Determine the potential for digitization and harmonisation of administrative process

Deliverable 9: Project End Report

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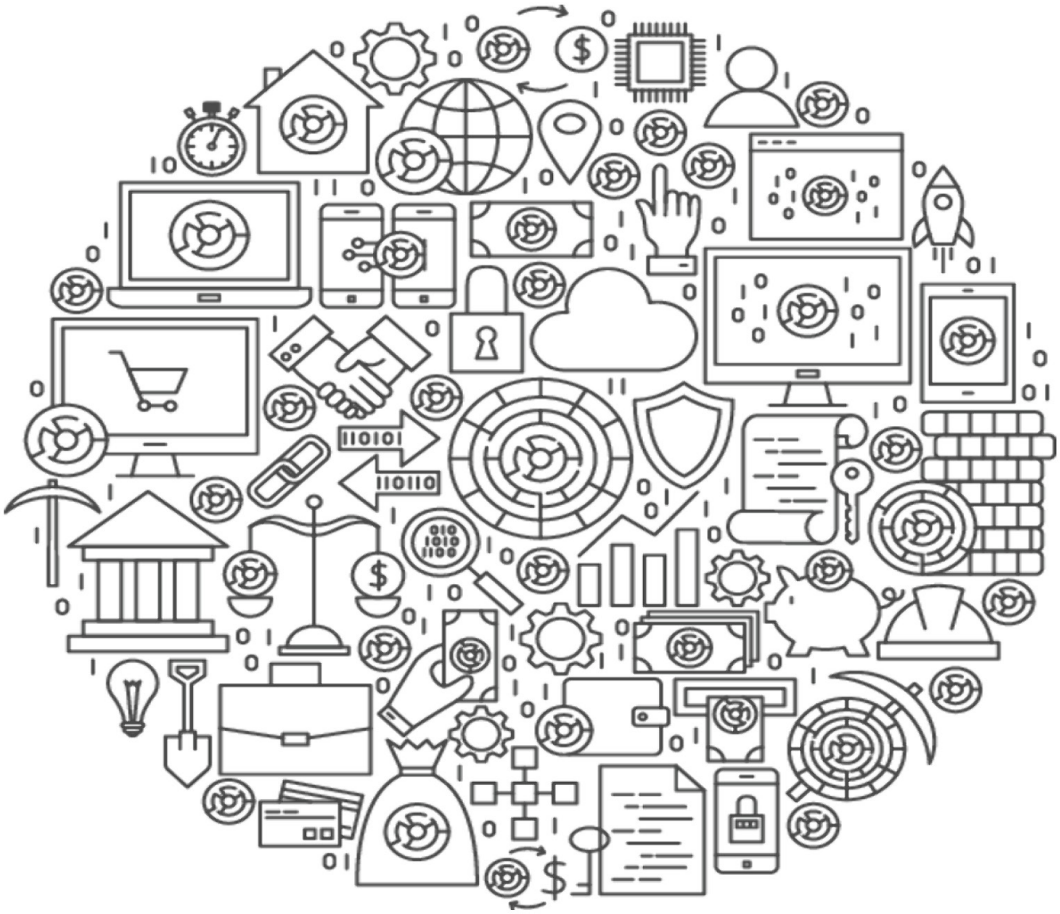

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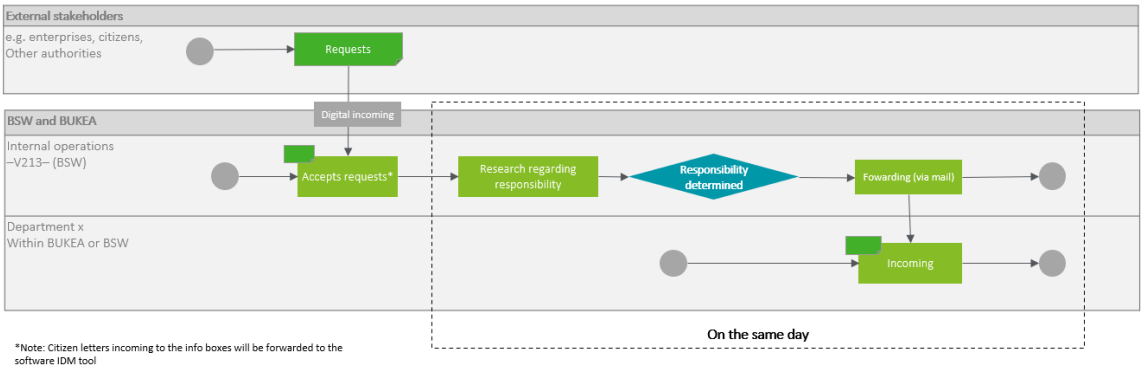

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List of abbreviations

Abbreviation	
AI	Artificial intelligence
API	Application Programming Interface
IDM	Intelligent Dialogue Management
BUKEA	*Behörde für Umwelt, Klima, Energie und Agrarwirtschaft* (Authority for Environment, Climate, Energy and Agriculture)
BSW	*Behörde für Stadtentwicklung und Wohnen* (Authority for Urban Development and Housing)

Project End Report

This deliverable is the project end report of the DG REFORM project "Determine the potential for digitization and harmonisation of administrative processes at the City of Hamburg".

Introduction and executive summary

This deliverable provides a summary of all project deliverables of the DG REFORM project "Determine the potential for digitization and harmonisation of administrative processes at the City of Hamburg". Furthermore, it entails conclusions regarding the project obstacles, best practices, lessons learned, post-project recommendations and presents a follow-up plan.

The annex to this deliverable provides the final reports of all deliverables to this project.

Summary of all project deliverables

During the course of the project, the team undertook several tasks to achieve the desired output. These tasks were diverse and are outlined below for the ten deliverables, put together in this Final Report.

Deliverable 1 ('Inception Report')

The project team organised a kick-off meeting with the project stakeholders from City of Hamburg and DG Reform. During the meeting, the participants agreed on a project timeline, discussed the project scope, and specified project organisation topics (e.g., members of the Steering Committee, frequency of Steering Committee meeting and work methodology). Furthermore, the contractor presented informational needs of the project team to accomplish the requested work for the individual deliverables. The outcome of the meeting was compiled in an inception report.

Deliverable 2 ('Current situation analysis')

Deliverable 2 provides an analysis of the current situation at BSW and BUKEA. It contains an analysis of the current situation regarding the digitalisation of administrative processes as well as an assessment of the relevant legal framework and a description of identified process and project key problems and risks. The deliverable also includes an introduction and presentation of the methodology used to identify relevant processes that can be automated. In addition, the technologies and systems are described and the long and short list of processes with automation potential is presented.

Deliverable 3 ('As-is business process model')

Deliverable 3 describes the as-is business process model of the five short list processes that were selected by the Hamburg-internal Steering Committee (see deliverable 2). This deliverable further contains a description of the process as well as an as-is business process model in business process model and notation (BPMN) format. The process description and BPMN models were developed based on the information gathered during the stakeholder interviews and the documentation provided. The BPMN models were further discussed and confirmed in bilateral meetings with the process owners. If any changes are made these will be updated accordingly. A detailed description can be found in the respective chapters, as well as a detailed description of the technologies in deliverable 2. The following is a summary of the most important points for each process.

Deliverable 4 ('Business requirements catalogue')

Deliverable 4 describes the business requirements for as well as the objectives and scope of the to-be solutions of the five short list processes selected by the City of Hamburg, 1) the brief written inquiries (*Schriftliche Kleine Anfragen*), 2) the knowledge management (*Wissensmanagement*), 3) the info boxes (*Infoboxen*), 4) the

imputing procedures (*Imputing-Verfahren*) and 5) the senate printed matter coordination (*Senatsdrucksachenabstimmung*). For these processes, four overarching non-functional and additional requirements were defined. These requirements foresee that the to-be solutions must provide interfaces to systems and databases that are connected to and/or are relevant for the short list processes and that the to-be solutions must be created with a responsive design and a cross-platform access. Furthermore, user-friendliness and efficient management control must be ensured. Thereafter, specific (functional) business requirements as well as the objectives and scope of each to-be process were defined and assigned to overarching clusters.

Deliverable 5 ('Business case')

Deliverable 5 elaborates and analyses three different alternatives for automation for each of the five short listed processes that were defined in Activity 2 (Elaboration of a Business Case). The aim of this assessment is to support the decision-making process of the City of Hamburg to determine the preferred alternative for each process.

Therefore, for each process, two different scenarios (alternatives) with a varying degree of automation were developed. This includes an alternative with minimum to intermediate adjustments and an alternative with more advanced AI features that would contribute to considerably automate the respective process. These alternatives are not conclusive and can continue to be adapted during implementation. The alternatives were analysed regarding their feasibility, risks and driving and restraining forces. Furthermore, for each process, an analysis of the alternatives regarding the stakeholder demands, the technological readiness and their impacts was conducted.

Deliverable 6 ('To-Be Situation Analysis')

Deliverable 6 outlines the to-be situation analysis for the five selected to-be processes brief written inquiries (Schriftliche Kleine Anfragen), senate printed matter coordination (Senatsdrucksachenabstimmung), the imputing procedure (BohrIS process), info boxes (Infoboxen) and the knowledge management process (Wissensmanagement) for the respective selected alternatives as of deliverable 5 (Business Case). This entails an overarching description of the technical, legal, organisational and operational implications of the different technologies that would be implemented. Furthermore, the overarching conceptual considerations for the technological IT architecture will be outlined. Thereafter, for each to-be process, the foreseen IT infrastructure and its components is described and analysed in detail.

Deliverable 7 ('To-be business process model')

Deliverable 7 presents the to-be process models in BPMN format as well as their operational implications of the five selected to-be processes. In order to obtain and specify the information for the to-be process models, five stakeholder workshops with the respective process owners were conducted as part of this deliverable. As part of these workshops, details regarding the respective to-be process models and additional aspects regarding the IT architecture were discussed.

Deliverable 8 ('Roadmap')

Deliverable 8 provides an overview of the indicative project implementation plans for the five to-be models with the result to develop a Minimum Viable Product (MVP) for each of the five processes.

The timeline of the different activities to be carried out is foreseen with a start in January 2023 (after the finalisation of the REFORM 2021/064 Deloitte project). For the implementation of the respective MVPs, it is suggested that the City of Hamburg and an external service provider with knowledge and project references regarding the building, testing, release and deployment of AI models work together in close collaboration. An implementation of all five to-be processes in parallel could yield synergies regarding budget and resource allocation and efficiency gains through project organisation (e.g. following an agile project, labelling of different processes, development of components that could be used for more than one process).

Deliverable 9 ('Project end report')

Deliverable 9 provides a summary of all project deliverable of the DG REFORM project "Determine the potential for digitization and harmonisation of administrative processes at the City of Hamburg". Furthermore, it entails

conclusions regarding the project obstacles, best practices, lessons learned, post-project recommendations and presents a follow-up plan.

The annex to this deliverable provides the final reports of all deliverables to this project.

Deliverable 10 ('Communication material')

Deliverable 10 provides communication material for the purpose of presenting the project to third parties. Therefore, a project description summarising the project and the context, as well as the support delivered, and results achieved in text format, two drafted social media text and visual materials have been created. The communication material furthermore entails a PowerPoint presentation summarising the technical content of the project as well as its context, approach, deliverables, activities, key findings and lessons learned.

Project obstacles, best practices, lessons learned and post-project recommendations

This chapter entails an overview of the project obstacles and assigns best practices to address them, key lessons learned and post-project recommendations.

Project obstacles and best practices

The following table summarises the key project obstacles and best practices to address these obstacles during the project.

Table 1: Project obstacles and best practices

Project obstacles	Best practices
Identifying digitalization and automation potential in the processes of the City of Hamburg	Was solved with a **hybrid approach of desk research and stakeholder workshops** to understand the processes and work out the key features for productivity gains through digitalization strategies
Reduce the manual effort and intermediate steps in the processes	**Two core optimization clusters** were located: 1. Optimization of the communication and work environment through the introduction of a browser-based process management environment (**IDM workflow management**). 2. the support of complex work steps by **artificial intelligence in appropriate situations** (example: Intelligent Forwarding Assistant and Intelligent Search). These two core optimization clusters were flanked with process-individualized improvements in the to-be-model
Future-proofed infrastructure and process environment	Setting up the **process management environment via browser-based programming** ensures operating system-independent development and is state of the art implementation technology. Furthermore, the connection of the artificial intelligence modules via microservice ensures the easy exchange and maintenance of the modules and new artificial intelligence modules can be added independently of the programming language.
A large part of the employees in the public sector will retire in the near future, so knowledge transfer is eminently important	The **IDM workflow architecture provides for a variety of archiving and storage systems as well as databases**, which preserve the process knowledge much better in a readable form than today's documentation. Furthermore, new documentation of the tools and the process steps is made during the digitization of the processes, which represents a knowledge archive for future generations.

Redundant development of the same functions in different processes	By implementing the **IDM workflow framework and the microservice architecture** of the artificial intelligence modules, we ensure minimal redundant programming. Furthermore, components required by several processes, such as the labelling environment for annotating data to train supervised learning models, are set up centrally and used in the implementation of digitization in several processes.
Stakeholder uncertainty in the use of the new systems	Uncertainty of the stakeholders in the use of the new systems is counteracted by **proactively communicating with the stakeholders** and picking them up close to the development in an agile project management as product owners. Furthermore, fallback variants, e.g. in the communication via office tools, are still kept ready.

Source: Deloitte

Lessons learned and post-project recommendations

Various lessons have been identified during the project. These **lessons learned** were clustered into **three categories**. It is recommended to take these lessons learned into consideration when implementing the to-be processes within the follow-up project.

Table 2: Lessons learned and post-project recommendations

Lessons learned	Post-project recommendations
General lessons learned	
The treated subjects and issues within the project as well as the stakeholder setting itself involved a **high level of complexity**. Various process owners across various departments and even authorities needed to be considered, each of them having **proper expectations and needs**.	Given these circumstances, the **implementation of a change manager or a related role** could be suited to improve the alignment between the authorities themselves as well as between the process stakeholders.
	Owners for each authority and each stakeholder group should be assigned and **designated timelines** should be given to ensure a comprehensive and concise review process and to meet the planned timelines.
	To get a better understanding of potential boundaries and restrictions, a **continuous review related to "showstoppers"** (such as reluctance regarding AI projects in general) should be performed, together with accompanying communication with the involved stakeholders.
Lessons learned related to organisational and structural factors	
As consultations and workshops with the process owners of the process 'info boxes' have shown, process automations encounter the **fear by employees of being replaced or not needed anymore**.	Hence, a **proper communication** underlining the necessity of restructuring the processes and demonstrating that the concerns are unfounded is recommended.
	The **clarification of overall objectives, roles, tasks** of all stakeholders involved as well as strategic restrictions should be ensured at the beginning of the implementation phase. Any change or deviations from project objectives should be communicated transparently and in a timely manner.
Lessons learned related to the implementation of the follow-up projects	
The **implementation** of the five to-be processes **largely builds on the same infrastructure**, e.g., the labelling	Hence, the **implementation of various to-be processes at the same time** can **unfold synergies** and lead to an **overall reduction in costs and person days** as the infrastructure and

Lessons learned	Post-project recommendations
environment that needs to be set up as part of the implementation.	some microservices can be used for various to-be processes and therefore only have to set up once.
	The **central setting up of the labeling environment** increases synergies, since it can be used by all processes that have implemented artificial intelligence modules. Furthermore, it makes sense to **implement the IDM tool in a basic version as a central framework**, which is installed in all processes and then expanded individually for the respective process in separate modules, which facilitates maintenance, since central functions only have to be maintained once and all processes get the update. Another point that raises synergies is the **setting up of the artificial intelligence modules via a microservice approach**, since these microservices can be addressed by different processes if necessary.
The **complexity of the to-be processes** (in particular the **Brief Written Inquiries** (Schriftliche Kleine Anfragen) and the **imputing procedure** (Bohranzeigen bearbeiten)) is quite high and demands a thorough understanding of the process and its technical and procedural implications. On the contrary, **for some to-be processes** (Senate printed matter coordination – Senatsdrucksachenabstimmung), **an AI solution is not suitable and desired**.	**The establishment of clear procedures** for the engineering of the requirements save time and increase the efficiency throughout the follow-up implementation project. Therefore, the **IT department and the external stakeholder foreseen in the implementation phase** should already be **involved at a very early stage** of the project, so that the required information and the level of detail can be substantiated in close collaboration with the process owners and the strategic levels of the City of Hamburg.
	In order to enable quick wins, it could be pragmatic to **limit** the implementation to the **essential needs**. This means that only the elements that are essential to carry out the activity in an automated way would be implemented. **Agile methods** such as the Scrum principle[1] could further support this process.

Source: Deloitte.

Follow-up plan

The following follow-up plan is issued as an initial draft for a possible implementation of the five selected to-be models. This timeline is based on the results of deliverable 8.

Table 3: Exemplary follow-up plan of the to-be models

Phase	Indicative timeframe	Description/ Core activities
1. Warm-up	Month 1 – month 2 (5-6 weeks)	The warm-up phase covers a period of approximately 5-6 weeks and includes the **harmonisation of the projects with the business requirements** formulated in this project, the check of the integration into the existing IDM tool and a **short analysis of the IT architecture**. Key aspects here are to ensure that the software and hardware conditions, as well as interfaces, necessary computing capacity, data protection and similar topics are given.

[1] Within project management, Scrum is a lightweight, iterative, and incremental framework for developing, delivering, and sustaining products in software development. The framework challenges assumptions of the traditional, sequential predictive or planned approach to software development because it acknowledges that the customers may change the project scope during the development phase and there will be unpredictable challenges.

Phase	Indicative timeframe	Description/ Core activities
		It is particularly important that these points are defined and coordinated at an early stage, if possible, directly after the start of the project. In addition, an **agile project management** will be set up, led by the City of Hamburg.
2. **Planning**	End of month 1 – end of month 3	The objective of this phase is to **define the structure of the database** and to **analyse the corresponding data** that is needed to train the models. Depending on the data format, a certain amount of effort for data preparation must be planned before labelling can begin. For the info boxes, this phase is expected to take six months given the fact that currently, data are not stored and therefore, a data basis needs to be built up in these six months.
3. **Set-up of labelling environment (only for some to-be processes)**	Beginning of month 2 – beginning of month 5	After the analysis of data, phase 3 starts with the **implementation of a labelling and annotation environment**, as well as the infrastructure. This is planned over a course of approximately two months, depending on the quantity and quality of data. Subsequently, this labelling environment will **be built, tested, released and deployed** for another three weeks, completing the entire third phase
4. **Development of microservices (only for some to-be processes)**	Mid of month 3 – mid of month 6	Phase 4 includes the **conception of the models**, several **iterations of labelling**, as well as the **training and evaluation of the models**. This phase is planned over approximately three months, depending on the respective to-be process, with several iterations of labelling, training and evaluation iterations of the models following the labelling iterations.
5. **Implementa-tion of toolset extensions**	End of month 3 – mid of month 8	Throughout the development of the microservices, the implementation of toolset extensions will be started. Throughout the duration of this phase, **changes to the dashboard are made** depending on the development status and the documentation is developed at cyclical intervals and iteratively adapted and completed. In addition, the **developed microservices are iteratively built, tested, released and deployed**. Within the test phase, **performance tests** and the interaction of all components are tested in a first step. Furthermore, speed optimisations for the model components and feedback from user tests are obtained. The latter, user feedback, is a crucial point in the agile development of software products and is intended to prevent software from being developed for years only to find that it does not meet user requirements. Thereafter, (final) acceptance tests by the respective process owners after each sprint and before the go live should be conducted and specific training for the process users in the respective business departments should be prepared.
6. **Project management**	Month 1 – month 8	The project management, led by the City of Hamburg, includes the **coordination and communication with all involved stakeholders** throughout the entire duration of the project as outlined in the change management plan (see chapter Change Management Plan) to ensure a proper collaboration between all parties. Furthermore, a **detailed quality assurance** should take place, in particular via continuous testing activities conducted by dedicated experts within the City of Hamburg. This quality assurance also entails to flag any upcoming obstacles in a timely manner.

Phase	Indicative timeframe	Description/ Core activities
		At the beginning of the project, a **detailed project planning and specification of the core contents** of the project based on the results from the Deloitte concept development project (REFORM SC2021/064) is recommended. **The budgeting and procurement of services** that will be performed by external service providers needs to be conducted **prior to the start** of this implementation project.

Source: Deloitte.

Annexes

All project Deliverables are annexed to this report. The list below provides an overview over the individual Deliverables (the name of the Deliverable is a hyperlink to the corresponding section in this report).

Deliverable 1	Inception Report
Deliverable 2	Current Situation Analysis
Deliverable 3	As-Is Business Process Model
Deliverable 4	Business Requirement Catalogue
Deliverable 5	Business Case
Deliverable 6	To-Be Situation Analysis
Deliverable 7	To-Be Business Process Model
Deliverable 8	Roadmap
Deliverable 10	Communication Material

Inception Report

This report is the Deliverable 1 of the project “Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg”.

Executive Summary

This inception report is the Deliverable 1 of the project “Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg”. The structure of this document is as follows: Firstly, a project overview and the steps completed in activity 1 will be given, followed by an initial analysis of the priorities and objectives and, thirdly, the organisation of this project. The document concludes with the description of the next steps. The annex contains the kick-off presentation, the list of stakeholders that were interviewed as part of the strategic interviews and the interview guideline that was used for these interviews.

Activity 1 consisted in three steps: the kick-off presentation, in which the organisation, the content and the scope of the project was agreed, the conduction of strategic interviews and an initial document analysis. Based on these steps, the priorities, the objectives and the scope of the project was clarified. The project should focus on such processes that can be transmitted to other fields of application, prioritise processes that are expected to yield to substantial efficiency gains and concentrate on processes that can relieve employees from routine or rather unattractive tasks. Regarding the execution of the project, three main challenges were identified: Firstly, the handling of potential reluctance and reservations of employees, secondly, legal challenges and thirdly, challenges regarding the use cases. When identifying processes with automation potential, the project should aim to reach the following objectives: 1) reduction of administrative burden, 2) improvement of the quality for citizen services and 3) efficiency gains.

During the kick-off meeting, the participants accepted the project timeline indicated in the proposal, which foresees the finalisation of the project within twelve months, i.e., by the end of October 2022. The project is split into ten deliverables. The general scope for each deliverable is described in the proposal, which is based on the tender documents and further specified in the kick-off meeting slides (see annex). The deliverables will be further refined during the execution of the project. The proposed work methodology from the proposal was discussed and accepted with minor refinements. The project team is comprised of six team members, including the project management, with a technological and a public sector background. The project team will be accompanied by a Steering Committee comprised of representatives from the contractor, DG Reform and the City of Hamburg.

Project overview and steps completed in Activity 1

The Free and Hanseatic City of Hamburg Administration designed, in collaboration with DG REFORM, in a previous engagement an IT system to support the processing of unstructured interactions with citizens, referred to as citizen letters. This prior engagement was collaboratively developed with a team from Deloitte and addresses all the essential processes and elements defined specifically for the processing of citizens letters. Following the experiences of this pilot project, the scope of determining the potential of automation and digitisation of processes should now be extended to further administrative processes of the City of Hamburg. Concretely, this project aims to identify and map the relevant structures, processes, information flows and information, communications, and technology (ICT) systems involved. To this end, the ICT system currently in production, the intelligent dialogue management (IDM), is to be reused for other, more ‘generic’ tasks and processes.

