)	(1) Plan and justify	(2) Extract, (3) Create control-flow model and connect event log, (4) Create Integrated Process Model	(5) Interpret	

PDM (Bozkaya et al., 2009)		(1) Log preparation, (2) Log inspection	(3) Control flow analysis, (4) Performance analysis, (5) Role analysis	(6) Transfer results
PM² (van Eck et al., 2015)	(1) Planning	(2) Extraction, (3) Data processing, (4) Mining & Analysis	(5) Evaluation	(6) Process Improvement & Results
Proposal by Aguirre et al. (2017)	(1) Project definition	(2) Data preparation, (3) Process Analysis		(4) Process Redesign
MAPPER (Fischer et al, 2024)	(1) Strategize, (2) Identify	(3) Select, (4) Implement		(5) Monitor

Table 4: Synthesis and categorisation of the individual phases of PM methodologies.

3.1.5 Process Transparency & Awareness

PM enables the exposure and visualisation of processes as they actually occur in IT systems. These representations are often closer to the 'true' process execution than indicated in static process models or in the approximate knowledge of an organisation's tacit process understanding. The introduction of PM therefore creates a new level of process transparency and process awareness within an organisation. The data-based and therefore empirically grounded analysis of processes also enables a better normative evaluation and discovery of process executions and their characteristics, which can be traced back to the persons involved and responsible for them. This increased process awareness triggered by PM-induced transparency has various effects on the socio-technical structure and dynamics of the implementing organisation. These effects can be exacerbated and pose particular challenges and risks when sensitive and personal process data is used or when process data is shared beyond the organisation, e.g. for complex or outsourced PM set-ups (Burattin et al., 2015; Eggers et al., 2021; Rafiei & van der Aalst, 2023).

How this transparency affects the organisation depends on its PM governance approach: PM initiatives can be initiated top-down by management or bottom-up by employees. Various mechanisms determine the influence of increased PM transparency and

awareness on the organisation. For instance, standardised monitoring of sub-processes and end-to-end processes is enabled by PM and the aggregation of process-related knowledge through PM can lead to its democratisation (Eggers et al., 2021). In addition, all types of processes can be explored, resulting in a shared cross-departmental understanding of processes and functions. Top-down approaches can lead to more standardized awareness but might risk igniting resistance and spur superficial compliance due to lack of user engagement. In contrast, bottom-up approaches can foster shared awareness, especially when employees were enabled to use PM tools and techniques themselves. However, bottom-up efforts often lacked cross-departmental integration, which can result in fragmented insights (Eggers et al., 2021).

Transparency and awareness can also lead to social complications within the organisation. Some employees may feel monitored, refuse to commit, and try to turn internal corporate governance structures against PM activities. Large amounts of process data might also overwhelm those involved in PM and being exposed to its analyses. If conclusions about the performance of individual employees can be drawn from the PM results, this might also have a negative impact on attitudes towards and commitment to PM. (Eggers et al., 2021) The anonymisation of process data, data literacy training and democratic access to PM platforms are possible ways to manage and mitigate adverse effects. Furthermore, PM has the potential to enable teams to uncover hidden inefficiencies, align cross-functional processes, and reconfigure roles. Beyond that, it can cause intra- and inter-departmental reflection, leading to changes in coordination, performance measurement, and even corporate structures (Burattin et al., 2015; Eggers et al., 2021).

3.2 Process Mining in Public Administration

Relevant articles deal with PM and explicitly refer to its usage in the context of public administration. Since the body of literature linking PM and PA is still limited, articles that deal with PM in the broader public sector adjacent to administration are also considered. Articles focusing on the public sector but referencing distinct sub-sectors with significantly different characteristics, such as education or healthcare, are only to be included if they deal with PA-equivalent functions. In principle, the organisational and procedural context of public administration should play an explicit role in the selected articles. Articles that exclusively use log data from public administration processes for

technical case studies should be excluded. Table 5 provides an overview of the defined inclusion and exclusion criteria. National and regional constraints are neglected.

Inclusion criteria	Exclusion criteria
[IC2.1] Context of the public sector	[EC2.1] Context of public administration negligible
[IC2.2] Focus on administrative activities and processes	[EC2.2] Focus on non-administrative specialized processes, e.g. health data
[IC2.3] (Organisational) characteristics of the public sector are taken into account	[EC2.3] Log data from public administration is used exclusively to validate technical concepts as part of a case study
	[EC2.4] Data mining of other public administration data, e.g. text mining

Table 5: Inclusion and exclusion criteria for the literature search on PM in public administration.

Based on the search objectives, the following keywords were identified: *process mining*, *public administration, public sector, government* and *governmental*. Combined with the inclusion and exclusion criteria, the following search string was defined for the search in the WoS collection:

> *"process mining" AND (government* OR "public administration" OR "public sector") (Topic) and Proceeding Paper or Article or Review Article or Book Chapters or Early Access (Document Types)*

This search yielded 41 results, of which eleven were selected as relevant. Nine additional articles were selected through backward and forward searches as well as justified additions. A total of 20 articles form the basis of this literature review. All articles are in English, except for one justified addition, which is in German.

This extracted body of literature reveals three literature groups: (1) Motivational Factors & Objectives [7], (2) Areas of Use [11], and (3) Challenges [2]. Each item is primarily categorized under one sub-theme, though it may also relate to others.

3.2.1 Motivational Factors

The motivational factors and objectives underlying the use of PM in public administration commonly relate to the core PM techniques (discovery, conformance checking, enhancement). They fit into the broader picture of the pursuit of efficiency within the frameworks of new management approaches in the public sector. The benefits of PM can be harnessed particularly in the digitisation of administrative activities and the procedural

changes this often bring about. PM is usually part of existing BPM activities in public authorities and therefore anchored in existing BPM routines and structures (Racis & Spano, 2024; Rawiro et al., 2022).

Public authorities often have a heterogeneous and non-standardised process landscape. Therefore, PM can be used to identify and map processes in IT systems. Process management, process documentation and process modelling are also often not standardised or centrally organised. Here, PM might also help to develop a central understanding of process flows and process characteristics. In addition, PM can contribute to ensuring standardised process execution through data-driven conformance checking. Organisation-wide data management can also be optimised using PM, e.g. data silos, which are often found in public administrations, can be pooled and mapped within legal constraints (Lück-Schneider, 2016; Racis & Spano, 2024).

Many processes in public administration are characterised by numerous manual and analogue process steps. In addition, many processes are primarily handled using one or more documents, e.g. forms. Adding to that, processing often takes place in legacy IT systems, which are inadequately maintained but contain important process knowledge that is not stored elsewhere in the organisation. Process discovery can play an integral role in addressing these process-related issues (Fioretto, 2023). Repta et al. (2018) propose using PM to identify document flows in eGovernment systems. The aim is to extract and discover document- and human-intensive workflows. The architecture they propose allows process instances to be identified and process models to be derived from stored documents and their meta- and process data. Pérez-Castillo et al. (2012) present PM as a technology for extracting process knowledge from legacy systems. Process log data, system source code and derived process models thereby enable the recovery of process models and the process understanding implied in them. Legacy systems are prevalent in public authorities and map workflows that were once established by public policies and have often been modified subsequently. PM thus has the potential to enable a better understanding of current process realities and preserve process knowledge.

Public administrations are under internal and external pressure to modernise and digitise their public service delivery (G2G, G2B, G2C). This requires efficient, interface-compatible and digitised processes. Data-driven evaluation and improvement of processes can thus enhance the digital maturity of processes within a public authority.

This also facilitates the implementation of business process reengineering, which is an integral component of digitisation and modernisation measures, ensuring a more precise and effective execution. Once eGovernment systems for citizen service delivery have been implemented, allowing the export of log data and clear case assignment, the citizen experience can be continuously improved through PM conformance checking and enhancement. This allows for as-is process representations to be compared against to-be models and be benchmarked against them. PM-induced recommendations for action regarding the design of digital public services can trigger institutional changes and thus also have a potential lasting effect on the structure and dynamics of the institution (Kalenkova et al., 2018; Racis & Spano, 2024).

As in all other organisations, PM tools can be used to increase the efficiency of an organisation through a process-driven lense, i.e. to maintain an increased level of output with the same amount of utilised personnel and other resources. Public authorities are not usually subject to profit-maximising rationales, but often operate with limited public funds. Consequentially, PM can enable the data-driven identification of inefficient resource allocations within processes across an organisation and evaluate overall process performance against set KPIs (Molnár, 2017; Pernici et al., 2023). Bottlenecks in sequential processing configurations might also be quickly identified, allowing resources to be reallocated. Data-based process models may further be used to simulate process instances, enabling process improvements to be tested and diagnosed ex-ante, before being implemented in a critical environment such as public service delivery (Lück-Schneider, 2016; Rawiro et al., 2022).

As already mentioned, processes in the public sector are subject to special legal requirements and deadlines. Processes are often designed according to legal requirements and must comply with specific processing and review regulations. PM has the capacity to verify the conformity of individual and aggregated process instances with legally defined standards. The application of PM can therefore enable new levels of objective transparency in public authorities, although this depends on the accessibility of the results (Racis et al., 2024). PM can also play a role in authority-wide quality management, e.g. to monitor compliance with regulations in internal processes or perform quality assurance in the delivery of public services. Should log data contain time stamps, it might become possible to monitor the achievement of deadlines, thus allowing any violations to be detected at an early stage. (Lück-Schneider, 2016; Racis & Spano, 2024).

PM-induced data-driven process management might constitute or support the basis for leveraging artificial intelligence (AI) and automation, such as Robotic Process Automation (RPA). A comprehensive understanding of processes, mature data management and a reliable data foundation are prerequisites for the supervised and unsupervised training of AI models for predicting, simulating and optimising processes or for combining PM representations with other AI applications (Fioretto, 2023; Mingazov & Celli, 2024). PM projects in the public sector often originate from individual employees who are interested in data analytics or PM and experience organisational pressure to digitise (Zuidema-Tempel et al., 2022).

3.2.2 Areas of Use

A limited range of concrete exemplifications of PM in the public sector can be located in the selected literature. Several PM techniques can be identified in the selected cases, which consist of process discovery, conformance checking and enhancement (Rawiro et al., 2022). Table 6 provides a comprehensive list of these case studies, systematically linking them to motivational factors and objectives as well as to the utilised PM techniques.

PM is particularly prevalent for conformance checking, e.g. in the context of compliance checks or monitoring conformance with process specifications (González & Delgado, 2021; Goron & Chesñevar, 2016). For example, PM was used to analyse public procurement decision-making processes in the Philippines to improve public accountability and decision traceability (Sangil, 2020). The improvement of public service delivery is also frequently associated with enhancement and BPI validation, e.g. in the simulation of process changes in an emergency call centre in France (Lamine et al., 2015). It has also been used to analyse eGovernment application journeys and user experiences in order to improve digital public service delivery (Delgado & Calegari, 2022; González & Delgado, 2021; Shrivastava & Pal, 2017). Efficiency is the most common motivating factor behind the use of PM and can be found in all areas of application, for instance, in the end-to-end analysis of court proceedings or the standardisation of processes across local authorities to realise automation potential (Mingazov & Celli, 2024; Pernici et al., 2023). Often, budget-related processes in administration, i.e. in budget management, are mined due to good data availability and quality as well as clear expectations and measurable cost savings as KPIs (Zuidema-

Tempel et al., 2022). In summary, PM is used in various areas of the public sector, but is often limited to a single field of action for a specific purpose and is not strategically integrated into the organisation's overall (process) management.

The conclusions drawn from this literature synthesis are limited in their external validity due to the large number of differing administrative and cultural contexts underlying the case studies, which span eight different countries. Nevertheless, several descriptions of specific challenges faced by BPM in the public sector overlap across all articles, allowing for the assumption of valid cross-contextual results. In addition, all PM uses were classified as generally successful, with no failures reported. However, the low number of publications could indicate barriers to research and apply PM in the public sector.

Paper	Case Study	Motivational Factors	Discovery	Conformance Checking	Enhancement
Delgado & Calegari, 2022	Discovery & Analysis of eGoverment processes	Compliance, Efficiency, Improve public service delivery, Discovery	X		
Erasmus, 2024	Combating corruption in the public sector	Compliance, Accountability	X	X	
Goron & Chesñevar, 2016	Process compliance checking for administrations	Efficiency, Compliance		X	
González & Delgado, 2021	Compliance requirements modelling & evaluation	Compliance, Transparency		X	X
Lamine et al., 2015	Enhance processes in an Emergency Call Center	Efficiency, Simulation, Bottleneck identification, Improve public service delivery			X
Mingazov & Celli, 2024	Process discovery across several municipalities	Process Modelling, Process Standardization, AI automation	X		
Pernici et al., 2023	Analysis of judiciary performance	Efficiency, Transparency, Improve public service delivery		X	
Racis et al., 2024	Evaluate & improve court processes	Objective process evaluation, Bottleneck identification, Efficiency		X	X
Sangil, 2020	Analysis of public procurement logs	Discovery, Compliance, Transparency, Accountability	X	X	
Spagnolo et al., 2016	Checking process compliance of a community port	Compliance, Efficiency, Accountability		X	

	management system				
Shrivastava & Pal, 2017	Real time analysis of eID ecosystem processes	Compliance, Efficiency	X	X	

Table 6: Overview and categorisation of identified case studies.

3.2.3 Challenges

PM encounters problems in the public sector in the areas of people, organisation and technology. In particular, the low level of maturity of PM capabilities and the special legal and hierarchical structures make it difficult to introduce use and strategically align PM.

The necessity for interdisciplinary teams within the context of PM utilisation is often not met in the public sector, as individuals with administrative training and corresponding skill sets are typically hired. Data management and analysis skills are of particular importance for PMs, retraining in these areas is usually time-consuming and costly. Furthermore, employees may exhibit reluctance towards the implementation of PM within the organisation due to concerns regarding potential monitoring of their work performance, fears of disproportionate surveillance, or the perceived prospect of job losses resulting from automation (Racis & Spano, 2024). Additionally, a deficiency in methodological knowledge exists, which fails to account for the peculiarities inherent to public administration. Nevertheless, PM methodologies from the private sector are usually also not anchored in employee training in public authorities. This lack of methodical and structured implementation guidance can create a perception among civil servants that there are high barriers to implementing PM. (Racis & Spano, 2024).

In addition, public authorities tend to have a highly hierarchical structure and a corresponding top-down work and innovation culture, which can hinder the introduction of innovative technologies such as PM. PM is often observed to be initiated by individuals in middle management positions, but must be met with openness by senior management to be exploited as an opportunity (Zuidema-Tempel et al., 2022). Furthermore, it has been argued that elevated levels of bureaucracy and political attitudes within the organisational structure have the capacity to impede the execution of PM activities (Racis & Spano, 2024; Zuidema-Tempel et al., 2022).

An enduring commitment to PM by management is essential to ensure the consistent strategic alignment of PM, which is often considered a problem area. Furthermore, roles in public authorities often have limited authorisations and permissions linked to their hierarchical positioning, which can make evaluation and interpretation of mining results difficult, especially when data needs to be evaluated across different departments (Zuidema-Tempel et al., 2022). The processes and their digital traces in public authorities are also often subject to particularly strict data protection regulations, as they may contain sensitive data about citizens and civil servants (Racis & Spano, 2024). The size of the public organisation in terms of employees has been demonstrated to be a contributing factor to the challenges encountered during the implementation of PM. It has been observed that smaller implementing organisations may not possess the necessary skills and resources to demonstrate these over time, which can impede the successful execution of PM. (Zuidema-Tempel et al., 2022).

IT systems in public authorities are frequently characterised by fragmentation and protracted usage. Resultingly, functions for exporting logs are not always available and may need to be retrospectively added by the manufacturer or in-house. As a result, data quality is often inadequate and log data sets often require time-consuming preparation (Mingazov & Celli, 2024; Racis & Spano, 2024). In addition, many systems are operated in a wide variety of configurations across different local authorities, such as municipalities (Mingazov & Celli, 2024). Such a heterogeneous system and process landscape can hinder the initiation of PM, as it complicates configuration and can make scaling difficult (Rawiro et al., 2022).

These problems can lead to PM projects in the public sector often getting stuck in the pilot phase for many years and not being holistically integrated into organisational structures and used strategically. Zuidema-Tempel et al. (2022), for example, describe how in many public authorities in the Netherlands, PM is still located in the business intelligence departments as a rather incidental additional function, even after several years. In addition, the value added by PM is also significantly influenced by the design of general BPM capabilities in public authorities.

3.3 State of the Art

This chapter concludes with an overview of the articles reviewed, their scope, and the identified gaps in the literature.

3.3.1 Managerial Aspects of Process Mining

The selected articles within the literature strand focusing on the organisational aspects of PM were cited an average of 17.25 times, with a median of 5.5. The citation range spans from zero to 194, indicating that only a small number of publications in this area have received substantial academic attention within the broader PM research community. This disparity suggests that organisational aspects are, to date, of limited academic interest.

However, 50% of the identified articles were published between 2022 and 2025, representing 30% of the total search period. This indicates a recent surge in interest, suggesting that the managerial implications of PM are increasingly recognised by scholars as a relevant research gap. All identified articles were published in journals related to computer science, information systems, and systems engineering. The field is in an emerging stage, characterised by individual methodological contributions and design artefacts, but it may still lack a fully established and consistently used terminology. Increasing academic attention is being directed towards the interpretation of process mining results within organisational contexts and the development of organisational PM capabilities.

3.3.2 PM in Public Administration

The average number of citations for publications on PM in the public sector is 3.3, with a median of 2. The minimum is zero and the maximum is 12, indicating that this is a research area that has received limited scholarly attention to date. However, over 50% of the selected articles were published from 2022 onwards, with the earliest dating back to 2012. This trend suggests that the field may be gaining traction, particularly within the broader context of research on public sector digitalisation and automation.

The selected publications span journals on public management, business innovation, and information systems. Most contributions adopt an exploratory approach, reflecting an initial engagement with PM in the public sector context. Many are single case studies, and organisational implications, apart from a few exceptions, are generally treated as a

secondary concern. The focus is often placed solely on technical aspects. Specific conditions of PA or the generation of public value are generally not considered. The case studies typically examine the implementation of process mining ex-post, without addressing the actual implementation process.

4 Research Design & Methodology

This thesis aims to address the existing research gap concerning the limited scientific knowledge on the use of PM in PA and the methodological approaches for its application. It seeks to contribute to closing this gap by developing a method that enables PA to identify and realise the potential of PM within their specific organisational contexts. To achieve this, the Design Science Research (DSR) paradigm was identified as the most appropriate framework for addressing the research objectives. The DSR paradigm is oriented towards solving real-world problems through the development of artefacts that embody actionable design knowledge (Hevner et al., 2004).

DSR differs from behaviourally oriented research approaches in that it generates prescriptive and practically applicable knowledge. By means of iterative design cycles, DSR bridges the problem space and the solution space, with the objective of identifying an appropriate representation of a solution. The design process is characterised by repeated cycles of construction and evaluation, in which both the environment and the existing knowledge base act as key sources of influence and guidance (vom Brocke et al., 2020).

This chapter outlines the configuration of the DSR paradigm, detailing its phases, the development of the artefact and the evaluation process. Methodological limitations are discussed in Chapter 9.3.

4.1 Design Science Research Activities

DSR is typically carried out through a series of sequential phases that resemble structured processes, ultimately resulting in an evaluated artefact. This thesis adopts the six activities for DSR projects as proposed by Peffers et al. (2007): (1) Problem identification & motivation, (2) Definition of objectives for a solution, (3) Design and development, (4) Demonstration, (5) Evaluation and, (6) Communication. As this thesis is initiated from a problem-centred perspective, all sequences are addressed starting from activity one. The following subsections will provide a detailed explanation of each individual activity. The sixth activity, the communication of results, is carried out by submitting this thesis. Figure 3 provides an overview of the adoption of the DSR steps for this thesis.

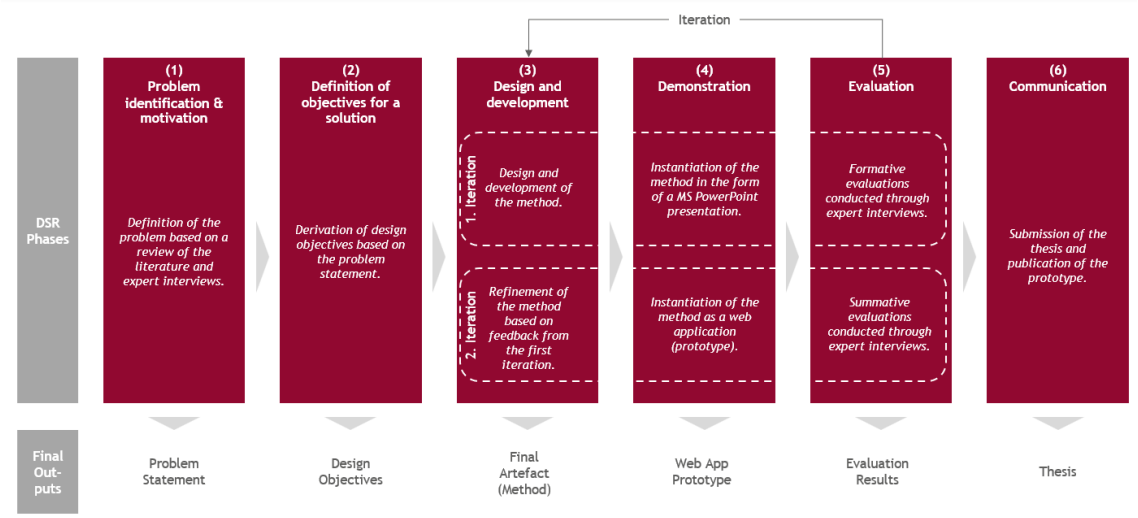

Figure 3: Overview of the DSR process used in this thesis. Adapted from Peffers et al. (2007, p. 54).

Chapter 5 presents the results of the first activity, Chapter 6 those of the second, Chapter 7 covers the first iteration of activities three, four, and five, and Chapter 8 presents the second iteration of said activities. Table 10 provides an overview of the activities for which experts were involved to provide empirical input, as well as the number of experts engaged in each activity. Appendix F contains a table outlining the characteristics of the individual interviews. As the interview transcripts contain organisation-specific and personal details, and the author did not receive permission from several participants to publish them in full, they are not included in the appendix. However, selected interview excerpts are presented in the following chapters, and the full transcripts can be viewed upon request. The engagement with participants was conducted in accordance with the Menlo Principles for ethical ICT research (Dittrich & Kenneally, 2012). All interviews were conducted in German and subsequently translated into English.

ID	DSR Activity	Input	Output	Evaluation Type	Number of Interviews
E1	Problem Identification	Initial Problem Statement	Problem Statement	Formative, naturalistic, ex-ante	7
E2	Evaluation, first iteration	Instantiation of initial method design	Improved design of the method	Formative, naturalistic, ex-post	6

E3	Evaluation, second iteration	Instantiation of final method design (web app prototype)	Feedback on usefulness and fulfilment of DOs	Summative, naturalistic, ex-post	8
					21

Table 7: Overview of the evaluation activities with experts. Adapted from Sonnenberg and vom Brocke (2012, p. 393)

4.1.1 Problem Identification & Motivation

This activity aims to further characterise the problem, justify its relevance, and determine the extent to which it is solvable (Peffers et al., 2007; vom Brocke et al., 2020). To this end, the results of the SLR are first analysed, with a particular focus on the questions of what supports an effective implementation of PM in organisations and why such an implementation poses specific challenges in PA. Both strands of the SLR are therefore relevant. Based on this analysis, an initial problem definition is developed, see Appendix G. This definition then served as the foundation for designing an interview questionnaire, which was used to conduct interviews with experts. The insights gained from the literature and the expert interviews were subsequently synthesised into a consolidated problem statement. The empirical grounding and evaluation of the problem can contribute to a deeper understanding and broaden the perspective on the issue by complementing the researcher's viewpoint with that of practitioners (Tuunanen et al., 2024, p. 433). This can be regarded as an ex-ante evaluation (Sonnenberg & vom Brocke, 2012, p. 392).