This project consists of five activities that are described below in full detail. This inception report contains the results of activity 1. Activity 1 consisted of the kick-off meeting, the conduction of strategic interviews and an initial document analysis.

The **kick-of meeting** was held on **November 30th, 2021**. During the meeting, representatives from the contractor, DG Reform, and the City of Hamburg were present. The meeting was held as a Microsoft Teams meeting. The contractor prepared slides for the kick-off meeting that were shared before and presented during the meeting. The slides are attached to this report as an appendix. In addition to an introduction of all parties and team members, the scope and methodology of the project and the project organisation were discussed.

In order to verify the project priorities and objectives and to identify underlying challenges regarding automation, **strategic interviews** were conducted. Five strategic interviewees that represent BUKEA (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft)[2], BSW (Behörde für Stadtentwicklung und Wohnen)[3] and the City of Hamburg were identified and have been interviewed using semi-structured interview guidelines. The interviews had a duration of 45 to 60 minutes and were held via Microsoft Teams. The list of interview partners and the interview questions are included in the annex of this document.

The third step of activity 1 consisted of an **initial analysis of documents** the City of Hamburg has provided access to. The initial document analysis aimed to get an overview and an understanding of the existing processes and its structures and as well had the objective to determine an initial clustering of processes that will be refined and worked out in more detail in activity 2. It shall be noted, however, that the lists of processes the City of Hamburg provided is fragmented and varies with regard to its level of detail.

Initial analysis of the priorities and objectives

Baseline situation and challenges

In its Digital Strategy 2020[4], the City of Hamburg emphasises that a digital transformation and its resulting new forms of work and collaboration are essential to remain competitive. New digital and technologies that can automate processes are, according to this strategy, a fundamental pillar of the administration of the City of Hamburg. Citizens increasingly expect administrative services to be digital, available 24/7 and user-friendly, as they are already used to in their private environment.

Digitalising and automating administrative processes has also become a priority for the City of Hamburg due to the fact that a retirement wave and the demographic change in the next five years will aggravate the already existing staff shortage, according to the strategic interviewees. In some departments, this would lead up to a 25 % decline in employees[5]. Parallely and also caused by the staff shortage, several interviewees point out that the workload in administrations increases continuously.

In this context, automation and digitalisation of administrative processes are conceived, according to the interviewees, as a possibility to reduce administrative burden, to optimise processes and to support employees in their task completion. The interviewees thereby highlighted several **priorities** of the City of Hamburg with respect to identifying automation potential:

- Focus on such processes that can be transfered to other fields of application
- Prioritising processes that are expected to yield to substantial efficiency gains
- Concentration on processes that can relieve employees from routine or rather unattractive tasks

In our initial analysis, we have identified several **challenges** regarding the identification and implementation of processes with automation potential. These challenges were grouped into three clusters: 1) The handling of potential reluctance and reservations of employees, 2) legal challenges and 3) challenges regarding the use cases.

1) Handling of potential reluctance and reservations of employees

Technological innovation and the introduction of automated processes induces, by its nature, a change in processes and structures. This change can be accompanied by reservations, concern or even objections of employees. One interview partner outlined that the current roll-out of a robotic process automation technology (RPA) is leading to reluctance against this technology due to the fear of a potential loss of jobs. The initiation of the citizen letters project was mentioned as another example for employees' concerns.

[2] Authority for Environment, Climate, Energy and Agribusiness
[3] Authority for Urban Development and Housing
[4] The City of Hamburg, 2020. Digitalstrategie für Hamburg.
[5] According to one interviewee.

A pro-active and open communication and the highlight of the fact that employees should be relieved from their workload can help to mitigate this challenge. Scepticism towards automatisation but also the limitations of automation should be considered in managing expectations. A roll-out of technologies in departments with a greater openness towards these technologies also ensures positive experiences. All interviewees stressed the importance to build a 'coalition of the willing' and involve staff councils from the very beginning into the discussions.

2) Legal challenges

Many administrative processes involve sensitive data or imply legally binding decisions. Another characteristic of administrative processes is their transparent and traceable documentation. The use and the degree to which machines and automation tools such as artificial intelligence (AI) or RPA can replace human actions needs to be clarified. In the case of automating the civil register, the City of Hamburg has already initiated a legislative amendment that will allow machines to retrieve data from the civil register. The interviewees remarked that changes in legislation can and will be pursued in parallel but acknowledged that a higher effort is necessary to automate processes where a major change in the legislation would be necessary. However, such processes should not be completely excluded from the process list. Many potential use cases of automated processes such as the automation of legally binding decisions are not compliant with existing regulations. Hence, the existing regulation imposes hurdles to the application of automated tools, and it is probable that workaround solutions will be needed in the short term.

To address these challenges, the interviewees suggested to start with processes with a low threshold and that possess little legal relevance. This approach would exclude administrative acts and other acts of law. As potential further, yet more complex use cases, some interviewees named decisions without any margin of discretion should be considered.

3) Challenges regarding the use cases

All interviewees confirmed that many of the processes are not documented. Therefore, it is necessary to first collect information about all processes before starting the documentation and screening regarding relevant processes. This also includes additional work for employees that need to identify and prepare these processes or collect data and information to train the automation tools. From the perspective of the implementers, additional effort will be required before the automated solutions yield any efficiency gains.

To tackle these challenges, expectations should be managed clearly by involved stakeholders in the development and implementation of use cases, according to the view of the interviewees. Therefore, special focus must be placed on ensuring that the automation of processes does not result in the loss of know-how and practice among employees, as one of the interviewees emphasised that if the automated sub-process fails, knowledge could no longer be available on the human side. Furthermore, attention must be paid to maintaining job satisfaction. The elimination of certain processes or sub-processes through automation could be detrimental to some employees who are especially involved in these tasks.

Objectives of the project

The objectives to be achieved with this project are to explore the potential of digitisation and efficiency increase of administrative processes of the City of Hamburg and a better usability of existing technologies, as well as the identification of processes that should be adapted. These defined goals also coincide with the desired and expected goals and long-term effects on which the interviewees placed a particular focus during the interviews.

In the analysis of the interviews conducted, three different objectives can be formulated, which were addressed by all interviewees: 1) Reduction of administrative burden, 2) Improvement of the quality for citizen services, 3) Efficiency gains.

1) Reduction of administrative burden

Due to the upcoming retirement wave and demographic changes that will exacerbate staff shortage, digitisation and automation of administrative processes should be used to optimise the work allocation of employees. All interviewees agreed that one of the main goals of automation and digitalisation of administrative processes is, and should be, to reduce the workload of employees, particularly to relieve them from repetitive and monotonous tasks. This, in turn, would lead to an increase in quality and efficiency of other

duties, as employees' working time can be redistributed. Thus, faster decisions can be made, which, consequently, would meet the rising expectations of citizens.

Another objective mentioned by the interviewees is to automate standard decision-making processes. Such processes that require for example a submission and simple approval (e.g., business travel approval, procurement) can be accelerated. In the kick-off meeting, some preliminary criteria to identify the most suitable processes for automation were presented (see page 10). These criteria include time criticality, volume, complexity and relevance, among others. Standard decision processes could cover a number of these criteria and would therefore be potentially suitable candidates for automation. This analysis will be carried out in activity 2.

2) Improvement of the quality for citizen services

The automation of certain processes can lead to faster decisions, which in turn benefits the citizens. This was also considered one of the most important objectives of automation by some of the interviewees. Since citizens closely link the quality of citizen services with the time they spend at public authorities and in administration, saving time would bring them measurable added value and thus concrete benefits. These benefits also include the overall quality of administrative services and outcomes for citizens. In addition, digitised and optimised processing time can increase the perception and reputation of public administration among citizens. Especially in the interface with citizens, the state must present itself as efficient and also possibly have an influence on the economic design of private processes (e.g. building permits) by the state setting positive impulses, according to one of the interviewees in particular.

3) Efficiency gains

Prioritising those processes that are expected to yield to substantial efficiency gains is another target that should be in the focus of this project, so several interviewees. Different types of efficiencies can be examined in this process, on the one hand economic efficiencies in the sense of cost reductions and on the other hand time savings.

Efficiency gains should be measured by a healthy mix of different factors, according to one of the interviewees. For example, the reduction in employee working hours should not be the only factor measured, but the prevention of other costs such as investments and on-the-job instructions should also be included. Other approaches are the measurement of additional revenue that may be generated by automation, as well as 'citizen satisfaction' in the context of time savings on the part of citizens.

The listed objectives show that both, the reduction of administrative burden and efficiency gains, ultimately would also benefit the citizen. Administration should significantly improve its ability to meet the expectations of citizens in terms of services offered and increase satisfaction, one interviewee stated as a long-term effect of the automation and digitisation of processes. In addition, openness to artificial intelligence (AI) projects can increase employee engagement, with well-implemented automated processes if they ease employee workloads, which in turn provides the opportunity for further automatisation and digitalisation. Another important point in terms of long-term effects, is the expansion of automated processes and connected systems to other authorities and departments of the City of Hamburg. One interviwee also emphasised that by implementing current topics and further development of the digital strategy, which gives citizens the opportunity to use online and digital administrative services, the public's view of the administration is improving.

Scope of the project

During the kick-off meeting, the participants agreed on the material, temporal and geographical scope of the project as a further specification to the the tender and proposal documents. The material scope is set on the filtering of processes, among others by authority and office, with a focus on BUKEA and BSW. The current legislation should also be a particular topic of attention, according to several interviewees. In the further stages of this project, legislative challenges should be kept in mind as possible major obstacles. The temporal scope was defined at current and ongoing processes, and possibly also future processes. As a geographical scope, the emphasis is primarily on BUKEA and BSW, with the possibility of expanding to other administrative units at a later stage. During the interviews, this project scope was also reaffirmed. With regard to the method of

screening the processes, some interviewees suggested a collection of all processes while other interviewees preferred a focus on specific processes.

Based on the findings from the strategic interviews and the initial document analysis, a preliminary specification of scope was carried out:

- Overall, processes with high potential of efficiency gains or high scalability should be especially considered, some of the interviewed emphasised. The measurement of such efficiency gains and the degree of scalability will be analysed, among others, in activity 2.
- Another prerequisite with regards to the project scope was, according to the interviewees, that the processes under consideration should have the possibility to be extended to other authorities of the City of Hamburg.
- The potential implementation of an automated solution should also be a decisive criterion for the screening process.
- Processes with no or little legal effect on the outside should be prioritised.

The highest automation potential was seen by the interviewed persons mainly in processes regarding the preparation of notices (internal and external), processing of requests, preparation of general permits and the allocation of internal responsibilities. All respondents pointed out that the departments and authorities should be consulted to determine the exact processes. The respective district offices could also be a helpful point of contact. In the second activity, further stakeholder interviews will be conducted on the basis of the above-mentioned contact points and the provided documents, with the aim to consider the expertise and opinions of a diverse range of stakeholders and to gather as much information as possible on the administrative processes.

During the kick-off meeting, the participants agreed that the general framework and the scope of the deliverables is sufficiently explained by the tender and proposal documents as well as the kick-off meeting slides and that the exact scope of the deliverables should be agreed upon during the project work on the respective deliverables. It was remarked that any solution proposed by the contractor must be a user-centric to guarantee high rates of adoption by its users.

Organisation of the project

Project team

The project team from Deloitte consists of six team members. Martin Flisgen is the Engagement Partner and will be responsible for the project at a strategic level. Sebastian Pachl is the project manager and responsible for the operational execution of the project. He will be supported by the senior expert Dr. Frederik Bauer and the junior experts Carlotta von Ulm-Erbach and Franziska Hörth. Peter Wirnsperger will serve as the quality assurance partner and contact point in Hamburg.

The project team from the City of Hamburg has three members, Jan Billhardt, Ingmar Runge-Tölken, who are responsible for the project at the operational level, and Jan Hüttemann, who serves as an advisor due to his involvement in the citizens' letters project. The City of Hamburg-internal steering committee consists of Dr. Nadine Bräuninger (ZRL/BUKEA), Rüdiger Junge (VRL/BSW), Mathias Bock (Z40/BUKEA/BSW) and Dr. Annika Busse (ITD21).

Timeline

It is envisaged to finalise the project **within twelve months**. In general, the proposed project timeline from the proposal document and the kick-off meeting slides (page nine) have been accepted by the contractee. The following table lists the **expected finalisation** of each deliverable:

#	Activity	Deliverables	Expected finalisation
1	**Activity 1: Project inception**	Deliverable 1	End of January 2022
2	**Activity 2: Analysis of the current situation and business process model**	Deliverable 2 Deliverable 3 Deliverable 4	End of May 2022
3	**Activity 3: Elaboration of a Business Case**	Deliverable 5	End of July 2022
4	**Activity 4: Definition of the To-be situation**	Deliverable 6 Deliverable 7 Deliverable 8	End of October 2022
5	**Activity 5: Project Closing**	Deliverable 9 Deliverable 10	End of November 2022

Any delay during project execution should be communicated clearly as well as noted and reflected in the approval of the deliverables (see also Project risks and mitigation measures). During the kick-off meeting, the focus was set on discussing the deliverables one to four (Activity 1 and 2) to favour an in-depth discussion on the near-term project work. The deliverables five to eight (Activity 3 and 4) and the project closing (Activity 5) will be discussed in more detail at a later stage of the project. The proposed methodologies from the proposal were **accepted** in general.

Information needs

During the kick-off meeting, the contractor listed several information needs relevant for the project work. It was agreed that the City of Hamburg provides relevant documents, digitisation ideas and samples via a **shared drive**, operated by the City of Hamburg, for the project team. This shared drive was set up right after the call. It was remarked that all relevant documents are in German, which is not an issue for the project work given that the project team members are **native German speakers**. The project team will apply all relevant compliance rules of the City of Hamburg and Deloitte during the project.

Steering Committee

The purpose of the Steering Committee is to control the project execution and to oversee all planned activities, to ensure effective coordination and engagement. The Steering Committee will be comprised of the following **representatives**:

Institution	Representative
City of Hamburg	Mathias Bock, Jan Billhardt
DG Reform	Francisco Garcia-Moran, Román Diez-González
Deloitte	Sebastian Pachl, Benoit Vandresse, Martin Flisgen, Peter Wirnsperger

The Steering Committee will first meet on the 17th February 2022 and then three times until the finalisation of the project. The contractor will share a presentation regarding project progress two days before each meeting. The following meetings are planned: The second meeting will take place on 25.05.2022, the third meeting is planned for the 28.07.2022 and the fourth meeting will be scheduled for the 27.10.2022. Safe-the-date-blockers were sent by Deloitte to all Steering Committee members. The exact date of the Steering Committees will be communicated by Deloitte shortly before each meeting, depending on the availabilities of all Steering Committee members.

Project risks and mitigation measures

The following table sets out our current understanding of the main risks and challenges associated with carrying out the project, as well as our proposed mitigation actions. These challenges and risks were identified based on the information gathered during the kick-off meeting as well as during the strategic interviews. We will update and maintain this risk log throughout the project to ensure continuous tracking of involved project risks, threats, and issues.

Project risk	Mitigation measures
Acceptance of employees (concern/rejection because automation is seen as a threat to jobs)	Sensitive approach to AI and its implementation among certain employees, involvement of employees (representatives) and demystification of AI due to provision of information and concrete explanations about the functions and limitations of AI.
Communication problems	Regular project reports and workshops
Not enough relevant processes	Clear screening methodology and definition of the scope of the project
New and complex technology of software (IDM tool) to be examined	Through the information provided by the City of Hamburg, the project team will develop a thorough understanding of the software. The software (IDM tool) stems from the citizen letters project in which members of the Deloitte project team were already involved in. In addition, a contact person who works closely with the software would be beneficial.

Communication Arrangements, Feedback-Processes and Project KPIs

It was agreed that **progress reports** are sent monthly via email. The email will comprise a general update on activities conducted since the last update and an update on the overall project progress as well as ongoing issues and challenges. Furthermore, it was agreed that such reports should be communicated directly to DG Reform and City of Hamburg team members, but additional team members should be included in any communication in cc. The following accesses were created by the City of Hamburg for Deloitte members to exchange documents in a more secure manner:

Tool	Access
Nextcloud	All project team members from Deloitte and the City of Hamburg
Zuvex	All project team members from Deloitte and the City of Hamburg

It was agreed that any delay during project execution stemming from the complexity of the project should be clearly communicated by the project team as well as noted and reflected in the approval of the deliverables.

During the project work, the collaboration between DGReform and the City of Hamburg in the Supervisory Planning and Monitoring processes will require an **intensive communication** with both parties, especially in the choice of possible processes and in the identification of the preferred alternative in Activity 3.

The **project KPIs** listed in the kick-off meeting slides (page 18) have been accepted but were not discussed in greater detail throughout the meeting. Following further KPIs were discussed and added during the kick-off meeting:

- Risk control and implementation of adequate mitigation measure
- On-time delivery of all project deliverables
- Commitment of all stakeholders to the agreed results and communication of these results in the workshops
- As complete an overview (list) as possible of the existing processes
- Identify as many processes for digitalisation as possible including potential for AI use cases

- Agreement found on best processes for automation
- Appropriate communication to stakeholders

Preparation of reports

It was agreed that every document which will be handed in as a project deliverable should contain an **executive summary** that is short and simple and is a maximum of four to five pages long. Document drafts should be provided in **MS Office format** to allow easy commenting on content, but final documents should be provided in **PDF format**. Any final document should contain information when it has been accepted by the contractee. Furthermore, each document should honour the **terms and visibility of DG Reform** as stated in the framework contract (the front page of this Inception Report should serve as an agreed example).

Next steps

With the submission of the Inception report, the project will continue with activity 2. The purpose of this activity is to prepare the deliverables 2,3 and 4. Those deliverables consist of the currents situation analysis (D2), which results in an as-is business process model (D3) and a business requrenments catalogue (D4). The procedure and the next steps of this activity comprise of a desk research and a detailed analysis of the documents provided as well as the execution of stakeholder interviews at an operational level. For this purpose, stakeholders to be interviewed will be identified based on references from the interviews conducted in activity 1 and further suggestions of the City of Hamburg. The stakeholder selection will take place in close cooperation with the City of Hamburg.

In addition, one of the next steps of the activity 2 will be the preparation of the first Steering Committee Meeting held on the 17th of February 2022. Each of the Steering Committee members has already received an invitation to the virtual meeting. It will be organised by Deloitte and the project team will submit a presentation regarding the progress of the project two days ahead of the steering committee call.

Deliverables 2, 3 and 4 are planned to be handed in at end of May 2022.

Annex

The annex includes the list of stakeholders that were interviewed as part of the strategic interviews, the interview guideline for these strategic interviews, and the kick-off presentation.

List of stakeholders

The following table provides a list of stakeholders including their functions in the respective departmens within the City of Hamburg that were interviewed as part of activity 1.

Name	Function	Department within the City of Hamburg
Dipl.-Ing. Bock, Mathias	· Chief Digital Officer (BUKEA and BSW) · Member of the City of Hamburg-internal project steering group	State Ministry for Environment, Climate, Energy and Agriculture (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft, BUKEA)
Dr. Bräuninger, Nadine	· Head of Office 'Central Fields of Activity, Legal, Holdings' (Amt für zentrale Aufgaben, Recht und Beteiligungen) · Member of the City of Hamburg-internal project steering group	State Ministry for Environment, Climate, Energy and Agriculture (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft, BUKEA)
Dr. Busse, Annika	· Head of Unit 'Digital automation of the administration' · Representative Chief Information Officer (CIO), · Member of the City of Hamburg-internal project steering group	Senate Chancellery (Senatskanzlei)
Hauenstein, Sven	· Head of Office Projects and Processes BUKEA and BSW · Coordination and support of the digitalisation activities of the City of Hamburg	State Ministry for Environment, Climate, Energy and Agriculture (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft, BUKEA)
Röder, Normann	· Head of Administration BSW · Representative member of the Digital Management Board of the City of Hamburg	State Ministry for Urban Develompent and Living (Behörde für Stadtentwicklung und Wohnen, BSW)

Interview guideline

The following interview guideline is a translation from German to English and was sent to the strategic interviewees as a basis for the interviews.

Introduction to the project

The Free and Hanseatic City of Hamburg Administration designed, in collaboration with DG REFORM, in a previous engagement an IT system to support the processing of unstructured interactions with citizens, referred to as citizen letters. This prior engagement was collaboratively developed with a team from Deloitte and addresses all the essential processes and elements defined specifically for the processing of citizens letters. Following the experiences of this pilot project, the scope of determining the potential and automation and digitisation of processes should now be extended to further administrative processes of the City of Hamburg. Concretely, this project aims to identify and map the relevant structures, processes, information flows and information, communications, and technology (ICT) systems involved. To this end, the ICT system currently in production is to be reused for other, more 'generic' tasks and processes.

Background information on the interviews

As part of the project, strategic interviews are conducted with the aim of obtaining assessments of the focus of the project, the priorities and challenges in the automation of processes.

The questions listed below reflect our information needs as part of the project. However, not all questions have to be covered, they rather serve as a "conversation support" and the focal points can vary depending on the background, expertise and prioritization of the respondent. The interviews are carried out via video conference (Microsoft Teams). The length of the interviews will be around 45 to 60 minutes.

The information transmitted during the interview will be treated confidentially and the knowledge gained will only be recorded anonymously. The personal data that are collected to conduct the interviews are processed in accordance with the GDPR.

Interview questions

1. About your **background**: What role and activities do you have in the administration of the City of Hamburg? What specific points of contact / tasks do you have in relation to this project?

2. What **general needs and priorities** does the City of Hamburg have regarding the automation and digitisation of processes?

3. What **challenges** do you see in the automation and digitisation of administrative processes in the city of Hamburg?

4. What **objectives** should the automation and digitisation of processes pursue? Which aspects do you think are particularly important here?

5. What **long-term effects** of the automation and digitisation of processes are you hoping for?

6. What **priorities** should the project team set in terms of automation and digitisation when carrying out the project?

7. Where do you see the **greatest potential for automation** and why? Are there any processes that you have an eye on for automation?

8. Can you give us **documents and sources** (e.g., a process list) that we can use to obtain more information about the processes in the city of Hamburg? Where should we go for more information about the processes?

9. **Other**: Can you name other contacts who can give us information that is relevant to our project? Do you have any other comments?

Kick-off presentation

The slides below were presented during the kick-off presentation on November 30th, 2021.

Current situation analysis

This deliverable is a diagnosis report and analysis of the current situation regarding the administrative processes of the authorities BUKEA and BSW. As a result, this deliverable presents a list of processes to be analysed in detail in the following deliverables (short list).

Executive Summary

This current situation analysis is the Deliverable 2 of the project “Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg”. The structure of this document is as follows: Firstly, an introduction and a review of the existing situation at BUKEA (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft) and BSW (Behörde für Stadtentwicklung und Wohnen) is given, including the analysis of the current situation regarding the digitalisation and automation of administrative processes, the assessment of the relevant legal framework and the identification of key problems and risks. This is followed by a presentation of the methodology used to identify processes with automation potential and the processes identified. The annex contains the organisational charts of BUKEA and BSW, the workshop presentation, a list with the participants of the workshop, the list of stakeholders that were interviewed as part of the stakeholder interviews and the interview guideline that was used for these interviews.

Activity 2 consisted of six steps: the information gathering, in which all available documents to processes and systems were gathered, the definition of a set of processes to be supported by the Software and the review of the existing situation, by analysing the gathered documents and conducting 13 Stakeholder interviews. In addition, Activity 2 consisted of the exchange of information between the beneficiary and the EU authorities covered by the monthly reports, as well as the identification of business requirements and a workshop with stakeholders of the City of Hamburg held on May 19, 2022. The activity 2 includes three deliverables: the current situation analysis, the business process model and business requirement catalogue. These three deliverables were written collectively and complement each other's information.

It was decided to examine not only processes that can be automated using the IDM (Intelligentes Dialogmanagement) tool, but also processes that can be automated using other AI and statistical technologies. On the short list of 5 processes with automation potential, which were discussed and agreed upon in a workshop, are processes that can be automated with the IDM tool (or extensions) as well as with other technologies.

Introduction

This deliverable is an analysis of the current situation at BSW and BUKEA. It contains an analysis of the current situation regarding the digitalisation of administrative processes as well as an assessment of the relevant legal framework and a description of identified process and project key problems and risks. The deliverable also includes an introduction and presentation of the methodology used to identify relevant processes that can be automated. In addition, the technologies and systems are described and the long and short list of processes with automation potential is presented.

The information for this deliverable was gathered through desk research of documents and files provided by BUKEA and BSW via a shared drive as well as detailed interviews at an operational level with stakeholders and process owners and a workshop conducted with representatives of the City of Hamburg.

Review of the existing situation at BUKEA and BSW

This chapter provides a review of the current situation at the authorities BUKEA and BSW.

This includes 1) an analysis of the current situation regarding the digitalisation and automation of administrative processes, 2) an assessment of the relevant legal framework and 3) the identification of key obstacles and challenges as well as their corresponding risks in the current situation.

Analysis of the current situation regarding the digitalisation and automation of administrative processes

In its Digital Strategy 2020[6], the City of Hamburg emphasises that a digital transformation and its resulting new forms of work and collaboration are essential to remain competitive. New digital and technologies that can automate processes are, according to this strategy, a fundamental pillar of the administration of the City of Hamburg. Citizens increasingly expect administrative services to be digital, available 24/7 and user-friendly, as they are already used to in their private environment.

Digitalising and automating administrative processes have also become a priority for the City of Hamburg due to the fact that a retirement wave and the demographic change in the next five years will aggravate the already existing staff shortage, according to the strategic interviewees conducted in activity 1. In some departments, this would lead up to a 25 % decline in employees. Parallely and partly caused by the staff shortage, several interviewees point out that the workload in administrations increases continuously.

In this context, automation and digitalisation of administrative processes are conceived, according to the interviewees, as a possibility to reduce administrative burden, to optimise processes and to support employees in their task completion. The interviewees thereby highlighted several **priorities** of the City of Hamburg with respect to identifying automation potential:

- Focus on such processes that can be transfered to other fields of application
- Prioritising processes that are expected to yield to substantial efficiency gains
- Concentration on processes that can relieve employees from routine or rather unattractive tasks

In the light of the strategic objectives mentioned above, the authorities **BUKEA and BSW currently aim to digitalise various internal administrative processes as well as processes that include external stakeholders** such as citizens, enterprises and other authorities and administrations at a federal and a national level. It was further confirmed that various large Hamburg-wide digitalisation projects have been rolled out in order to accelerate the digitalisation of administrative processes. Such projects include ePob or the extension of existing software such as SAP. ePob is a project of the Senate Chancellery (Senatskanzlei) that aims the digitalisation, proceeding, classification and allocation of all incoming paper mail and will be piloted in Q4 of 2022 at BSW. The broader rollout is expected for Q3 of 2023. Other projects focus on assessing the possibilities of existing software such as SAP to scale or extend digital solutions. The large financial volume, that is currently invested in the digitalisation of these processes, demonstrate the efforts to enhance the digital capacities of BUKEA and BSW. A process analysis conducted by a BUKEA official that was carried out parallely to this Activity 2 analysed the digitalisation potential in depth.[7]

[6] The City of Hamburg, 2020. Digitalstrategie für Hamburg.

[7] BUKEA- and BSW-internal project carried out by Sven Hauenstein (Head of Office Projects). The objective is to record processes within BUKEA and BSW that have digitalisation potential.

Digitization, as a **highest priority** at BUKEA and BSW, is being actively implemented and is a fundamental prerequisite for the automation of processes. The **automation of processes**, which is a **major priority** following digitization, is implemented wherever possible **as a second step**. However, no dedicated resources are currently allocated to the development of automated processes.

However, as was pointed out by many stakeholders that were interviewed on an operational level as part of activity 2, the **degree of digitalisation of processes varies substantially** both across and within the departments of BUKEA and BSW.

Some departments such as ABH (Department for Building Regulations and Structural Engineering; Amt für Bauordnung und Hochbau) at BSW **confirm that all core operational processes have already been digitalised** several years ago. Regarding the automation of processes there are ongoing discussions about a potential use of AI-assisted building permit proceedings. Given the complexity and the high degree of decision-making of the processes at ABH as well as the legal framework, **no concrete automation project has been fostered so far**.

In several departments, the **use of e-mailing and generic mailboxes is an important digital tool** for the respective processes. Examples include the allotment process (Kleingartenbeschwerden), the info boxes (Infoboxen) and different types of inquiries such as parliamentary inquiries (parlamentarische Anfragen) and brief written inquiries (schriftliche kleine Anfragen) in both authorities. In these types of processes, data and information is forwarded via mail to the corresponding departments and stakeholders. The process of selecting the department or person in charge takes place via implicit knowledge or the use of internal organisation charts.

In several departments, **internal knowledge management** plays an important role in the fulfilment of tasks. As confirmed by the presidential department (Präsidialabteilung) at BSW, data and information is **currently stored on a drive** which, however, is **oftentimes only accessible for the respective unit** and does not allow cross-unit or even cross-department access of data that might also be relevant for other departments. Implicit and non-written knowledge are important to orientate oneself in the broadly branched folder structures.

Assessment of the relevant legal framework

Many administrative processes involve sensitive data or imply legally binding decisions. This includes adhering to legally binding deadlines and forms when processing and responding to requests, decisions, and permits. We therefore identified the relevant legal framework during the desk research and Stakeholder interviews, paying special attention to legal restriction.[8] During the interviews conducted as part of activity 2, few legal restrictions were mentioned in particular, which we would like to explain briefly in the following chapter.

We will further analyze and elaborate on these initial identified legal constraints during the creation of the use cases in activity 3.

Identification of key problems and risks

The following chapter sets out our current understanding of the main risks and challenges associated with carrying out the project. These were identified based on the information gathered during the kick-off meeting, steering committee meeting as well as during the strategic and stakeholder interviews conducted during the activities 1 and 2.

The table below provides a structured list of obstacles and challenges and their corresponding risks regarding the automation of processes at BUKEA and BSW. The obstacles and challenges were clustered into five categories, namely 1) legal aspects, 2) technical aspects, 3) procedural aspects and 4) structural aspects.

[8] We however must exclude any formal legal advice as this would have to be implemented over a separate contract with our Deloitte Legal entity.

Table 4: Key obstacles and challenges and corresponding risks regarding the automation of processes at BUKEA and BSW

#	Obstacles and challenges	Risks
1.	Legal aspects	
1.1	**Obligation to constitutional jurisprudence** Some processes are bound by constitutional case law (Art. 25 of the Constitution of the Free and Hanseatic City of Hamburg (HV)) to legally compliant deadlines and forms	Due to the legal binding, it is mandatory to comply with these required deadline and forms and therefore minimize the risk of errors and possible slowdowns.
1.2	**Processes with sentitive information subject to strict data protection regulations** Many processes involve the proceeding of sensitive personal data. Data protection issues are of particular relevance in these cases and the corresponding legal requirements must be complied.	If sensitive personal data is involved, the risk of errors must be minimised. Further, the access to this information by unauthorised persons must be prevented. However, the procedures in place to meet these legal requirements can still lead to errors and unintended access to sensitive information.
1.3	**Legal setup and framework of BUKEA and BSW** The legal setup and framework of both authorities has, by definition, a very narrow legal scope. Officials are in a subordination relationship (*Weisungsgebundenheit*).	The legal setup entails more complex confirmation, approval and communication mechanisms and therefore contains an implicit risk of more intricate processes and digitization procedures.
2.	Technical aspects	
2.1	**Media discontinuity and manual work** Many processes are characterised by a high amount of manual work and media discontinuity. Examples include the use of different formats, scanning of documents to digitalise them and the switch between phone, mail, post letters, fax and other.	The high degree of media discontinuity and manual work entails the risk that actuality, consistency, correctness and completeness of data cannot always be ensured.
2.2	**For cross-department processes almost no system integration** The exchange of knowledge across departments is very limited as cross-department system integration (e.g. common storage, shared drives) are almost non-existent.	The lack of system integration could lead delays and time lags in processing and in communication which, in turn, could lead to double work and inconsistencies.
2.3	**Exchange of data is cumbersome** The exchange of data between departments and across authorities is cumbersome and laborious as there is little system integration and the exchange in many cases takes place via mail.	Despite manual controls, the risk of inconsistencies remains. Increased time expenditure due to the necessity of additional controls is a consequence.
2.4	**Concentration of communication via generic mailboxes** For various processes, communication is bundled via generic mailboxes, where citizen concerns, general request and also sensitive information are received.	The bundling of communication via generic mailboxes could lead to an information overload and a risk of incorrect forwarding of sensitive information.

#	Obstacles and challenges	Risks
2.5	**Large amounts of data cannot be sent via mail** Some processes (such as approval processes) involve the transfer of large amounts of data. Currently, this data is mostly sent via mail or sent in a paper form. As there is a limit of 20 MB, large amounts of data cannot be sent via mail.	This fact could slow down processes, entails the risk of losses of information and implies that information must either be printed out or other workarounds must be found.
3. Procedural aspects		
3.1	**Legal timeframe and tight deadlines** Many requests for permits and applications from citizens and enterprises need to be delivered in a very tight timeframe (the night work permit is a particular example of such quick deliveries). Reaction cycles are becoming shorter, so decisions must be made quickly, even at night and on weekends.	The tight deadlines that result from the legal timeframe involve the risk of extra hours and a high workload that could be prone to errors. The expected staff shortages in the coming years could further aggravate this risk.
3.2	**High degree of stakeholder involvement in most of the processes** Many processes involve a high degree of stakeholder involvement, oftentimes from various units or across departments. This imposes protractions and a high degree of coordination especially in the case of complicated approval processes and when different tools are used.	In processes with a high degree of stakeholder involvement there is a risk for process owners to obtain relevant information and a risk of higher efforts to collaborate efficiently.
3.3	**Complex and multifaceted processes** Various processes (including approval processes regarding construction sites) have a high degree of complexity and/or involve long time horizons, sometimes over years.	Such complex and multifaceted processes entail the risk of losses of knowledge, in particular when employees retire or when documentation takes place either implicitly or is largely paper based.
3.4	**Heterogeneous client groups** Client groups of processes that involve external communication with citizens and enterprises are very heterogeneous with respect to their demands, need and level of digital knowledge.	Heterogeneous needs, demands and levels of knowledge could lead to higher and more targeted efforts to proceed requests and could also involve (the combination of) more tools (paper-based, phone, mail, fax, scanned documents).
3.5	**Implicit and non-written knowledge of processes** The knowledge about some processes (especially those that are not (fully) digitalised) consists mainly of implicit and non-written knowledge. Written process charts and information about procedures are oftentimes nonexistent.	If process owners retire or change departments, the stock of knowledge for a respective process could go lost.
4. Structural aspects		
4.1	**Complex organisation charts with many departments**	The complex organisation of both authorities increases the risk of protractions in processes, anonymity and slow knowledge transfers.

#	Obstacles and challenges	Risks
	Both authorities BUKEA and BSW have a complex organisational structure with many departments, subdepartments and units involved.	
4.2	**Dynamics in the organisation that involve changes in responsibilities** At the beginning of and also within a legislative period many lead and head roles and their responsibilities change.	Dynamics in responsibilities could lead to losses of knowledge and protractions in communication regarding the person that replaces the role.

Source: Deloitte 2022

The following table provides an overview of the key obstacles and challenges and their corresponding risks that are inherent to the implementation of this project. This risk log will be updated throughout the project to ensure a continuous tracking of involved project risks, threats, and issues.

Table 5: Key obstacles and challenges and corresponding risks regarding our project

#	Obstacle and challenges	Risk
1	**Acceptance of employees** Employees that are the owners of processes with automation potential could perceive the project as a threat and hence reject it because their jobs could be at risk.	Since the input and cooperation of the employees is of great importance for both the analysis and the automation of the processes, a rejection of the employees could delay and even jeopardise the project.
2	**Communication problems** Close communication with process owners is required to schedule appointments (interviews, workshops, etc) and gather new information. The input from the process owners is crucial to understand and elaborate the processes.	Lengthy and inconvenient communication channels with delayed scheduling pose a risk of not involving the process owners sufficiently in the project and of running into time delays due to scheduling difficulties.
3	**New and complex AI technologies** The IDM (Intelligent Dialogue Management) tool that will be extended and applied (conceptually) to other use cases during the project as well as other AI technologies involve complex and new AI technologies.	The conceptualisaton of use cases with new technologies could entail the risk that the application might not be possible for the specific circumstances and that other unforeseen hurdles must be overcome.
4	**Compatibility of processes with automation potential in BUKEA and BSW** Each process with automation potential that was identified during activity 2 of the project should have a counterpart (i.e. a similar process) in the other authority to be accepted for the short list.	This procedure imposes the risk that for processes in one authority that might be very suited for an automation no counterpart in the other authority can be found. Such processes would therefore then – despite their potential – not be considered further.

Source: Deloitte 2022

Identification of relevant administrative processes

Introduction

This chapter outlines our methodology in order to determine the short list of processes that will be analysed in detail in the upcoming deliverables. Thereafter, a detailed examination of the administrative

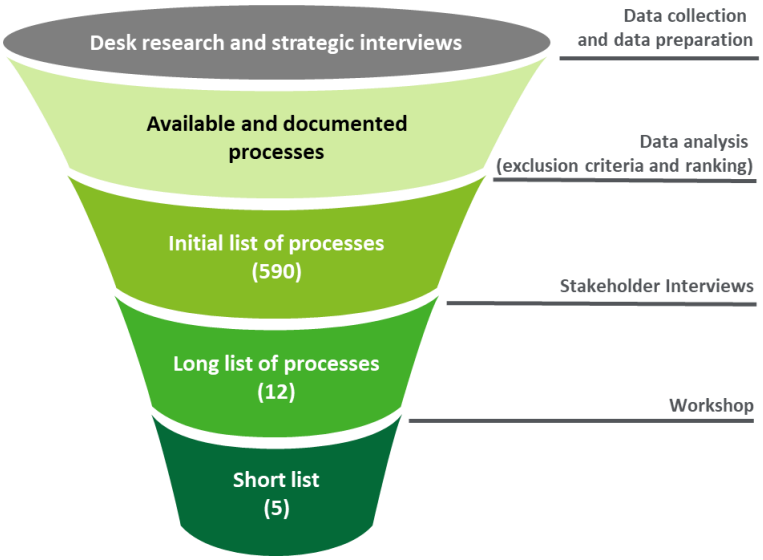
processes both from a business and from a technological perspective will be presented. The chapter concludes with the presentation of the long list and the description of the short list of processes.

Methodology

In order to obtain the short list of five processes, a tailored methodology was developed. This methodology consists of a four-step funnel approach to screen and analyse the administrative processes of BUKEA and BSW.

The following figure provides an overview of this methodology that was used to determine the short list of processes.

Figure 1: Four-step funnel approach to determine the short list of processes



Source: Deloitte 2022

Building on the existing desk research and the strategic interviews that were conducted in activity 1, the basis for the analysis of administrative processes consisted in various sources:

- Aris: software that is currently in use at the City of Hamburg to create process graphics. The software is used for processes with a need of visualization, e.g. for analysis / optimization purposes
- ViFlow: software that was formerly used to create process graphics. The software was used for processes with a need of visualization, e.g. for analysis / optimization purposes.
- Potential analysis (Potenzialanalyse): BUKEA- and BSW-internal project carried out by Sven Hauenstein (Head of Office Projects). The objective is to record processes within BUKEA and BSW that have digitalisation potential.

As a first step, the data collection and data preparation based on available and documented processes was conducted with the aim to collect and prepare all available (documented) processes within BUKEA and BSW that were gathered through the sources from Aris, ViFlow and the potential analysis (Potenzialanalyse). It is important to note that an overall overview (neither graphically nor as a textual description) does currently not exist at BUKEA and BSW. Having collected all available and properly documented processes, an initial list of 590 processes was created. In total, approximately 200 processes resulting from the excerpts from the provided documentation (Aris, ViFlow) and another approximately 390 processes form the potential analysis (Potentialanalyse) were listed. A duplication check was conducted thereafter to delete duplicate processes.

In a second step, the data analysis and, as part of it, the application of the exclusion criteria was conducted. Each of these processes was checked whether a predefined exclusion criterion was applicable. In the case a process was classified with one or various of the six exclusion criteria, this process was not considered for further analysis. The exclusion criteria and their definition are listed in the table below.

Table 6: Preliminary exclusion criteria for evaluating the automation potential of processes

#	Criterion	Definition
1	No time criticality	The process is not time-critical (e.g. to be closed within a certain number of days)
2	Low volume	The process is not performed on a frequent cycle and does not involve a lot of manual labour
3	High complexity	The process is highly complex with both structural and functional as well as dynamic properties
4	Little relevance	The process is not relevant and important for the daily work of the City of Hamburg
5	Not properly defined	The process is not properly defined or changes frequently. The tasks performed in the process are not repetitive or processed in the same order, and use systems that change (frequently)
6	Not rule-based	A process in which employees do not follow a strict set of predefined rules with no discretionary decision-making

Source: Deloitte 2022

The remaining processes were ranked according to their relevance regarding automation potential. Therefore, scores between 0 and 10, with 0 being the lowest relevance and 10 being the highest were assigned.

In the third step, **stakeholder interviews** with process owners for the highest-ranking processes were conducted. In sum, 13 stakeholder interviews with stakeholders on an operational level from both BUKEA and BSW were conducted during April and May 2022. A specific interview guide with questions regarding the scope, volume, involved stakeholders and other details of the respective process as well as regarding the current situation was developed (see Annex).

In a fourth step, a detailed assessment of all processes mentioned in the stakeholder interviews was conducted using a predefined list of criteria (**long list process assessment using long list criteria**). The following table presents the long list criteria that were used to determine 12 processes for the long list. All processes on the long list fulfill these criteria at least to a high degree.

Table 7: Long list criteria

#	Criterion	Dimensions
1	Scalability of the process	Yes, no
2	Volume of the process	[in time dimensions]
3	Rule based process	Yes, no
4	Time saving potential	[in minutes]
5	Transferability of the process	Yes, limitedly, no
6	Relevance of the process for the authority	Low, medium, high
7	Potential for future use of the process	Low, medium, high
8	Complexity of the process	Low, medium, high
9	Time criticality of the process	Low, medium, high
10	Definition of the process	Yes, no

Source: Deloitte 2022

All long list of processes were further examined along the following three dimensions:

1. The extent of process modifications to adapt the process to the existing Intelligent Dialogue Management (IDM) software that was developed in the context of the citizen letters project
2. The need to add functionalities to the IDM software itself

3. The potential to automate this process with another AI technology

In a fifth step, the **short list of processes with automation potential was determined**. Therefore, a workshop presentation (see Annex) that summarised the outputs of the steps that had been carried out so far was prepared. This presentation also included a preliminary suggestion of five short list processes by the project team. The aim of this workshop was to develop the final short list of four to five processes which will be analysed in the subsequent deliverables in more depth. During the workshop with participants from the Hamburg-internal steering committee (see Annex), all long list processes were discussed in-depth. The outcome of the workshop was a preliminary validated short list, that was approved subsequently by the Hamburg-internal steering committee. All short list processes were discussed regarding their potential for automation with the (modifications and/or extensions of) the IDM tool or other AI technologies. The following table lists the short list criteria that were used to determine the short list.

Table 8: Short list criteria

#	Criterion
1	Expected reduction in workload
2	Scalability of the AI technology for other use cases and processes
3	Expected quality improvement
4	Technical feasibility of the automated solution
5	Procedural feasibility of the automated solution
6	Automation potential of the process: - IDM compatibility - Other low-threshold AI solution - AI use case

Source: Deloitte 2022

Further in-depth analyses of the short list processes will be conducted during the creation of the business cases in activity 3 and the to-be model in activity 4.

Examination of administrative processes that could be automated

Assessment from a business perspective

The various administrative processes at BUKEA and BSW can, from a business perspective, be clustered into various subgroups. As resulted from our analysis and examination described in the subchapter on methodology, not all process groups are equally suited for automation. During the analysis of the administrative processes, it became clear that some process clusters are more suitable than others.

The following table provides an overview of process clusters and their suitability for automation that was developed during activity 2.

Table 9: Process clusters

Process cluster	German translation	Suitability for automation
Approvals	Genehmigungen	Medium
Allocations of responsibility	Zuständigkeiten, Zuordnungen	High
Updates and analysis of data (e.g. in Excel)	Einpflegen und Analyse von Daten (z.b. in Excel)	High
Applications	Anträge	Medium
Requests	Anfragen	High

Process cluster	German translation	Suitability for automation
Completeness checks	Vollständigkeitsprüfungen	High
Subsequent requests	Nachforderungen	High
Creation of notifications	Erstellen von Bescheiden	Medium
Planning procedures	Planungsprozesse	Low
Plausibility and adequacy checks	Prüfungen auf Plausibilität und Angemessenheit	Low

Source: Deloitte 2022

Given the **varying degree of automation potential** of the different process clusters, the project team only focussed on those processes that are expected to have an automation potential that was at least ranked as medium.

Besides the suitability for automation, several **external factors** must be taken into consideration when assessing the business perspective.

- One important aspect refers to the **legal framework**, i.e. data protection issues and competencies of officials that cannot be delegated to AI technology. Approval processes and creations of notifications must therefore be considered with particular diligence as the setup of an AI technology could already be a legal grey area. A potential automation of those processes must therefore be analysed also regarding its potential legal consequences.
- Another factor refers to the involvement of **human decision-making within a hierarchic context.** Planning procedures as well as plausibility and adequacy checks are therefore processes that are both too complex and involve too much decision-making at various levels for an automation.
- The **involvement of external stakeholders** (such as other authorities, citizens and enterprises) oftentimes involves interfaces and the use of different tools as well as diverging levels of knowledge, linguistic expression and other. Processes such as applications and approvals that involve external stakeholders should therefore also be considered being reviewed thoroughly.

From a business perspective, processes that involve allocations, updates and analysis of data, completeness checks and subsequent requests are therefore particularly suited to be automated.

Assessment of the technologies and systems for automation of processes

During activity 2, the project team also assessed technologies related to AI that could be used to automate the processes that were identified as suitable from a business perspective (see above). Seven technologies have been as particularly relevant in the context of these processes.

The following section describes the technologies and IT systems that can be used to automate the selected processes. A closer examination and use of the technologies will be examined in the course of activities 3 and 4.