The interviews were conducted in a semi-structured format using open-ended questions to guide the interviews but also allow for flexibility, see Appendix H for the questionnaire (Adams, 2015). Experts were also given the opportunity to share their own experiences independently of the guiding questions, in order to allow for serendipity and open exploration in the problem definition. The interviews were audio-recorded, partially machine-transcribed, and subsequently revised manually to enhance readability and clarity. The final transcripts were then imported into the analysis software *Lumivero NVIVO 15*. As part of a thematic analysis, which enables the identification of patterns of meaning in qualitative data, the aim was to identify the experts' perceptions of problems, perceived benefits, and intended uses of PM (Mayring & Fenzl, 2019). To achieve this, the interviews were open-coded using descriptive codes. These codes were developed

inductively and iteratively from the transcripts (Corbin & Strauss, 2008, p. 160). Subsequently, the codes were clustered according to the Five-Level Framework for research on PM to better structure the problem statement (vom Brocke et al., 2021). See Appendix K for the codebook and Appendix A for a Code Summary Report.

To ensure and validate the reliability of the coding, an inter-rater reliability score was calculated (Braun & Clarke, 2020). For this purpose, two interview transcripts were independently coded by a second coder using the same codebook. After completion, *Cohen's kappa* was calculated to measure the level of agreement between the second coder's results and the author's original coding (Landis & Koch, 1977). A *Cohen's kappa* value above 0.8 indicates a reliable coding outcome (Braun & Clarke, 2020, p. 1). In this calculation, *Cohen's kappa* was 0.86, suggesting a high level of coding reliability.

4.1.2 Definition of Design Objectives

Based on the problem statement, objectives for a potential solution design are defined. These objectives must be validated for logical consistency with the problem statement (vom Brocke et al., 2020). In addition, the type of artefact to be developed should be justified. The DOs play a key role in determining how the proposed method improves upon existing approaches and contributes to the solution of the outlined problem. In addition, a framework of generally applicable requirements for methods in Information Systems research is introduced, which should be followed during the design phase (Denner et al., 2018). Since a method typically follows a well-defined structure and concrete method requirements are introduced, there is no need to specify detailed design requirements. Instead, high-level objectives should be formulated, focusing on addressing the identified problem and achieving the intended goals. As the problem statement has already been evaluated with the expert panel, an empirical evaluation of the DOs is omitted due to the limited scope of this thesis.

4.1.3 Design and Development

This activity focuses on the creation of the artefact and is carried out in two iterations. The previously defined DOs guide the development and structure of the artefact. Situational Method Engineering (SME) is used as a guiding framework for the development of the method. SME provides a methodology for constructing methods tailored to specific contexts, i.e. situations. In this case, it concerns the development of a

method for PM in PA. Within the SME framework, methods are assembled from method chunks, which in turn consist of method fragments. These method chunks may be derived from existing methods, as identified in the literature, or newly designed. The method developed in this thesis follows a *deontic matrix* approach, i.e. it is rule-driven and links techniques, tasks, and goals, which may be either mandatory or recommended (Henderson-Sellers & Ralyté, 2010; Ralyté et al., 2003).

1. Iteration: At the outset, a new method is developed based on the DOs and insights from the literature. The DOs serve as strategic guidelines, while relevant method chunks and other findings are derived from the literature to inform the method. The composition of the method must be well justified and grounded in a clear rationale.

2. Iteration: In this iteration, the proposed modifications from experts gathered during the first evaluation round are reviewed and, where appropriate, incorporated.

4.1.4 Demonstration

The demonstration of the artefact is intended to illustrate how it can address the identified problem. For the purpose of this demonstration, the designed artefact is instantiated. That means, it is concretely represented and realised within either a real or a simulated environment (Gregor & Hevner, 2013, p. 341). Instantiation supports the accessibility of the artefacts and is typically carried out using software tools (vom Brocke et al., 2017).

1. Iteration: The designed method was represented in a *Microsoft PowerPoint* presentation to facilitate its introduction to the experts during the first evaluation activity. This format also enabled a hypothetical application of the method to real-world conditions that the experts face within their respective organisations.

2. Iteration: To enable a realistic evaluation of the method's application by the experts to their own organisational contexts, the developed method was implemented as a prototypical web application (Floyd, 1984; Wensveen & Matthews, 2014). The prototype can provide an indication of how the method might be implemented as a standalone software or integrated into existing BPM software. The no-code tool *Bubble.io* was used for this purpose, as it offered the most suitable combination of ease of use and functional capability. No-code platforms offer the advantage that people without extensive coding knowledge can develop functional applications (Truss & Schmitt, 2024, p. 5). While

Bubble.io has the clear limitation that the application source code can only be exported in a proprietary format, this constraint is deemed acceptable given the focus of this thesis. The web application was subsequently made accessible for evaluation purposes via a private domain owned by the author.

4.1.5 Evaluation

This activity aims to evaluate how effectively the designed artefact addresses the identified problem. In particular, methods should be assessed with regard to their ease of use, efficiency, generality, and operationality (Sonnenberg & vom Brocke, 2012, p. 391). This thesis follows the recommendations of Venable et al. (2016) for conducting evaluations within the context of DSR. Accordingly, a *quick and simple* evaluation strategy was chosen, as the social or technical risks and uncertainties for this artefact are relatively low. This approach allows the evaluation to progress quickly from a formative to a summative stage (Venable et al., 2016, p. 82). Venable et al. (2016) distinguish between two functional purposes of evaluation: *formative*, which aims to improve the artefact during its development, and *summative*, which assesses the performance of the final artefact. Furthermore, they differentiate between two evaluation paradigms: *naturalistic*, which involves real-world contexts such as organisational settings, and *artificial*, which takes place in controlled, laboratory-like environments. As both evaluation iterations were conducted with experts and intentionally incorporated their experiences from within their respective organisations, the evaluation paradigm applied here is naturalistic. Both rounds of evaluation are carried out *ex-post*, focusing on the assessment of constructs that are already built (Sonnenberg & vom Brocke, 2012, p. 392).

1. Iteration: This evaluation primarily aims to improve the initially designed artefact and is therefore formative in nature. During the expert interviews, the instantiated artefact is presented by the author, and the experts are asked to share general reflections as well as explicit suggestions for modifications, based on their practical context. The interviews are conducted online using video conferencing software, guided by semi-structured prompt-driven interview protocols, see Appendix I (Jiménez & Orozco, 2021). The instantiation is demonstrated via screen sharing. As with the problem definition phase, the interviews are transcribed. All proposed changes are then compiled in a spreadsheet, along with references to the respective experts and supporting quotations. For each suggested modification, a justification is provided as to whether it will be adopted or not.

2. Iteration: The objective of this summative evaluation round is to assess the improved artefact as a prototypical instantiation in terms of its usefulness and its fulfilment of the design objectives. To this end, expert interviews of the same condition as the previous ones were conducted using a semi-structured interview protocol that, similar to that of the first evaluation, intends to foster a prompt- and conversation-driven evaluation, see Appendix J (Jiménez & Orozco, 2021). The experts' opinions were assigned to the respective method components in a spreadsheet. In addition, the expert panel also participated in a quantitative online survey evaluating the method. The aim of the survey was to obtain a quantifiable measurement of the final artefact's performance (Sonnenberg & vom Brocke, 2012). For this purpose, the experts psychometrically evaluated various statements using a Likert scale with values from one to seven, allowing for an appropriate granularity in the assessment (Joshi et al., 2015). The online survey is designed using *Microsoft Forms* and followed generally accepted best practices for survey design (Braun et al., 2021). Its participation is anonymous. This triangulation of evaluation techniques is intended to provide a more comprehensive understanding of the performance of the final artefact.

Both evaluation rounds were conducted through individual interviews and a quantitative survey with members of the expert panel. In cases where the experts did not share experiences from their own organisations, fictional vignettes, see interview protocols, were used to situate the artefact within an organisational context (van Liempd & Heldbjerg, 2024).

4.2 Expert Panel

An expert panel was formed for the evaluations. An individual is considered an expert if they have engaged intensively and over an extended period with a specific subject area, e.g through professional experience or formal education (Kaiser, 2021). For this thesis, individuals with extensive experience in BPM within public authorities or within adjacent organisations, e.g. consultancies, are considered relevant. While experience with PM in this context is helpful, it is not a prerequisite, as such experience is limited and should not be required for the implementation of the method. This expert panel offers the advantage that the selected individuals are not only experts in the relevant field but also represent potential users of the method. This is particularly important for the demonstration and

evaluation of the method, as it allows for an assessment of whether the method can effectively bridge existing knowledge gaps.

The experts were identified and contacted through three channels: (1) A profile search was conducted on the professional network LinkedIn using relevant German-language keywords, e.g. *öffentliche Verwaltung, GPM, process mining, Prozessanalyse*. Individuals identified as relevant were contacted directly via a private message. While not all relevant individuals have a LinkedIn account, the platform still allows for the identification of suitable candidates based on their listed skills (Ha-Thuc et al., 2015) From over 20 contact attempts, two experts ultimately agreed to participate. (2) A call for participation in this research was published via a mailing list within a practitioner network focused on eGovernment in Germany (*NEGZ*) This resulted in a total of six committing experts. (3) Three additional potential experts were identified through a snowballing approach, based on recommendations from the initially identified experts (Parker et al., 2019).

Table 8 lists all experts who participated. Due to scheduling constraints and the continuous snowballing process, not all participants were able to take part in every evaluation activity.

					Participated in		
ID	**Role**	**Organisation**	**PM experience in PA (in years)**	**BPM experience in PA (in years)**	**E1**	**E2**	**E3**
P1	PM Industry (PA) Expert	PM vendor	3	>10	X	X	X
P2	PM Expert	PM vendor	5	>10	X	X	X
P3	Programme Manager Process Intelligence	State administration	>5	>10	X		
P4	Project and Process Manager	State administration	-	>5	X		
P5	Process Consultant	Federal administration	-	>5	X		
P6	Head of Project and Process Management	Subordinate administrative body	-	>10	X	X	X
P7	Process Analyst	Subordinate administrative body	-	>1	X	X	X
P8	Programme Manager Process Automation	Municipal administration	3	>5		X	X

P9	Manager E-Government & Processes	District administration	-	>5		X	X
P10	Chief Digital Officer	Municipal administration	-	>5			X
P11	Process Manager	Federal administration	4	>5			X

Table 8: Characteristics of the expert panel's individuals.

5 Problem Identification & Motivation

This chapter addresses *RQ2*.1 and *RQ2*.2. To enable a detailed discussion and analysis, the problem was broken down into three distinct fragments: (1) perceived benefits of process mining (PM) and the intention to use it, (2) barriers to the use of PM, and (3) the inadequacy of existing PM methodologies. These problem fragments were subsequently synthesised into a consolidated problem statement.

5.1 Perceived Benefits & Motivation to use PM

The perceived benefits of PM in public administration mentioned by the experts and identified in the literature were clustered into five overarching themes which emerged from open coding the interviews and clustering the literature: BPM, Compliance, Digitalization, Management and Performance. Table 9 lists all perceived benefits extracted from the coded interviews and the SLR. Although all benefits items are assigned to one theme, this does not render them mutually exclusive as they may also relate to other themes and complement each other.

BPM: If implemented, PM could potentially support BPM in a public authority throughout the entire BPM lifecycle and across all its core elements (Dumas et al., 2018; Rosemann & vom Brocke, 2010), as indicated by both expert consensus and existing literature. It may enhance transparency and traceability within administrative processes. For instance, by making document flows visible and enabling more accurate process modelling based on digital trace data, particularly in connection with the widespread introduction of eFile DMS. Data-driven process analysis also allows for more objective evaluations of processes, thereby reducing the reliance on subjective assessments often based on employee interviews. Consequently, the analytical capabilities of PM could serve to strengthen core organisational BPM competencies. By promoting the dissemination of PM-derived process insights across the organisation, BPM could be "democratised". That is, enabled and supported at the level of individual departments and close to actual process execution, without significantly increasing the demand for human resources to do so. P3 explains that they intend to use PM to simplify and substitute manual process documentation:

> *And in the context of this project, we said, well, we do a lot of manual process screening, but shouldn't we also look into whether we can use data-driven process*

analysis - at least where data-driven process analysis is actually possible? – P3, Interview I3

P7 reports that they would like to use PM to gather latent process knowledge and thus supplement the often imperfect process-related information provided by employees:

There was already a process survey done using spreadsheets, where people were supposed to enter their own processes, and it became quite clear that they often didn't really understand what exactly counts as a process and what's a subprocess. And if you're not just relying on what employees remember, but can instead extract that information from systems and data, then that's obviously a big advantage for us as the coordinating body. – P7, Interview I7

Compliance: In the domain of PA, procedures are predominantly governed by legal frameworks, i.e. laws and regulations, and are therefore firmly rooted in the principle of the rule of law (*Rechtsstaatsgebot*). This frequently includes legal deadlines associated with administrative processes and related applications. These processes represent a substantial component of public service delivery and the provision of public goods. Consequently, it is essential that all parties involved comply with the applicable legal requirements. The use of PM and, in particular, conformance checking of actual process executions in PA enables the identification and reporting of deviations from legally defined or ideal process flows. This could be conducted in real time across large volumes of process data, reducing the need for personnel to dedicate significant time to manual oversight. Moreover, this approach enhances accountability by increasing process transparency. P4 outlines the compliance checking potential for PM at their agency:

If we were to get specific and look at where the greatest potential lies, it would be in the area of drinking water. That's the drinking water quality, and there's an interface standard that has been developed for the processes between laboratories, water suppliers, and public health authorities. These processes are still analogue at the moment and are checked manually for compliance. If process mining could be used to carry out regular, automated checks there, especially within our agency, that would be fantastic. – P4, Interview I4

Digitalisation: An enhanced understanding of processes through PM could also contribute to software development within the broader context of PA digitalisation. The analysis and interpretation of process flows could support the formulation of more precise and effective requirements for the design of IT systems. Furthermore, the identification of recurring routines within process chains may reveal opportunities for workflow automation through robotic process automation (RPA). In addition, the data-driven process models generated by PM may not only help to identify digitalisation gaps but also support the strategic development of an authority's enterprise architecture management (EAM), as illustrated by the following quote from P3:

> *But where we actually want to go is toward continuous process management being actively practiced within the organisations, and contributing to digitalization. […] So what does that mean? From a central perspective, I actually want to use process mining to support our enterprise architecture management in a new way. – P3, Interview I3*

Management: Experts and existing literature have also identified promising use cases for PM in the context of general management, controlling, and steering functions within public authorities. The implementation of PM could facilitate resource allocation based on process data, enabling more evidence-based decision-making. By quantitatively identifying procedural bottlenecks, resource constraints can be detected and addressed at an early stage. Moreover, the large-scale evaluation of process data holds the potential to serve as a catalyst for the broader development of internal data analytics capabilities within public sector organisations. P6 describes how their motivation to use PM for strategic management purposes:

> *I believe that we need appropriate process mining for the strategic management of our organisation. We don't just want to assess how administrative processes are carried out and where we need to become more efficient, but also, especially when it comes to financial management, there's a real opportunity for administrations to gain a strategic steering tool to allocate resources more effectively. – P6, Interview I6*

The consideration of finance-related processes, for example in supplier management and procurement, in order to uncover discrepancies, is also frequently mentioned:

> *Basically, you can apply process mining anywhere large amounts of money are moved. At the [Federal Agency], for example, one topic was e-invoicing for supplier payments – to check things like: how many duplicate payments are being made? Which suppliers are being paid twice? You wouldn't believe how many cases there are. – P1, Interview I1*

Performance: This theme concerns the performance of processes, with particular emphasis on efficiency and effectiveness, and emerged as highly prominent. PM enables the aggregated analysis of process executions and their associated time stamps, allowing potential business process improvements (BPIs) to be identified and implemented within an organisational context. A reengineered process that is executed more efficiently would deliver the same outcome while requiring fewer resources, such as personnel. Key performance indicators in many public authorities include the processing time for applications as well as their formal and substantive correctness. In principle, additional performance benchmarks could also be defined and operationalised using PM analysis. Enhancing process effectiveness, e.g. by identifying and eliminating redundancies, may improve the degree to which the process fulfils its underlying policy objective. This, in

turn, can contribute to a more positive citizen experience in administrative interactions. Accordingly, P6 exemplifies performance as a perceived benefit:

> *We also need to take another look at where we can improve our performance, how we can make the application process more efficient and carry it out more quickly. – P6, Interview I6*

ID	Theme	Perceived Benefit	Interview References	Literature References
B1	BPM	Discover document flows	-	Repta et al., 2018
B2		Enable departement-level BPM	P3	-
B3		Enable objective process evaluation	P2, P6	Lück-Schneider, 2016, Racis et al., 2024
B4		Leverage strategic BPM	P3	Racis & Spano, 2024
B5		Establish process transparency & awareness	P3, P4	González & Delgado, 2021
B6		Extract process knowledge from legacy systems	-	Pérez-Castillo et al., 2012
B7		Leverage central BPM capabilities	P2, P3	Racis & Spano, 2024
B8		Substitute manual process screening and modelling	P3, P6, P7	-
B9		Standardize processes	P3, P4	Mingazov & Celli, 2024; Racis & Spano, 2024
B10		Simulate process changes	-	Lamine et al., 2015
B11	Compliance	Enforce policy compliance	P3, P4	Delgado & Calegari, 2022; Goron & Chesñevar, 2016; González & Delgado, 2021; Sangil, 2020; Spagnolo et al., 2016
B12		Support institutional accountability	-	Erasmus, 2024; Sangil, 2020
B13	Digitalisation	Enhance IT requirements engineering	P4	-
B14		Identify/ realise automation potential	P4	Racis & Spano, 2024; Fioretto, 2023
B15		Leverage digitalization efforts	P3, P4	Racis & Spano, 2024; Fioretto, 2023; Zuidema-Tempel, 2022
B16		Support EAM	P3	-
B17	Management	Enhance data analytics capabilities		Mingazov & Celli, 2024
B18		Leverage strategic controlling	P6	-
B19		Optimize budgeting	P1, P2, P7	-
B20		Detect bottlenecks	P3	Pernici et al., 2023; Molnár, 2017
B21	Performance	Conduct performance benchmarks	-	Pernici et al., 2023; Molnár, 2017
B22		Improve citizen experience	P3	Lamine et al., 2015; Pernici et al., 2023; Kalenkova et al., 2018
B23		Increase process efficiency, i.e. free up resources	P1, P2, P3, P6, P7	Delgado & Calegari, 2022; Shrivastava & Pal, 2017; Racis & Spano, 2024; Kalenkova et al., 2018
B24		Monitor processing times	P4	Lamine et al., 2015; Pernici et al., 2023; Lück-Schneider 2016

Table 9: Perceived benefits of PM in PA.

Amongst eight out of nine of the participating experts that work in PA (P3-P11), an intention to explore and utilise PM in their respective contexts was documented, as Figure 4 illustrates. However, it should be noted that the research design explicitly sought experts who had already dealt with PM in some capacity, albeit in a hypothetical one. Nonetheless, this might indicate that there is some degree of broader awareness and intention to use PM in PA in Germany. An example of this is the administration of P3:

> *As part of this, we've already experimented with process mining in a few areas - just to see whether it works, whether it's applicable, and whether it makes sense. For example, in the area of housing benefits, we have both a specialized IT system and manual processes. For the part handled by the IT system, we carried out a data analysis using process mining and were able to achieve significant process improvements. After these pilot projects, we concluded that it does make sense to introduce process mining as a strategic tool across [City]'s public administration. – P3, Interview I3*

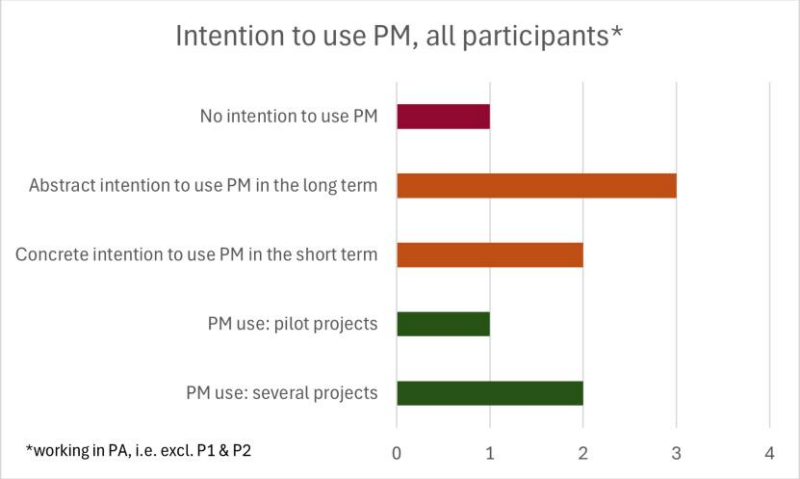

Figure 4: Intention to implement and use PM tools among all participants working in PA. Own illustration.

5.2 Barriers to PM in Public Administration

Based on the identified perceived benefits of PM, the question arises as to why public authorities do not adopt and implement PM tools more frequently to generate added value. This section classifies the barriers to PM adoption, identified both in expert interviews and the literature, according to three levels: Organisational, People (comprising individuals and groups), and Technical. These levels were drawn from the Five-Level Framework for research on PM proposed by vom Brocke et al. (2021, p. 485). The following texts summarise all findings relating to the problem items listed in Table 10. Each problem item is assigned to a single theme, however, they can also be relevant to other themes.

Organisational: The organisational structure of authorities is generally characterised by a hierarchical system, with clearly defined responsibilities for each distinct organisational unit, sometimes leaving little room for new and experimental approaches such as PM. Processes are frequently marked by rigidity, requiring thorough justification and evaluation before any proposed changes can be integrated into the organisational structure. As a result, decisions often require approval from multiple committees prior to implementation, particularly for initiatives that interface with processes, operations and technology, such as PM. Moreover, these organisations operate under a politically and legally defined mandate, which can limit the modification and analysis of processes. The political decision-making level may also exhibit a degree of risk aversion towards transparency-enhancing measures. The handling of sensitive citizen data within these processes further complicates data processing, as specific approvals may be required and strict data protection measures must be adhered to. Unlike customers of a private company, citizens generally have no option to opt out of data processing.

The roles and functions of civil servants and staff in PA are also strictly defined. Since PM requires interdisciplinary teams with both process and data expertise, assigning responsibilities and accountabilities within the typically static roles found in PA can be difficult. The implementation of PM generally necessitates meeting specific technical requirements, selecting and procuring a suitable PM software platform, and acquiring PM-related expertise. This usually involves a substantial initial investment. Justifying such an investment, along with the required time commitment, can be challenging, as many of the benefits of PM only become apparent over time, as illustrated by P3 and P6:

> *I always present [PM] as one of the reasons why we need to introduce electronic files and why we have to transition our processes into digital workflows. But it's also something that requires a longer time horizon and consistent, well-reasoned arguments. – P6, Interview I6*

> *I think the biggest challenge for us is to actually find departments that are willing to do something like this with us on top of their regular work, because, at first glance, they don't see any direct benefit from it. – P3, Interview I3*

In addition, the value added by PM may be less tangible in public administration, as the outcomes of administrative activities are often more abstract and not easily quantifiable in monetary terms, unlike in the private sector. Several experts also reported a lack of sufficient internal personnel resources for PM tool selection, implementation, and operation, which is largely due to inelastic and static personnel planning within public

administration. As a result, external service providers, such as professional services firms, are frequently engaged to carry out PM-related tasks. This can result in knowledge remaining external to the organisation and the emergence of long-term dependencies, which may pose a significant financial burden. Consequently, PM initiatives often remain in pilot stages for extended periods and face difficulties in achieving broader organisational scaling, as illustrated by P4:

> *Honestly, I'm not really sure what exactly needs to be done for [PM]. We worked with two providers to try things out a bit, but we haven't really seen any concrete results yet. And then, of course, it becomes difficult. The decision-makers feel it's taking too long, and the service providers cost money. – P4, Interview I4*

Furthermore, according to several experts, the effective use of PM depends on the presence of a mature BPM environment and a robust BPM culture into which PM can be integrated. In cases where the BPM setup is fragile or underdeveloped, identifying PM potential and coordinating with stakeholders becomes considerably more difficult. Strategic alignment of PM with the broader BPM strategy, governance structures, and organisational context is considered essential for selecting appropriate PM use cases and for integrating PM-derived recommendations back into the organisation. Moreover, public administrations are often characterised by a heterogeneous process landscape, where different modelling languages and tools coexist. This complexity introduces additional challenges when attempting to identify PM opportunities collaboratively with stakeholders. As P5 and P7 note, their organisations, for instance, use different modelling notations and exhibit varying levels of methodological expertise:

> *Process expertise is relatively limited - especially when it comes to documentation and the question of what level of detail to use. How high-level or granular should the processes be documented, and what's actually reasonable for the specific project at hand? – P5, Interview I5*

> *So, it's very heterogeneous at the moment. First, we have - well, let me start differently - we have a diverse and incoherent collection of process models that were created using different notations for specific purposes. But these were never really managed further; they're more like snapshots that were made to support project implementation or to represent technical requirements. – P7, Interview I7*

These structural conditions can cause PM initiatives in PA organisations to remain unsuccessful, be delayed or not even get off the ground in the first place.