Table 10: Technologies and systems supporting the processes

Technology / System	Short description
IDM (Intelligent Dialogue Mangement) Workflow	In an earlier project, the administration of the City of Hamburg, in cooperation with DG REFORM, developed an IT system, to support the processing of unstructured interactions with citizens, the so-called citizens' letters. This was subsequently elaborated for further use and renamed intelligent dialogue management (IDM). The IT systems are currently in production with the following building blocks: Search function, rights administration, and determination of responsibility. An e-mail routing support as an add on is planned.

Technology / System	Short description
	The overall **metadata** of the IDM tool includes mainly the information about the process, such as details, history, comments, and dispositions, participants, and attachments. The information that can be displayed with the IDM workflow are listed below. • Details: Transaction number, sender, subject, received on, response deadline, release required, sensitive information, processor, status, priority. • History: What action, at what time, was performed by whom. • Comments and dispositions: Free text in comment form Participants: who is authorized to participate in the process • Attachments: additional files The IDM-Tool further contains an editor window for the responses and citizen letter, an operation overview and **transparent work organization,** a search function with database for closed processes and a transfer function to select the routing.
Intelligent search: Dense Information Retrieval	In our case, the information retrieval system is an internal search engine backed by modern technologies such as AI (Artificial intelligence) and ML (machine learning). It can be used asymmetrically, like a google search, by entering some keywords and finding relevant documents corresponding to the search query or symmetrically were e.g., a hole pdf document is used as search query to find similar documents. The dense information retrieval systems can be extended to search other documents as well. For example, an image can be used to find correpsoning texts or video files in the internal system. Intelligent search can deliver smarter results faster and provides a single point of access to enterprise content sources, allowing data to be enhanced, searched, and analyzed in both structured and unstructured formats.
Dashboards	In information management, a dashboard is a graphical user interface used to visualize data. Commonly used tools in a dashboard are the target-actual comparison, traffic light warnings and progress curves
Imputing	Missing values in datasets can cause problems for many machine learning algorithms and can impact the quality of data. Therefore, it is good practice to identify and replace missing values. A popular approach for data imputation is to calculate a statistical value for each column (such as a mean) and replace all missing values for that column with the statistic. Imputed values can be an estimate or an implicitly derived value with no uncertainty.
Named Entity Extraction	Name entity recognition is a subtask of Natural Language Processing that seeks to locate and classify named entities mentioned in unstructured text into pre-defined categories such as person names, organizations, etc. With named entity extraction, it is possible to understand the subject or theme of a body of text and quickly group texts based on their relevancy or similarity.
Predictive Analytics	Predictive analytics is a branch of advanced analytics that makes predictions about future outcomes using historical data combined with statistical modeling, data mining techniques and machine learning.
Classification / Determination of responsibilities	Classification models are a subset of supervised machine learning and can be performed on structured or unstructured data. Classifiction is a technique where data is categorized into a given number of classes. The main goal is to identify the category/class to which a new data should be assigned. In this case, classification can be used for the determination of responsibilities.

Source: Deloitte 2022

Long list of processes with automation potential

After having conducted the process analysis and having obtained detailed information from the stakeholder interviews, the long list of processes was determined. This list contains processes from both authorities as well as processes with different business perspectives.

The following table contains the long list of 12 processes with an automation potential that was presented in the workshop with the Hambur-internal steering committee members.

Table 11: Long list of processes

#	Long list process (German denomination)	English translation	Process cluster	Organisational setting of the process[9]
1	**BohrIS – Vollständigkeit**	BohrIS Completion procedure	Completeness check	BUKEA -> W -> W3 (Geologisches Landesamt)
2	**BohrIS – Nachverfolgung**	BohrIS Tracking	Subsequent requests	BUKEA -> W -> W3 (Geologisches Landesamt)
3	**Bezirkliche Ersuchen**	District Requests	Requests	BUKEA -> P (Präsidialabteilung)
4	**Bürgerschaftliche Eingaben**	Citizen submissions	Requests	BUKEA -> P (Präsidialabteilung)
5	**Senatsdrucksachen-abstimmung**	Senate printed matter coordination	Allocation of responsibility	BUKEA -> P (Präsidialabteilung)
6	**Schriftliche Kleine Anfragen**	Brief written inquiries	Allocation of responsibility	BUKEA -> P (Präsidialabteilung)
7	**Physischer Posteingang**	Physical inbox	Allocation of responsibility	BSW and BUKEA
8	**Marktüberwachung**	Market surveillance process	Updates and analysis of data (e.g. in Excel)	BUKEA -> E1
9	**Wärmekataster**	Heat cadastre	Updates and analysis of data (e.g. in Excel)	BUKEA -> E1
10	**Wissensmanagement**	Knowledge Management	Data updates and data analysis	BSW -> P (Präsidialabteilung)
11	**Infoboxen**	Info boxes	Allocation of responsibility	BSW -> V213 (Innerer Dienstbetrieb)
12	**Berichtswesen**	Reporting	Updates and analysis of data (e.g. in Excel)	BSW -> VR V2

[9] A detailed organisational chart of BUKEA and BSW is provided in the Annex to this document.

Source: Deloitte 2022

Each of these processes was presented during the workshop and the short list recommended by the project team was presented and discussed. The feedback and comments of the workshop participants on the individual processes were discussed and recorded and are briefly summarized below.

There were general feedbacks on the scalability of the individual processes to other authorities, which will be investigated in more detail in the next activity. In addition, it was decided to find other BSW-specific processes for the 'BohrIs' process that could be automated using the same technologies. A few processes were identified (more on this in Deliverable 3) and the process is now called the 'Imputing Procedure' and is demonstrated using the BohrIs process as an example. For all of the five selected processes, further discussions will be held as part of activity 3 with the process owners in order to deepen further details such as volume, scalability etc.

Short list of processes with automation potential

After presenting and discussing the long list of processes in a workshop with stakeholders from the City of Hamburg (see annex), a short list of five processes was agreed upon. This list contains processes with a high automation potential, as well as a high degree of scalability to other departments as well as other authorities within the City of Hamburg.

The following Table presents the 5 processes that were agreed on for the short list including a short description. These processes will be presented in detail in Deliverable 3.

Table 12: Short list of identified processes with short description

#	Process	Short description
1	Brief written inquiries (Schriftliche Kleine Anfragen)	Brief written inquiries are inquiries on public matters, which are addressed to the Senate by members of the Parliament. These inquiries are transmitted forthwith to the Senate and are to be answered in writing by the Senate within eight days.
2	Knowledge Management (Wissensmanagement)	The knowledge management describes a process, where officials from the unit P1 at BSW store, document and access information on a shared drive. This folder system can only be accessed by officials from this unit and has been maintained since 2005. As main activity of this process, officials access this folder system and try to extract relevant documents and information.
3	Info boxes (Infoboxen)	The info boxes are a generic mail address (funktionales Mailpostfach) that serves as a collection point for a wide variety of inquiries. The requests vary from daily topics on procurement procedures and budgetary requests to applications for tender procedures. Those inquiries are then forwarded to the relevant departments.
4	Imputing procedure (Imputing-Verfahren)	With regard to the general process "Imputing procedure", several processes were found in the course of the process evaluation, on the basis of which the AI-supported imputing procedure can be represented. For the short list and as well as for the illustration of this process in this deliverable, the process of drilling indications was selected. This process describes the various steps involved in processing and completing the of drilling indications.
5	Senate printed matter coordination (Senatsdrucksachenab-stimmung)	Senate printed matter coordination are issues of fundamental importance, which are decided by the Senate. These issues are regulated on the Senate's Rules of Procedure (*Geschäftsordnung*) and are addressed by the respective departments of the authorities (e.g. in the case of ordinances or draft laws). This is a completely internal process.

Source: Deloitte 2022

Annex

The annex includes the following elements:

- organisational charts of BUKEA and BSW
- the list of stakeholders that were interviewed as part of the stakeholder interviews
- the interview guideline for these stakeholder interviews
- the patricipants of the workshop
- the workshop presentation

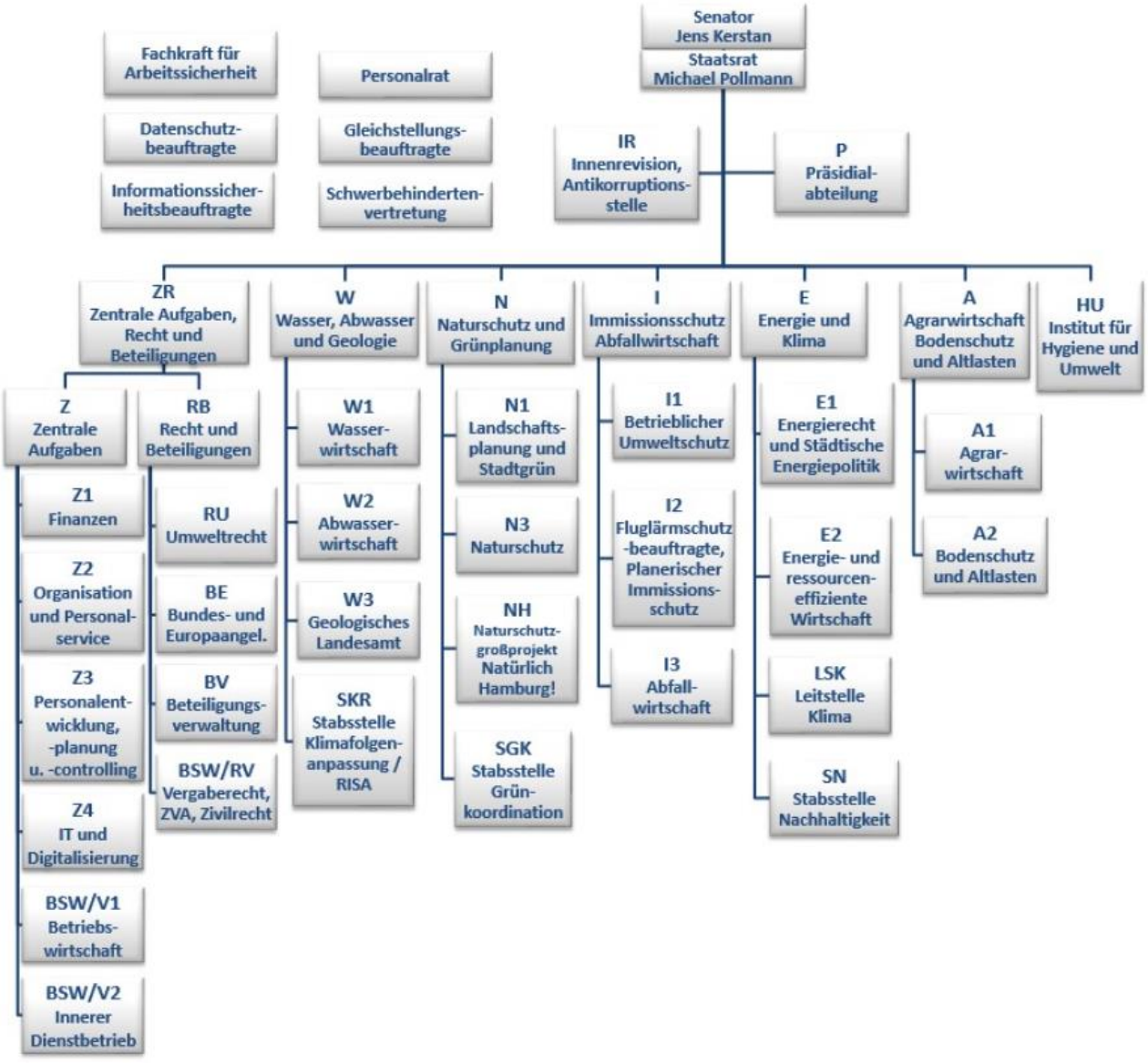
Organisational charts of BUKEA and BSW

Given several references to departments within BUKEA and BSW in this document, high-level organisation charts from BUKEA and BSW are provided below.

Organisational chart of BUKEA

The following illustration provides an overview of the organisational structure of BUKEA (Behörde für Umwelt, Klima, Energie und Agrarwirtschaft) as of April 2022.

Figure 2: Organisational chart of BUKEA

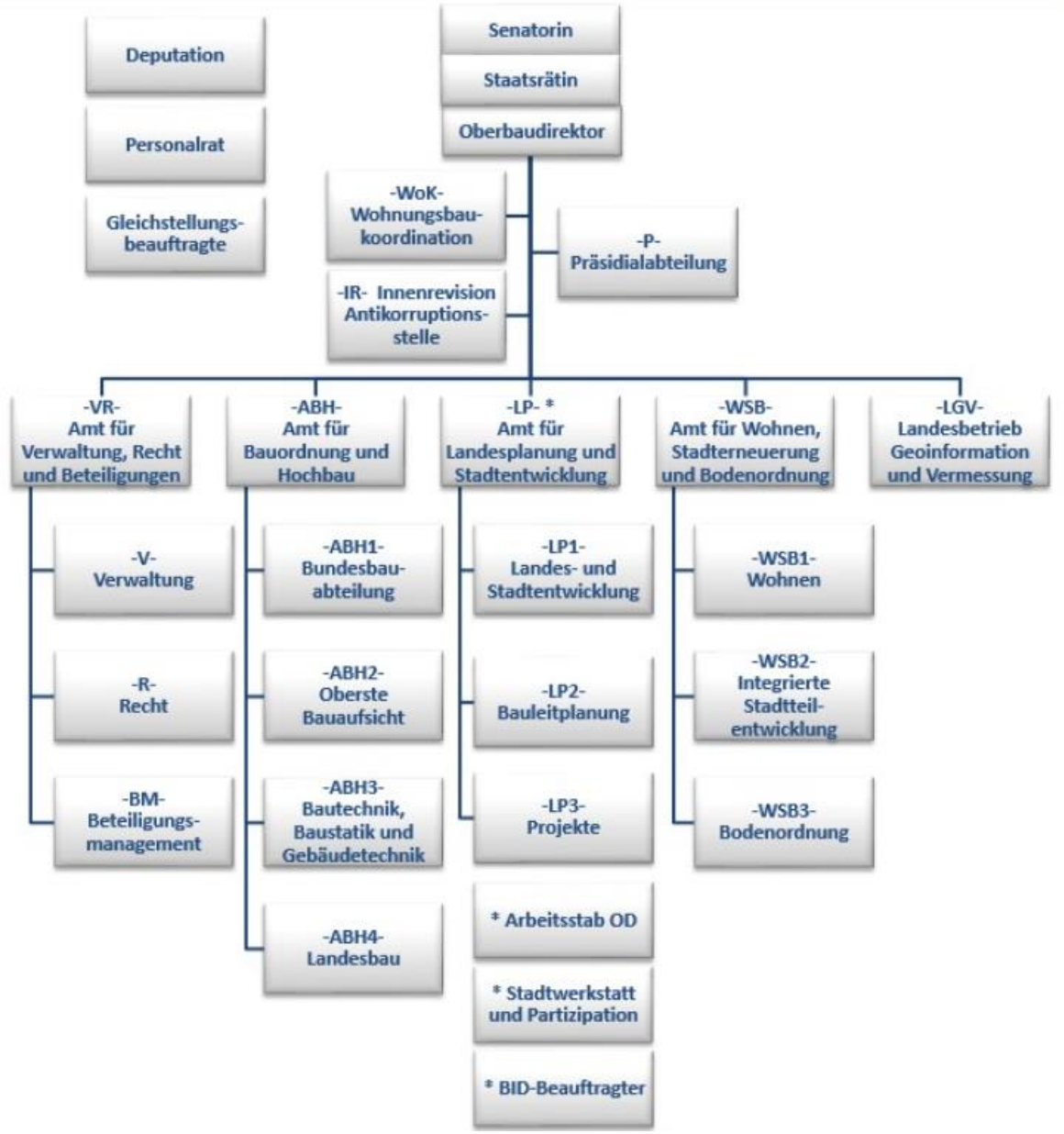


Source: City of Hamburg, FHH Portal (2022).

Organisational chart at BSW

The following illustration provides an overview of the organisational structure of BSW (Behörde für Stadtentwicklung und Wohnen) as of April 2022.

Figure 3: Organisational chart of BSW



Source: City of Hamburg, FHH Portal (2022).

List of interview stakeholders

The following table provides a list of stakeholders including their functions in the respective departments within the City of Hamburg that were interviewed as part of activity 2. Processes marked in **bold** are short list processes. The list is presented chronologically according to the time the interview took place.

Table 13: List of stakeholder interviews in Activity 2

#	Names	Function	Processes
1	Nicolai Schulz-Witte, Dionysios Arsenis, Jan Skillandat	Head of Digitalization Staff Unit (*Leiter Stabsbereich Digitalisierung*), ABH201 (BSW)	· Citizen submissions (*Bürgerschaftliche Eingaben beantworten*) · Issue statement approval IS (*Aussagegenehmigung erteilen IST*) · Process claim notification (*Schadensmeldung bearbeiten*) · Create distribution plan (*Aufteilungsplan erstellen*)
2	Thomas Haupt, Susanne Aarburg, Johanna Berckhan	State Geological Office (*Geologisches Landesamt*), BUKEA	**Drilling indications (*Bohranzeigen*)**
3	Caroline Lorenz, Angela Henkies	Service provider, not directly employed by BSW, BSW	Review disbursement request for release (*Auszahlungsanforderung zur Freigabe prüfen*)
4	Kristina Höcker, Gerrit Osterrath, Dragen Petrikic	Presidential Department (*Präsidialabteilung*), BUKEA	· District Requests (*Bezirkliche Ersuchen/Anfragen*) · Citizen submissions (*Bürgerschaftliche Eingaben*) · **Senate printed matter coordination (*Senatsdrucksachenabstimmung*)** · **Brief written inquiries (*Schriftliche kleine Anfragen*)**
5	Christiane Wichmann, Martina Spriewald	Head of Unit V213 - Internal Service Operations, Department V Administration (*Verwaltung*) BSW, also responsible for internal service boxes, among others	**Info boxes (*Infoboxen*)**
6	Britta von Hollen	Head of Unit N140, Department N1 Landscape Architecture and Green Cities (*Landschaftsplanung und Stadtgrün*), BUKEA	Complaint letter allotment area (*Beschwerdeschreiben Kleingartenbereich*)
7	Tobias Meyer	Head of Unit Internal Operations (*Innerer Dienstbetrieb*), BSW	Physical inbox (*Physischer Posteingang*)
8	Jan Hüttemann	Officer at Z412 Project and Process Management Office (*Projekt-und Prozessmanagement-Office),* Office for Central Tasks, Legal Affairs and	· 51 Permit (*51er Genehmigung*) · Application procedure in general (*Antragsverfahren allgemein*) · Water permits (*Wasserrechtliche Erlaubnisse*) · Leaf blower (example) (*Laubbläser (Beispiel)*)

#	Names	Function	Processes
		Participations (*Amt für zentrale Aufgaben, Recht und Beteiligungen*), BUKEA	· Air quality plan (*Luftreinhalteplan*)
9	Sven Hauenstein	Head of Unit Z410 - Project and process management office, Department Z 'Central Tasks (*Zentrale Aufgaben*), BUKEA	· 51 Permit (*51er Genehmigung*) · Application procedure in general (*Antragsverfahren allgemein*) · Water permits (*Wasserrechtliche Erlaubnisse*) · Leaf blower (example) (*Laubbläser (Beispiel)*) · Air quality plan (*Luftreinhalteplan*)
10	Fabian Preiß	Head of Unit P1, Presidential Department (*Präsidialabteilung*), BSW	Knowledge Management (*Wissensmanagement*)
11	Harald Lenuweit	Head of Unit V2 Internal Operations (*Innerer Dienstbetrieb*), Department V Administration (*Verwaltung*), BSW	Reporting (*Berichtswesen Haushalt*)
12	Matthias Erhard	Officer at E1 (*Energierecht und Städtische Energiepolitik*), E – Energy and Climate (*Energie und Klima*) BUKEA	· Market surveillance process (*Marktüberwachung*) · Energy transition in private households (*Energiewende in den privaten Haushalten*) · Heat cadastre (*Wärmekataster*)
13	Andrea Stöckmann	Planning (*Planungsstab*) Administration Office, Senate Chancellery (*Senatskanzlei*)	Brief written inquiries (*Schriftliche kleine Anfragen*)

Source: Deloitte 2022

Interview guideline

The following interview guideline is a translation from German to English and was sent to the stakeholder interviewees as a basis for the interviews.

Introduction to the project

The Free and Hanseatic City of Hamburg Administration designed, in collaboration with DG REFORM, in a previous engagement an IT system to support the processing of unstructured interactions with citizens, referred to as citizen letters. This prior engagement was collaboratively developed with a team from Deloitte and addresses all the essential processes and elements defined specifically for the processing of citizens letters. Following the experiences of this pilot project, the scope of determining the potential and automation and digitisation of processes should now be extended to further administrative processes of the City of Hamburg. Concretely, this project aims to identify and map the relevant structures, processes, information flows and information, communications, and technology (ICT) systems involved. To this end, the ICT system currently in production is to be reused for other, more 'generic' tasks and processes.

Background information on the interviews

Interviews will be conducted as part of the project with the aim of taking into account the expertise and opinions of a wide range of stakeholders and gathering as much information as possible about the administrative processes. The interviews will be conducted to identify those processes that have a high potential for automation.

The questions listed below reflect our information needs within the project. However, not all questions need to be covered, they serve more as " "conversation support" and focal points may vary depending on the background, expertise and prioritization of the interviewee. Interviews will be conducted via telephone or video conferencing (e.g. Skype for Business, Zoom, Microsoft Teams). The length of the interviews will be approximately 60 minutes.

The information transmitted during the interview will be treated confidentially and the knowledge gained will only be recorded anonymously. The personal data that are collected to conduct the interviews are processed in accordance with the GDPR.

Interview questions

Part A: Introduction

1. About your background: What role and activities do you have in the administration of the City of Hamburg? What specific points of contact / tasks do you have in relation to this project?

2. Please describe the most significant and/or largest internal process groups and workflows (e.g., approvals, application processes, etc.) in your office/area. Do you recognize any particular patterns or groupings, e.g. by type or subject area of processes, that you consider particularly relevant?

Part B: Questions about the individual processes

We would like to discuss with you in detail the process(es) mentioned by Jan Billhardt.

3. Stakeholder
    - Which and how many stakeholders (areas and people) are involved in these processes?
    - Who is the contact person (technical) for this process?

4. With regard to the processes you have just mentioned, we still have various detailed questions per process:
    - Is the process scalable? (yes, no)

- What is the volume of the process (in hours, how many repetitions, what frequency)? (Answer in hours)
- Is the process rule-based? (yes, no)
- What potential savings in minutes could an automation solution yield? (Answer in min)
- Is the process transferable to other areas? (yes, conditionally, no)
- How relevant is this process in general? (low, medium, high)
- How relevant will this process be for the future? (low, medium, high)
- How time critical is this process? (low, medium, high)
- How complex is this process? (low, medium, high)
- Is the process well defined? (yes, no)

5. Which IT tools have been used for this process so far?

6. What challenges do you see in automating this process??

7. What other reasons speak in favor of automating the process? - Qualitative reasons (less error-prone, 'troublesome' processes), cost reasons, personnel reasons, political/strategic reasons, other reasons

8. Do you already have possible solution ideas for automating this process?

Part C: General questions (short)

1. Which additional processes from your field of activity are particularly labor-intensive and/or repetitive and would therefore also have automation potential?