People (Individuals & Group): The people dimension was frequently identified by experts as a particularly problematic area. This is largely due to perceptions, especially concerning risks, held by both leadership and the broader workforce regarding innovation

in general, and PM in particular. PM inherently increases transparency by visualising actual process flows and illustrating how employees interact with IT systems. Such transparency may expose discrepancies between system-recorded activities and the verbal or informal accounts provided by employees. This, in turn, can raise concerns among staff that the insights generated through PM could be used for performance monitoring or individual evaluation. As described by P5 and P6:

> *I believe process mining creates a kind of radical transparency around processes - and that kind of transparency may not be welcome in many areas. – P5, Interview I5*

> *This kind of transparency naturally also provides insight into other departments and can lead to resource conflicts. Because when processes change and it suddenly becomes visible what exactly is happening and how many cases are being handled, it can become clear that some people may not be fully utilized. – P6, Interview I6*

Furthermore, individual privacy concerns are also expressed by employees, and there is a general fear of digital surveillance. P6 explains what this means for them in terms of communication:

> *I believe we need to position ourselves very well in terms of communication. If we can succeed in easing the fears - especially around performance monitoring and the potential negative consequences for employees - then we'll be in a much better place. – P6, Interview I6*

The manifestation of such adverse attitudes has the potential to develop into a systemic issue, particularly when collectively expressed by employee representatives and incorporated into formal decision-making processes. In public administration in Germany, staff councils must be involved and formal approval obtained whenever process data from IT systems is analysed. Experts note that a considerable degree of persuasion is often required due to a typically protective stance taken by these bodies. If these concerns are not addressed comprehensively and in coordination with the relevant committees, negative perceptions of PM can quickly emerge. This may lead to a complete rejection of PM implementation or, alternatively, to insufficient stakeholder buy-in at the departmental level. As a result, log data remains uninterpreted within its administrative context, hindering the identification and realisation of business process improvements (BPIs) and other benefits of PM. This issue is further exacerbated when key personnel are either unwilling or unable to allocate time to PM initiatives. Even where leadership supports PM adoption, this can cause delays and reduce overall effectiveness. More broadly, a general lack of awareness that PM exists as a tool for advanced BPM and performance optimisation, particularly within the administrative context, has been reported by several experts and in the literature. P7 describes this phenomenon as follows:

> *First, there needs to be an overall awareness across the entire organisation. Even our executive board hasn't fully grasped what a [process data] treasure we actually have here and what possibilities it opens up. – P7, Interview I7*

Furthermore, a lack of methodological knowledge regarding the use of PM has been identified, specifically in areas such as identifying PM potential, assessing technical and organisational prerequisites, and operationalising PM results. It is apparent that existing methodologies do not sufficiently account for the unique context of PA. This is further compounded by a general lack of process and data analytics expertise within operational units ("on the shop floor"), which can be attributed to the function-oriented administrative law training typically received by civil servants and PA employees. Additionally, motivation to adopt PM is often unevenly distributed across organisations. PM initiatives frequently originate from a single interested individual rather than being institutionally anchored.P6 demonstrates this by talking about a coworker who experimented with PM:

> *I think in this case, it really comes down to the individual - he's intrinsically motivated to improve the process. Partly because it means that many issues won't always land on his desk anymore, but can be addressed much earlier within the organisation. – P6, Interview I6*

Technical: The reliable availability of log data, which accurately reflects the essence of processes, is imperative for PM. Experts pointed out that several processes in PA are still performed entirely or partially in analogue form, i.e. they take place in circulation folders and on paper. Consequently, the absence of digital log data hinders the full or partial analysis of process steps, negatively impacting the efficacy of PM activities. P2 reports from their own experience that processes do not have to be completely digitised. It can be sufficient for relevant sub-processes to be digital, depending on the respective PM objectives:

> *If I don't have any data, then I can't do process mining. Of course, I don't necessarily need the entire process to be fully end-to-end digitalized, certain sections are often enough. For example, if specific parts of the application processing - regardless of the type of application - are already digitalized, then that's sufficient. – P2, Interview I2*

The procurement and development cycles for software in public administration, particularly for specialised procedures (*Fachverfahren*), are often not conducted in an agile manner and may extend over long timeframes, as reported by P7:

> *We're assuming that we'll roll out our electronic files in cycles of about one and a half years. That means we probably won't have an electronic file until the end of 2026 - and only then will the question arise: how can we extract data from the system, and how do we involve our staff council in the process? – P7, Interview I7*

Requesting and implementing changes to this software therefore often requires considerable time and may even trigger additional tendering procedures. This poses a challenge, particularly if the software lacks built-in functionality for exporting event log data. Retrofitting such capabilities can be time-consuming and financially burdensome, and may be further constrained by the limitations of public budgets. P3 describes how their organisation now explicitly considers PM compatibility when procuring new IT systems:

> *That's why, in [City]'s public administration, we're establishing a basic principle: any software developed or purchased in the future must be process mining–capable. And for legacy systems that don't support it yet, we'll need to assess whether it can be integrated whenever changes are planned. – P3, Interview I3*

However, it was also noted that most specialist software is typically supplied with a database specification manual from the vendor, allowing the required data to be identified and extracted in some format and subsequently transformed. Nonetheless, this process demands personnel resources and may require the authority's IT specialists to develop new competencies. Data processing, such as the removal of sensitive information and pseudonymisation, can also be time-consuming.

Furthermore, technical prerequisites for the data sets, including clear case identifiers, time stamps, and distinguishable process steps, must be clarified, verified, and, if necessary, adapted. Compounding these challenges, the IT systems supporting processes in public administration are often fragmented. As a result, process-related log data may be distributed across multiple systems, requiring considerable effort to consolidate and link, or, in some cases, may not be fully exportable at all. When selecting PM solutions, one expert expressed concerns about potential vendor lock-in and the use of cloud-based environments, which are common among commercial PM tools but are sometimes viewed as insecure or unsuitable for handling sensitive public sector data.

ID	Level	Barriers / Challenges	Interview References	Literature References
C1	Organisation	Complex committee coordination	P6, P7	-
C2		Complex process landscape	P3, P4, P5, P6, P7	Racis & Spano, 2024
C3		Data protection concerns	P1, P2	-
C4		Dependencies on external consultancy	P3, P4, P5	-
C5		Fight for resources induced by increased transparency	P6	-
C6		Adverse political attitudes	-	Racis & Spano, 2024
C7		Fragile BPM culture	P1	-
C8		Heterogeneous BPM approaches	P7	-

C9		High upfront investment	P3	-
C10		Lack of strategic PM alignment	P5	Zuidema-Tempel, 2022
C11		Legal constraints	P1, P3, P4, P5, P6	Lück-Schneider, 2016
C12		Long (PM) pilot phases	P1, P4	Zuidema-Tempel, 2022
C13		Unclear responsibilities	P3, P4, P5	Zuidema-Tempel, 2022
C14		Unclear value proposition	P3	-
C15	People	Afraid of performance monitoring	P1, P3, P4, P5, P6, P7	-
C16		Constrained individual availability	P3, P4	
C17		General employee resistance to change	P1, P4	Racis & Spano, 2024
C18		Individual privacy concerns	P1, P7	-
C19		Lack of awareness of PM	P1, P3, P4, P6, P7	-
C20		Lack of leadership commitment	P1	-
C21		Lack of methodological PM knowledge	P3, P4, P5, P6, P7	Racis & Spano, 2024, Zuidema-Tempel, 2022
C22		Scepticism towards innovation	P1, P3	-
C23	Technical	Afraid of vendor lock-in (PM solution)	P1	-
C24		Analogue processes	P1, P3, P4	-
C25		Complex data transformation required	P3	-
C26		Demanding data extraction	P3, P4	-
C27		Fragmented IT systems	P3, P4, P6, P7	Mingazov & Celli, 2024
C28		Inability to export log data	P1, P2, P3	-
C29		Required on-premise operation	P1, P2	-
C30		Unclear technical prerequisites	P7	-
C31		Insufficient data quality	P1, P3	Racis & Spano, 2024

Table 10: Barriers to PM use in PA.

5.3 Inadequacy of Existing PM Methodologies

The outlined challenges, i.e. the lack of relevant PM knowledge, limited stakeholder engagement, misalignment with BPM and unclear value propositions, may be addressed through a structured and context-sensitive PM methodology. However, an analysis of existing PM methodologies in the literature, Chapter 3.1.4 and Table 4, reveals that they typically rely on several key prerequisites: (1) established and reliable process (data) management, (2) personnel with appropriate skills and clearly defined roles, (3) sufficient data availability and quality, (4) clearly predefined PM objectives, and (5) a well-defined PM value proposition and understanding of the added value.

The approaches described by existing methods are largely linear, focus on individual processes in isolation, and fail to account for specific organisational circumstances

beyond basic role definitions and project teams. Most of the methods reviewed (e.g., L*, PDM, PM²) also assume a singular perspective on processes occurring within a single IT system, not accounting for fragmentation. An exception is MAPPER, which addresses the development of PM portfolios and offers a more sophisticated understanding of PM value cases (Fischer et al., 2024).

However, PA operates within a unique context that must be considered when initiating and aligning PM projects and when attempting to derive value from their outcomes. None of the existing methodologies inherently accommodate more complex forms of value creation, such as public value in PA, which extend beyond monetary gains and straight forward process efficiency (Meynhardt, 2009). Likewise, they do not sufficiently account for the legal and technical constraints specific to the public sector.

5.4 Summarized Problem Statement

Based on expert interviews and the literature, it can be assumed that there are substantial perceived benefits and a spectrum of intentions, ranging from abstract to concrete, for using PM in PA in Germany. However, numerous barriers and challenges complicate the identification and realisation of these benefits.

In summary, the organisational structures of PA entities may hinder the adoption of PM, as BPM in PA is not always mature enough to provide a suitable starting point. Processes are often subject to specific legal requirements and formalised procedures, process landscapes are complex, and public value creation involves dimensions that go beyond efficiency or monetary return commonly focused by BPI-focused PM activities. Additional obstacles include negative perceptions among staff, often driven by concerns about surveillance and performance evaluation, as well as a general lack of awareness and methodological understanding of PM. Moreover, many PM initiatives remain in prolonged pilot phases and therefore fail to achieve long-term scalability. Unclear role definitions and responsibilities further impede implementation. On the technical side, the IT landscape is highly heterogeneous; some processes are partially or entirely analogue, and the extraction, transformation, and integration of data can be technically challenging.

Some of these barriers could potentially be addressed through a methodical PM approach. However, existing PM methodologies do not adequately account for the specific characteristics of PA.

6 Definition of Design Objectives

This chapter addresses *RQ3* aims to justify and specify the nature and objectives of the target artefact, i.e. the method. The SLR and expert interviews were used to develop a problem understanding, which was further analysed in the problem statement. Based on this, the following objectives were logically deduced and specified. Through logical reasoning, the design objectives (DO) were validated for consistency and coherence with the findings from the problem statement and the SLR. The DOs were formulated to remain within the scope of what is feasible within the context of this thesis.

6.1 Justification of Artefact Type

In DSR, there are a variety of possible target artefacts that attempt to solve a specific problem using design knowledge (Offermann et al., 2010, p. 81). Therefore, several suitable artefact types were considered by the author to address the identified problem.

For instance, a capability-oriented enterprise architecture model could support the integration and configuration of PM capabilities in public administration. However, such an approach would not adequately address the specific gaps related to implementation. Similarly, a framework for PM in public administration, including a tailored vocabulary, could help structure solution approaches and enhance problem understanding. Nevertheless, its high level of abstraction would limit its practical applicability. Reference processes for the use of PM in public administration would offer a more application-oriented solution, but are likely to be too rigid to accommodate diverse organisational conditions, such as variations in stakeholder attitudes. A generalised approach to PM in the public sector could also be formulated as an artefact, yet such a solution would lack actionable guidance and therefore have limited utility in practice. While it would also be possible to develop a dedicated software suite with PM capabilities tailored for public administration, the problem analysis consistently indicated that the technical challenges can largely be addressed using existing tools on the market. The core challenges lie instead in the organisational implementation of PM.

Consequently, the two artefact types closely considered for this thesis were *methodology* and *method*. Both address the need for specific targeting of objectives within a structured and systematic approach and guidance (Offermann et al., 2010) and have been mentioned as essential for organisational PM capability (Zerbato et al., 2022). However, a

methodology is a broader concept that can encompass principles, rules and several methodological procedures. In contrast, a method describes a specific procedure for achieving a certain predefined goal and usually includes a description of clear steps necessary to achieve it. For this research project, a situational method was therefore chosen as the appropriate target artefact. An explicit description of a procedure in a specific context, i.e. the *situation*, is required to address the problem (Henderson-Sellers & Ralyté, 2010).

6.2 Objectives for Designing a Method

The following DOs were developed in line with the overall problem statement and the requirements and mandatory components (attributes and elements) for methods proposed by Denner et al. (2018, p. 335). Table 11 lists the mandatory method components, which will further guide the construction of the artefact and are therefore to be regarded as an integral part of the design objectives. The criterion of repeatability has to be considered as slightly limited, as the method generally has the broad and diverse scope of public authorities in Germany and its application must be adapted to the respective local context. This compilation of DOs attempts to be as comprehensive as possible, but is by no means complete as the solution space revealed by the problem statement is extensive.

	Name	Description
Attributes	Goal orientation	Methods must strive for achieving specific goals
	Systematic approach	Methods must include a systematic procedure model
	Principles orientation	Methods must follow general design guidelines and strategies
	Repeatability	Methods must be repeatable in different contexts
Elements	Activity	Task that creates a distinct (intermediate) output
	Technique	Detailed instruction that supports the execution of an activity
	Tool	Tool that supports the execution of an activity
	Role	Actor that executes or is involved in the execution of an activity
	Defined output	Defined outcome per activity

Table 11: Mandatory method components. Taken from Denner et al. (2018, p. 335)

The DOs were categorised into three groups. Table 12 links each individual design objective to the motivating problem items presented in the preceding chapter.

Overarching Objective of Method:

DO1.1: The method enables public authorities to identify and evaluate the domain-specific potential for process mining within their organisation, including suitable processes and general value cases.

DO1.2: The method guides public authorities in creating, implementing, and scaling a process mining project portfolio aligned with organisational goals and capacities.

Characteristics of Public Administration:

DO2.1: The method takes into account that administrative processes in public authorities often depend on heterogeneous IT landscapes, marked by fragmentation, data silos, and analogue components.

DO2.2: The method explicitly considers the regulatory constraints of administrative processes and incorporates multiple dimensions of public value creation.

DO2.3: The method acknowledges that public authorities operate within hierarchical structures and that the transparency introduced by process mining might raise certain governance and trust-related issues.

Organizational Embedding:

DO3.1: The method provides an exemplary organizational setup to embed and sustain process mining activities within a public authority.

DO3.2: The method outlines the basic organizational and technical capabilities required to initiate and support process mining initiatives in a public authority.

Design Objective	Motivating Problem Items
DO1.1	C7, C8, C10; C12
DO1.2	C7, C8, C10, C13,
DO2.1	C24, C25, C26, C27, C28, C30, C31
DO2.2	C11, C14
DO2.3	C1, C2, C3, C15, C17, C18,
DO3.1	C7, C8, C20
DO3.2	C21, C30

Table 12: Linking of Design Objectives to respective Problem Items.

6.3 Out of Scope Objectives and Neglected Problem Items

Within the search space for possible DOs that aim at addressing the problem items, the following DOs were identified as well but deemed infeasible within the scope of this thesis.

- The method provides a detailed description of the ETL operations required to utilise event log data.
- The method provides specific information on software, i.e. *Fachverfahren*, frequently used in German administration.
- The method supports the selection and procurement of suitable PM software.
- The method enables the calculation of necessary personnel capacities (FTE) for the implementation of PM projects.
- The method provides a detailed data protection framework for assessing necessary data protection measures.
- The method supports the configuration of the PM software, e.g. closed or open source, cloud or on-premise operation.

In addition, the following components of the problem statement were disregarded in the definitions of DOs because they are out of scope for this thesis or cannot be solved, or only to a limited extent, using a single method: *C4, C5, C6, C22, C23.*

7 Design & Development of Method

This chapter addresses *RQ4* and presents the final state of the Design & Development activity and the results of the first evaluation of the artefact. Firstly, it introduces the improved version of the method, which incorporates the results of the first artefact-related evaluation (E2). The initial design can be found as an instantiation in Appendix A. Secondly, this chapter presents the aggregated results of the evaluation by listing all proposed changes and discussing their adoption. The design of the method is determined by the DOs and informed by the SLR.

7.1 Presentation of Final Artefact

The goal to be achieved through the developed method is to enable public administrations to identify, evaluate, realise, and scale PM potentials within their specific context. Ultimately, the authority should possess a value-adding portfolio of PM processes tailored to its organisational needs. For simplification and recognisability, the method is called PIPPA, which stands for *P*rocess M*i*ning for *P*ublic *A*dministration – the second *P* is added for smoother pronunciation. Figure 5 provides a high-level overview of PIPPA.

The method was designed in alignment with the SME methodology, in a flexible manner, incorporating both newly developed and literature-adapted method chunks. Appendix O maps the components of PIPPA to the literature identified in the SLR.

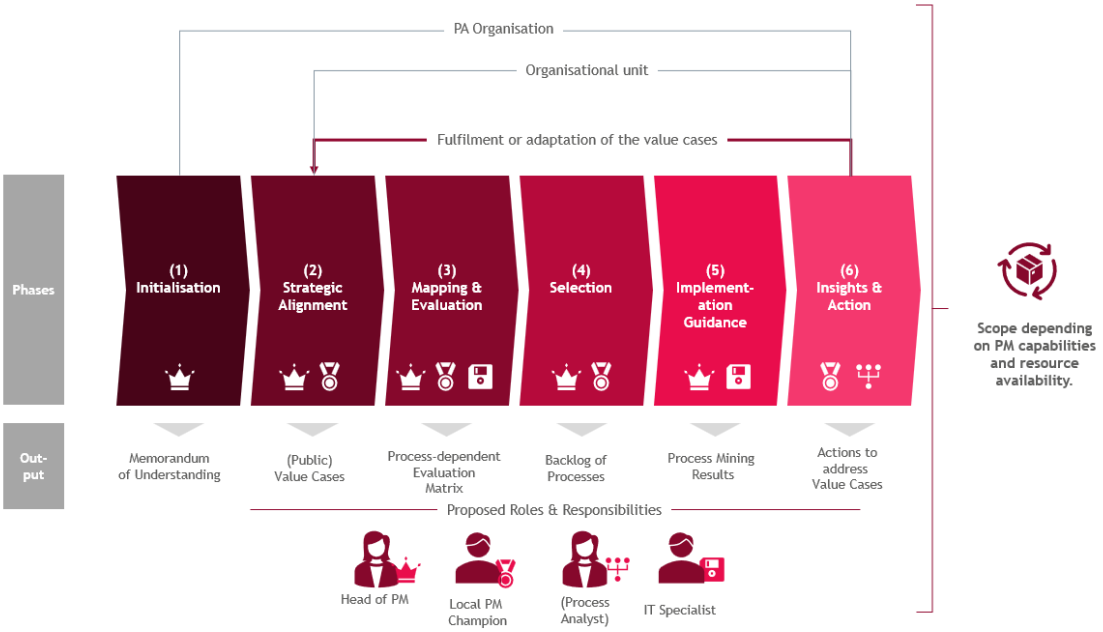

Figure 5: High-level overview of PIPPA. Own illustration.

7.1.1 Phases & Activities

Based on the design objectives and Denner et al.'s (2018) requirements for methods, this chapter outlines the six phases of PIPPA: (1) Initialization, (2) Strategic Alignment, (3) Process Mapping & Evaluation, (4) Process Selection, (5) Implementation und (6) Monitoring & Actions.

These phases are based on the phases commonly found in PM methodologies, see Table 4 and Chapter 3.1.4. In particular, this is guided by the phases of PM2 and MAPPER (Fischer et al., 2024; van Eck et al., 2015). However, PIPPA arranges the phases differently. The definition of value cases is done first and independently of specific processes, allowing for the mapping of comprehensive (public) value cases. In addition, PIPPA takes into account the special regulatory conditions of administrative processes, as well as their technical fragmentation and incorporates this into the process evaluation & selection.

Table 13 outlines all phases. The initialisation phase should be carried out for the entire organisation, or at least for several organisational units. The subsequent phases, however, should be carried out for each organisational unit individually. It is advisable to begin with just one unit.

Phase	Key Activities	Primary Roles	Outputs
Initialization	• Establish Organisational and Role Readiness • Prepare Technical and Capability Foundations (Gap Assesment) • Initiate Stakeholder Engagement and Build Trust	• Head of PM	• Memorandum of Understanding • High Level IT System Overview Assessment • Preliminary Stakeholder Acceptance Assessment
Strategic Alignment	• Problem Identification • Documentation of Objectives • Formulation of Value Cases	• Head of PM • Local PM Champion	• Structured List of Problems and Objectives • Set of Value Cases • Strategic Justification for PM
Process Mapping & Evaluation	• Identify Processes for Evaluation • Evaluate Each Process Against Four Criteria • Aggregate and Document Evaluation Results	• Head of PM • Local PM Champion • IT Specialist	• Process Evaluation Matrix
Process Selection	• Define and Use Selection Paradigms • Apply Evaluation Matrix • Prioritise and Filter Processes	• Head of PM • IT Specialist	• Process Backlog
Implementation	• Secure Organisational Alignment and Trust for specific PM cases • Define and Execute Data Extraction • Conduct Process Mining Analysis	• Head of PM • IT Specialist	• Approved Scope and Permissions • Prepared and Pseudonymised Event Logs • Initial Process Mining Results

Insights & Actions	• Interpretation of PM Insights • Derivation of Improvement Actions • Alignment and Iteration with Value Cases	• Local PM Champion • Process Analyst	• Interpreted PM Findings • Actionable Improvement Recommendations • Value Case Adjustments • Updated Process Modells

Table 13: Method phases and activities.

7.1.1.1 Initialization

This phase establishes the minimum organisational readiness required for implementing PIPPA. Its primary objective is to ensure that all foundational elements are in place to enable the successful execution of the subsequent phases. This includes clearly defining the organisational set-up, ensuring the general availability of the necessary capabilities, and preparing appropriate communication strategies. Accordingly, this phase focuses on the initialisation of PM capabilities, the setup of the organisational framework, and the creation of low-threshold PM awareness among relevant stakeholders. It is important to note that the concrete configuration of these capabilities will vary depending on the specific characteristics of the authority in question. As such, PIPPA defines a schematic target state that should be achieved prior to advancing to the next phases.

The provision, readiness and configuration of PM capabilities is mainly based on findings from the literature on PM capabilities and maturity in chapters 3.1.1 and 3.1.3. The understanding of the organisational set-up is mainly derived from the synthesis in chapter 3.1.2. The capabilities should be regarded as dynamic in terms of their provision during the method execution. Chapters 3.1.1 and 3.1.3 identify the following capability areas for PM implementation from the literature: personnel resources, methodological knowledge, technological resources & knowledge and stakeholder readiness. The methodological knowledge is mainly provided by PIPPA. However, certain steps, e.g. data extraction or project management, can be partially supplemented by other methods.

Organisational set-up: The organisational set-up can be considered as generally ready when three preconditions are met: (1) The roles and their description proposed in chapter 7.1.2 have been adapted to the context of the authority. (2) The roles have been assigned to individuals within the authority. (3) The individuals with the corresponding roles have a clear understanding of these roles and accept them.

Personnel resources: It is essential to ensure that individuals assigned to specific roles are reliably available and can receive task-related information in a timely manner. This

enables the development of effective planning capacities. The actual level of involvement required for each role will depend on how the method is implemented and on the scope of the resulting PM projects. Estimating the number of FTEs potentially required per role can support the early identification of resource needs. This is particularly important given the often inflexible personnel planning structures in public authorities.

Technical resources & knowledge: There is no immediate requirement to procure or implement a PM tool at the outset. This can be deferred until potential PM projects have been identified. Developing a well-substantiated PM value case can support the justification of procurement decisions and the associated costs. However, it may be beneficial to conduct an early market exploration to identify suitable PM tools. This exploration should take into account the preferred deployment model, i.e. cloud-based or on-premise, as well as the suitability of commercial versus open-source solutions. Moreover, it is essential that the Head of PM and the relevant IT specialists possess foundational knowledge of process mining. This may be acquired through professional development activities such as training programmes or online courses. In addition, an initial overview should be obtained of the software currently in use and an early assessment of its capability to export event log data.

Stakeholder readiness: Four key stakeholder groups should be involved at this stage: (1) *Leadership (Behördenleitung)*: Senior management must be regularly informed and updated on PM activities to ensure sustained leadership commitment. (2) *Staff Council (Personalrat)*: The staff council should be engaged from an early stage to support transparency and alignment with employee representation frameworks. (3) *Data Protection Officer*: The data protection officer must be informed about planned PM activities to ensure compliance with data protection regulations. Other officers, i.e. those responsible for equality or anti-discrimination, may also be informed informally, where relevant. (4) *Organisational units (Sachgebiete)*: It is advisable to conduct an informal assessment of the various organisational units to gauge their openness to PM. Based on this, a stakeholder openness map can be created for each unit to inform further planning and engagement strategies.

Furthermore, during this phase, a Memorandum of Understanding should be signed by all involved parties and communicated transparently. This document should explicitly guarantee that insights gained through PM will not be used for the evaluation of individual

staff performance or surveillance purposes. It must also ensure that any sensitive employee or citizen data contained in the event logs is filtered out prior to any mining activities.

By the end of this phase, three concrete outputs should have been created: (I) A Memorandum of Understanding aimed at building trust and acceptance. (II) A high-level overview of the software systems in use, along with an initial assessment of their capability to export log data. (III) A preliminary assessment of stakeholder acceptance of PM within the organisational units.

Capability	Target state (baseline)
Organisational set-up	• Roles clearly defined • Roles clearly allocated • Participants understood their role
Personnel resources	• Role availability determined • Minimum required FTEs defined • Staff availability planned
Technical resources & knowledge	• Early market discovery for a fitting PM tool conducted • Basic knowledge of PM established • Early overview of software/ *Fachverfahren* established
Stakeholder readiness	• Staff council informed in advance • Data protection representative informed in advance • Leadership commitment secured • Willingness of potential stakeholders across organisational units screened • Communications & *talking points* prepared • Lines of communication established

Table 14: Recommended capability target states.

7.1.1.2 Strategic Alignment

In this phase, clearly defined value cases for PM are developed. It is advisable to begin with organisational units that have already expressed a willingness to participate or where there is strong leadership commitment. The phase entails aligning the unit's identified

problems and strategic or operational objectives with appropriate PM techniques. Unlike conventional PM methodologies, which typically focus on individual processes, this approach adopts a process-independent perspective on strategic alignment. This broader view enables the analysis of complex, cross-process value creation and issues within PA. It also enables a comprehensive evaluation of the cost-benefit ratio when selecting processes for PM in subsequent phases. The method explicitly includes the definition of problems and objectives, as such systematic approaches, i.e. the use of OKRs, are not consistently established within public authorities. Furthermore, this method allows for the explicit integration of PA-specific factors, such as regulatory requirements and citizen experience, into the strategic alignment and their systematic mapping to suitable PM techniques.

This phase is carried out in the following three steps. The Head of PM and the designated PM Champion within each unit are responsible for the execution. The definition of value cases is conducted in close collaboration with the staff of the respective unit. Process Analysts or IT Specialists may be consulted as needed. Steps one and two can be executed in parallel.

(1) Problem Identification: All relevant issues faced by the organizational unit are documented in a structured list. The exact formulation of the problems is at the discretion of the contributors. However, it is essential that each issue is clearly and unambiguously specified. These problems may be specific to the unit or adopted from the broader organization. PIPPA proposes three overarching categories for classification: *organisational issues, regulatory issues*, and so-called *citizen pain points*, i.e., problems related to the citizen experience in public service delivery.

Examples of identified problems include:

- Long processing times: Citizens report excessive waiting periods for the processing of application A38 (*citizen pain point*)
- Staff shortages: As of Q3 2025, three FTE positions remain unfilled (*organisational issue*)
- Deadline violations: In the processing of funding applications, statutory deadlines were once again exceeded (*regulatory issue*)

(2) Documentation of Objectives: In this step, all strategic and operational objectives to be achieved by the organisational unit are documented. These objectives may originate

from higher organisational levels, i.e., in the context of organisation-wide initiatives affecting individual units, or they may be specific to the unit itself. Objectives are typically derived from either *organisational priorities* or *regulatory mandates*. While objectives may be related to identified problems, such a connection is not mandatory. Where possible, it is advisable to quantify objectives in order to support later evaluations.

Examples of objectives include:

- Implementation of OZG services: The reuse of the housing benefit application form from the Social Platform must be implemented (*regulatory mandate*)
- Acceleration of application processing: The average processing time should be reduced from 12 days to 8 days (*organisational priority*)
- Design of a new application form: Due to changes in the German Social Code (SGB), forms E22 and E27 must be redesigned based on current processes (*regulatory mandate*)

(3) Formulation of Value Cases: In this step, the documented problems and objectives are systematically linked to suitable PM techniques. The set of PM techniques includes process discovery, conformance checking, and process enhancement. The analysis considers what level of process understanding and management is required to address the identified problems and achieve the defined objectives. A value case precisely specifies how PM can generate value for the organisational unit. Each value case should be linked to at least one problem or objective, and should clearly outline how the application of one or more PM techniques can contribute to their resolution or fulfilment. These value cases play a critical role in supporting stakeholder communication, i.e., with staff or staff councils, and in justifying potential additional costs associated with technical implementation. They also define the technical configuration of the PM implementation.

Example of a potential value case:

Title: Early Detection of Bottlenecks in Application Processing

Description: By continuously analysing event logs with time stamps, throughput times and temporal differences between process steps can be calculated and monitored over time. This enables the early identification of resource bottlenecks, which can then be proactively addressed.

Relevant PM Technique: Enhancement (analysis of throughput time)

Linked Problems: Long processing times; Legal deadline violations

Linked Objectives: Acceleration of application processing

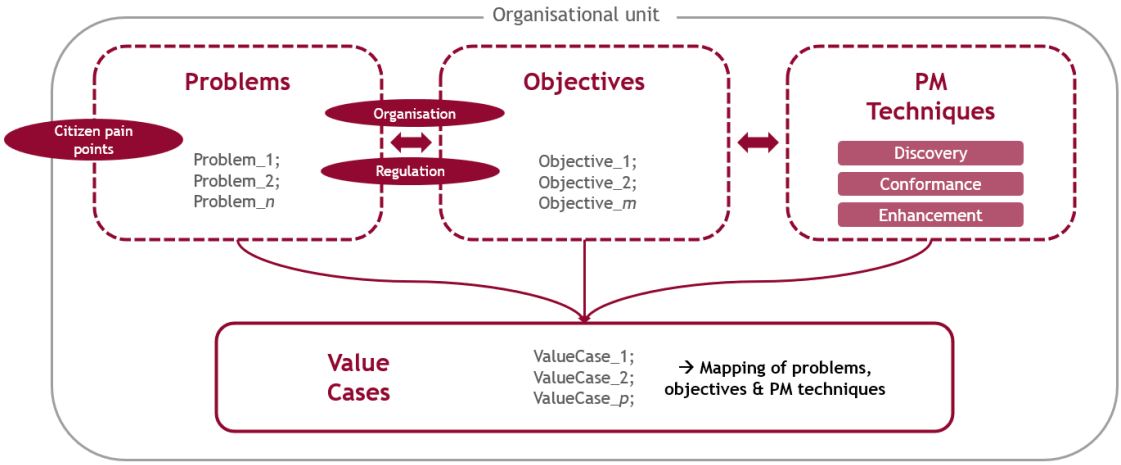

Figure 6: Components involved in the value case definition. Own illustration.

7.1.1.3 Process Mapping & Evaluation

In this phase, all or a selected subset of processes within an organisational unit are evaluated with regard to their suitability for PM. It is recommended to use existing process maps for this, e.g. by exporting process overviews from platforms such as PICTURE. Either all processes within an organisational unit can be evaluated, or processes can be prioritised based on the defined value cases or their underpinning IT systems. Each process is assessed using the following four criteria, rated on an ordinal scale with discrete values ranging from zero to three. The division into four evaluation levels is used to reduce complexity but can be customised if required. The evaluation is carried out individually for each process p_i,where $i \in \{1,2,\ldots,n\}$ and $n \in N$ denotes the number of processes within the organisational unit. Throughout this section, individual processes are represented by the symbol p. Table 15 provides guidance for the evaluation based on the proposed scale.

(1) Technical Feasibility: This criterion assesses the technical IT systems that support the process. The evaluation is based on the following five factors: (i) The number of IT systems involved in the execution of the process, i.e. system discontinuities, as well as whether parts of the process or the entire process are still carried out in an analogue manner. It should be noted that, in some public authorities, IT systems are outsourced to centralised data centres, such as the *ITZBund* or *Dataport*. In such cases, contact must

first be established with the relevant personnel at the respective institution. For more complex IT set-ups, it is recommended to use a digital canvas to map which IT software is used sequentially along the process chain. (ii) The effort required to extract event logs or other forms of digital trace data from these systems (data extraction). (iii) The quality of the exported data. Specifically, whether clear case identifiers, distinct process steps, and time stamps are present. (iv) The volume of available log data and whether it is sufficient to support a reliable analysis. (v) The effort required to transform the extracted data into PM-compatible formats, such as XES, and, if needed, enrich logs with necessary information (data transformation). The technical feasibility f can then be assessed for each individual process p_i:

$$f(p_i) \in \{0,1,2,3\}$$

(2) Value Case Relevance: This criterion evaluates the extent to which mining a given process can contribute to the realisation of one or more value cases. Each process may be linked to one or multiple value cases. It is essential to identify which processes are relevant for addressing the specific problems and objectives defined in the value cases. The relevance v of a process p_i in relation to one or more value cases can then be evaluated:

$$v(p_i) \in \{0,1,2,3\}$$

(3) Legal Barriers: This criterion considers whether, and to what extent, legal requirements and regulations govern the process. Firstly, it assesses whether specific safeguards must be implemented when analysing process data of a process p_i, e.g. due to the potential processing of sensitive citizen information, and the level of effort required to ensure compliance. Secondly, it evaluates how legal mandates related to process execution, which are common in PA, may restrict the realisation of value cases, particularly in instances where process modifications are legally impossible, i.e there is no process *changeability* (van Eck et al., 2015). The effort associated with fulfilling the legal requirements l for mining process p_i is subsequently assessed:

$$l(p_i) \in \{0,1,2,3\}$$

(4) Stakeholder Acceptance: In order to conduct PM effectively and to interpret its results within context, the acceptance of stakeholders involved in the process is essential. While it is, of course, possible for PM to be mandated by senior management, the quality and effectiveness of PM activities may suffer in the absence of stakeholder buy-in. Additional effort may then be required to convince and engage relevant stakeholders. It

is important to note that within an organisational unit, acceptance of PM may vary. For example, while the unit as a whole may be generally open to PM, specific PM activities, particularly those targeting certain subprocesses, may face lower acceptance from individual staff members. Furthermore, some processes extend beyond the boundaries of a single department, involving external stakeholders. In such cases, particularly for more complex processes, stakeholder mapping can be useful. It is also important to consider and assess how the staff council (*Personalrat*) and other appointed representatives, such as a data protection officer, evaluate the mining of the respective process. Stakeholder acceptance a for a given process p_i can be assessed and evaluated accordingly:

$$a(p_i) \in \{0,1,2,3\}$$

By evaluating all four aspects for multiple processes p, a matrix $M \in N^{n\times 4}$ is obtained, where each row corresponds to a process p_i and each column corresponds to one of the four evaluation criteria:

$$M = \begin{bmatrix} f(p_1) & v(p_1) & l(p_1) & a(p_1) \\ f(p_2) & v(p_2) & l(p_2) & a(p_2) \\ \vdots & \vdots & \vdots & \vdots \\ f(p_n) & v(p_n) & l(p_n) & a(p_n) \end{bmatrix}$$

This matrix can be used to present the evaluation results, for example, as radar charts or heat maps. Moreover, the results are relevant for process selection in the next phase. It is important to note that these evaluation criteria are not static and may change over time, in particular the stakeholder acceptance.

Criterion	*0*	*1*	*2*	*3*
Technical feasibility	The process is analogue or the export of event log data is not feasible.	The IT systems exhibit significant discontinuities, or data export is resource-intensive and results in poor-quality data.	Data extraction is feasible, but the transformation into suitable formats is resource-intensive.	Data can be extracted, easily transformed, and loaded into a process mining tool.
Value Case Relevance	No value case is addressed.	A value case is partially addressed.	A value case is fully addressed.	Multiple value cases are addressed.

Legal Barriers	Legal barriers prevent the application of PM.	Legal barriers significantly complicate PM.	Legal barriers impose specific requirements on PM.	Legal barriers to PM are minimal.
Stakeholder Acceptance	Key stakeholders oppose PM or are unaware of it.	Some stakeholders are informed but sceptical or disengaged.	Most stakeholders are informed and show cautious support.	Key stakeholders are informed, supportive, and actively engaged.

Table 15: Guidance for the evaluation levels used in the process evaluation.

7.1.1.4 Process Selection

The basis for selecting processes for PM is the previously developed evaluation matrix. If a process received a score of zero in any evaluation dimension, it is excluded from consideration at this stage. Process selection can now be guided by a selection paradigm. These paradigms depend on the level and availability of PM capabilities within the respective organisation. A selection paradigm defines minimum thresholds for the four evaluation scores. These paradigms can be customised to fit organisational needs. Precedingly, processes can be prioritised based on their associated value case, the nature of their impact (e.g. eGovernment, budget management, application processing), or the underlying IT systems. The selection paradigm takes into account the resources a PA organisation can allocate to PM, recognising that, especially in PA, these may vary and are often limited in the initial stages. At certain stages, only processes belonging to specific selection paradigms may be feasible for a public authority or a specific organisational unit. In discussions with the experts, the following selection paradigms were identified as particularly relevant for PA:

Quick Wins: All evaluation factors score highly, allowing for rapid and straightforward implementation. These processes can yield immediate results with minimal effort.

Pilot Projects: These processes are technically feasible, and stakeholders are receptive; however, they may contribute only marginally to a value case. Nevertheless, conducting PM in this context can be valuable for testing the technology and gaining initial experience.

High Impact: These processes strongly support multiple value cases but may be technically and socially more complex. They often involve core administrative processes and may offer significant strategic benefits.

Learning Case: These cases relate to more complex technical environments, where the implementation effort is considerable. However, they offer valuable insights and learning opportunities for future data extractions from the same systems. This can be particularly advantageous when there are highly motivated IT specialists available with the necessary time resources.

This phase results in a process backlog, containing all processes identified as having PM value potential, taking into account the state of the organisation's current PM capabilities.

	Technical Feasibility	Value Case Relevance	Legal Barriers	Stakeholder Acceptance
Quick Wins	3	≥2	3	3
Pilot Projects	3	≥1	3	3
High Impact	≥1	3	≥1	≥1
Learning Case	≥1	≥2	≥2	3

Table 16: Exemplary evaluation paradigms.

7.1.1.5 Implementation Guidance

The technical implementation of PM depends on the specific technical characteristics of the software in use, as well as the selected PM tool. Consequently, this phase aims to provide broadly applicable guidance for implementation rather than detailed prescriptive instructions. Between the previous phase and this one, the actual procurement of a PM tool, and, if necessary, external project teams for support, may occur if it has not already been done. This can be particularly beneficial when the organisation first seeks to determine the potential value-add of PM through the value case definition and evaluation matrix, thereby justifying the effort and cost of a formal procurement process and the actual technical costs. To guide the implementation, PIPPA proposes the following steps:

(1) Normative Anchoring: This involves synthesising the laws relevant to the process and specifically identifying which process steps are fixed by regulations and require particular attention. These legal constraints should be considered throughout the PM activities. Ideally, this information can be drawn from the existing process documentation.

(2) Organisational Commitment & Trust: Before mining one or more processes, approval must be obtained from the staff council (*Personalrat*). In making the case, it is helpful to refer to the value cases and, where applicable, the potential reduction in staff workload. Senior management must also be convinced, which can likewise be achieved by highlighting the value cases. Employees in the affected department must be assured that the PM results will not be used to assess their individual performance. Ensuring trust is a continuous task and falls under the responsibility of both the Head of PM and the local PM Champion.

(3) Defining the Extraction Scope: In this step, the scope of the actual event log extraction is determined. It is particularly important to consider which PM technique is required by the underlying value case. Additionally, the required data granularity must be defined, as well as the relevant attributes to be included. The software canvas created for this process should also be consulted to identify from which systems the data needs to be extracted to analyse a given process. It is also important to ensure alignment with the PM technique associated with the value case. This step is carried out by the IT specialist in collaboration with the local PM Champion.

(4) Extracting Event Data: This step involves extracting the event log data from the respective systems. Responsibility for this task lies with the IT Specialist.

(5) Preparing Event Data: This step involves processing the extracted data. For example, specific viewpoints may be defined, and individual events may be split or merged. At this stage, data should also be pseudonymised, and any personal information removed from the datasets. Additionally, the event log data may need to be transformed into a format suitable for mining. Here too, consideration of the PM techniques associated with the related value cases is important. The IT Specialist is primarily responsible for this task, implementing the requirements specified by the local PM Champion.

(6) Process Mining: At this stage, the data is loaded into a PM tool, e.g. ProM, and analysed algorithmically. The resulting process visualisations and other PM outputs are then made available to the Head of PM, the local PM Champion, and, if applicable, the process analysts for interpretation.

7.1.1.6 Insights & Action

This final phase focuses on the interpretation of insights by the local PM champion, the relevant department, and, if applicable, a process analyst. A sound understanding of the operational context and implicit (process) knowledge is essential to interpret the results accurately and to derive actions that are both appropriate and feasible. PIPPA proposes the following three activities:

(1) Interpretation of Insights: The outcomes of PM, i.e. the generated process representations, must be analysed and understood by the local PM champion in collaboration with the respective department and, if needed, a process analyst. By adding contextual knowledge, meaningful interpretations can be drawn from the PM results. The IT specialist or the Head of PM can adjust the technical visualisation of the PM outputs within the tool as needed. For example, by modifying the sensitivity of detection algorithms. It is essential to comply with the conditions agreed upon with the staff council, particularly the restriction against accessing individual performance data. A role- and permission-based access control system within the PM tool can help ensure this compliance.

(2) Derivation of Actions: Based on the identified value cases, actionable recommendations, typically in the form of BPIs, are to be derived from the insights. The results of the prior normative anchoring, as well as the agreements with the staff council, play a guiding role in BPR. Implicit process knowledge is crucial for ensuring that the proposed actions are contextually appropriate and practically feasible. Therefore, the involvement of all relevant stakeholders, including those from other departments or units, is of significant importance.

(3) Alignment with Value Cases: The implementation of the derived actions is the responsibility of the respective organisational unit. To ensure that process modifications are clearly documented and accessible, the process analyst can model the updated processes accordingly. As actions are continuously derived and implemented, it is important to iterate and, if necessary, reconfigure the associated value cases. Actions may be linked to specific hypotheses, for instance: If action *X* is implemented, the throughput time will be reduced by two days. Such hypotheses can then be tested in later iterations or, where technically feasible, monitored continuously.

7.1.2 Proposed Roles & Responsibilities

PIPPA proposes exemplary roles and responsibilities to support the integration of PM into the organisational structure of public authorities. Ideally, the *PM unit* is embedded within the organisational unit responsible for BPM and digitalisation, typically a central staff unit (*Stabstelle Digitalisierung*). Given the often inflexible and limited resources in PA, the establishment of a full Centre of Excellence (CoE) is not recommended, at least not in early phases. Instead, a centralised anchoring of PM in the role of a Head of PM is suggested. It is important to note, however, that this represents a general recommendation and should be adapted to the specific context of each authority. The proposed roles are intended as additional responsibilities assigned to existing FTEs within the organisation, rather recommend than the creation of new positions. PIPPA proposes the following four roles. These results are based on the findings regarding organisational set-ups and role distributions from Chapter 3.1.2.

Head of PM: This individual holds a central position, for example, within a staff unit. They possess in-depth expertise in PM and serve as the central coordination point where all activities converge. The head supports the departments in implementing PIPPA and acts as the key liaison to senior management and the staff council. The Head of PM uses the PM tool in collaboration with the IT specialist, as this tool is typically provided centrally. The person is responsible for acceptance communication “upwards” within the organisation.

Process Analyst: This is an optional role within PIPPA. It involves a person who engages with organisational processes independently of specific units. Through specialised expertise, e.g. in BPMN, this role facilitates the more effective integration of PM into the existing BPM framework. The process analyst might thereby also contribute substantial methodological expertise in BPM such as the management of reference processes and the comparability of processes.

Local PM Champion: This role is assumed by someone within the respective organisational unit, often by an individual who already holds responsibilities within the local process management context, i.e. in process documentation. The role is essential for effective communication between the unit and the Head of PM. Moreover, this person plays a crucial role in contextualising PM activities and results, ensuring their relevance

and alignment with departmental specifics. The person is responsible for acceptance communication “downwards” within the organisation.

IT Specialist: The IT specialist possesses detailed knowledge of the domain-specific applications in use, particularly the software and database specifications typically provided by the vendor. They also have a technical education and a solid understanding of IT in general. They are responsible for the ETL activities required for PM. Together with the Head of PM, they usually operate the PM tool and provide the PM results to the local PM champions and process analysts.

This role distribution is limited to the essential set-up required for the execution of PIPPA. In an actual implementation, there may be many user roles with varying levels of engagement and intensity of use (Ammann et al., 2025).

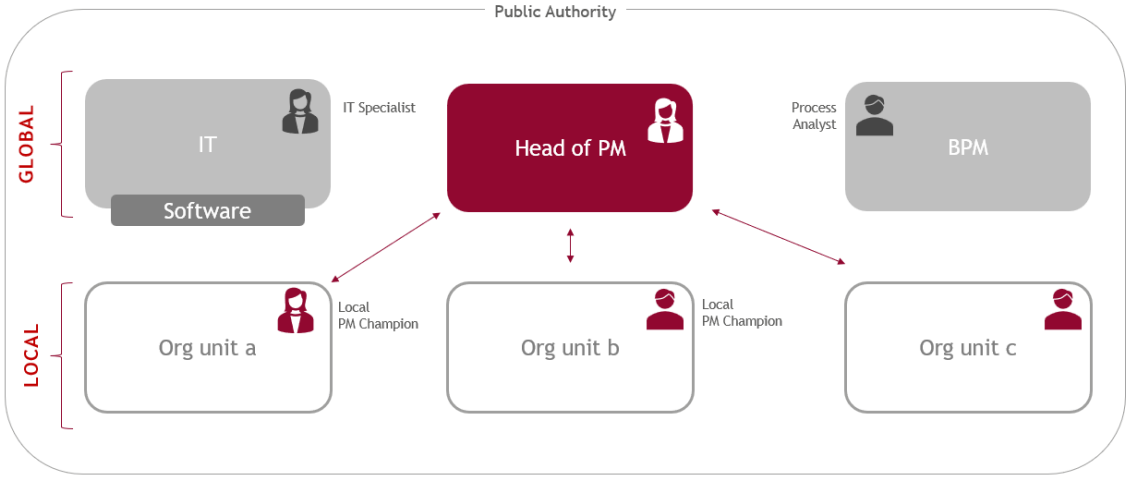

Figure 7: Proposed exemplary role set-up. Own illustration.