2. What changes should generally be made through the automation and digitization of processes? Which aspects do you consider particularly important here?

3. How can you measure efficiencies or efficiency gains in your specific area of activity?

4. The following table shows the preliminary list of evaluation criteria that will be used to assess the automation potential of various processes. How do you assess the suitability and relevance of the individual criteria? Which would you add?

Evaluation criteria	Suitability	Relevance
Expected time savings		
Expected cost savings		
Technical feasibility/implementability		
Procedural feasibility/implementability		
Degree of automation of the solution		
Others, if applicable:		

Participants of the workshop on the determination of the short list

The following table provides a list of stakeholders including their functions in the respective departmens within the City of Hamburg that were participants of the workshop on the determination of the short list as part of activity 2.

Table 14: List of workshop participants (determination of the short list)

Name	Function	Department within the City of Hamburg
Jan Billhardt	· Head of unit Z43 "Innovation and Information Management, IT Finance"	BUKEA and BSW IT Service
Dipl.-Ing. Mathias Bock	· Chief Digital Officer (BUKEA and BSW) · Member of the City of Hamburg-internal project steering group	BUKEA and BSW IT Service
Dr. Nadine Bräuninger	· Head of Administration ZR 'Central Fields of Activity, Legal, Holdings' (*Amt für zentrale Aufgaben, Recht und Beteiligungen*) · Member of the City of Hamburg-internal project steering group	BUKEA
Dr. Annika Busse	· Head of Unit 'Digital automation of the administration' · Deputy Chief Information Officer (CIO), · Member of the City of Hamburg-internal project steering group	Senate Chancellery (Senatskanzlei)
Rüdiger Junge	· Head of Administration VR (Amt für Verwaltung, Recht und Beteiligungen), BSW	BSW
Dr. Maik Möller	· Head of Department Z Central tasks (*Zentrale Aufgaben*)	BUKEA
Normann Röder	· Head of Department V (*Verwaltung*) BSW · Representative member of the Digital Management Board of the City of Hamburg	BSW

Source: Deloitte 2022

Presentation of the workshop on the determination of the short list

The following slides are the output slides that were presented on 19th May 2022 for the determination of the short list.

As-is Business Process Model

This deliverable entails an as-is business process model in BPMN format of the five processes from the short list as well as their corresponding descriptions.

Executive Summary

This as-is business process model is the deliverable 3 of the project "Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg". The structure of this document is as follows: After a brief introduction of a short list to be automated with the Intelligent Dialogue Management (IDM) tool as well as other AI & statistical technologies, an as-is process description of each short list process is presented. This includes the key characteristics of the process as well as the as-is BPMN model of each of the five processes on the short list. Some processes include two BPMN models that represent the process from different perspectives or hierarchic levels. The annex contains the as-is BPMN model in German for each short list process.

The process description and BPMN models were developed based on the information gathered during the stakeholder interviews and the documentation provided. The BPMN models were further discussed and confirmed in bilateral meetings with the process owners. If any changes are made these will be updated accordingly. A detailed description can be found in the respective chapters, as well as a detailed description of the technologies in Deliverable 2. The following is a summary of the most important points for each process.

The first process is the 'brief written inquiries' (Schriftliche Kleine Anfragen) process, which involves inquiries from members of parliament to the Senate of the City of Hamburg, which is required to respond within a few days. For this process multiply technologies can be used to achieve an automation, the IDM tool for a general workflow management, an intelligent search which can be implemented to search for similar inquiries and a classification for the determination of responsibilities to identify the authority that should provide information to answer the inquiry. The process 'knowledge management' (Wissensmanagement) describes a process of storing and accessing information and data via a drive that can be accessed within a unit. Automation can be achieved through an intelligent search or a dashboard to easily access the information and data. The process 'info boxes' (Infoboxen) represents a collection point for a wide variety of inquiries and requests (e.g. from citizens, applications for tender procedures, awarding, EU inquiries and letters from citizens). The receipt of the inquiries is exclusively a digital receipt via an email inbox. Automation for this process can be achieved through classification and Named Entity Recognition, to extract the relevant information to identify the responsible department. Furthermore, regarding the general process 'imputing procedure' ("Imputing-Verfahren"), the process analysis performed in activity 2 of this project found several processes that can be used to illustrate the imputing procedure. For the short list and for the purpose of illustrating this category of processes in the present deliverable, the process of drilling reports, was selected. The last process on the short list is the 'senate printed matter coordination' (Senatsdrucksachenabstimmung), which are items on which the Senate is to make a decision. This process could be automated by using the IDM tool for a general workflow management, as well as Named Entity Recognition, for an automated filling of the template, on which the Senate has to vote.

In activity 3, these processes are analyzed in detail and further conversations will be held with the process owners, leading to business cases of three different alternatives of the level of automation of the processes on the short list.

Introduction

The present document describes the as-is business process model of the five short list processes that were selected by the Hamburg-internal Steering Committee (see deliverable 2). This deliverable further contains a description of the process as well as an as-is business process model in business process model and notation (BPMN) format.

The structure of this Deliverable is as follows: firstly, the short list of processes and AI (Artificial intelligence) processes that could serve to automate these processes is presented and characterised in more detail. Thereafter, the short list processes are described, thereby focussing on process steps, stakeholders involved and activities to be conducted. This description also includes a process flowchart in BPMN format.

The annex of this document entails the BPMN versions in German that were also discussed with and validated by the respective process owners.

Definition of a short list to be automated

As described and outlined in deliverable 2 and described in more detail in the subsequent chapter, the following five short list processes were determined by the Hamburg-internal Steering Committee:

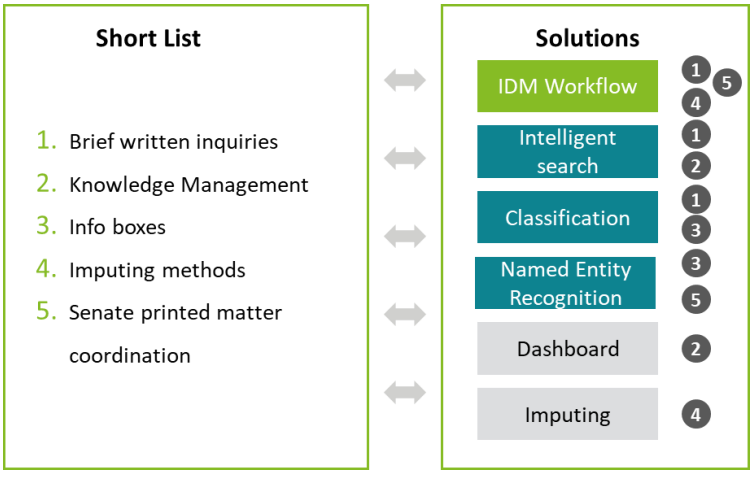
- Brief written parliamentary inquiries (Schriftliche Kleine Anfragen)
- Knowledge Management (Wissensmanagement)
- Info boxes (Infoboxen)
- Imputing methods (Imputing-Verfahren)
- Senate printed matter coordination (Senatsdrucksachenabstimmung)

This chapter explains the technologies that can be used to automate the short list processes determined as part of activity 2. These technologies can broadly be classified into two groups:

1. Processes that can be supported by the IDM-tool
2. Processes that can be automated using other AI & statistical technologies technologies, e.g. Natural Language Processing or statistical methods

The following figure shows the short list processes mapped to the corresponding proposed solutions for automation.

Figure 4: Short list processes mapped to the corresponding solutions



Source: Deloitte 2022

The solutions were divided into three different categories (colored in the figure above).

- The first category is the IDM Workflow system, coloured in green, which refers to the system already in use for the routing of citizen letters.
- The second category (blue) represent natural processing methods.

- The third category, coloured in gray, includes statistical methods and Dashboards.

Definition of processes that can be supported by the IDM tool

In the following section the processes that have automation potential using the IDM tool, by using already existing tools of the IDM or by using modifications or by adding new functionalities of the IDM-tool will be presented. The processes to be automated by the IDM tool can be divided into a cluster of processes, in which the main task is to route the process through several steps to different departments, each of which has to perform an activity. For this purpose, the use of the IDM Workflow system would be suitable. In particular, the following three processes are addressed:

- Brief written inquiries (Schriftliche Kleine Anfragen)
- Imputing methods (Imputing-Verfahren)
- Senate printed matter coordination (Senatsdrucksachenabstimmung)

For more information about the IDM system refer to deliverable 2 chapter “Assessment of the technologies and systems for automation of processes”. In a further step, the IDM tool could be modified to include other useful add-ons. Possible further features could be the generation of answers (currently not yet available in the tool) and the display/suggestion of comparable requests/ procedures.

Definition of processes that can be automated using other AI & statistical technologies

In addition to processes that can be automated through the IDM Tool, other automation potentials using AI technologies were also examined. Each of the above shortlist processes could be further automated through the use of AI. The proposed AI methods can be grouped into four clusters:

- Completion of missing data: Impution methods[10]
- Natural Language Processing[11]: Named Entity Recognition[12], Dense Information Retrieval[13]
- Predictive analytics[14]: Dashboards[15], Predictive Analytics
- Classification: Determination of responsibilities

For more information about the other AI technologies refer to deliverable 2 chapter “Assessment of the technologies and systems for automation of processes”.

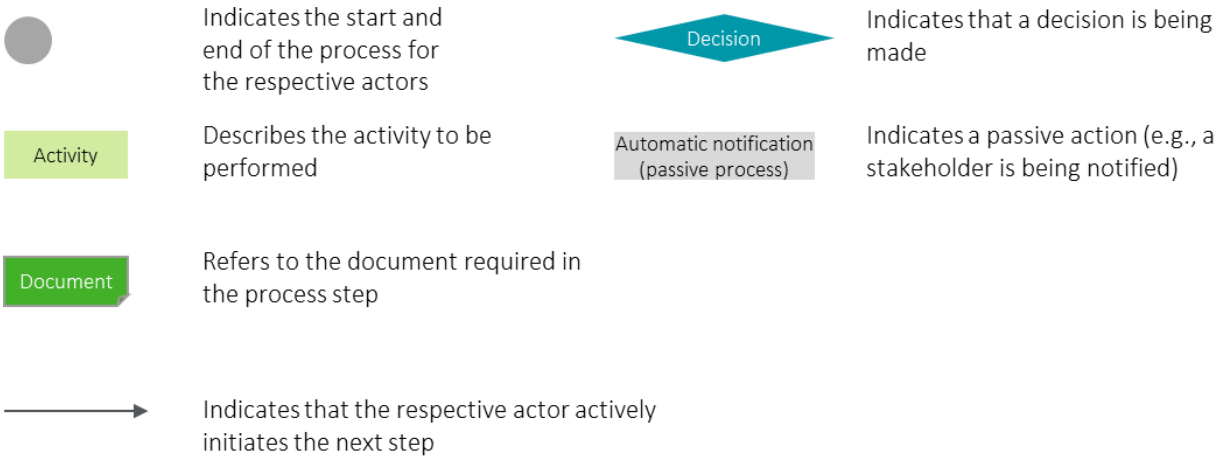
As-is business process models in BPMN format

The BPMN models for the five short-list processes are illustrated and described in the following subchapters. These graphics are a simplified representation of the current process and should be understood in the context of the descriptions provided. The BPMN models only focus on those aspects of the process that are relevant for a potential automation of the process.

[10] In statistics, imputation is the process of replacing missing data with substituted values.
[11] Natural language processing (NLP) is a subfield of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, in particular how to program computers to process and analyze large amounts of natural language data.
[12] Named Entity Recognition (NER) (also known as (named) entity identification, entity chunking, and named entity extraction) is a subtask of information extraction that seeks to locate and classify named entities mentioned in unstructured text into pre-defined categories such as person names, organizations, locations, medical codes, time expressions, quantities, monetary values, percentages, etc.
[13] Dense Information Retrieval systems conduct first-stage retrieval using embedded representations and simple similarity metrics to match a query to documents.
[14] Predictive analytics is a branch of advanced analytics that makes predictions about future outcomes using historical data combined with statistical modeling, data mining techniques and machine learning.
[15] A dashboard is a type of graphical user interface which often provides at-a-glance views of key performance indicators (KPIs) relevant to a particular objective or business process.

Descriptions and legend

Figure 5: Descriptions and legend to the as-is BPMN Models



Source: Deloitte 2022

Prozess 1: Brief written inquiries (Schriftliche kleine Anfragen (SKA))

On a superordinate level, the process of brief written inquiries (*Schriftliche kleine Anfragen)* can be shown in the process flow chart (Figure 6) from the perspective of the Senate Chancellery. As an example, the process within an individual agency can be seen in the process flow diagram Figure 4. In the following, the process is described along the flowcharts.

As-is process description of brief written inquiries

The SKA process involves inquiries from members of parliament to the Senate of the City of Hamburg, which is required to respond within a few days. The process is divided into two sub-processes: firstly from the point of view of the Senate Chancellery, and secondly from the point of view of the individual authorities (by way of example).

Regarding the process from the perspective of the Senate Chancellery (see Figure 3):

The inquiries of the members of parliament are collected by the office of the citizenry (*Bürgerschaftskanzlei*) and transmitted to the Chancellery of the Senate (*Senatskanzlei*) via the portal ESIS/EVIS.[16] The questions of the members of parliament to the Senate of the City of Hamburg, must answered within a few days. The deadline is determined by legislation and is approximately eight days from receipt to the response to the inquiry. In terms of content, the inquiries are very broad (e.g. requests for information on the state of affairs) and concern the entire administration of the city of Hamburg.

All inquiries are first collected by the office of the citizenry (*Bürgerschaftskanzlei*), afterwards the appropriate distribution list is selected via the portal and sent collectively to all presidential departments of the authorities. The authorities decide among each other which one will take the lead in answering individual SKAs and reports this to the Senate Chancellery, which forwards back the respective written inquiries number and the agenda item via the portal. After the leading authority has answered the SKA and all other agencies involved have submitted their answers, the answer is forwarded via ESIS/EVIS in a Word format to the Senate Chancellery, which collects all answers, converts them into a PDF format and forwards them to the inquiry committee. This commission meets on Tuesdays and Fridays. Within the framework of this commission, the city councils discuss the proposals of the authorities and determine the final version of the response. The Senate Chancellery takes minutes of this meeting and incorporates the discussed changes into the answers and finally forwards them to the office of the citizenry (*Bürgerschaftskanzlei*) in

[16] System and database for all SKA and meetings. More details below.

bundled form. The office of the citizenry (*Bürgerschaftskanzlei*), in turn, sends the answered questions to the members of parliament.

In the case that the lead in answering individual SKA cannot be clearly decided or clarified among the authorities, **two different conflicts** can arise:

- Negative conflict of competence: None of the agencies want to take the lead in responding to the inquiry
- Positive conflict of competence: Multiple agencies want to take the lead in responding to the inquiry

Agreement is first reached among the agencies themselves, but if this is not possible, the Senate Council decides on the lead. The Senate Chancellery assumes a purely coordinating role in this regard.

The **deadlines and form** of the SKAs are determined by constitutional law. The deadline from receipt to response is specified as eight days (including weekends). The Senate Chancellery is responsible for ensuring that deadlines are met and, if necessary, following up with all agencies involved in responding. If the deadlines are not met, constitutional requirements are violated, and the deputy would have the right to file a complaint with the Constitutional Court.

The **system** currently in place in the context of processing SKAs is the ESIS/EVIS system. The system serves as a database for all SKAs and meetings, allowing to create records with information and master data (e.g. rapporteurs, questioners, etc.). In this system, the collected requests are forwarded to the Senate Chancellery and serves as an interface between the Senate Chancellery,the office of the citizenry (*Bürgerschaftskanzlei*) and the City Council. The system serves the forwarding of the SKA by email, as well as the selection of different mailing lists. In addition, agendas and printed matter numbers can be generated and files can be converted into various formats (e.g. Word to PDF). The minutes are also documented in ESIS/EVIS.

Regarding the process from the perspective of a presidential department of an individual authority (see Figure 4):

All presidential departments of the individual authorities receive all SKAs bundled by mail from the Senate Council. The presidential departments have the choice of which SKAs they would like to respond to and select them from the total collected requests. If an authority wishes to respond to a request, it agrees with the other presidential departments among themselves who will take the lead to answer the request. After deciding on the lead, the lead authority reports this to the Senate Chancellery and receives the relevant printed matter number and agenda item. If the authorities do not agree on the lead, the two cases described above arise.

The Presidential Department forwards the selected SKA to departments and district offices that can and should provide answers to the SKA and subsequently collects all answers. It then determines the content and form in which the SKA should be answered and forwards it by mail and in a Word format to the Senate Council.

There is no uniform routing solution within the agencies. Each agency uses its own systems (e.g. ESIS/EVIS, Mail, SharePoint etc.).

Table 15: Key characteristics of the SKA as-is process

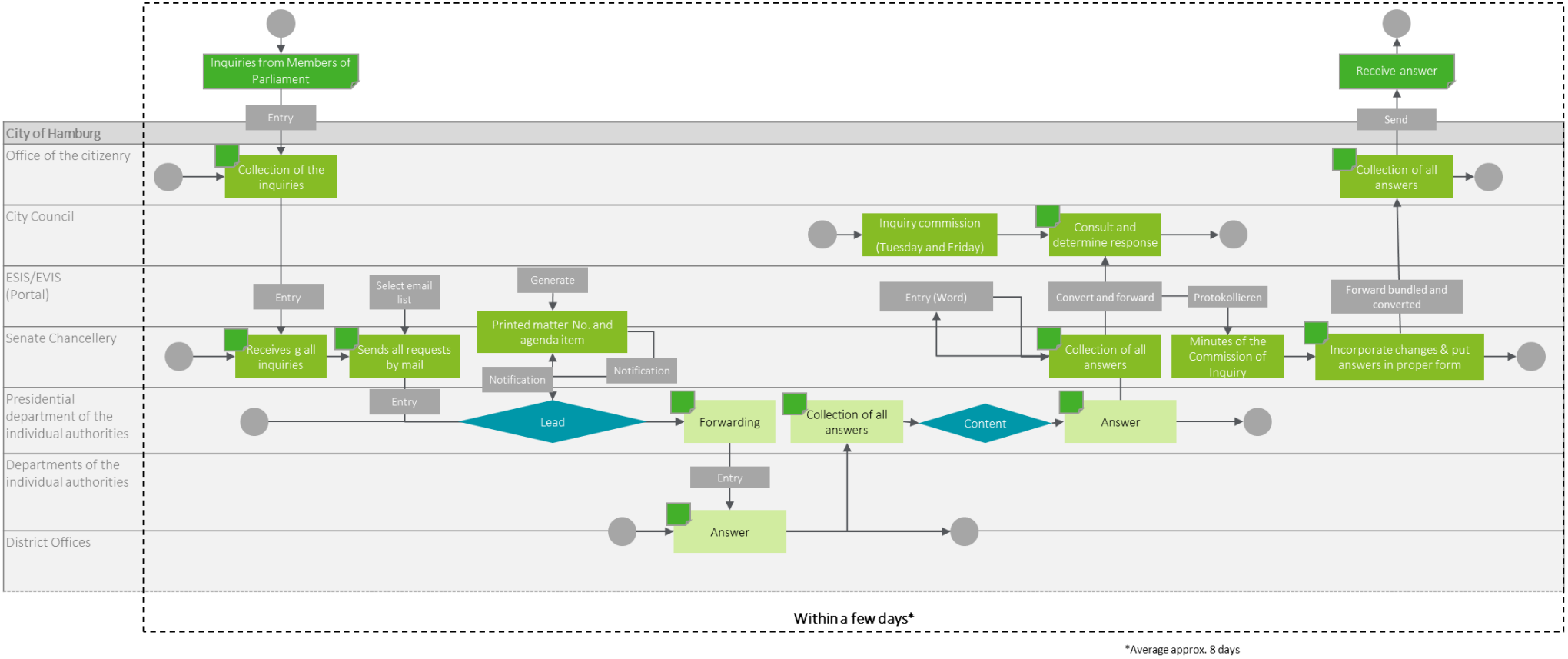
Key characteristics	Specification
Degree of digitization (low, medium, high)	High
Complexity (low, medium, high)	High
Scalability (yes, no)	Yes
Time criticality (low, medium, high)	High
Rule-based (yes, no)	Yes

Volume	• BUKEA/BSW: 10 per day • Senate Council: 50-70 per week
Organization chart	• BSW - Presidential Department • BUKEA - Presidential Department • Senate Council

Source: Deloitte 2022

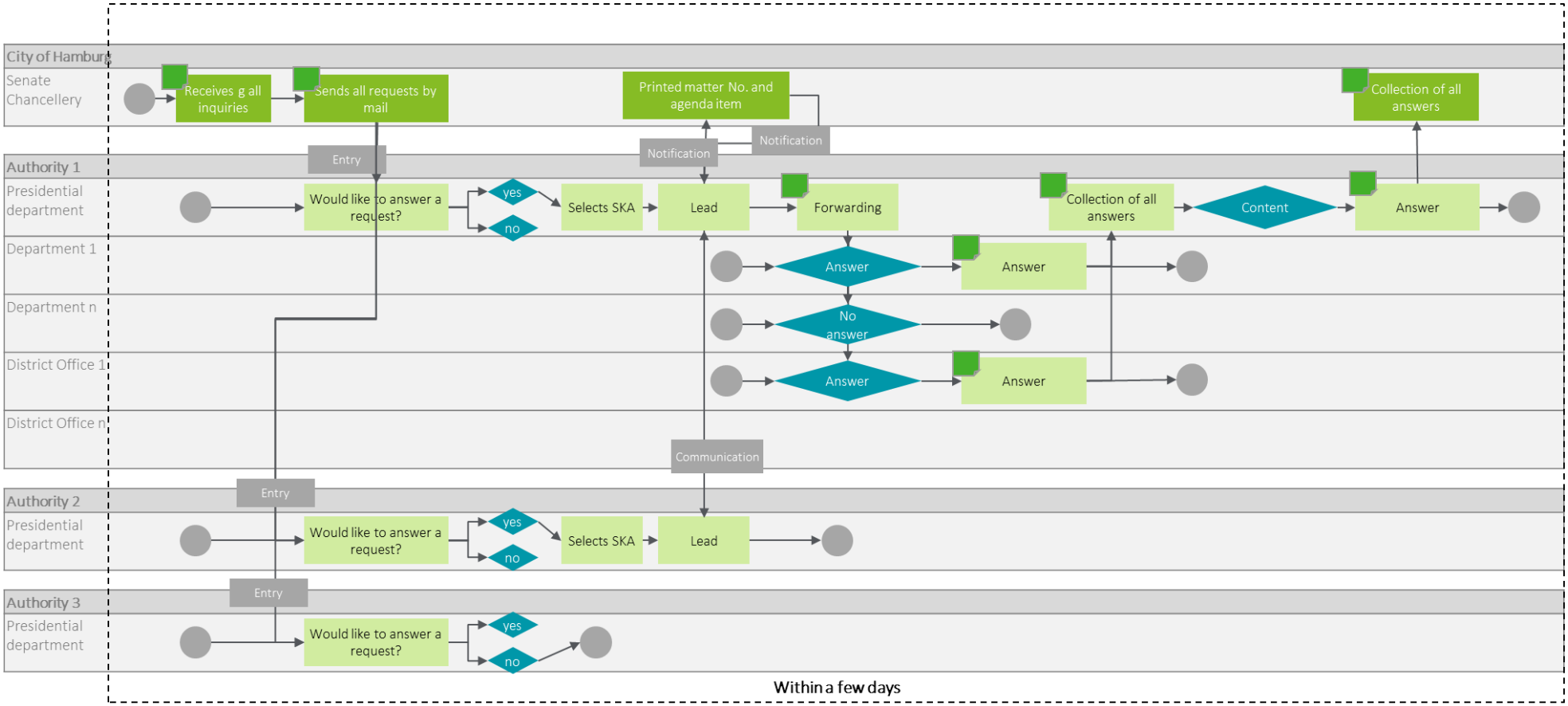
As-is BPMN Model

Figure 6: As-is BPMN Model SKA - From the perspective of the Senate Chancellery



Source: Deloitte 2022

Figure 7: As-is BPMN Model SKA - From the perspective of the individual departments (example)



Source: Deloitte 2022

Process 2 – Knowledge management (Wissensmanagement)

The process 'knowledge management' describes a process of storing and accessing information and data via a drive that can be accessed within a unit.