7.2 Results of First Evaluation of the Method

This formative evaluation aims to gather suggestions for improving the method. These proposed changes are presented below with supporting quotes. Overall, the method was perceived positively. The fact that it includes a proposal for organisational anchoring was also commended. Most experts appreciated that the method enables scaling PM across the entire organisation, allowing public authorities to move from a singular process view to a more comprehensive, cross-organisational perspective. As P8 exemplifies:

I think it would be great if, at some point, we had a kind of cockpit that would allow us to use process mining to shine a light on the entire city. That would be really

cool, if we could move in that direction. I'd also love it if we could meaningfully link it with the topic of automation. – P8, Interview I8

Drawing from their own PM project experience in their organisation, P8 also validated that a PA-specific PM method is needed and that concepts from the private sector do not fit:

What doesn't work, and I'm convinced it definitely won't work, is applying the same concepts used in the private sector. For example, if we promote it by saying we'll save the equivalent of eight positions or something like that, it just won't be effective. People won't go for it. – P8, Interview I8

Furthermore, P9 confirms that the central anchoring of process mining would be appropriate for their organisation:

Yes, so we have the central digital task force, responsibility for processes lies with them. They are essentially in charge of PICTURE, they hold the licenses and model the processes. They're also the ones who carry out organizational analyses, really looking at how the organization functions. And they should be the ones doing the process mining. – P9, Interview I10

Recommended Change 1: Understanding the Final Phase and Implementing Actions as a Continuous Effort [P1, P2, P8]

Some experts suggested framing the final activity more strongly as iterative, emphasising the continuous adjustment of value cases to underline that value generation through PM, particularly in the context of public administration, is an ongoing effort. This suggestion was adopted, as the DOs focus on long-term value creation.

It's really important that it doesn't just end with a one-time result. Process mining can only be justified if it's applied iterative. Especially in public administration, where changes take a long time, this is really important in my experience. – P2, Interview I11

Recommended Change 2: Consideration of Stakeholder Acceptance in the Evaluation of Processes [P1, P6, P7, P9]

For the individual evaluation of processes within an organisational unit, the willingness of all involved stakeholders should also be assessed. Even processes within the same unit may involve different stakeholders, such as other departments. This suggestion was adopted, as the design objectives explicitly call for consideration of complex stakeholder dynamics.

I think in our case, looking at the processes we're currently working on, another important factor would definitely be how open they are. That would really play a role for us. We have departments that are very eager to work with us and are

pushing hard for process improvements. And then there are others that have already been through a lot and aren't really up for it at the moment. So that would definitely be another factor to consider. – P7, Interview I13

Recommended Change 3: Consideration of Citizen Pain Points in Problem Definition [P2]

One expert suggested explicitly incorporating citizens' experiences with administrative processes, as this can serve as a compelling value proposition for PM within the organisation. This suggestion was adopted, as the method is intended to explicitly consider public value, in this case through the lens of citizen experience.

I think it's also important to include citizens' experiences when defining the problem. This can add a whole new level of impact when presenting the rationale to the agency's leadership. – P2, Interview I11

Recommended Change 4: Clear Definition and Configuration of Selection Paradigms [P1, P6, P8]

It was repeatedly noted that the presence of many PM-capable processes within an organisational unit does not necessarily imply that all of them can be implemented. As a result, a prioritisation based on different paradigms that take into account the resource availability within the authority was suggested. This suggestion was adopted, as the method should acknowledge the gradual development of PM capabilities and that PA takes longer to adopt to new technologies.

Yes, I was just thinking about how I would apply this. Given that we're quite behind in some areas, I would initially try to implement as many quick wins as possible to simplify a lot of things right away. Then I would strategically select a pilot project for something technically more complex, see how it goes, and use that as a basis to roll out the broader transformation.- P6, Interview I12

Recommended Change 5: Consideration of Additional Committees in Organisational Set-up [P6]

It was suggested that the method description should also include other appointed representatives, such as the gender equality officer or the anti-discrimination officer. Particularly when sensitive process data is processed, their proactive involvement is important for building trust. This suggestion was adopted to help ensure trust within the complex approval coordination required for PM initiatives.

Recommended Change 6: Provide clear Recommendations for the Design of Job Descriptions [P9]

It was suggested that the method should include concrete guidance for adapting job descriptions for PM roles. This suggestion was rejected, as it falls outside the scope of the method and is highly organisation-specific.

> *I can imagine that if we pursue this seriously, we would eventually set it up as a full program and establish it accordingly. As part of the program, services would be built up. That's how we're currently handling process mining as well. Over time, people will come to the city administration for it. But it's not as straightforward as in the private sector, where you can just assign a certain number of people to the task. In public administration, it's always a matter of creating and evaluating positions. In that context, job descriptions would be really helpful.- P7, Interview I13*

Recommended Change 7: Identification of RPA potential [P2, P8]

It was suggested that the method should also include the identification of automation potential through RPA. This suggestion was rejected, as it lies outside the scope of the method. However, such potential could be addressed as a value case within the method.

Recommended change 8: More Detailed Description of the Implementation Phase [P1, P2, P8]

Several experts with prior experience in PM projects within PA noted that a more detailed and technical specification of the implementation phase could be beneficial. This suggestion was partially accepted, the implementation phase was elaborated in greater detail, while technical aspects were considered only in a generalised manner.

Recommended change 9: Addition of permission management [P6]

It was suggested that the method should include an permission management component to control access to and viewing of PM results. While this suggestion is understandable, it was not adopted as it falls outside the scope defined by the DOs.

> *Yeah, I think when it comes to this topic, permissions are probably really important. If I think about SAP, for example, it's very clearly divided who has which permissions. And of course, you also need someone on the team who can access all areas, in case access is restricted." – P6, Interview I12*

Recommended Change 10: Definition of the Structure and Content of a PM Knowledge Repository [P6, P7, P8]

It was suggested that the method should include structural and content-related guidance for PM knowledge, as such knowledge remains scarce within public administration. This need was acknowledged in the problem statement. However, PM manuals containing

essential knowledge are already available on the market, and the development of such a repository falls outside the scope of a method. Therefore, the suggestion was rejected.

8 Demonstration & Evaluation of Method

This chapter addresses *RQ5* and presents the final instantiation of the method and the results of the evaluation of the second iteration (E3). The prototypical instantiation reflects the method presented in the previous chapter, which already incorporated the results from the first artefact-related evaluation (E2). This enables a demonstration of its application and fulfils the methodological criterion that the method should be supported by an IT tool (Denner et al., 2018).

8.1 Instantiation & Implementation of Method as Web Application

For demonstration & evaluation purposes, the method was implemented as a clickable prototype. The no-code web application thus enables the execution of a fictitious method instance. To enhance clarity and illustrate a practical application, example processes from the *KGSt (Municipal Joint Association for Administrative Management)* sample process catalogue for municipalities were plugged in (Beckmann, 2018), along with a sample organisational structure and roles & responsibilities assigned to fictitious individuals. Due to limited space, this section presents only a small selection of screenshots and depicts only selected sections. Additional screenshots can be found in Appendix L, along with a link to the web application and login credentials in Appendix M.

Management of the defined value cases:

In the tiles, the value cases are linked to the problems, objectives, and PM techniques, represented as icons, for visual representation.

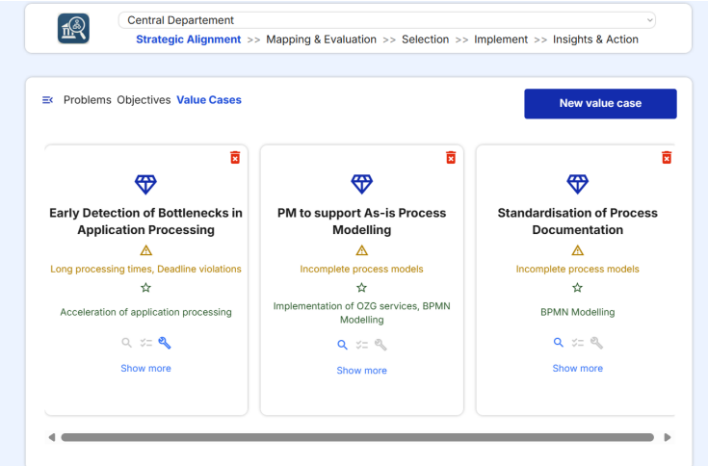

Figure 8: Value Case Definition, PIPPA Prototype. Screenshot

Mapping & Evaluation:

The tiles provide an overview of the mapped processes. The colouring of the icons indicates the rating of the respective evaluation score, which can be viewed when hovering above or *show more* is clicked. From here, the evaluation panel can also be accessed.

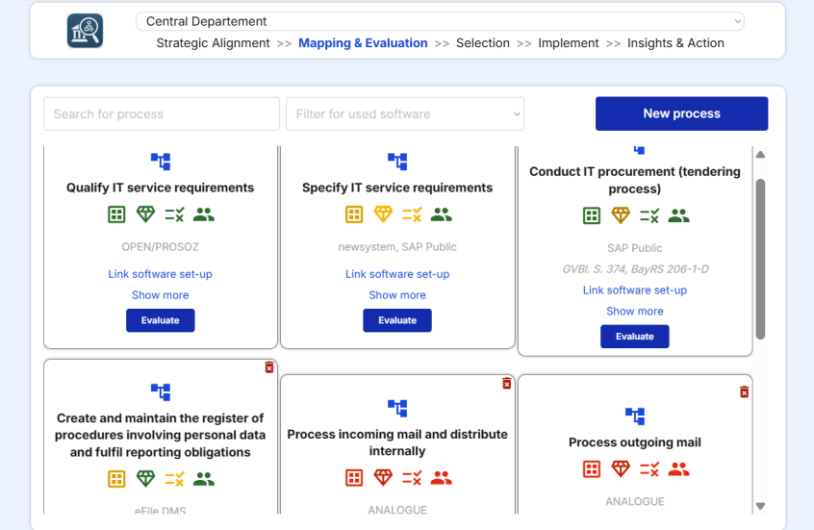

Figure 9: Mapping & Evaluation, PIPPA Prototype. Screenshot.

Assessment of underpinning IT systems:

In a virtual canvas, as proposed in the method, the IT systems underlying the process can be visualised via drag-and-drop. This is intended to simplify the following evaluation step. By dragging, the IT systems used within the organisation (left) can be assigned to the process (right).

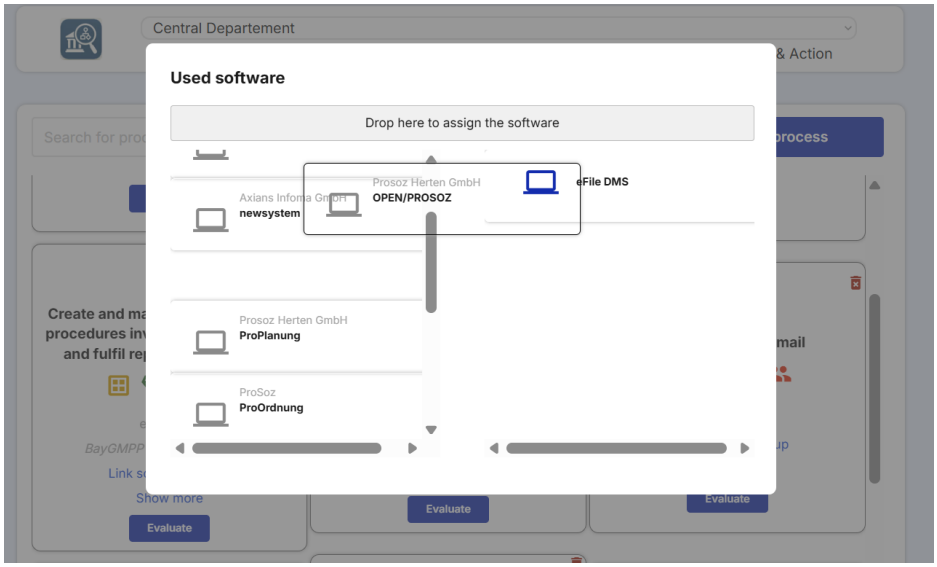

Figure 10: Mapping of respective IT Systems, PIPPA Prototype. Screenshot.

Assessment panel:

The assessment panel guides the user through all four evaluation phases and provides prompts to support the assessment. A slider allows the user to evaluate the process for each individual criterion.

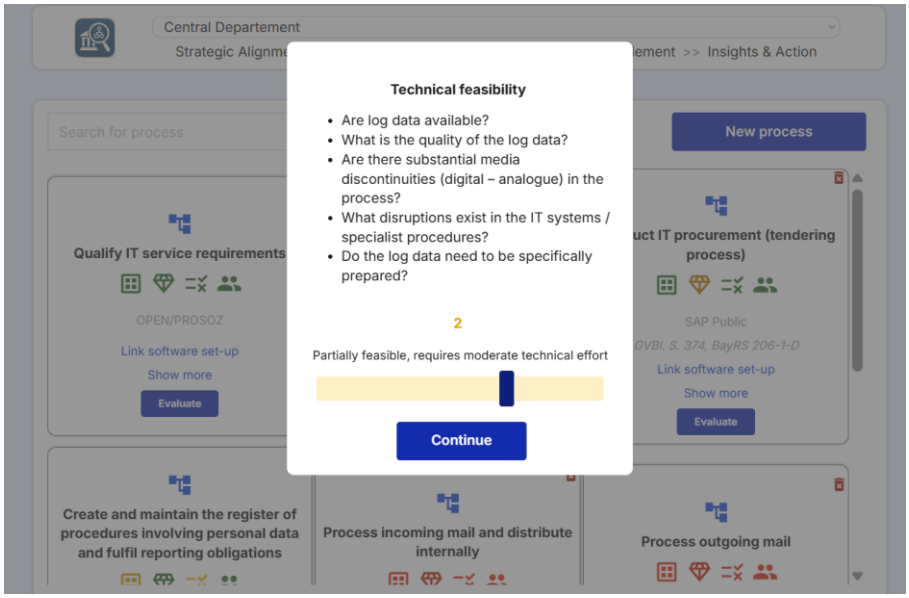

Figure 11: Evaluation Panel, PIPPA Prototype. Screenshot.

8.2 Results of Second Evaluation of the Method

The following sections present the results of the qualitative interviews and the quantitative survey conducted with the expert panel as part of the second and final

artefact-related evaluation (E3). These aim to assess whether the artefact is useful and whether the DOs have been attained.

8.2.1 Results of Qualitative Evaluation

This section presents aggregated observations derived from the interview data with supporting quotes.

Observation 1: The method is perceived as a helpful structuring tool [P6, P7, P10, P11]

Overall, the method was evaluated as helpful by all experts. In particular, the logical structure was praised, as it allows for a clear and transparent understanding of the results. The linking of problems with objectives and PM techniques was considered meaningful. It was also repeatedly emphasised that the value cases could serve as a basis for justifying the procurement of a PM tool, thereby confirming one of the method's underlying assumptions.

> *It was very easy to follow, especially the part about process selection, which I found particularly relevant. I also know that many municipalities already analyse or document their processes. So it would definitely be helpful to say there's some kind of connection or interface, or at least a way to link it together somehow. Otherwise, well, to be honest, I have to admit I wouldn't really know how the technical part actually works. – P10, Interview I19*

> *I think that's really good. The way the value cases are structured. Seeing things in isolation, whether it's challenges, goals, or anything else, is always difficult. It becomes hard to recognize the connections. So bringing everything together in this method, showing the relationships, where the challenges lie, what the goals are, and what might be tackled together in one go - that's really valuable. – P11, Interview I21*

Observation 2: The process selection phase is idealistic, the effort involved is often underestimated [P6, P8, P11]

Some of the experts described the process selection as an ideal state, while also noting that actual conditions often differ and that project structures tend to operate in a more erratic manner. Several experts reported that such initiatives in their authorities often emerge in a sporadic and ad hoc fashion. For a planned and structured methodological implementation, such as PIPPA, the necessary resources are frequently unavailable.

> *When I look at our procurement process, there are so many legal requirements for so many different things, you really don't want to have to work through all of that yourself. Sure, you can write it all down somehow, but there are experts for these*

kinds of things. Depending on your role, it could be pretty tough to deal with all those legal aspects right at the beginning. – P6, Interview I14

Observation 3: The organisational structure is clear, but the issue of acceptance is underestimated [P6, P7, P11]

The proposed roles and responsibilities within the organisational set-up also received positive feedback. However, it was noted that ensuring acceptance will remain challenging and that a considerable degree of mistrust is likely to persist, even with active measures such as a memorandum of understanding in place.

Observation 4: Opinions on the level of detail in process evaluation are divided [P1, P8, P10, P11]

Some experts criticised the method for being overly technical in certain areas of the evaluation activity. However, opinions on this matter varied. While some experts preferred a simplified selection process, others expressed a desire for greater detail and precision in the selection criteria and rating scales.

We don't start from the software side, but at the very least, we need to have a data foundation. I'd say our starting point is more about identifying someone who's willing and motivated, someone who's up for it. In that very first step, we do a kind of small proof of concept, and then we look at whether it makes technical and economic sense and whether the necessary data foundation is in place. – P8, Interview I19

Observation 5: The benefit-based value argument is convincing but should be tailored to specific target groups [P8]

It was pointed out that different target groups need to be considered in the communication and justification of PM, and that messaging should be tailored accordingly. For example, communication with employees should emphasise workload reduction, whereas communication with senior management should focus on efficiency gains.

It always depends on who you're pitching it to. Personally, within the administration, I always argue from the perspective of reducing workload. Always. I know others approach it differently, but I think it's smarter to talk about relief rather than efficiency gains. Of course, if you're getting funding from the finance department to test or implement certain technologies, then you do have to calculate cost-effectiveness. And ultimately, yes, it's also about figuring out what tasks the machine can take over that people might no longer need to do. But still - you always have to tailor your message to your audience. – P8, Interview I19

Observation 6: Integration of the method into existing Process Platforms is desired [P1, P6, P8, P10, P11]

Several experts who are directly involved in process management within their organisations, or are operationally responsible for it, noted that the method should ultimately not function as a standalone solution, but rather as an addition, e.g. as a plug-in, to existing process management methodologies. PICTURE and SAP Signavio were explicitly mentioned in this context. According to these experts, the process attribute data available within such platforms would allow for a more efficient and effective implementation of PIPPA's evaluation activity.

> *In my opinion, this should really be integrated into a process platform. Ideally one that also provides an overview of the Fachverfahren used, the databases, the underlying technologies. After all, these are essentially just attributes of the individual processes. I would place this directly within process management, rather than storing it separately in a dedicated application. I can manage it through that platform, since process mining has its own technical requirements, but so do many other things. At the end of the day, it's not much more than that. – P11, Interview I21*

> *We used a platform to look at all the processes we have and captured certain attributes to create a solid foundation. In the past, our focus was strongly on identifying digitalization potential. Based on specific indicators, we were able to say, for example, "Let's take a closer look at these particular processes," because they are especially relevant for digitalization. Application processes, high case volumes, and a high degree of standardization are some examples that come to mind right away. – P8, Interview I19*

Observation 7: Data privacy issues were perceived to be solvable [P8, P10, P11]

Several experts clearly stated that they are willing to mine processes involving sensitive data and consider the associated compliance-related effort to be acceptable. They propose to aggregate data from individual levels so that a direct associations from data points to individuals is not possible. In this evaluation, the issue was regarded as less problematic than in previous iterations. It was noted that the legal anchoring concerning sensitive data might be overly emphasised in the method.

> *From our perspective, this is generally, I'd almost say, entirely feasible. Of course, when it comes to processing personal or citizen-related data, we're able to visualize who within our organization is involved and when. But we don't do this at the individual level. Instead, we approach it via roles or positions. For example, as in your case, we would say that the finance department's case processing is involved and that typically includes several people. So we're not dealing with identifiable individuals. From my point of view, that's usually not a problem at all. – P10, Interview I18*

8.2.2 Results of Quantitative Evaluation

The experts' perception and assessment of the method were captured through a survey, see Appendix N. Participants rated various statements about the method using a Likert scale from one to seven, where one indicates *very strong disagreement* and seven indicates *very strong agreement*. The results are presented in the following figures. The colour scheme links the bars to the corresponding evaluation units, and the number within each bar indicates how many times the respective rating was selected. The statements relate to the attainment of the DOs, the clarity of the method, its usefulness, ease of use, efficiency, generality, and operationality (Sonnenberg & vom Brocke, 2012, p. 391).

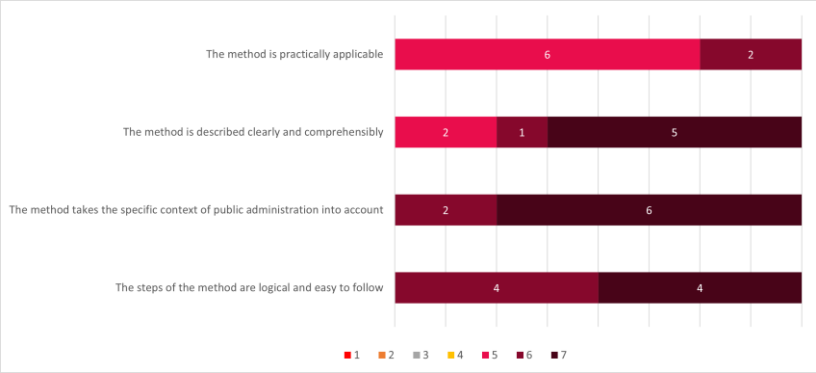

Figure 12: Results of Evaluation Survey 1/3. Own illustration.

Figure 12 shows that the experts generally perceived the method as practically applicable, although agreement with this statement was somewhat lower compared to others. In contrast, the clarity of the method was rated slightly more positively. The strongest agreement was recorded for the statement that the method specifically addresses the context of public administration. Experts also strongly indicated that the method is logical and easy to follow.

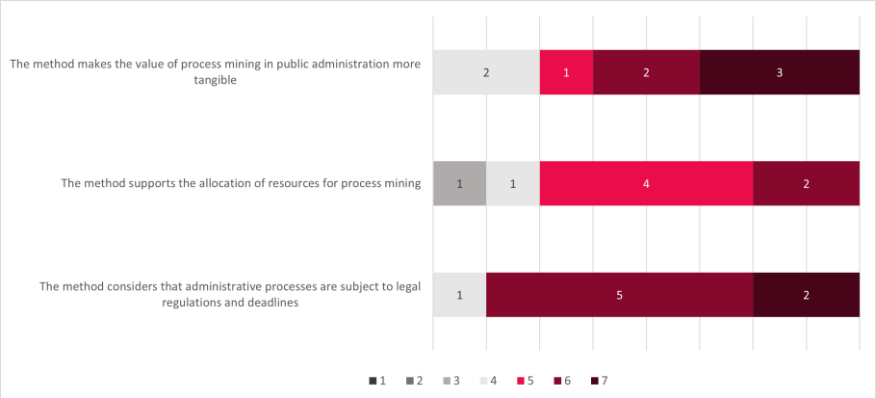

Figure 13: Results of Evaluation Survey 2/3. Own illustration.

Figure 13 indicates that a majority of the experts agreed that PIPPA makes the value of PM more tangible. The provision of resources for implementing the method received mixed responses, revealing a divided picture, although the majority expressed agreement. The specific legal constraints associated with administrative processes were perceived by the experts as being adequately considered within the method.

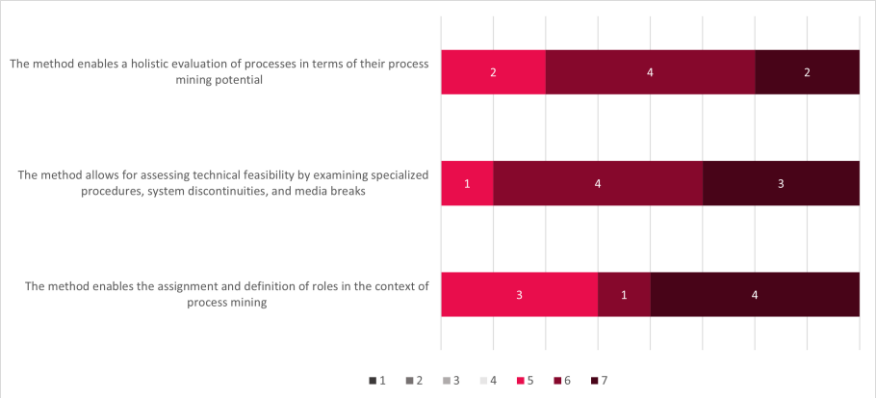

Figure 14: Results of Evaluation Survey 3/3. Own illustration.

Figure 14 shows that the experts agreed processes can be evaluated for their PM potential across dimensions relevant to public administration. There was particularly strong agreement with the statement that the assessment of technical feasibility specifically considers the characteristics of IT systems in the public sector. The proposed roles and responsibilities were also positively received.

8.2.3 Attainment of Design Objectives

Based on the qualitative and quantitative evaluation results, Table 17 summarises whether the design objectives were achieved. Overall, the expert panel confirmed the attainment of the design objectives. However, the facilitation of resource and capability

provision for PM was clearly identified as a weakness of PIPPA in both the interviews and the survey results. As the requirements for methods defined by Denner et al. (2018, p. 335) were also adopted as secondary DOs, the adherence to them was checked by the author through logical reasoning in both evaluation rounds.

Design Objective	Assessment of Expert Panel
DO1.1	Fully attained.
DO1.2	Fully attained.
DO2.1	Fully attained.
DO2.2	Fully attained.
DO2.3	Fully attained.
DO3.1	Fully attained.
DO3.2	Partially attained, method considers capabilities as secondary.

Table 17: Assessment of Attainment of DOs.

9 Discussion

This chapter summarises the key findings of the thesis, discusses their implications for practice and research, and highlights several limitations of the research design and the findings.

9.1 Summary of Findings

This thesis pursued the research goal of proposing a domain-specific method that enables public authorities to realise PM value within their organisation. Based on this objective, five subordinate research questions were derived to provide guidance. The following section presents a summary of their respective answers.

RQ1: What is the current state of the literature regarding managerial aspects of process mining and process mining in public administration?

The literature on managerial aspects of PM is still emerging but increasingly recognises the importance of organisational capabilities, strategic alignment, and governance structures. Recent research has expanded beyond technical execution to include maturity models, implementation methodologies, and the organisational impact of process transparency. Research on PM in PA remains sparse, technically oriented, and exploratory, with little attention to managerial or organisational implementation and no substantial methodological guidance available.

RQ2.1: What, if any, perceived benefits do relevant practitioners in public administration associate with process mining?

Practitioners indicate that, if effectively implemented, PM could support BPM in PA by enhancing transparency, traceability, and data-driven decision-making. It may also strengthen legal compliance through automated checks, facilitate digitalisation by informing IT development and automation, and improve strategic management through better resource allocation. Additionally, PM has the potential to boost process performance by identifying inefficiencies and improving public service delivery outcomes.

RQ2.2: Why are these benefits currently not being realised?

PM benefits are mainly not being realised because public authorities face significant organisational, technical, and human barriers, including rigid hierarchies, risk aversion, limited resources, and strict data protection rules which negatively impact the use of PM. Additionally, there is often a lack of event logs, process transparency is met with resistance, and the necessary skills, awareness, and institutional support for PM are frequently absent.

RQ3: What objectives should a domain-specific method pursue that aims to overcome the outlined problems?

To solve the outlined problem, a method should help public authorities identify suitable PM opportunities, evaluate their potential, and scale them along pre-defined value cases. It should also account for fragmented IT systems, legal constraints, hierarchical structures, and provide guidance on the organisational and technical foundations needed to embed and sustain process mining effectively.

RQ4: How should a method that fulfils the defined design objectives be designed?

The developed method, called PIPPA, consists of six sequential phases: Initialisation, Strategic Alignment, Process Mapping & Evaluation, Process Selection, Implementation, and Monitoring & Actions. It supports public authorities in identifying process mining opportunities, aligning them with organisational goals and problems, evaluating processes based on feasibility, relevance, acceptance and legal factors, and guiding implementation through a structured, value-driven approach. PIPPA also includes role definitions and practical recommendations for embedding PM within the specific technical, legal, and organisational constraints of PA.

RQ5: How do relevant practitioners in public administration perceive and evaluate a domain-specific method for process mining?

Practitioners generally perceived the method positively and acknowledged, to varying degrees, its attainment of the design objectives. However, they also pointed out certain limitations, noting that the method would be best used in conjunction with existing process platforms. Furthermore, the method assumes ideal conditions, whereas the reality of BPM within public authorities is often less structured and project initiation more ad hoc.

9.2 Implications for Research & Practice

From a practical perspective, this method offers an initial point of reference for the topic of PM. It is important to characterise and treat PIPPA as a starting framework for PM applications in PA. This thesis represents only an initial contribution and practitioners may choose to apply only selected components of the method, such as the organisational set-up. Current discourse within PA practitioner communities focuses heavily on process-driven automation and efficiency potentials, often in connection with AI and RPA (Rabe, 2025; Schmidt, 2023). In this context, the thesis aims to raise awareness of PM, encouraging individuals in PA to regard it as an additional, valuable instrument among other AI tools.

Furthermore, PIPPA must critically address the question of how it differentiates itself from existing PM methodologies. Like MAPPER, PIPPA shares the goal of enabling the scaling of organisational PM portfolios (Fischer et al., 2024). However, MAPPER primarily defines value cases in terms of BPI projects. In contrast, PIPPA offers a multidimensional approach to value case definition, better reflecting the non-profit-oriented value creation characteristic of PA. MAPPER, PM2 and other PM methodologies generally assume the availability of data and overlook the actual fragmentation of IT systems in some industries (Aguirre et al., 2017; van der Aalst, 2011b; van Eck et al., 2015). They further do not provide a mechanism for evaluating legally prescribed process requirements. In addition, PIPPA introduces a role set-up that accounts for hierarchical structures and the complexity of committee coordination within public authorities. As such, PIPPA might serve as a blueprint for the development of other domain-specific PM methodologies in future research.

From a research perspective, this thesis contributes to two strands of scholarly interest: first, to the organisational implications of PM, and second, to domain-specific applications of PM. The author positions this thesis as a contribution to two academic disciplines: *Information Systems*, particularly in relation to the impact of process mining on socio-technical systems, i.e. organisational aspects, and *Public Administration*, with a disciplinary focus on the digitalisation and modernisation of PA. This thesis aligns especially with recent trends exploring the use of machine learning techniques to enhance public value creation within public authorities (Anshari et al., 2024; Mikalef et al., 2023).

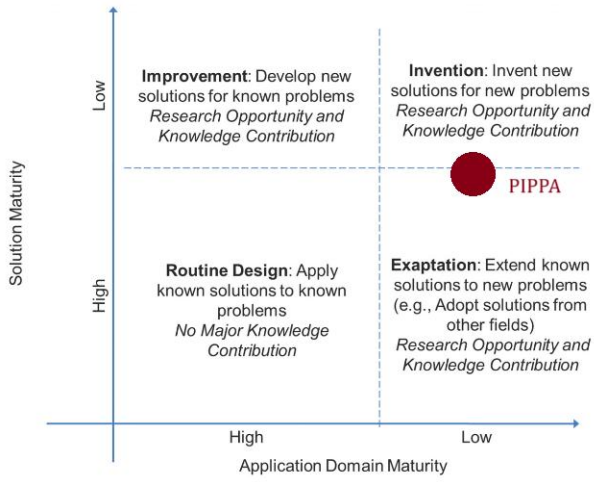

Figure 15: Positioning of PIPPA within the DSR Knowledge Contribution Framework. Adapted from Gregor & Hevner et al. (2013, p. 345)

Applying the DSR Knowledge Contribution Framework, the target artefact of this thesis can be positioned between an *exaptation*, as existing methodological knowledge was adapted, and an *invention*, as a previously unexplored problem was addressed (Gregor & Hevner, 2013). This indicates that future research can build upon these findings to further improve the maturity and goal fulfilment of a domain-specific PM method for PA.

9.3 Limitations

Before, during and after the research, the methodology was critically assessed with regard to its internal and external validity (McDermott, 2011).

Regarding internal validity, the DSR methodology by Peffers et al. (2007) was applied rigorously and tailored to the research goal. While a concrete single case study might have produced more consistent and in-depth results, it was not feasible due to the specific legal constraints of PA regarding research projects. The artefact was evaluated in a naturalistic setting, though this was confined to the conversationally conveyed perspectives and experiences of the experts. A real-world application of the method could further enhance both its practical validation and its empirical grounding. It should also be noted that the author had repeated contact with several of the experts, who were informed about the progress of the research. As a result, there is a possibility that some responses during the evaluation may not have been entirely candid, as participants might have been reluctant to provide critical feedback in order not to disadvantage the author.

In terms of external validity, it should be noted that the expert panel was composed of a specifically relevant target group. The selection of the eleven experts appears appropriate given the scope of the thesis, and the panel represents practitioners from all federal levels accounting for differing circumstances across levels and authority types. However, the panel might present a *selection bias*, as the individuals chosen primarily signalled a willingness to engage with PM in their contexts, either through membership in a professional network or via their skills listing on LinkedIn. Consequently, especially the data related to use intents should be interpreted as non-representative.

The target artefact itself also exhibits several limitations, which were noted and justified during the definition of the design objectives and the evaluations. For instance, the definition of capabilities is rather schematic, the role descriptions are relatively general, and the procedural steps are presented in a generalised manner. Moreover, technical aspects, such as data extraction, are addressed only at a high level and lack detailed specification. Methods as DSR artefacts are typically characterised by a constrained specificity and low maturity, as they serve to operationalise abstract design knowledge (Gregor & Hevner, 2013, p. 342).

10 Conclusion

Process mining can offer substantial benefits in the context of public administration. However, its application requires a domain-specific approach that takes into account the particular challenges faced by the public administration across the dimensions of people, technology, organisation, and value creation. This thesis introduces PIPPA as an initial methodological proposal to address this need. As it has several limitations, it is by no means final and should rather be seen as a starting point upon which further research and practical experience can build. PIPPA aims to enable the identification, evaluation, and scaled realisation of process mining value within public administration. In addition, it proposes exemplary roles and responsibilities to support organisational implementation. The problem analysis, as well as two instantiations of the method, were evaluated and refined through an expert panel consisting of eleven practitioners from or close to public administration.

This thesis represents the first in-depth engagement with process mining in public administration from a domain-specific organisational perspective. It also presents the first methodological proposal tailored to this specific context. Future research could extent on this by focusing on the following.

The method could be further evaluated, validated, and refined through application in case studies. A single case study, in which a public authority is actively observed in the introduction of process mining, could yield valuable insights that only emerge during the practical implementation of the method. Additionally, the method and broader knowledge of process mining in public administration could be explored in specific sub-domains, such as the judiciary or law enforcement. Furthermore, methodological knowledge on process mining in public administration could be integrated with existing BPM methodologies tailored to the public sector. The development of actual technical prototypes may also be of interest, for instance, to establish technical guidelines for common *Fachverfahren* and procedural standards such as *XÖV*. In addition, the interpretation of PM results within the context of public administration also presents an opportunity for future design science research.

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Appendix

A Supplements on GitHub Repository

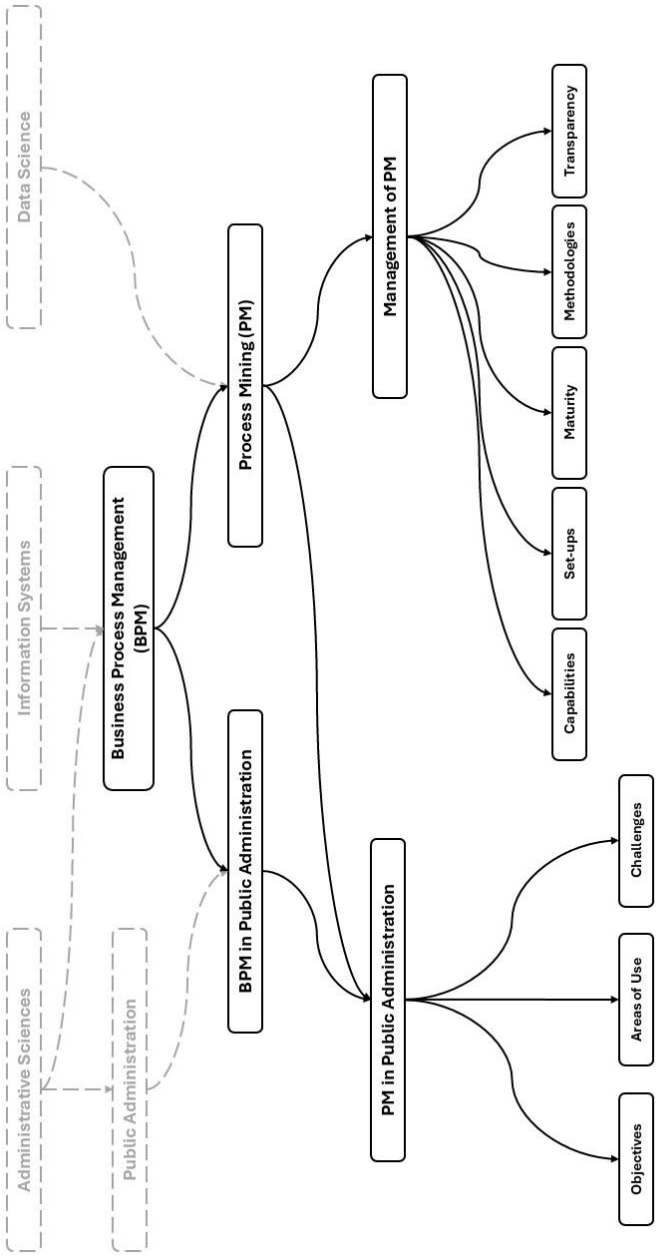
To keep the appendix of this thesis concise while ensuring the traceability of results, various supplementary materials are provided in a private repository maintained by the author.

Link to repository: https://github.com/androthan/ma-thesis-supplements

Contents of Repository:

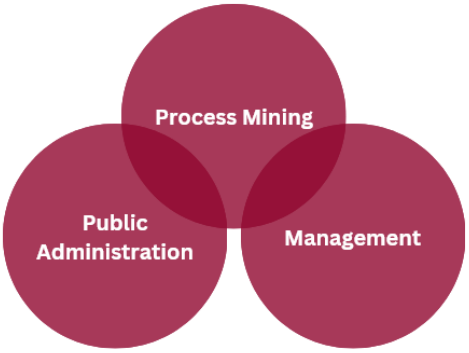
- The first instantiation of the method, in the form of a German-language Microsoft PowerPoint presentation as used during the demonstrations (2025-05_JG_MT_Instantiation-1-de.pdf)
- The first instantiation of the method, translated into English (2025-05_JG_MT_Instantiation-1-en.pdf)
- Code Summary Report for Problem Analysis Interviews, exported from NVIVO (2025-05_JG_MT_Problem-Interviews_Code-Summary.pdf)
- Source code of the web application prototype in the proprietary Bubble.io format (2025-05_JG_MT_Prototype-Instantiation-AppCode.bubble)
- SLR Results and Matrix of Primary Concepts (2025-05_JG_MT_SLR_PMMgmt_Results.xlsx & 2025-05_JG_MT_SLR_PMPub_Results.xlsx)
- SLR Justified Additions (2025-05_JG_MT_SLR_PMMgmt_OtherInclusions.xlsx & 2025-05_JG_MT_SLR_PMPub_OtherInclusions.xlsx)

B SLR Concept Tree



C SLR Search Operators

The SLR focuses on process mining, with two primary thematic areas: its application in public administration and the managerial aspects of the topic. Conceptually, these represent the intersection illustrated in the diagram below. For both searches, multiple keywords and keyword combinations were tested. After a brief qualitative assessment by the author, the following search strings were found to comprehensively cover all relevant articles and concepts.



Organisational aspects of PM:

"process mining" (Title) AND (organization* OR "management" OR "managerial" OR "portfolio") (Topic) NOT "educational" OR health* OR "manufacturing" (Topic) and Proceeding Paper or Article or Review Article or Book Chapters or Early Access (Document Types)

Filter criteria:
Date range: 2015 – 2025
Language: English

The search can be replicated using the following link and a university login to Clarivate Web of Science (WoS):

https://www.webofscience.com/wos/woscc/summary/61f3e74d-422e-47c3-8822-be63434a1b33-0156605d75/relevance/1

PM in the Public Sector:

"process mining" AND (government OR "public administration" OR "public sector") (Topic) and Proceeding Paper or Article or Review Article or Book Chapters or Early Access (Document Types)*

Filter criteria:
Language: English

The search can be replicated using the following link and a university login to Clarivate Web of Science (WoS):

https://www.webofscience.com/wos/woscc/summary/8fb46a76-980d-4e4e-8cf1-c3ef89eff770-0160ee8a38/relevance/1

D SLR Search Results and Concept Matrix

The search results were each exported into Microsoft Excel files for further processing and conceptual classification. These files have been uploaded to the associated GitHub repository.

Managerial aspects of PM: https://github.com/androthan/ma-thesis-supplements/blob/main/2025-05_JG_MT_SLR_PMMgmt_Results.xlsx

PM in public administration: https://github.com/androthan/ma-thesis-supplements/blob/main/2025-05_JG_MT_SLR_PMPub_Results.xlsx

E SLR Other Inclusions

A small number of papers were nonetheless considered for inclusion in the SLR, despite not appearing in the initial search results. These constitute *justified additions*. They either were not in the target language (English), were identified through alternative means such as Google Scholar during the exploratory phase, or were published after the search was conducted. These papers and their conceptual classification can be viewed in the associated GitHub repository:

Managerial aspects of PM: https://github.com/androthan/ma-thesis-supplements/blob/main/2025-05_JG_MT_SLR_PMMgmt_OtherInclusions.xlsx

PM in public administration: https://github.com/androthan/ma-thesis-supplements/blob/main/2025-05_JG_MT_SLR_PMPub_OtherInclusions.xlsx

F Expert Interviews

ID	Participant	Evaluation Activity	Date	Duration (in min)	Mode
I1	P1	E1	17/02/2025	35	Online Video Meeting
I2	P2	E1	21/02/2025	32	
I3	P3	E1	04/03/2025	30	
I4	P4	E1	07/03/2025	31	
I5	P5	E1	19/03/2025	32	
I6	P6	E1	01/04/2025	32	
I7	P7	E1	03/04/2025	37	
I8	P8	E2	23/04/2025	35	
I9	P1	E2	24/04/2025	35	
I10	P9	E2	25/04/2025	31	
I11	P2	E2	25/04/2025	30	
I12	P6	E2	29/04/2025	47	
I13	P7	E2	30/04/2025	47	

I14	P6	E3	06/05/2025	53	
I15	P7	E3	08/05/2025	53	
I16	P2	E3	09/05/2025	39	
I17	P1	E3	09/05/2025	46	
I18	P10	E3	15/05/2025	40	
I19	P8	E3	16/05/2025	51	
I20	P9	E3	16/05/2025	45	
I21	P11	E3	19/05/2025	55	

G Initial Problem Statement

Public administration faces significant challenges in using PM due to a complex process landscape and fragmented IT systems, which hinder data integration and analysis. Efforts might further be complicated by adverse political attitudes, legal constraints, and unclear responsibilities. This can lead to prolonged pilot phases and a lack of strategic alignment. Additionally, general employee resistance to change and insufficient methodological knowledge hinder PM adoption, while poor data quality undermines the reliability of PM insights. These barriers might prevent the effective implementation and scaling of PM initiatives in the public sector.

Problem Items Derived from the Literature:

Barriers / Challenges	Literature References
Complex process landscape	Racis & Spano, 2024
Adverse political attitudes	Racis & Spano, 2024
Lack of strategic PM alignment	Zuidema-Tempel, 2022
Legal constraints	Lück-Schneider, 2016
Long (PM) pilot phases	Zuidema-Tempel, 2022
Unclear responsibilities	Zuidema-Tempel, 2022
General employee resistance to change	Racis & Spano, 2024
Lack of methodological PM knowledge	Racis & Spano, 2024, Zuidema-Tempel, 2022
Fragmented IT systems	Mingazov & Celli, 2024
Insufficient data quality	Racis & Spano, 2024

H Interview Questionnaire for Problem Analysis Interviews

→ Phrase questions hypothetically if PM is not adapted by the authority and ask about intention to use.

Introduction

- Can you please introduce yourself and describe your current role in the public administration?
- How familiar are you with the concept of process mining? → Explain PM if necessary.
- (When and how did your organization first become involved with process mining?
- (What were the initial motivations for exploring or implementing process mining in your department?)

People

- Who are the main stakeholders involved in the process mining or BPM in your organization?
- How have employees responded to the introduction of process mining tools or projects?
- What kind of training or support was provided to staff using or affected by process mining?
- Can you share any examples of how process mining has changed daily work routines for staff?

Organization

- How would you describe your organization's general attitude toward innovation and digital transformation?
- What departments or processes were prioritized for process mining, and why?
- How is process mining integrated into your organization's process improvement or decision-making framework?
- Were there any internal barriers or resistance when implementing process mining? If so, which and how were they addressed?

Technology

- What process mining tools or platforms are currently being used? → ask for cloud or on-prem, not the specific tool
- How do you ensure data quality and availability for effective process mining?

- Were there any technical challenges in integrating process mining with your existing systems (e.g., ERP, document management)?
- How is data privacy and security handled, especially given the sensitive nature of public administration processes?

Perceived Benefits

- What tangible benefits have you observed since adopting process mining?
- Can you share a specific success story or project that demonstrated clear value?
- Has process mining influenced how performance is measured or how services are delivered?
- What would you say are the long-term strategic benefits of process mining for public administration?
- What advice would you give to another public administration agency considering process mining?

I Interview Protocol for First Artefact-related Evaluation (E2)

Introduction

- Explain the interview purpose: to gather input on the early version of the PM method for public administration.
- Emphasize focus on usability, feasibility, clarity, and improvement suggestions.
- Confirm consent to record and explain confidentiality.

Background

- Can you briefly describe your role and experience with process improvement or digital tools in public administration?
- Have you worked with or implemented process mining before? → Do not ask if you already interviewed them.

Evaluation by Phase

Phase 1: Strategy

- How clear and useful is the approach to defining value cases through problem-goal-function alignment?
- Are the distinctions between problem types (legal, organizational, citizen-focused) helpful and realistic?
- Does the model accommodate the complexity and rigidity of administrative structures effectively?
- What improvements would you suggest for defining strategic alignment in this phase?

Phase 2: Mapping & Evaluation

- Are the three evaluation criteria (technical feasibility, legal context, PM value case) sufficient?
- Do the scoring scales provide meaningful guidance for assessing processes?
- Would departments realistically be able to assess processes using these criteria?
- How could this phase be simplified, clarified, or made more actionable?

Phase 3: Selection

- Do the project type categories (Quick Wins, Pilot Projects, Transformation) make sense in your context?
- Does the matrix-based selection method support good prioritization decisions?
- Are there other selection criteria or classifications you would recommend adding?

Phase 4: Implementation

- How feasible is the technical implementation flow (data extraction, transformation, tool use)?
- Are the described roles and responsibilities in this phase sufficient and appropriate?
- What barriers do you foresee for successful implementation?

- What would help support practical use in a public administration setting?

Phase 5: Monitoring

- Does the method provide a workable approach for continuous monitoring and adaptation of value cases?
- Is it clear how results will lead to concrete actions or improvements?
- What's missing to support sustainable value realisation from PM?

Organizational Setup

- How realistic is the proposed central-local division of roles (central PM lead, local process owner, IT specialist)?
- Would these roles be easy to assign within your organization?
- Are the communication flows (upwards/downwards) and responsibilities well-defined?
- What would you change or improve in the role model?

Overall Impressions

- What is the most promising part of the method?
- What do you see as its biggest risk or shortcoming?
- What would be the most valuable change to implement before progressing further?
- Any additional suggestions or conclusions?

J Interview Protocol for Second Artefact-related Evaluation (E3)

Introduction

- Brief overview of PIPPA.
- Mention the method's phases and roles and its implementation as a web-based prototype.
- Request permission to record and assure confidentiality.

Background Questions

- Can you briefly describe your experience with process management in public administration?
- What current methods or practices are used to evaluate or scale process improvements?
- What challenges do you typically see in introducing new analytical or management methods in PA settings?

Walkthrough of the PIPPA Prototype

- Brief demonstration of the prototype/web application.
- Highlight key phases and features.
- Clarify that feedback will now follow the six phases of the method.

Phase-Based Evaluation of PIPPA

Phase 1: Initialization

- Does PIPPA cover the necessary organizational readiness for PM?
- How realistic are the recommendations regarding roles, stakeholder engagement, and technical preparation?
- What barriers do you anticipate in achieving these target states in real-world authorities?

Phase 2: Strategic Alignment

- Does the process of formulating value cases help align PM with strategic goals?
- Is the distinction between organisational, regulatory, and citizen-oriented problems useful?
- Can the concept of value cases help build a strong justification for PM in your context?

Phase 3: Process Mapping & Evaluation

- Are the four evaluation criteria appropriate?

- How feasible is this evaluation in your organization?
- Would stakeholders be willing and able to contribute to such an assessment?