In the following, the current state of the process 'knowledge management' is described. This process is allocated in the presidential departments (*Präsidialabteilungen*) at BUKEA and BSW, respectively, but can be found in many other departments of the City of Hamburg as well.

As-is process description 'knowledge management'

Within the as-is process 'knowledge management' all departments of the presidential department of the BSW currently have their own folder drives, which are managed by the central IT department Z4. The folder drives have an extensive unit-specific structure and have been maintained for many years (in the case of P1 since 2005). All members of a unit have access to the department drive, external departments can only gain access under special conditions and with an application.

Each member of the department can create a new process in this folder drive at any time by compiling relevant information, creating a new folder, setting up a suitable folder structure and filing documents.

Information searches are performed on the respective drive. The information needs of an official is usually very time-critical and must be met within a few hours or days. Therefore, the user can start a search in the folder drive. The official clicks through individual folders, opens documents that may be relevant and then orients themselves further until the information requirement is covered. This ends the process. The folder drive is used regularly (approximately daily to twice a week per person) to search for data and information. There is also a large amount of implicit (unwritten) knowledge about folder structures and content that individuals have built up over the years.

Cross-unit searches are not possible. Information from other drives must be requested by mail or telephone.

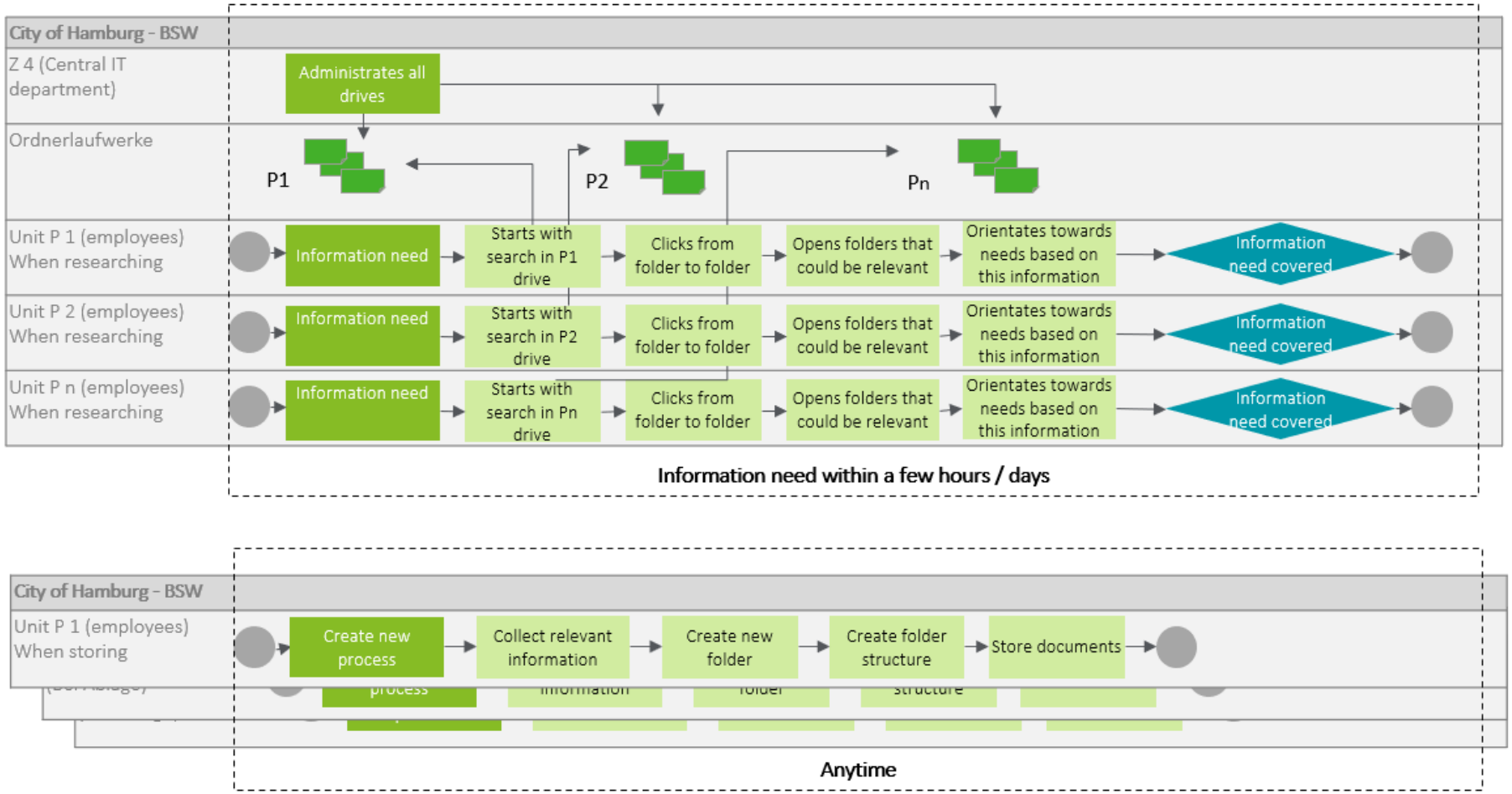
Table 16: Key characteristics of the knowledge management as-is process

Key characteristics	Specification
Degree of digitization (low, medium, high)	High
Complexity (low, medium, high)	Low
Scalability (yes, no)	Yes
Time criticality (low, medium, high)	High
Rule-based (yes, no)	Yes
Volume	Daily use (for P1, BSW)
Organization chart	BUKEA -> P BSW -> P

Source: Deloitte 2022

As-is BPMN Model

Figure 8: As-is BPMN Model knowledge management



Source: Deloitte 2022, based on stakeholder interviews

Process 3 – Info boxes (Infoboxen)

As-is process description

The process 'info boxes' resides in unit V 213 (Internal Operations) at BSW and represents a collection point for a wide variety of inquiries and requests (e.g., from citizens, applications for tender procedures, awarding, EU inquiries and letters from citizens). The receipt of the inquiries is exclusively a digital receipt via an email inbox. The assignment and forwarding usually takes place on the same day.

The assignment or research regarding the responsibility of the respective request within BUKEA and BSW is currently mainly carried out by using implicit knowledge and by additionally conducting research in the organizational charts of BSW and BUKEA. The process owner and employee in unit V 213 has been entrusted with this process for years and therefore has extensive experience in the assignment to the respective contact persons. The volume of inquiries varies from year to year and also depends on external factors and current events. During the corona pandemic, the number of inquiries tended to decrease somewhat and, according to V 213, amounted to around 1,000 inquiries per year (approx. 3-4 inquiries per day).

During the interviews, the process owner appeared highly reluctant regarding any potential automation and/or change of this process. It was therefore emphasised various times that the scope of this project is only to develop a potential automation concept of this process and not to automate the process itself. Given these circumstances, it can be expected that the future collaboration with this process owner can result in difficulties.

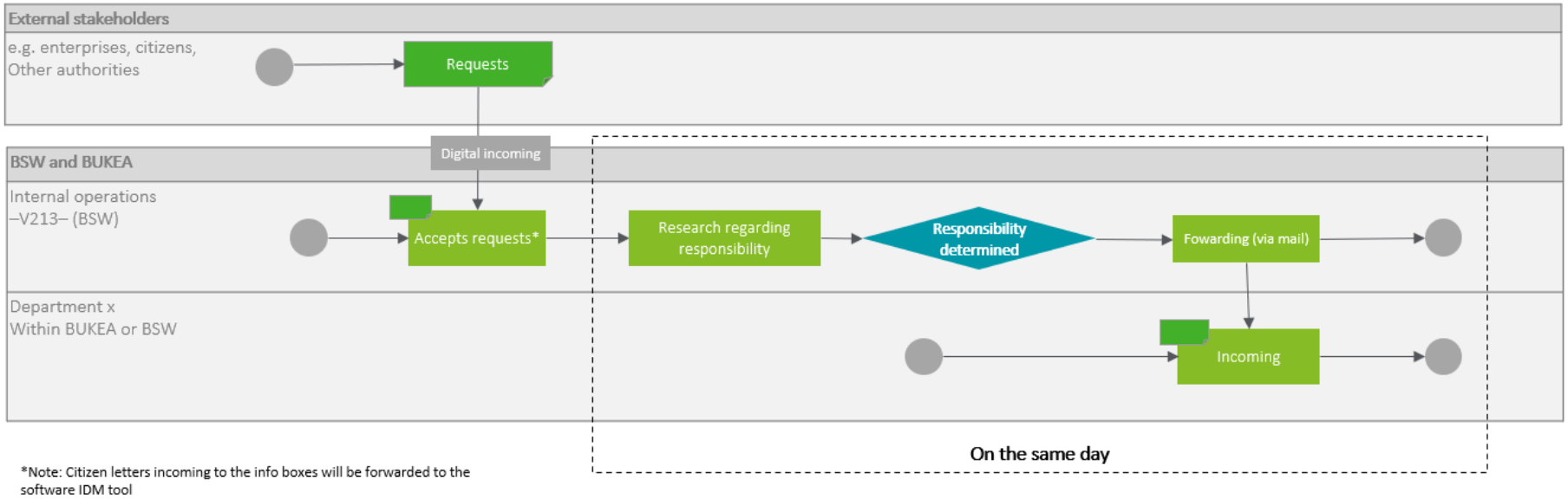
Table 17: Key characteristics of the Info boxes as-is process

Key characteristics	Specification
Degree of digitization (low, medium, high)	High
Complexity (low, medium, high)	Medium
Scalability (yes, no)	Yes
Time criticality (low, medium, high)	Medium
Rule-based (yes, no)	Yes
Volume	Approximately 1 000 emails per year (however, volume varies strongly due to external factors)
Organization chart	BSW -> V213

Source: Deloitte 2022

As-is BPMN Model

Figure 9: As-is BPMN Model Info-boxes



Source: Deloitte 2022

Process 4 – Imputing procedure (“Imputing-Verfahren”)

Imputing procedure in general

Regarding the general process "imputing procedure", the process analysis performed in activity 2 of this project found several processes that can be used to illustrate the imputing procedure. For the short list and for the purpose of illustrating this category of processes in the present deliverable, the process of drilling reports, allocated in the Geological State Office (*Geologisches Landesamt*) at BUKEA, was selected. The relevant steps of this process are characterized below as representative of other processes that could be automated using imputing methods.

As-is process description BohrIS review and tracking

This short-list process consists of two interrelated sub-processes and is part of the higher-level process "edit drilling reports", which is located at the Geological State Office of BUKEA. This overarching process is already maintained in the Aris database and describes the various steps involved in processing and completing the drill listings. The first sub-process relates to checking the timely receipt and completeness of the specific drilling data, the second sub-process is a process that is required by law as part of the Geological Data Act and includes the tracking of data that has not been received.

In the following, only those process aspects are described that are directly related to the sub-aspects of the process to be automated. Any content-related process steps (e.g., substantive assessments and analysis of the received data) to be carried out as part of the overall drilling notification process are not described in detail.

The Geological State Office operates a database (BohrIS) that collects various data on boreholes carried out in the City of Hamburg. The legally required data to be recorded are specialist data (*Fachdaten*; geological data on the content of the boreholes), optional evaluation data (*Bewertungsdaten;* e.g. conclusions and reports on boreholes) and verification data (*Nachweisdaten;* metadata such as location and time of a borehole). The technical and evaluation data of a bore are assigned to the verification data.

Upfront to these sub-processes, the reporting party who is carrying out the drilling provides information about the planned drilling via the NoBo portal (data portal that the City of Hamburg operates together with other neighbouring Federal States) and, if necessary, uploads verification data (meta information) about the drilling via this portal to the BohrIS database. The responsible department W3 in the Geological State Office checks the receipt of the verification data and accompanies the drilling professionally if necessary. If it is not received, W3 will request the verification data from the person making the notification by email and by telephone. The latter can then load them into the BohrIS portal. This iteration can be done any number of times. In the case of data in the context of water law, the Water Office (W1) of the Geological State Office is also informed about the receipt of the data.

Upon receipt of the verification data, the sub-processes relevant to the scope of this project begin:

The first sub-process, review of incoming drilling data, begins with W3 verifying the timely receipt of verification, specialist and (where relevant) evaluation data. If the data is not received by the deadline, W3 will request this data from the person making the notification by email or telephone. The reporting party can then send the missing data to the Geological State Office (W3) by email. W3 then enters this drilling data manually into the BohrIS database. It should be noted that the datasets have different formats and a different level of detail. Thereafter, the completeness of the data records is checked. If the data is received on time, the completeness check is carried out immediately after the receipt on time. The completeness check is currently carried out manually. If W3 comes to the conclusion that the data is not complete, the applicant will be asked again by email and telephone and the subsequently incoming drilling data will be entered manually in BohrIS. This iteration continues until the data set is complete, i.e. contains all legal requirements. Once the data set is complete, the data is checked for correctness in terms of content. Checking for the correctness of the content is not part of a possible automation and is therefore not explained in more detail.

The second sub-process, tracking the incoming drilling data, is a process that does not yet exist, as it has to be implemented by summer 2022 as part of the new legal obligations under the Geology Data Act. The

process is therefore described as it would be implemented without an automation solution. This sub-process starts immediately after checking for completeness. If the drilling data requested is not complete, the follow-up process will be initiated by W3. A reminder letter will manually be created by W3, which W3 sends to the person making the notification. It is then checked whether the reporting party has sent the drilling data to W3 by email within the legally stipulated period (varies depending on the type of drilling). If the data is not received within the deadline, various escalation steps such as reminders and fee notifications are initiated. If it is received within the specified period, the data received by email from W3 is entered manually in BohrIS and the data is compared again for completeness (see sub-process 1). If the data is still incomplete, the tracking process is restarted. This iteration takes place until the requested data is complete.

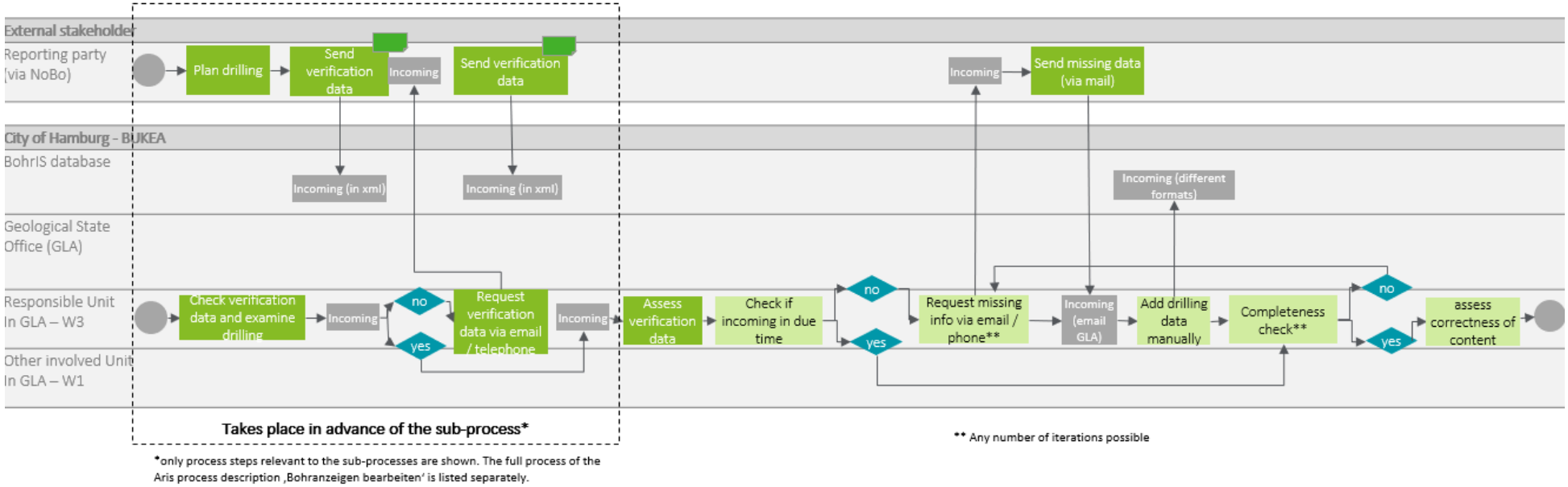
Table 18: Key characteristics of the BohrIS as-is sub-processes

Key characteristics	Specification
Degree of digitization (low, medium, high)	High
Complexity (low, medium, high)	Medium
Scalability (yes, no)	Yes
Time criticality (low, medium, high)	High
Rule-based (yes, no)	Yes
Volume	Approximately 20 new entries per day (ca. 5 000 new entries per year)
Organization chart	BUKEA -> W -> W3 (Geologisches Landesamt)

Source: Deloitte 2022

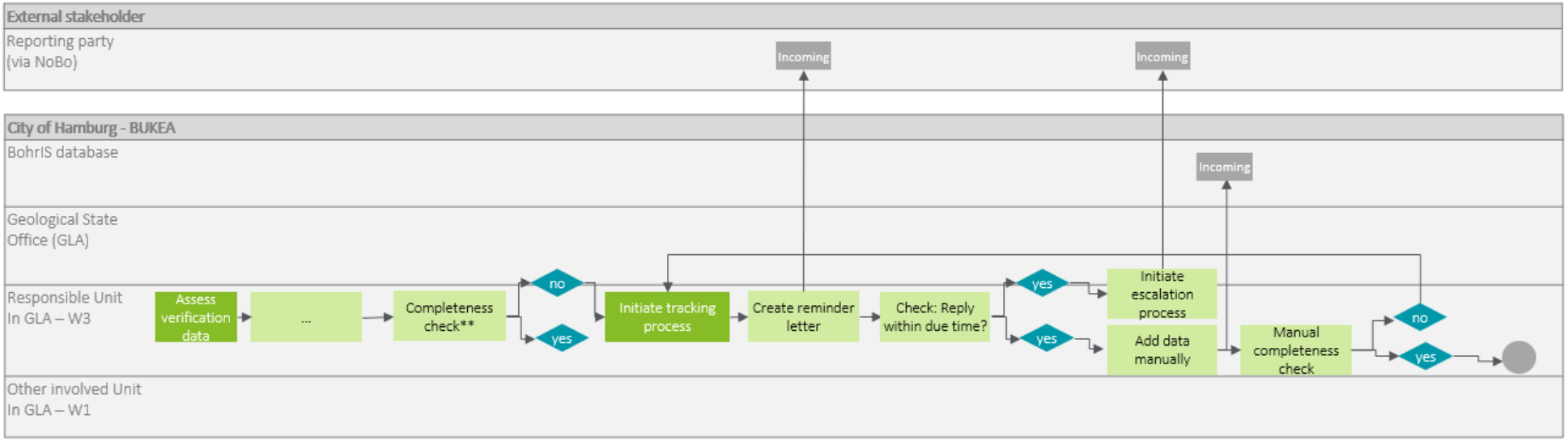
As-is BPMN Model

Figure 10: As-is BPMN Model Subprozess 1: BohrIS completeness check



Source: Deloitte 2022, based on the stakeholder interviews with the Geological State Office, BUKEA

Figure 11: As-is BPMN Model Subprocess 2: Tracking of missing BohrIS data



Source: Deloitte 2022, based on the stakeholder interviews with the Geological State Office, BUKEA

Process 5: Senate printed matter coordination (Senatsdrucksachenabstimmung)

At a higher level, the Senate printed matter coordination (*Senatsdrucksachenabstimmung*) process can be represented in the process flowchart (Figure 10) below. In the following, the process is described along the flowchart.

Senate printed matters are items on which the Senate is to make a decision. In general, the Senate decides on items of fundamental importance, those items are regulated in the Senate's Rules of Procedure (e.g. in the case of ordinances or bills). Before the Senate votes on the printed matter, the bills are coordinated with all involved authorities and forwarded by the Presidential Department.

As-is process description of Senate printed matter coordination

The content of the printed matter is first prepared and written by the department (*Fachamt*) of an authority and then forwarded to the respective presidential department of the authority (in a standarized template). The responsibility of the presidential department is to formally review the template of the printed matters and to coordinate it with other authorities. This template must be coordinated with all the authorities that it concerns. Those authorities who wish to comment on the printed matter or can provide additional information may submit their comments and statements. The presidential Department collects these statements from other authorities and forwards them collectively to the department (*Fachamt*) that prepares the template. The latter rewrites the printed matter if necessary and forwards it back to the presidential Department. The presidential department checks it again for completeness and forwards it to the Executive Board (*Behördernleitung*) for approval. After the approval of the Executive Board, the finished and completely coordinated template of the printed matter is forwarded to the Senate Chancellery and announced. The Senate Chancellery then takes it to the agenda for a vote.

In general, the entire administration of the Free and Hanseatic City of Hamburg is involved in this process. Taking the lead are the presidential departments of the authorities, which collect the Senate votes and coordinate them with the other authorities.

This is a preliminary description of the process and will be updated as modifications are needed.