Phase 4: Process Selection

- Do the selection paradigms support a pragmatic rollout?
- Would this step help prioritise efforts effectively in your context?
- How flexible are the paradigms when capacities are limited?

Phase 5: Implementation

- Are the steps clear and feasible?
- What organizational or legal barriers might complicate this?
- Would the described collaboration between roles be workable in your authority?

Phase 6: Monitoring & Actions

- Does the method support meaningful interpretation of PM outputs?
- Can it guide actionable and realistic improvements?
- How does the alignment with value cases during implementation help sustain process improvements?

Organizational Setup & Roles

- Are the proposed roles realistic?
- What adaptations would be needed for this to fit your context?
- How critical is the presence of a Local PM Champion for sustained success?

Scenario-Based Vignettes

→ Only use if expert doesn't bring examples from their context.

Please respond briefly to each vignette. For each:

- Would PIPPA help address this case?
- Where might it struggle or need adaptation?

- A city's citizen service center has long waiting times and manual processes.
- A regional administration has overlapping services after a department merger.
- A national permitting agency is under political pressure to deliver faster results.
- A municipal finance department wants to use PM to standardise procurement workflows.

Overall Impressions

- What do you see as the greatest strength of the PIPPA method?
- What would need to change for this to work in your context?
- Would you recommend piloting or further development of this method?
- Any final suggestions?

K Problem Analysis: Codebook

These codebooks was exported from NVivo. The code descriptions were enhanced using *OpenAI ChatGPT*.

Codes relating to Perceived Benefits:

Code	Definition
Discover document flows	Apply when a passage discusses uncovering or mapping how documents move through administrative processes. Use when interviewees refer to visualizing document paths or understanding document handovers across departments.
Enable department-level BPM	Use when the speaker describes empowering individual departments to manage or improve their own business processes. This includes mentions of decentralized process ownership or tailored BPM efforts.
Enable objective process evaluation	Apply when interviewees talk about using data to assess processes without bias. This includes references to fact-based analysis, removing subjective judgment, or relying on event logs for evaluation.
Enable strategic BPM	Use when a passage links Process Mining to high-level BPM initiatives or long-term planning. Look for mentions of aligning processes with organizational strategy or integrating BPM into broader governance.
Establish process transparency & awareness	Code when the speaker highlights making processes more visible or understandable across the organization. This includes improving

	stakeholder awareness or demystifying internal workflows.
Extract process knowledge from legacy systems	Apply when Process Mining helps to uncover process behaviour embedded in old or undocumented IT systems. Use when the interviewee refers to gaining insights from historical or hard-to-access data.
Leverage central BPM capabilities	Use when interviewees mention using organization-wide BPM tools, standards, or resources to improve processes. This includes central coordination or support structures for BPM.
Replace manual process screening and modelling	Apply when passages refer to automating traditional methods of process analysis, such as workshops or interviews. Use when Process Mining substitutes manual effort in modeling or understanding processes.
Standardize processes	Use when the speaker talks about harmonizing or aligning process steps across units or departments. Apply when Process Mining supports defining best practices or ensuring consistent execution.
Enforce policy compliance	Apply when Process Mining is used to detect violations or ensure adherence to rules and regulations. Look for references to identifying non-compliance or enforcing standards.
Support institutional accountability	Use when the passage links Process Mining to transparency in responsibilities, performance, or compliance. This includes mentions of enabling oversight or justifying decisions/actions.
Enhance IT requirements engineering	Code when Process Mining supports defining or refining IT system requirements. Use when interviewees mention using process data to inform system design or improvement.
Identify/realise automation potential	Apply when Process Mining is used to find areas where automation can be introduced or improved. Look for mentions of robotic process automation (RPA), efficiency gains, or repetitive tasks.
Leverage digitalization efforts	Use when the speaker links Process Mining to broader digital transformation initiatives. Apply when it supports modernization, digitized workflows, or use of digital technologies.
Support EAM	Apply when Process Mining is tied to managing IT landscapes, business capabilities, or aligning IT with business processes. Use when it contributes to system mapping or architecture decisions.
Enhance data analytics capabilities	Use when interviewees mention improved ability to analyze processes or operational data. Apply when Process Mining is part of a broader analytics or data-driven decision-making effort.
Leverage strategic controlling	Code when the speaker refers to using Process Mining in support of strategic performance measurement, planning, or decision-making. Use when controlling is tied to business goals or KPIs.
Optimize budgeting	Apply when Process Mining contributes to more accurate or efficient budget planning or resource allocation. Use when insights from processes inform financial decisions.

Conduct performance benchmarks	Use when Process Mining enables comparing performance across units, time periods, or standards. Look for mentions of identifying best performers or setting reference values.
Detect bottlenecks	Apply when Process Mining helps to identify slowdowns or process inefficiencies. Use when interviewees talk about locating process delays or resource constraints.
Improve citizen experience	Use when the passage links Process Mining to better service delivery, user satisfaction, or responsiveness. Apply when citizens are beneficiaries of improved processes.
Increase process efficiency	Use when interviewees refer to making processes faster, leaner, or more cost-effective. Apply to discussions of streamlining, reducing waste, or improving throughput.
Monitor processing times	Code when the focus is on tracking the duration of process steps or end-to-end execution. Use when interviewees mention using Process Mining to measure or reduce processing time.

Codes relating to Problems / Barriers:

Level	Code	Definition
Organisation	Complex committee coordination	Apply when the passage describes difficulties in aligning or coordinating decisions among various committees or stakeholders. Use when interviewees mention lengthy decision-making due to bureaucratic layers.
Organisation	Complex process landscape	Use when a passage refers to the challenge of mapping or managing a large variety of processes. Apply when complexity or heterogeneity of workflows is seen as a barrier.
Organisation	Data protection concerns	Code when data privacy regulations or fears of misuse of personal data are discussed as barriers. Apply when legal or ethical concerns about data handling are mentioned.
Organisation	Dependencies on external consultancy	Use when reliance on external experts is seen as a constraint or risk. Apply when the organization lacks internal PM competence or becomes too dependent.
Organisation	Fight for resources induced by increased transparency	Apply when transparency from PM leads to conflicts or competition over resources. Use when interviewees mention power dynamics or resource reallocation triggered by visibility.

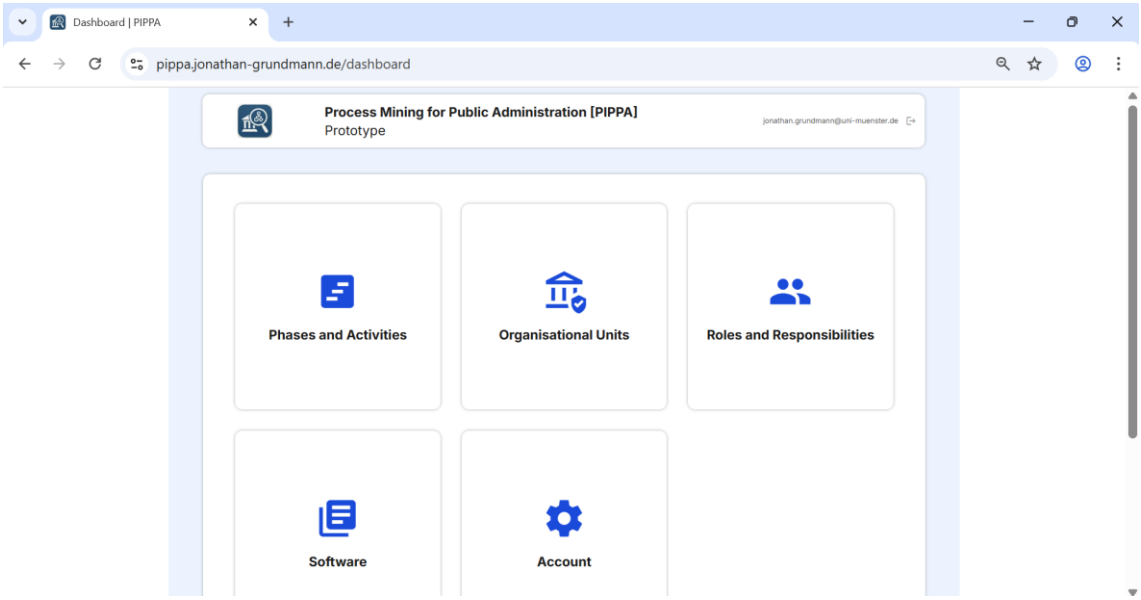
Organisation	Fragile BPM culture	Code when there's reference to a weak or immature business process management culture. Apply when BPM is not established or lacks institutional support.
Organisation	Heterogeneous BPM approaches	Use when different units or departments use inconsistent BPM practices or tools. Apply when lack of standardization is a barrier.
Organisation	High upfront investment	Apply when interviewees mention significant financial, time, or personnel costs as entry barriers. Use when initial resource commitment hinders PM adoption.
Organisation	Lack of strategic PM alignment	Use when PM is not integrated into the organization's strategic goals. Apply when PM is seen as isolated or disconnected from leadership priorities.
Organisation	Legal constraints	Code when legal frameworks or policies inhibit PM adoption or operations. Use when laws or contracts limit data use or process redesign.
Organisation	Long (PM) pilot phases	Apply when interviewees mention that extended pilot testing delays broader rollout. Use when slow proof-of-concept stages cause frustration or hinder scaling.
Organisation	Unclear responsibilities	Use when it's unclear who owns or manages PM-related activities. Apply when interviewees highlight lack of role clarity or accountability.
Organisation	Unclear value proposition	Use when PM benefits are not clearly communicated or understood. Apply when skepticism arises due to vague expectations or lack of ROI demonstration.
People	Afraid of performance monitoring	Code when individuals fear being evaluated or controlled based on PM data. Apply when monitoring is seen as a threat to job security or autonomy.
People	Constrained individual availability	Use when interviewees describe lack of time or competing responsibilities preventing PM participation. Apply when resource limitations at personal level are a barrier.
People	General employee resistance to change	Apply when resistance to new technologies or process changes is discussed. Use when employees express reluctance, fear, or discomfort.

People	Individual privacy concerns	Use when people are worried about how their actions or identities are tracked in PM systems. Apply when privacy is a personal, not just legal, concern.
People	Lack of awareness of PM	Code when PM is unfamiliar or misunderstood by staff. Apply when absence of basic knowledge is mentioned.
People	Lack of leadership commitment	Use when management is not actively supporting or driving PM efforts. Apply when leadership disengagement undermines success.
People	Lack of methodological PM knowledge	Apply when technical or conceptual gaps hinder effective PM use. Use when training needs or knowledge deficits are discussed.
People	Scepticism towards innovation	Use when interviewees express doubt or distrust in new technologies or practices. Apply when innovation is met with inertia or suspicion.
Technical	Afraid of vendor lock-in (PM solution)	Code when fear of being tied to a single PM software vendor is expressed. Apply when lack of flexibility or high switching costs are seen as a risk.
Technical	Analogue processes	Use when existing paper-based or manual processes obstruct PM implementation. Apply when digitization is a prerequisite.
Technical	Complex data transformation required	Apply when interviewees mention the difficulty of reformatting or cleaning data for PM use. Use when high data preparation effort is required.
Technical	Demanding data extraction	Use when pulling data from source systems is technically challenging or resource-intensive. Apply when access barriers or interface issues arise.
Technical	Fragmented IT systems	Code when a lack of system integration makes process tracking difficult. Apply when incompatible or siloed systems are barriers.
Technical	Inability to export log data	Use when systems do not support exporting relevant event data. Apply when lack of technical functionality limits PM.
Technical	Required on-premise operation	Apply when PM must run within local infrastructure due to policy or constraints. Use when cloud-based solutions are not an option.

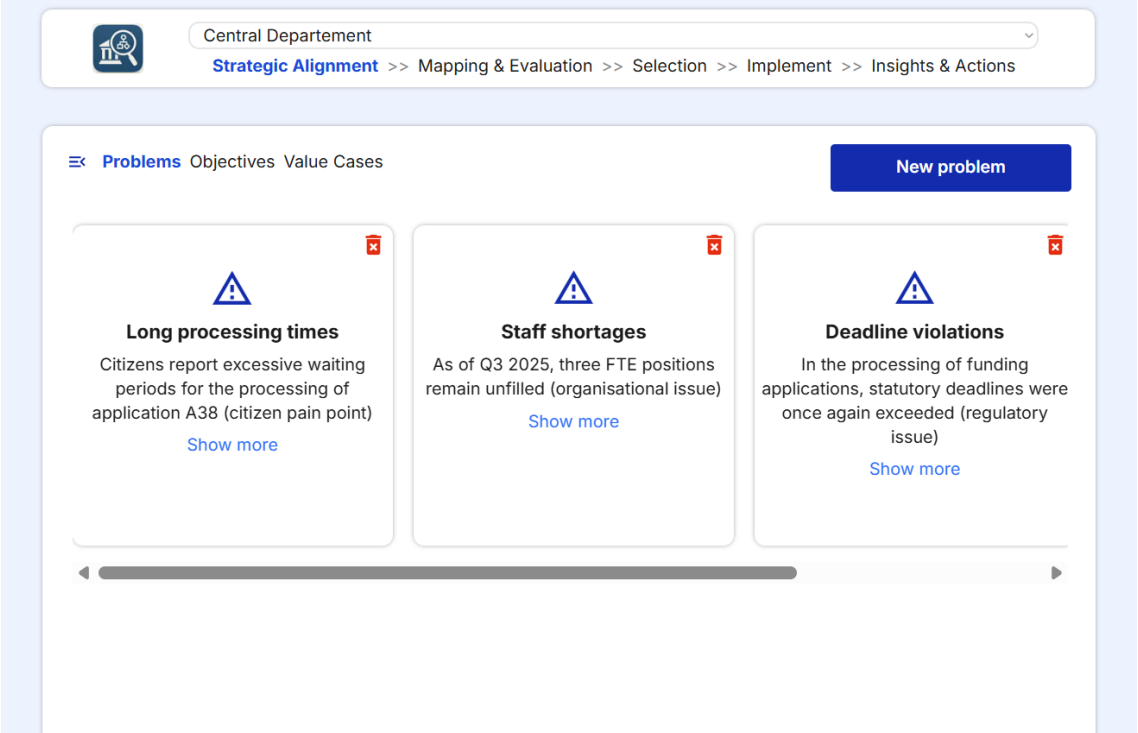
Technical	Unclear technical prerequisites	Use when it's unclear what systems, formats, or configurations are needed for PM. Apply when this lack of clarity delays implementation.
Technical	Insufficient data quality	Code when poor or inconsistent data undermines PM insights. Apply when interviewees mention incomplete, inaccurate, or noisy logs.

L Screenshots of Prototype

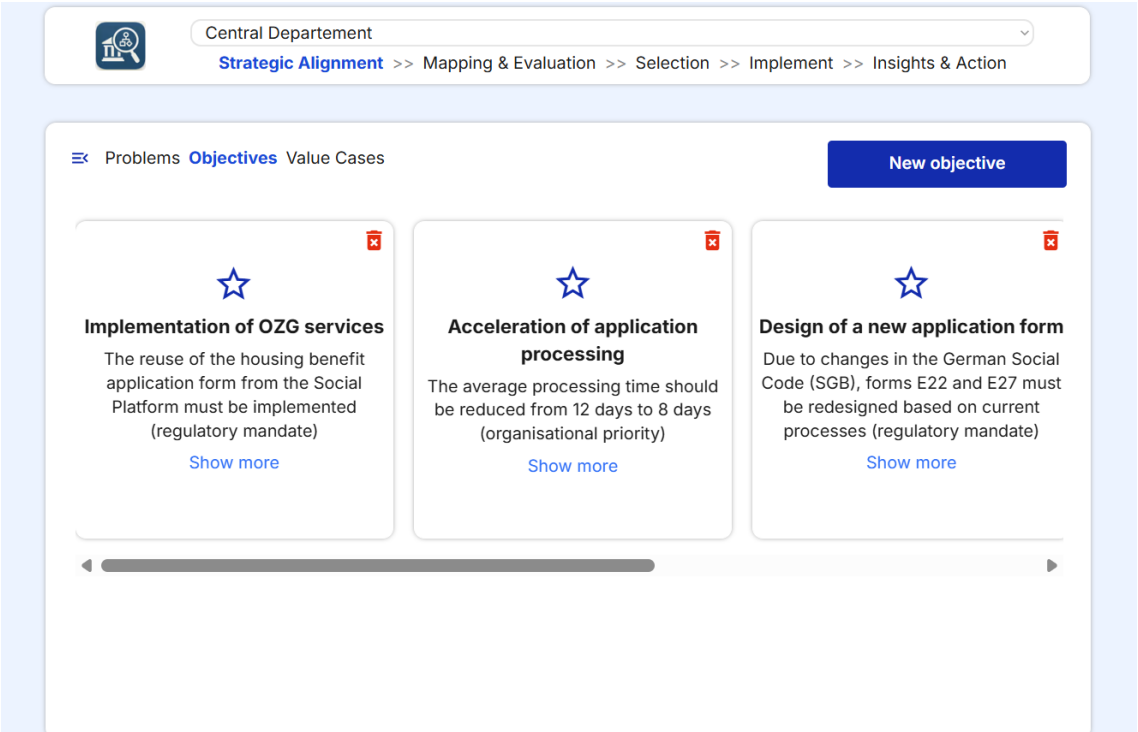
Homepage of prototype:



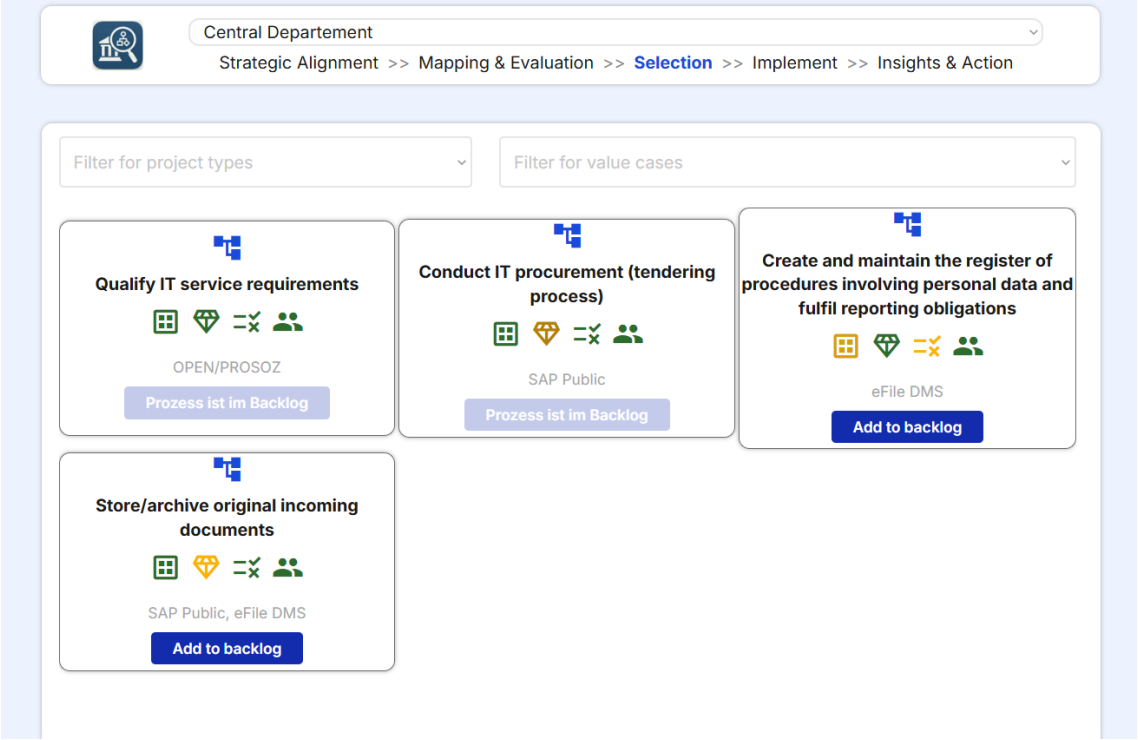
Strategic Alignment – Problem Definition:



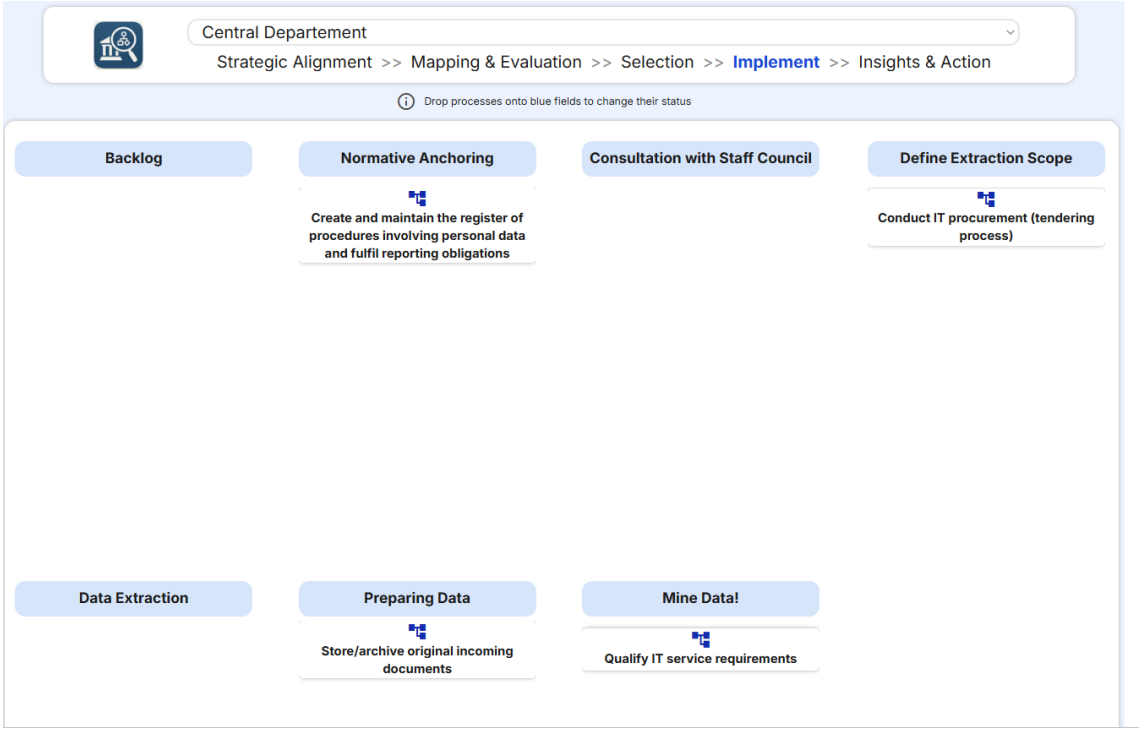
Strategic Alignment – Objectives Definition:



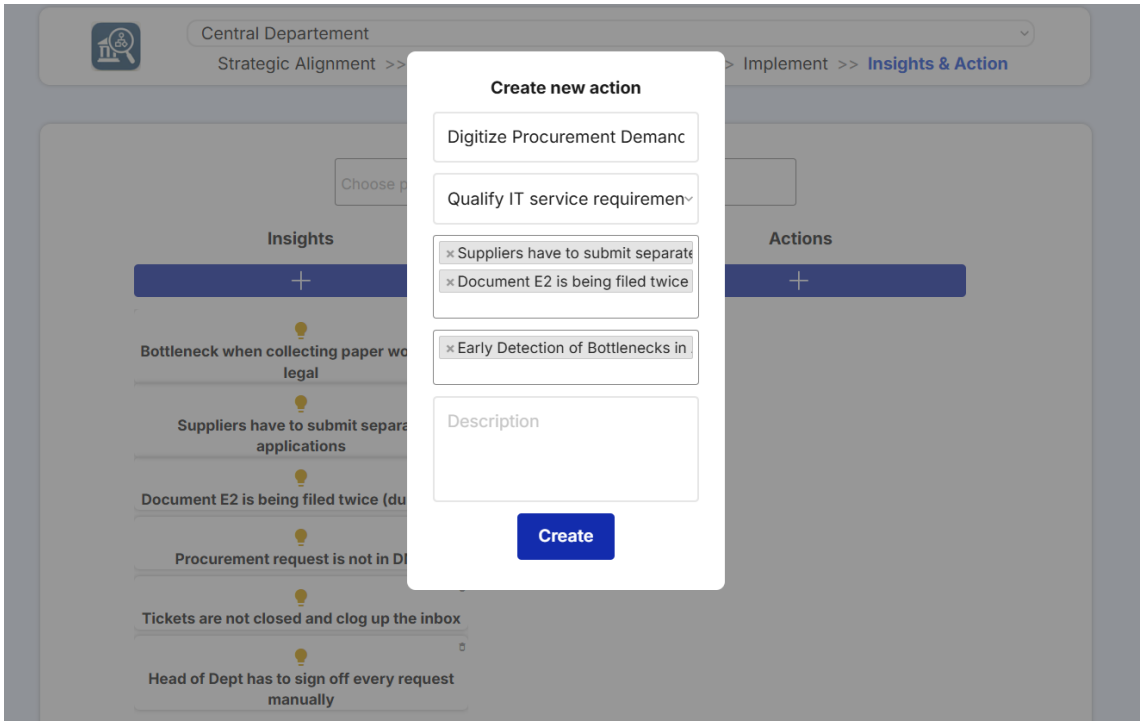
Selection:



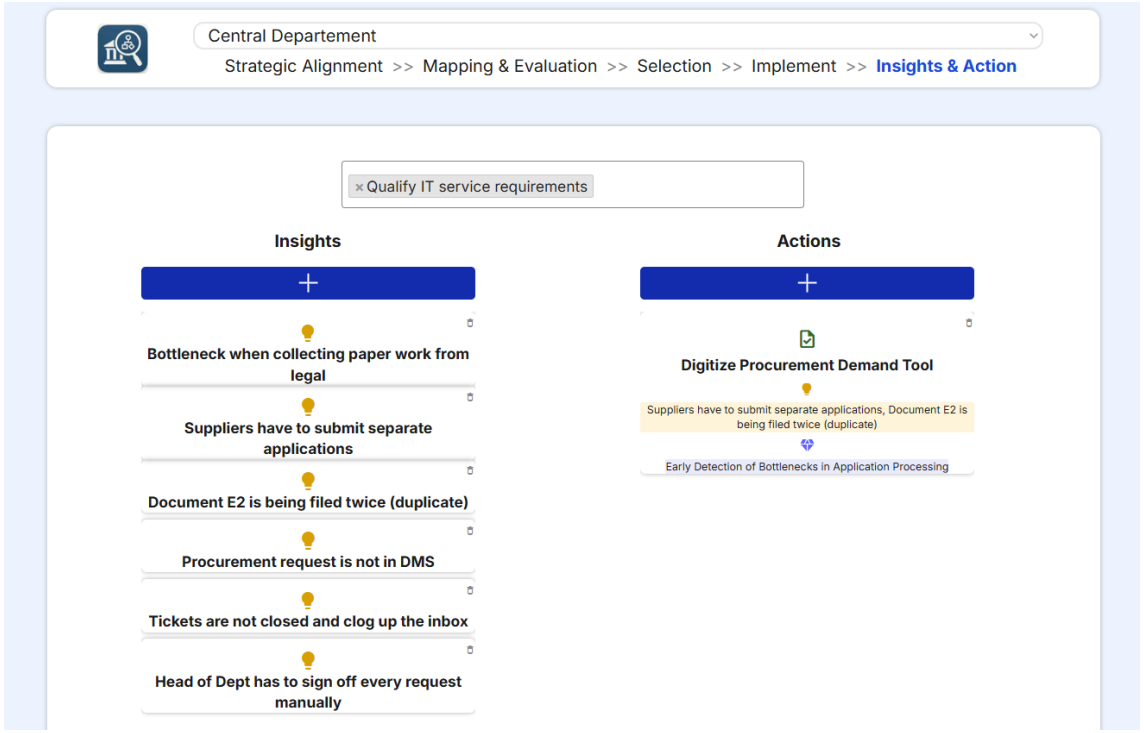
Implementation Guidance:



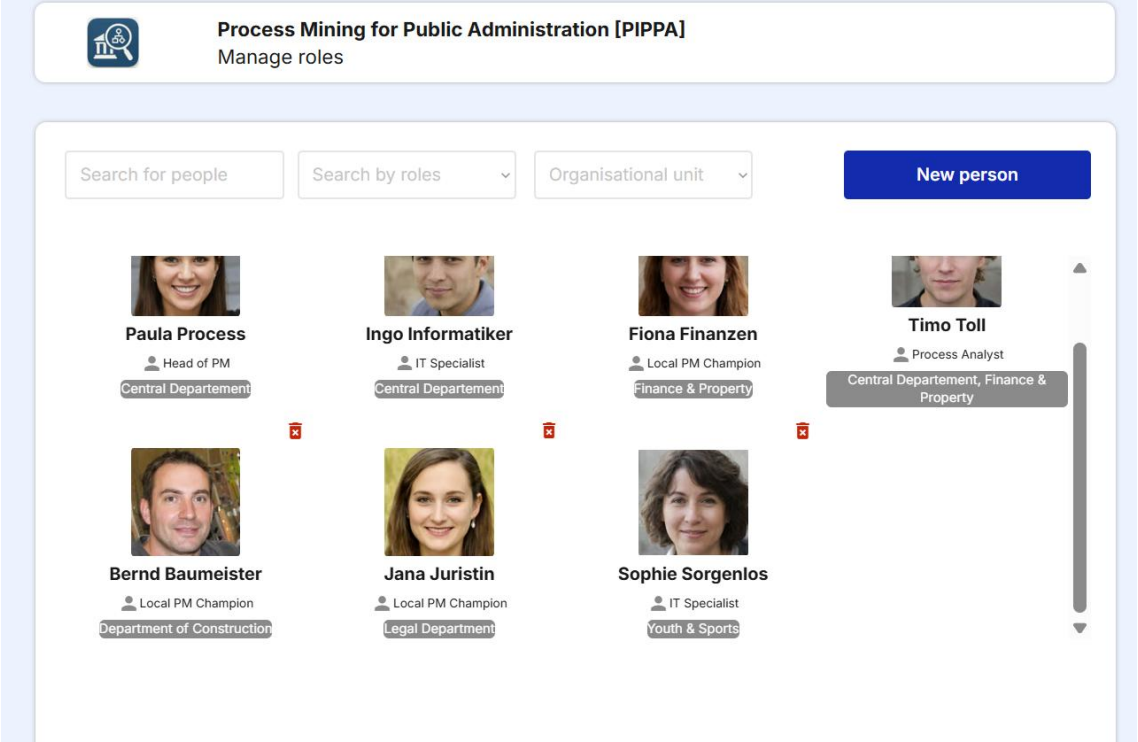
Insights & Action – Create new action:



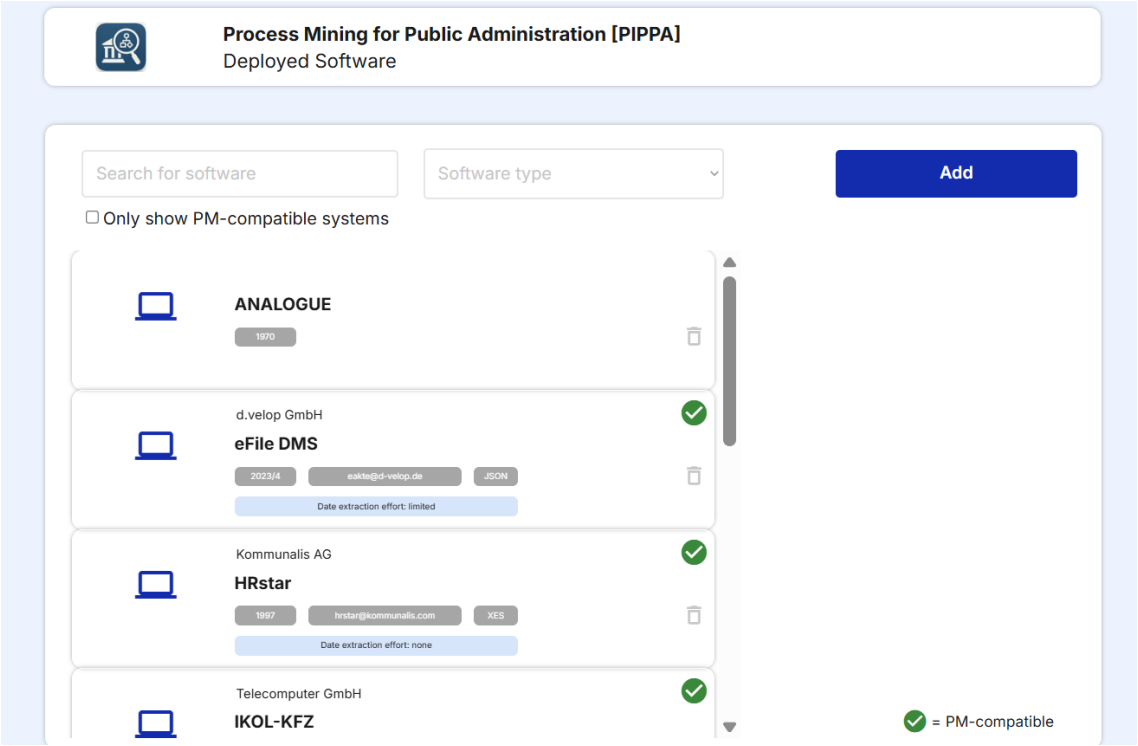
Insights & Action:



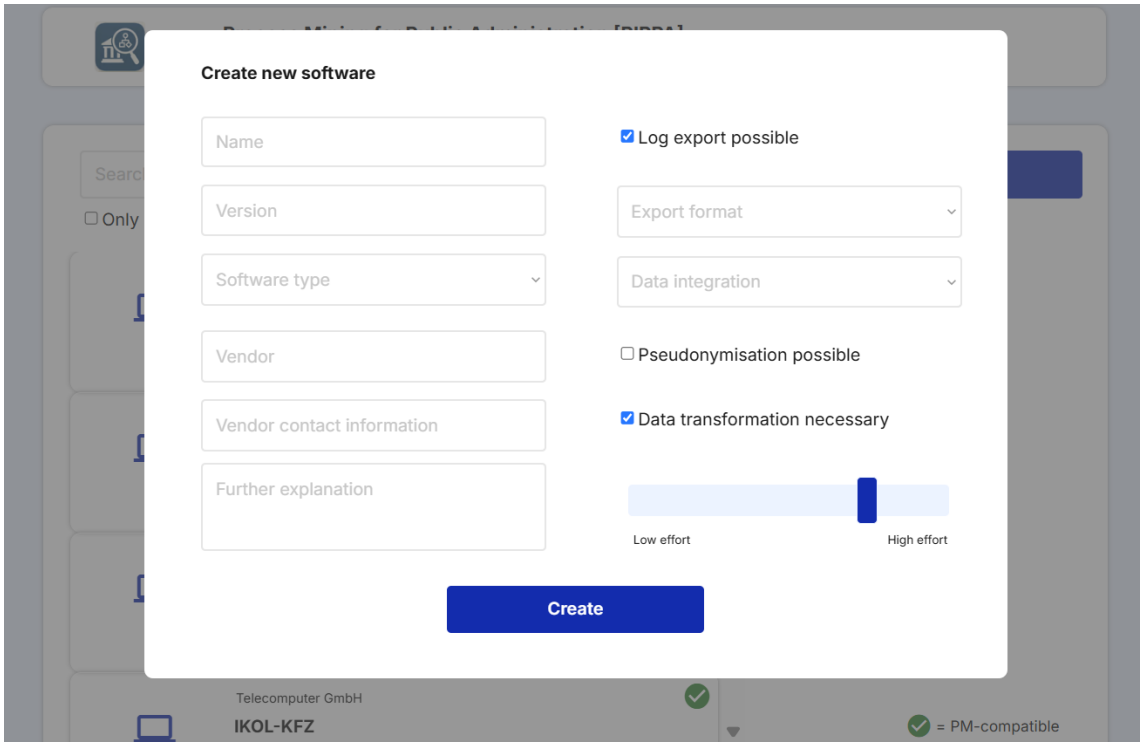
Roles & Responsibilities:



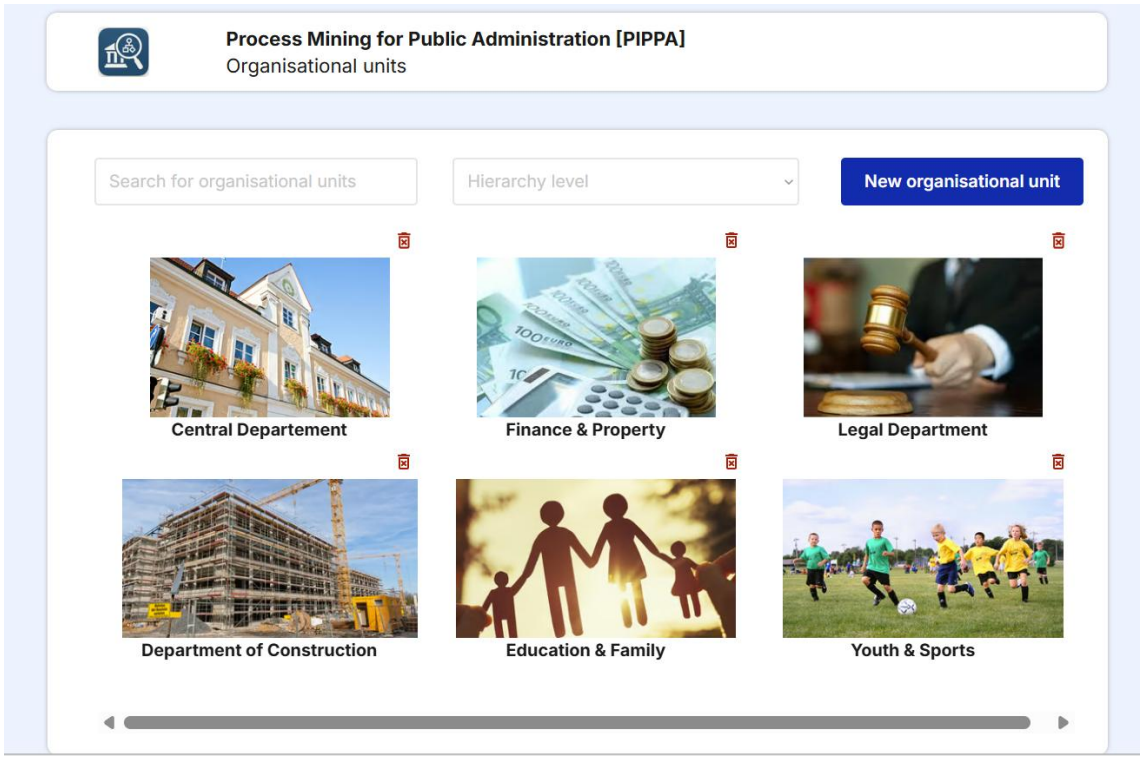
Deployed software:



Deployed software – add new software:



Organisational units:



M Web Application Prototype

The instantiation as a prototypical web application was hosted on a domain owned by the author to make it available to the experts upon request following the demonstration. It will remain available online at least until the thesis defence.

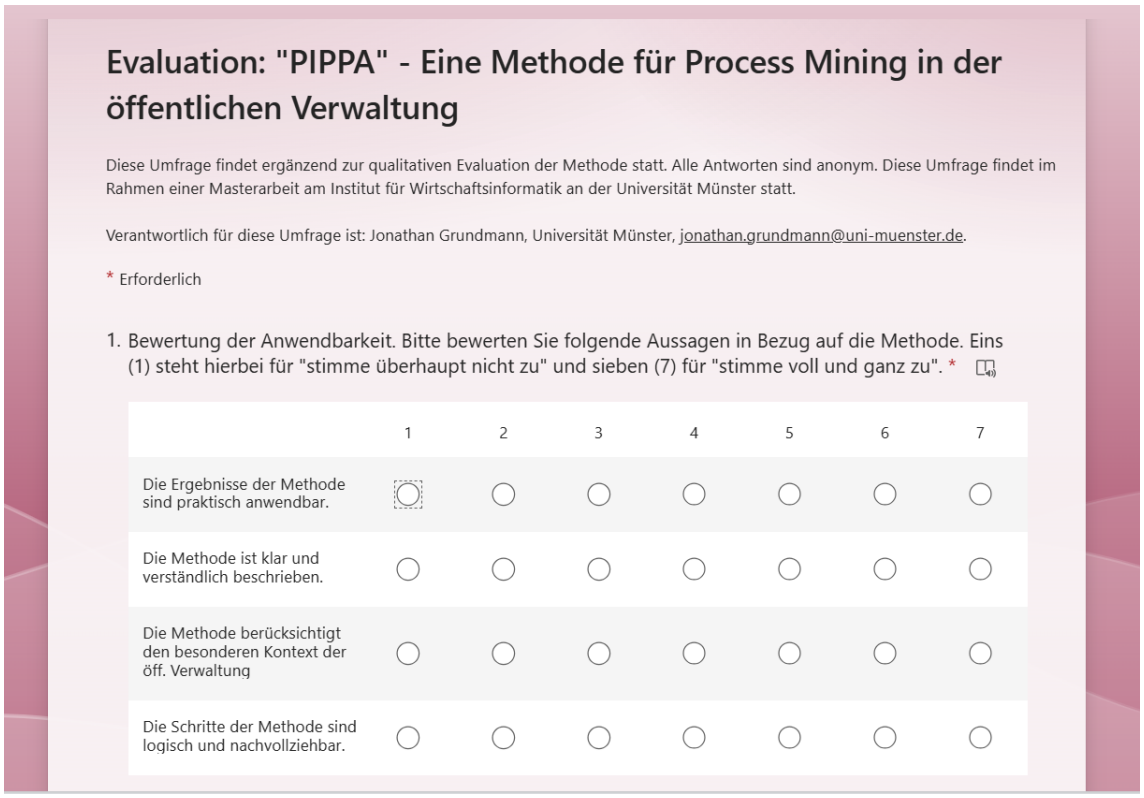
Link: https://pippa.jonathan-grundmann.de/

User name: [redacted]

Password: [redacted]

N Online Evaluation Survey

The following screenshots show how the online survey appeared to participants and which questions were included.



Evaluation: "PIPPA" - Eine Methode für Process Mining in der öffentlichen Verwaltung

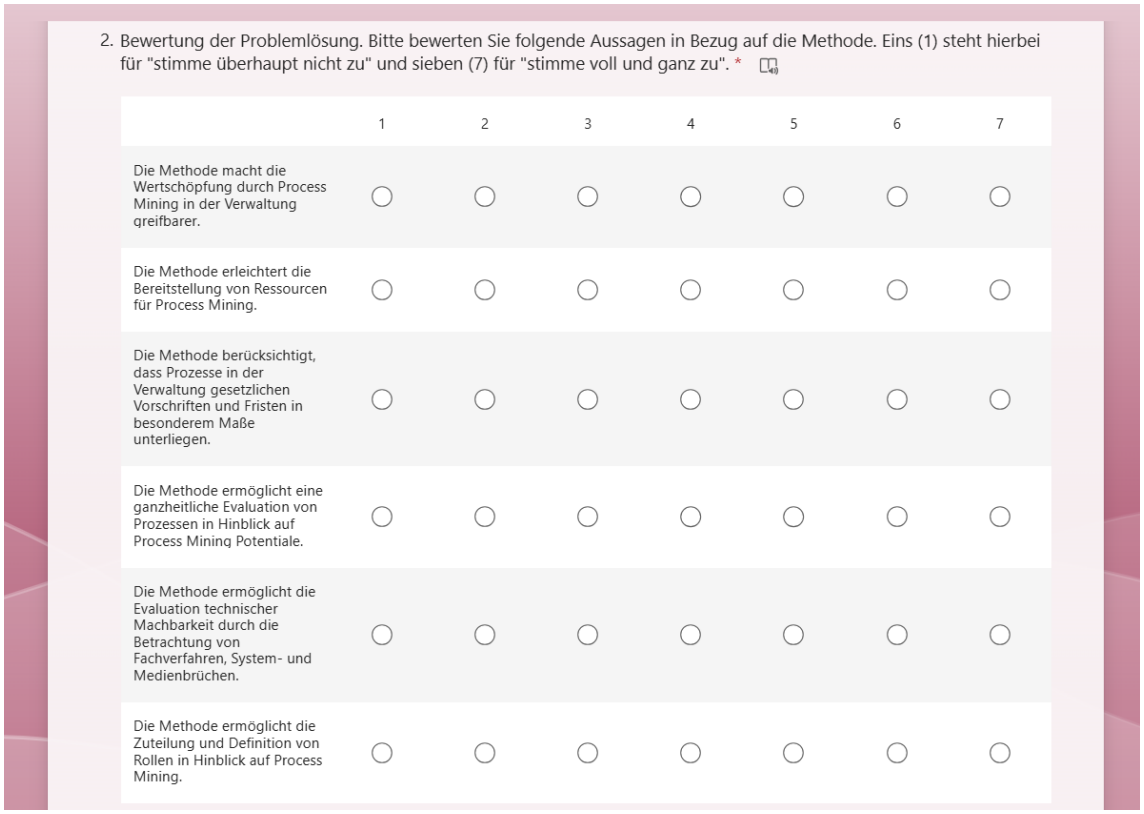
Diese Umfrage findet ergänzend zur qualitativen Evaluation der Methode statt. Alle Antworten sind anonym. Diese Umfrage findet im Rahmen einer Masterarbeit am Institut für Wirtschaftsinformatik an der Universität Münster statt.

Verantwortlich für diese Umfrage ist: Jonathan Grundmann, Universität Münster, jonathan.grundmann@uni-muenster.de.

* Erforderlich

1. Bewertung der Anwendbarkeit. Bitte bewerten Sie folgende Aussagen in Bezug auf die Methode. Eins (1) steht hierbei für "stimme überhaupt nicht zu" und sieben (7) für "stimme voll und ganz zu". *

	1	2	3	4	5	6	7
Die Ergebnisse der Methode sind praktisch anwendbar.	◯	◯	◯	◯	◯	◯	◯
Die Methode ist klar und verständlich beschrieben.	◯	◯	◯	◯	◯	◯	◯
Die Methode berücksichtigt den besonderen Kontext der öff. Verwaltung	◯	◯	◯	◯	◯	◯	◯
Die Schritte der Methode sind logisch und nachvollziehbar.	◯	◯	◯	◯	◯	◯	◯



2. Bewertung der Problemlösung. Bitte bewerten Sie folgende Aussagen in Bezug auf die Methode. Eins (1) steht hierbei für "stimme überhaupt nicht zu" und sieben (7) für "stimme voll und ganz zu". *

	1	2	3	4	5	6	7
Die Methode macht die Wertschöpfung durch Process Mining in der Verwaltung greifbarer.	○	○	○	○	○	○	○
Die Methode erleichtert die Bereitstellung von Ressourcen für Process Mining.	○	○	○	○	○	○	○
Die Methode berücksichtigt, dass Prozesse in der Verwaltung gesetzlichen Vorschriften und Fristen in besonderem Maße unterliegen.	○	○	○	○	○	○	○
Die Methode ermöglicht eine ganzheitliche Evaluation von Prozessen in Hinblick auf Process Mining Potentiale.	○	○	○	○	○	○	○
Die Methode ermöglicht die Evaluation technischer Machbarkeit durch die Betrachtung von Fachverfahren, System- und Medienbrüchen.	○	○	○	○	○	○	○
Die Methode ermöglicht die Zuteilung und Definition von Rollen in Hinblick auf Process Mining.	○	○	○	○	○	○	○

O Method Chunks and Informing Literature

Method Component	Sub-component	Justificatory Literature	Method Chunks
Phases	Initialization	Brock et al., 2024; van Eck et al., 2015; Hijriani & Comuzzi, 2024	
	Strategic Alignment	Fischer et al., 2024	Value Case Name & Idea adapted from MAPPER
	Process Mapping & Evaluation	Martin et al., 2021; van Eck et al., 2015)	Portfolio approach adapted from MAPPER
	Process Selection		
	Implementation	van der Aalst, 2011b; van Eck et al., 2015	Implementation Guidance adapted from PM2 and L*
	Monitoring & Actions	Fischer et al., 2024 Franzoi et al., 2025	Reiteration of value cases adapted from MAPPER
Exemplary Organisational Set-up (accompanying)	Definition of Roles	Marcus et al., 2024; Ammann et al., 2025; Kipping et al., 2022	

Declaration of Authorship

I hereby declare that, to the best of my knowledge and belief, this Master Thesis titled "Decoding Bureaucracy: Towards a Process Mining Method for Public Administration" is my own work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references.

Tallinn, 2 June 2025

Jonathan Grundmann

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