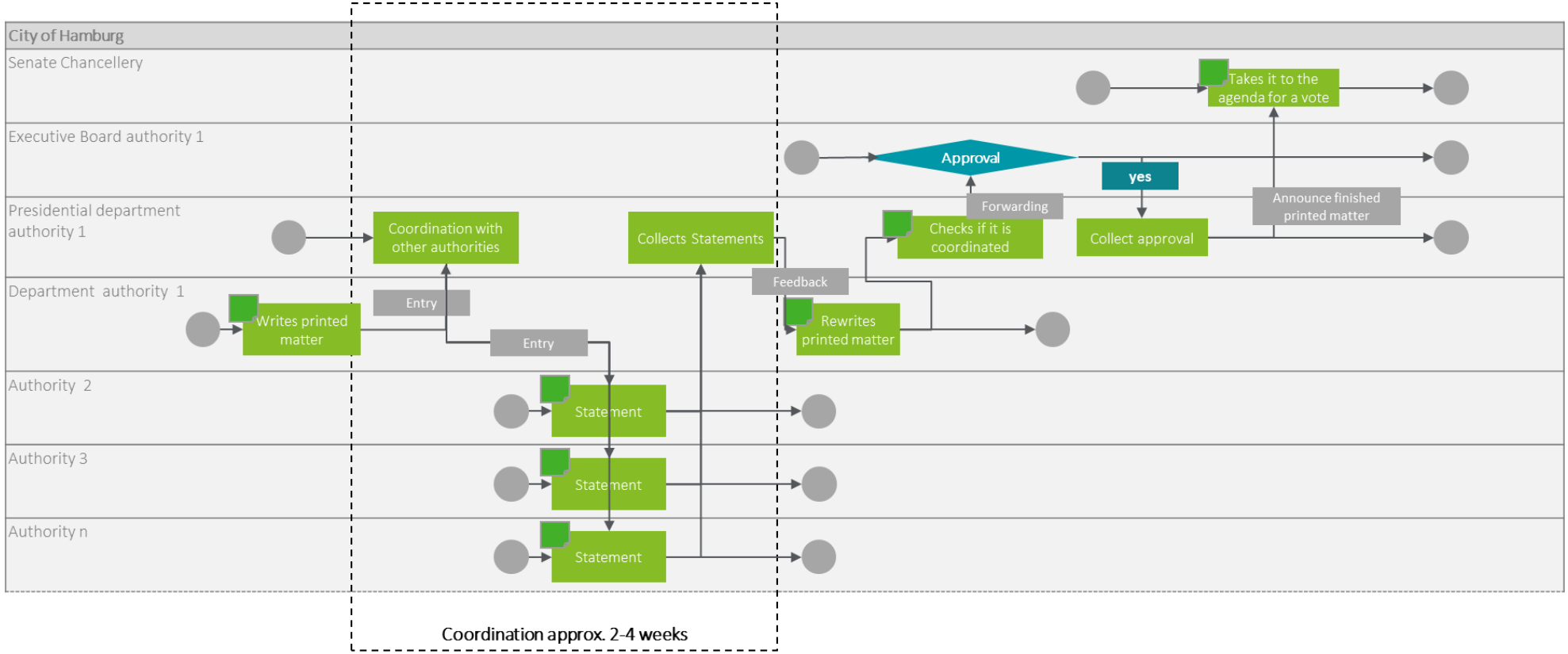
Table 19: Key characteristics of the Senate printed matter coordination as-is process

Key characteristics	Specification
Degree of digitization (low, medium, high)	High
Complexity (low, medium, high)	High
Scalability (yes, no)	Yes
Time criticality (low, medium, high)	medium
Rule-based (yes, no)	Yes
Volume	wenig (einmalig pro Inhalt), eher alle paar Jahre Aktualisierung,
Organization chart	• BSW - Presidential Department • BUKEA - Presidential Department

Source: Deloitte 2022

As-is BPMN Model

Figure 12: As-is BPMN Model Senate printed matter coordination



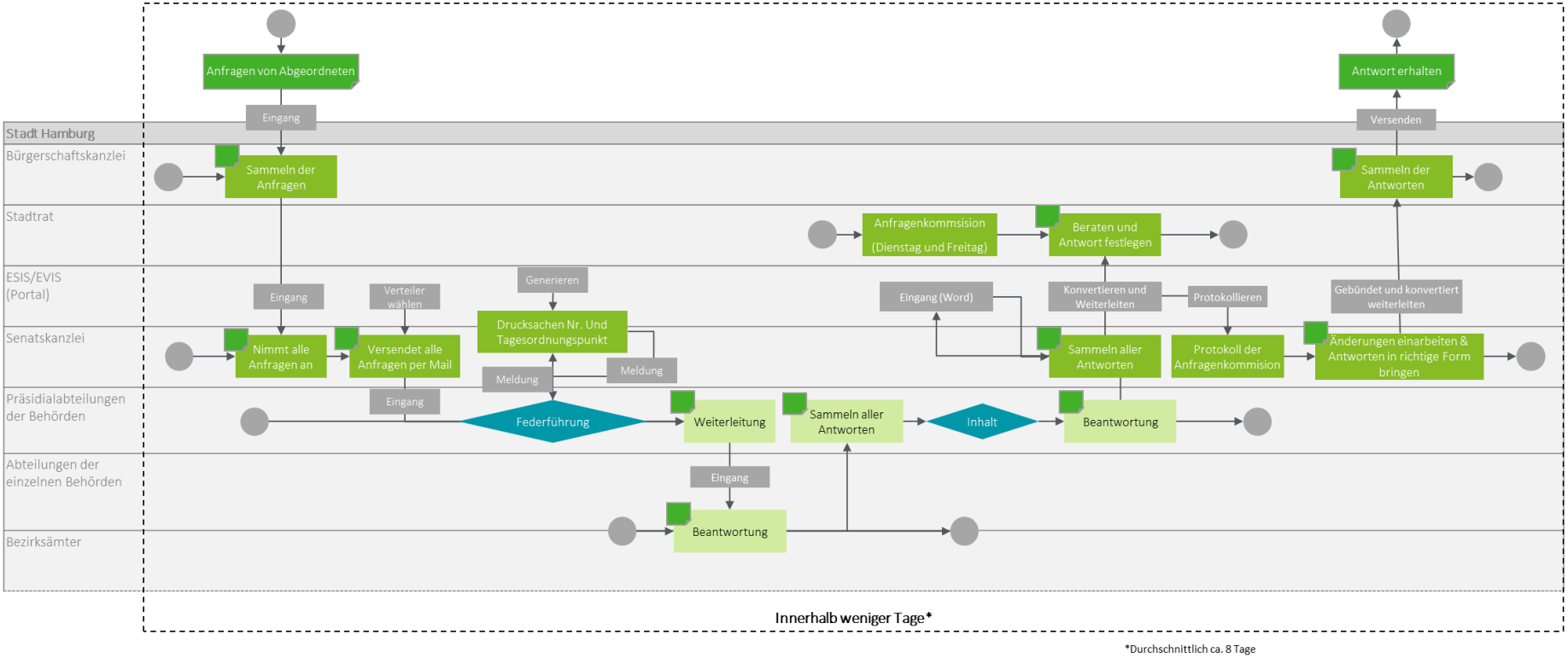
Source: Deloitte 2022

Annex

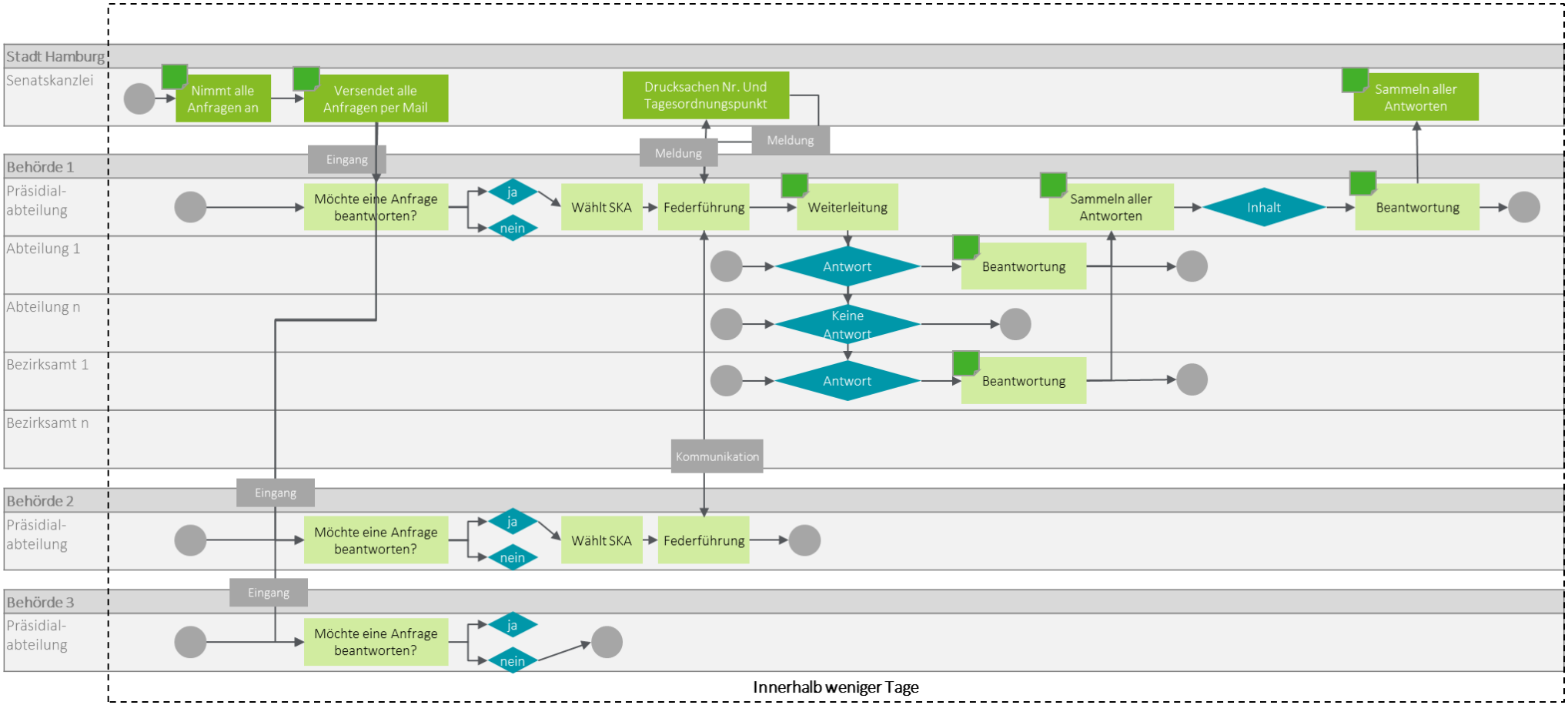
Below are included the BPMN models for the short list processes in German. These graphics are a simplified representation of the current processes and should be understood in connection with the texts listed above.

As-is BPMN Model ‘Schriftliche Kleine Anfragen’ in German

Figure 13: As-is BPMN Model ‘Schriftliche Kleine Anfragen‘ (German)



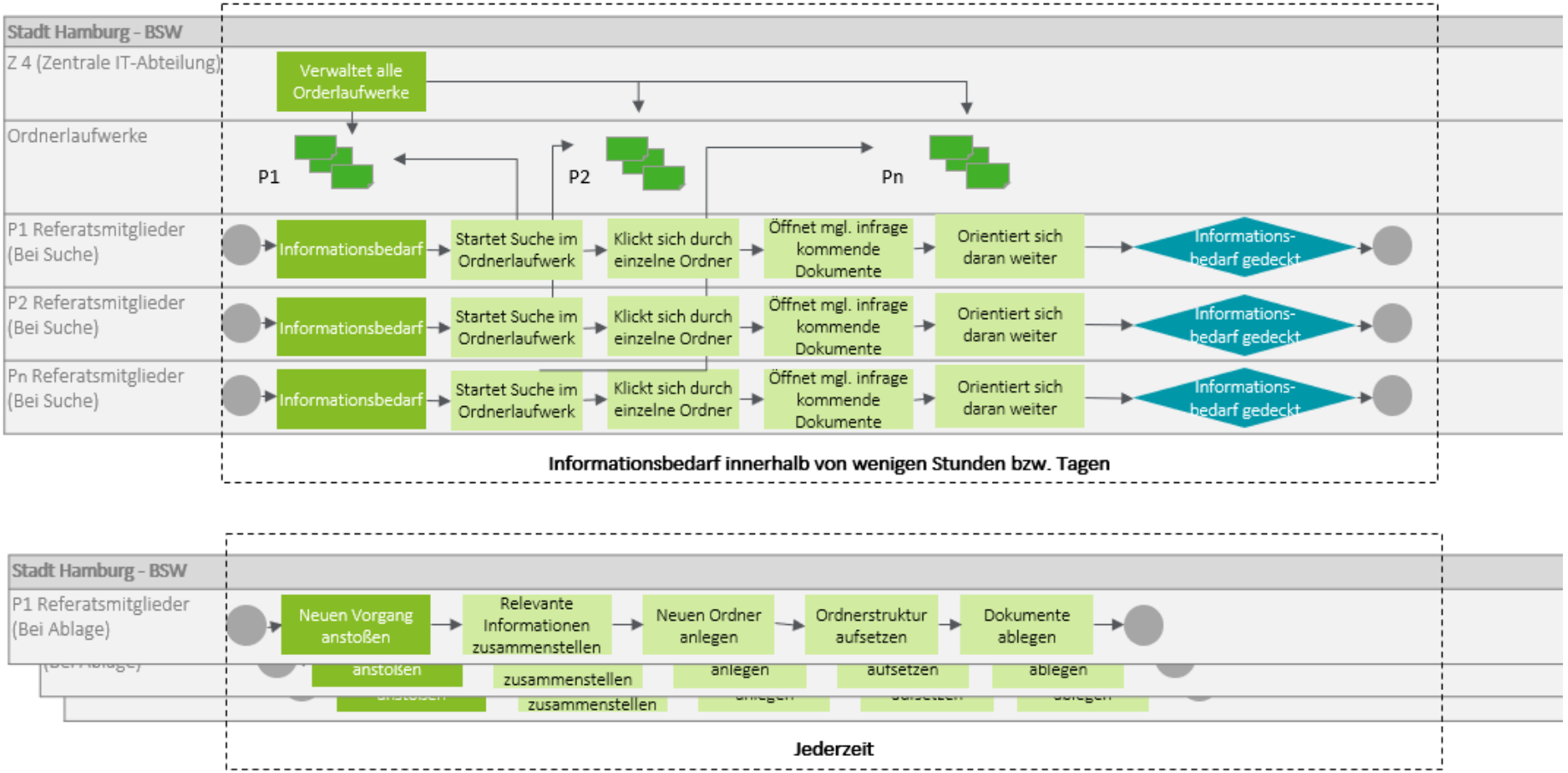
Source: Deloitte 2022



Source: Deloitte 2022, based on stakeholder interviews

As-is BPMN Model ‘Knowledge Management’ in German

Figure 14: As-is BPMN Model ‘Knowledge Management’ (German)



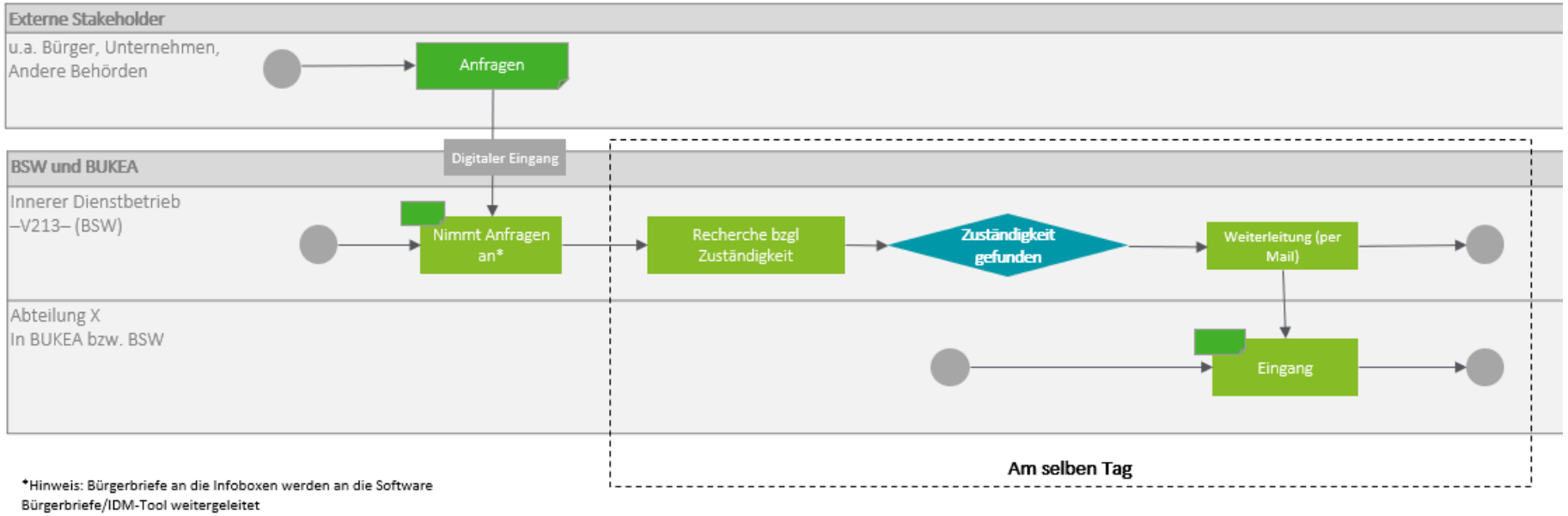
Source: Deloitte 2022, based on stakeholder interviews

As-is BPMN model ‘Infoboxen’ in German

Der Prozess ist beim Referat V 213 (Internal Operations) der BSW angesiedelt und stellt ein Sammelbecken für unterschiedlichste Anfragen dar (z.B. von Bürgern, Bewerbungen für Ausschreibungsverfahren, Vergabe, EU-Anfragen und Bürgerbriefe). Bei dem Eingang der Anfragen handelt es sich ausschließlich um einen digitalen Eingang über einen Emailpostfach. Die Zuordnung und Weiterleitung erfolgt in der Regel noch am selben Tag.

Die Zuordnung bzw. die Recherche bzgl. der Zuständigkeit der jeweiligen Anfrage innerhalb von BUKEA und BSW erfolgt aktuell vorwiegend mittels implizitem Wissen und Recherche in den Organigrammen von BSW und BUKEA. Die Process Owner und Referatsmitarbeiterin im Referat V 213 betreut diesen Prozess schon jahrelang und verfügt daher über einen umfangreichen Erfahrungsschatz hinsichtlich der Zuordnung zu den jeweils relevanten Ansprechpersonen. Das Anfragenvolumen variiert jährlich und hängt zudem von externen Faktoren dem aktuellen Tagesgeschehen ab. In der Coronapandemie wurde das Aufkommen der Anfragen tendenziell etwas weniger und belief sich laut Angaben von V 213 auf ca. 1 000 Anfragen jährlich (ca. 3-4 Anfragen pro Tag).

Figure 15: As-is BPMN Model 'Info boxes'



Source: Deloitte 2022, based on stakeholder interviews

As-is BPMN model ‚Imputing-Verfahren' in German

Dieser Short-List-Prozess besteht aus zwei miteinander zusammenhängenden Sub-Prozessen und ist Teil des übergeordneten Prozesses „Bohranzeigen bearbeiten", der beim Geologischen Landesamt der BUKEA angesiedelt ist. Dieser übergeordnete Prozess ist bereits in der Aris-Datenbank eingepflegt[17] und beschreibt die verschiedenen Schritte, die bei der Bearbeitung und Vervollständigung der Bohranzeigen durchlaufen werden. Der erste Subprozess bezieht sich auf die Überprüfung auf fristgerechten Eingang sowie auf Vollständigkeit der bestimmter Bohrdaten, der zweite Subprozess ist ein Prozess, der im Zuge des Geologiedatengesetzes gesetzlich vorgeschrieben ist und die Nachverfolgung von nicht eingegangenen Daten beinhaltet.

Im Folgenden werden nur diejenigen Prozessaspekte beschrieben, die unmittelbar mit den zu automatisierenden Teilaspekten dieses Prozesses zusammenhängen. Etwaige inhaltliche im Rahmen des Gesamtprozesses Bohranzeigen durchzuführende Prüfschritte werden nicht (detailliert) beschrieben.

Das Geologische Landesamt betreibt eine Datenbank (BohrIS), die verschiedene Daten zu in der Stadt Hamburg durchgeführten Bohrungen erfasst werden. Die gesetzlich vorgeschriebenen zu erfassenden Daten sind Fachdaten (geologische inhaltliche Daten zu den Bohrungen), optional zu erfassende Bewertungsdaten (z.B. Schlussfolgerungen und Gutachten zu Bohrungen) sowie Nachweisdaten (Metadaten wie Ort und Zeitpunkt einer Bohrung). Die Fach- und Bewertungsdaten einer Bohrung werden jeweils den Nachweisdaten zugeordnet.

Im Vorfeld dieser Subprozesse informiert der Anzeigende, der die Bohrung durchführt, über das Portal NoBo (Datenportal, das die Stadt Hamburg gemeinsam mit anderen angrenzenden Bundesländern betreibt) über die geplante Bohrung und lädt ggf. Nachweisdaten (Metainformationen) zur Bohrung über dieses Portal in die BohrIS-Datenbank. Die zuständige Abteilung W3 im GLA überprüft den Eingang der Nachweisdaten und begleitet die Bohrung ggf. fachlich. Erfolgt der Eingang nicht, fordert W3 per Mail und per Telefon beim Anzeigenden die Nachweisdaten nach. Dieser kann sie dann in das BohrIS-Portal laden. Diese Iteration kann beliebig oft erfolgen. Bei Daten im wasserrechtlichen Kontext wird punktuell außerdem das Wasseramt (W1) des Geologischen Landesamt über den Eingang der Daten informiert.

Bei Eingang der Nachweisdaten beginnen der für den Scope dieses Projekts relevanten Subprozesse:

Der erste Subprozess, Überprüfung der eingehenden Bohrdaten, beginnt damit, dass W3 den fristgerechten Eingang der Nachweis-, Fach- und (sofern relevant) Bewertungsdaten überprüft. Sind die Daten nicht fristgerecht eingegangen, fordert W3 diese Daten per Mail oder Telefon beim Anzeigestellenden an. Dieser kann dann die fehlenden Daten per Mail beim GLA (W3) nachliefern. W3 trägt diese Bohrdaten anschließend manuell in die BohrIS-Datenbank nach. Hierbei ist zu beachten, dass die Datensätze unterschiedliche Formate und einen unterschiedlichen Detailgrad aufweisen. Anschließend erfolgt die Überprüfung auf Vollständigkeit der Datensätze. Liegt ein fristgerechter Eingang der Daten vor, erfolgt die Überprüfung der Vollständigkeit unmittelbar nach fristgerechtem Eingang. Die Überprüfung der Vollständigkeit erfolgt aktuell manuell. Kommt W3 zu dem Ergebnis, dass die Daten nicht vollständig sind, wird erneut beim Antragstellenden per Mail und Telefon nachgefordert und die anschließend eingehenden Bohrdaten manuell in BohrIS nachgetragen. Diese Iteration erfolgt so lange, bis der Datensatz vollständig ist, also alle gesetzlichen Anforderungen enthält. Nach Vollständigkeit des Datensatzes erfolgt die Überprüfung der Daten auf inhaltliche Korrektheit. Die Überprüfung auf inhaltliche Korrektheit ist nicht Bestandteil einer möglichen Automatisierung und wird daher nicht näher erläutert.

Der zweite Subprozess, Nachverfolgung der eingehenden Bohrdaten, ist ein Prozess, der noch nicht exisiert, da er zum Sommer 2022 im Zuge der neuen gesetzlichen Verpflichtungen im Rahmen des Geologiedatengesetzes implementiert werden muss. Der Prozess wird daher so beschrieben, wie er ohne Automatisierungslösung implementiert werden würde. Dieser Subprozess beginnt unmittelbar nach Überprüfung der Vollständigkeit. Sind die angeforderten Bohrdaten nicht vollständig, wird der Nachverfolgungsprozess von W3 angestoßen. Dabei wird ein Erinnerungsschreiben erstellt, das W3 dem Anzeigenden schickt. Anschließend wird gecheckt, ob der Anzeigende innerhalb der gesetzlich vorgegebenen Frist (variiert je nach Art der Bohrung) die Bohrdaten per Mail zu W3 schickt. Sind die Daten nicht innerhalb der Frist eingegangen, werden verschiedene Eskalationsschritte wie Mahnungen und

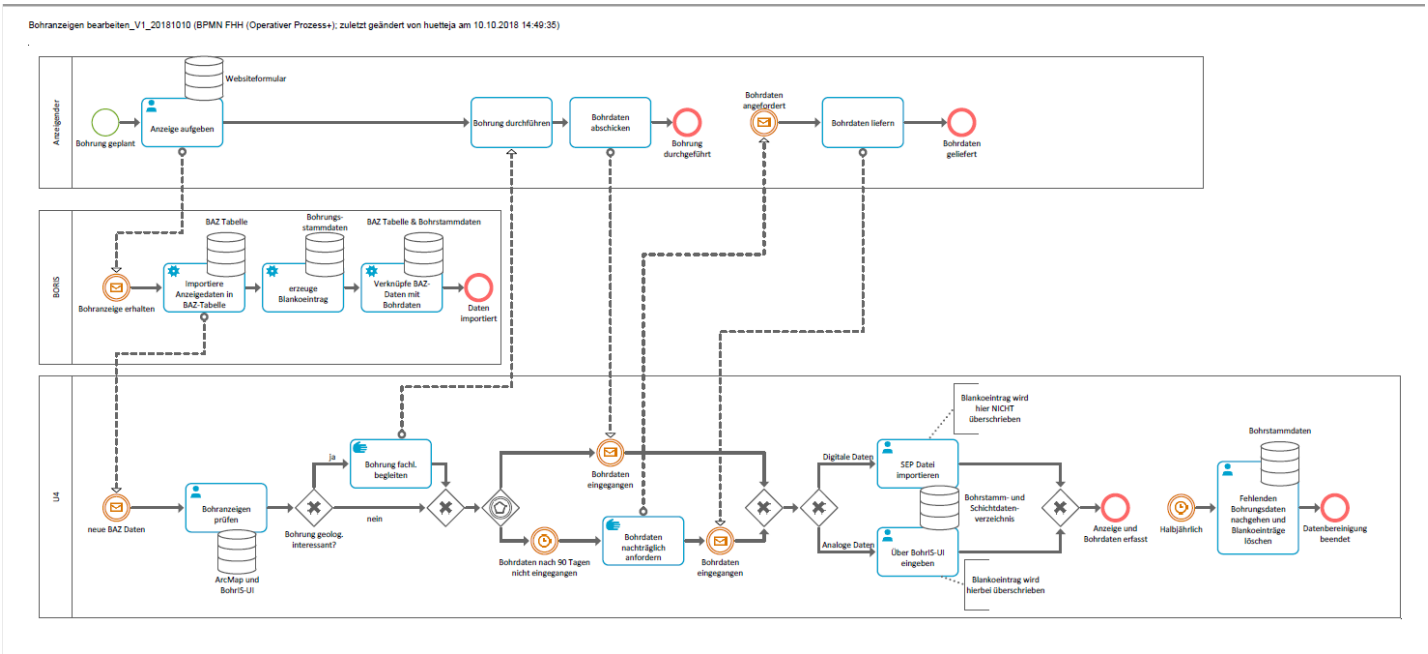
[17] Vgl. Aris-Prozess 77 – Bohranzeigen bearbeiten, zuletzt geändert am 10.10.20218

Gebührenbescheide eingeleitet. Erfolgt der Eingang innerhalb der vorgegebenen Frist, werden die per Mail erhaltenen Daten von W3 manuell in BohrIS nachgetragen und ein erneuter Abgleich der Daten auf Vollständigkeit (siehe Subprozess 1) vorgenommen. Sind die Daten immer noch unvollständig, wird der Nachverfolgungsprozess erneut angestoßen. Diesbezüglich sind beliebig viele Iterationen möglich.

Zu den verschiedenen Datentypen teilte das Geologische Landesamt im Nachtrag zu den geführten Interviews außerdem noch Folgendes mit:

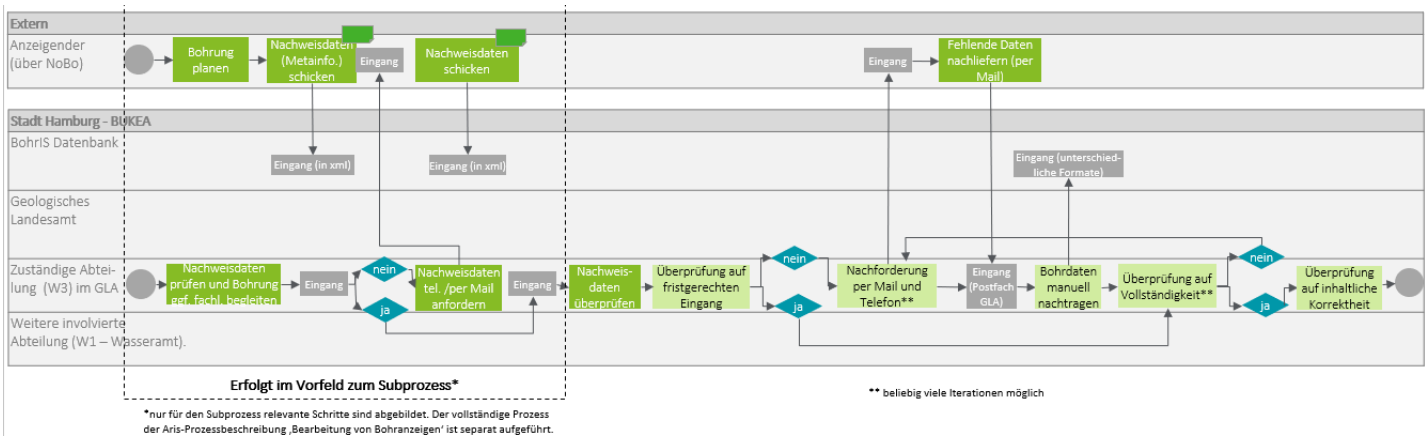
- Nachweisdaten (werden mit der Bohranzeige übers Nobo übermittelt, 2 Wochen vor Bohrbeginn): Hierzu gehören alle Metadaten wie Auftraggeber, Bohrfirma, Bohrzweck, Bohrverfahren, Lage der Bohrung, u.ä. Da die Bohrung dann noch nicht gebohrt wurde, können sich einzelne Datensätze – insbesondere die Lage – später noch ändern.
- Fachdaten (müssen spätestens 3 Monate nach Ende der Bohrarbeiten beim GLA eintreffen): Es handelt sich hierbei zumeist um Schichtenverzeichnisse oder Bohrsäulen. Digitale Schichtenverzeichnisse werden als SEP-Dateien von den Bohrfirmen an uns via Email übermittelt. Bei einigen Bohrungen überprüfen wir die Qualität der erstellten Schichtenverzeichnisse, in dem wir uns von den Bohrfirmen Gesteins-Proben schicken lassen, die von uns im GLA untersucht werden. Falls erforderlich werden die Schichtenverzeichnisse durch uns vor der Eingabe korrigiert. Bohrungen, deren Proben von uns untersucht und testiert werden, heißen bei uns Laborbohrungen. Alle anderen sind Infobohrungen. Wenn wir Schichtenverzeichnisse erhalten, prüfen wir auch die Daten zur Lage. Wir benötigen die exakten Koordinaten und auch einen Lageplan um die angegebenen Koordinaten überprüfen zu können (hier gibt es ein hohes Fehlerpotential). Lagepläne werden von uns häufig angefordert. Weitere Fachdaten sind z.B. Messdaten von Baugrunduntersuchungen, Korngrößenanalysen, oder andere Laboruntersuchungen. Auch die sollen uns via Email übermittelt werden. Die Nachverfolgung ist hier schwierig, da wir meist nicht wissen, was untersucht wird.
- Bewertungsdaten (müssen spätestens 6 Monate nach Ende der Bohrarbeiten beim GLA eintreffen): hierzu zählen Gutachten und Berichte. Auch hier ist die Nachverfolgung schwierig, da nicht zu jeder Bohrungen Gutachten oder Berichte erstellt werden.

Figure 16: As-is BPMN Model Edit drilling notifications (Overarching process)



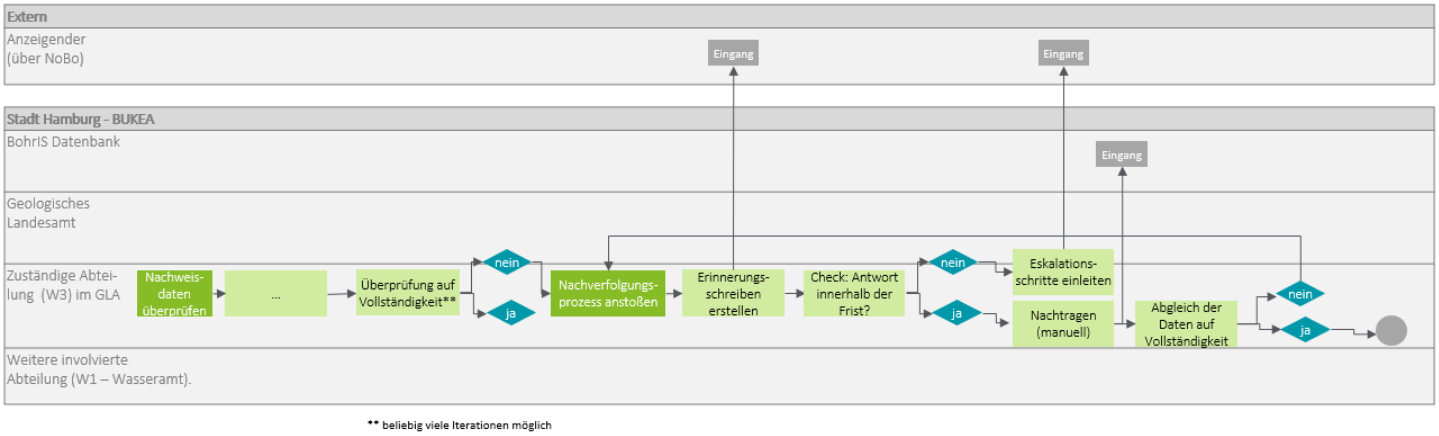
Source: Aris database (City of Hamburg)

Figure 17: Process Review of incoming drilling data (Überprüfung Bohranzeigen)



Source: Deloitte 2022, based on the stakeholder interviews with the Geological State Office, BUKEA

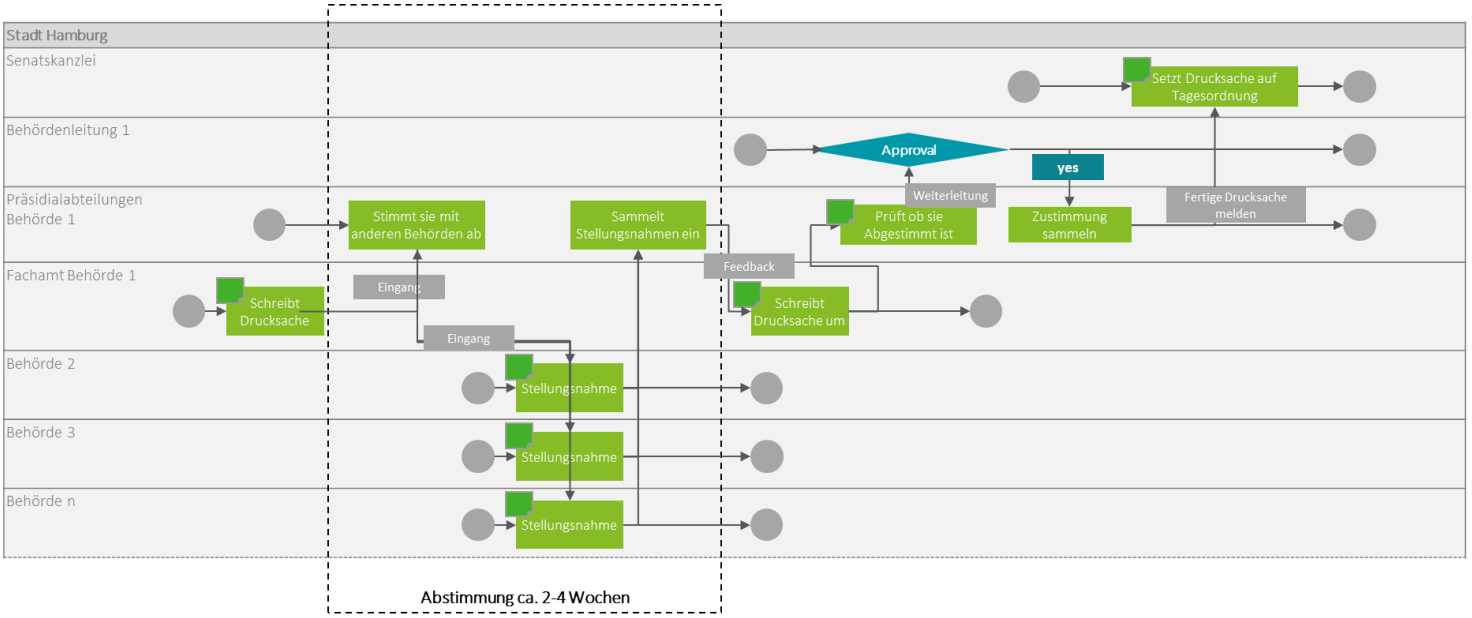
Figure 18: Process Tracking the incoming drilling data (Nachverfolgung Bohranzeigen)



Source: Deloitte 2022

As-is BPMN Model 'Senatsdrucksachenabstimmung' in German

Figure 19: As-is BPMN Model 'Senatsdrucksachenabstimmung' (German)



Source: Deloitte 2022, based on stakeholder interviews

Business requirements catalogue

This deliverable entails the initial list of business requirements for the five short list processes.

Executive Summary

This document describes the business requirements for as well as the objectives and scope of the to-be solutions of the five short list processes selected by the City of Hamburg, 1) the brief written inquiries (*Schriftliche Kleine Anfragen*), 2) the knowledge management (*Wissensmanagement*), 3) the info boxes (*Infoboxen*), 4) the imputing procedures (*Imputing-Verfahren*) and 5) the senate printed matter coordination (*Senatsdrucksachenabstimmung*).

For these processes, four overarching non-functional and additional requirements were defined. These requirements foresee that the to-be solutions must provide interfaces to systems and databases that are connected to and/or are relevant for the short list processes and that the to-be solutions must be created with a responsive design and a cross-plattform access. Furthermore, user-friendliness and efficient management control must be ensured.

Thereafter, specific (functional) business requirements as well as the objectives and scope of each to-be process were defined and assigned to overarching clusters.

For the to-be solution of the brief written inquiries, eleven requirements were defined. The requirements to establish a search functionality, to ensure cross-authority access, to establish user roles and responsibility system and to allow modifications of data were ranked as particularly important for the to-be solution.

For the to-be solution of the knowledge management, eight preliminary requirements were defined. The search functionality, the possibility to modify and export data and to process all relevant data formats have in this regard a high priority.

The to-be solution of the info boxes, five preliminary requirements were defined. Of particular relevance are the automatic forwarding, the personally identifying information (PII) protection, the functionality to export data and to recognise key criteria.

For the to-be solution of the imputing procedures, nine premiminary requirements were defined. The requirements target-acutal comparison, the possibility to send automatic subsequent requests via the workflow and the extraction of information were assigned with a high priority. Furthermore, the integration of existing workflows of relevant upstream or subsequent processes and an access rights management were identified as relevant.

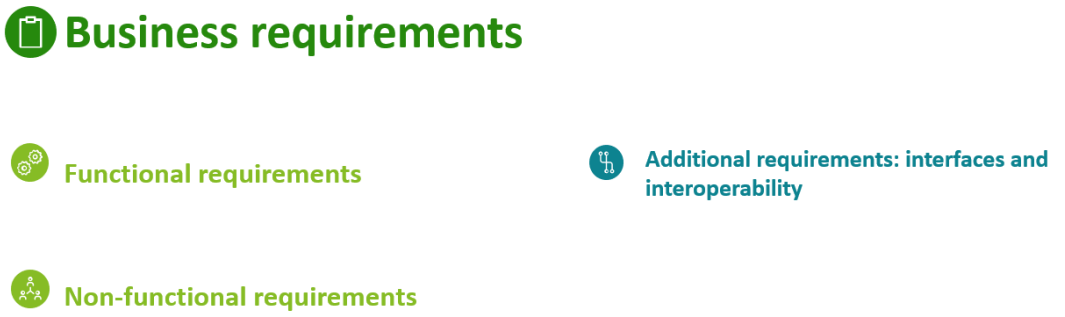
For to-be solution of the the senate printed matter coordination, nine preliminary requirements were defined. For this to-be process, cross-authority access, user roles and a responsibility system and the processing of all relevant data formats has a high priority, among others.

General information about the business requirement catalogues

This deliverable describes the business requirements for each short list process as well as overarching business requirements that apply for all short list processes.

For the scope of this project, it is necessary to distinguish different categories of requirements related to a (technological) solution (or product): Business requirements, functional and non-functional requirements and requirements related to interfaces and interoperability.

Figure 20: Categorisation of requirements regarding to-be business processes



Source: Deloitte 2022

Business requirements describe what is done with the solution from the business users' point of view, i.e., their needs and expectations. In contrast, **functional requirements** describe how this should be accomplished with functionalities, data, processes, and interactions. These functionalities are complemented by **non-functional requirements** that describe requirements regarding user friendliness, security, interfaces, interoperability, etc.[18] A solution (or product) may have **additional requirements related to interfaces and interoperability** to other solutions (or products).

Since this project is about developing technological solutions for existing processes, a particular focus was set on the collection of functional requirements that account for technological and functional aspects. In contrast, business requirements are already implied by the as-is model while the functional requirements largely influence the development and assessment of solution alternatives during the subsequent activities of the project.

The requirements were developed during the conduction of Activity 2 and are tailored to the respective short list processes. Depending on the complexity of the process, the collection of requirements is a very time-intensive endeavour. Given the early stage of this project, the level of complexity was adjusted to the information that was available regarding the short list processes. All requirements of this Deliverable are a suggestion from the project team.

The following chapters firstly describe **overarching non-functional and additional requirements** that apply to all short list processes and **thereafter list the specific functional requirements** for each of the five short list processes. All business requirements are categorised according to their **priority** (high, medium, low) and grouped along the following **clusters**:

- Workflow and collaboration
- Extracting and providing data
- User centricity
- Audit traceability and logging
- Data visualisation and monitoring
- Administration

[18] It is acknowledged that there may exist different definitions of these terms. Quite often, the terms "business requirements" and "functional requirements" are used interchangeably. However, from the view of the project team, these terms describe different types of requirements and should be distinguished accordingly. Also, the categories of requirements may vary per context. For this analysis, we considered the listed categories of requirements most relevant.

Overarching requirements for all short list processes

This chapter describes overarching non-functional and additional requirements that apply for all short list processes. These requirements build on the as-is process description conducted in Deliverable 3.

This list of requirements should not be considered as a definitive list but rather as the current state of all requirements that were considered relevant for the new solutions. It must be noted that the requirements depend on the concrete solution and will be reviewed according to their feasibility and efficiency, among others (see Deliverables 5-7). Therefore, this list should be updated and extended, if necessary, at later stages of the project.

The following table provides an overview over **non-functional and other requirements** that are relevant for all processes to be automated.

Table 20: Non-functional and additional requirements

Requirement	Priority	Description	Classification by cluster
Interfaces	High	The solution must provide interfaces to systems and databases that are connected to and/or relevant for the short list processes (IDM, ESIS/EVIS, BORIS, Noba, etc).	Interface and connectivity
Responsive Design & Cross Plattform Access	Medium	Responsive design implies that tools are created in a way that they are functional on all devices. A responsive design will automatically adjust for different screen sizes. Cross Plattform Access will ensure that a tool is accessible on all devices (e.g. Tablet with iOS and desktop with Windows).	Interface and connectivity
User-friendliness	High	The solution must be user-friendly for its users. User-friendliness means that the features and tools included are easy to use, intuitive to understand and to deal with.	User centricity
Ensure efficient management control	Medium	The solution must ensure efficient management control through appropriate control mechanisms (role concept).	Data visualization and monitoring

Source: Deloitte 2022

Business requirements for process 1 - Brief written inquiries (Schriftliche Kleine Anfragen)

The following table entails the detailed list of requirements was developed by the project team during Activity 2. Each functional requirement was categorised according to its area and (technological) focus by the project team in retrospective.

Objectives and scope

The **objectives,** which were derived in cooperation with the City of Hamburg, for the knowledge management process should aim to:

- enable **media continuity**,
- reduce the **duration** of the determination of the responsibility and routing
- enable an **integrated search**,
- integrate **cross-department databases**
- be **user-oriented** and **intuitive**,

- avoid any **duplicate recoding** of information
- Create a **better overview** of the workflow
- enhance the **interdepartmental communication**

The **scope** of the new solution was initially defined as follows:

- Technical representation of **business processes** through workflows.
- Integrate well into the current and future **IT landscape** at BUKEA and BSW
- A **document management system** is out-of-scope.

Business and functional requirements

The following table entails all functional requirements for the the brief written inquiries process.

Table 21: Business and functional requirements for the brief written inquiries process

Requirement	Priority	Description	Classification by cluster
Cross-authority access	High	The solution must allow the various authorities and Senate offices to access the requests	Workflow and collaboration
User Roles & Responsibility System	High	The solution must be able to prevent unauthorized or unauthorized persons from accessing sensitive information and to guarantee data protection and other regulations.	Administration
Modification of data	High	The solution must enable the user to modify data points.	Workflow and collaboration
Process all relevant data formats	High	The solution must be able to process all relevant data formats the presidential department is currently working with.	Extracting and providing data
Search functionality	High	The solution must provide an advanced search functionality for the user (consider filter criteria in search).	Extracting and providing data
Determine required requests workflow	High	The solution must provide a workflow to determine required activities. This includes the automatic creation of activities and manual creation of activities.	Workflow and collaboration
Export of data	High	The solution must enable the user to export data.	Extracting and providing data
High usability	Medium	The solution must provide a FAQ, be explicit with regards to capturing data, and provide standardised categories (via drop-down menu) wherever appropriate.	User centricity
Central cockpit view (dashboard)	Medium	The solution must offer a cockpit view (dashboard) that enables filtering of topic-specific information (i.e., information shown varies per topic).	Workflow and collaboration
Reminder functionality	Low	The solution should provide a calendar reminder system for deadlines of the requests.	Administration

Requirement	Priority	Description	Classification by cluster
Track workflow status	High	The solution must enable the user to track status of planning and approval process.	Workflow and collaboration

Source: Deloitte 2022

Business requirements for process 2 - Knowledge Management (Wissensmanagement)

The following table entails the detailed list of requirements was developed by the project team during Activity 2. Each functional requirement was categorised according to its area and (technological) focus by the project team in retrospective.

Objectives and scope

The **objectives** of the new solution for the knowledge management process should aim to:

- enable **media continuity**,
- reduce the **duration** of the search time
- enable an **integrated search**,
- integrate **cross-department databases**
- be **user-oriented** and **intuitive**,
- avoid any **duplicate recoding** of information

The **scope** of the new solution was initially defined as follows:

- Integrate well into the current and future **IT landscape** at BUKEA and BSW
- A **document management system** is out-of-scope.

Business and functional requirements

The following table entails all functional requirements for the knowledge management process.

Table 22: Functional requirements for the knowledge management process

Requirement	Priority	Description	Classification by cluster
Search functionality	High	The solution must provide an advanced search functionality for the user (consider filter criteria in search).	Extracting and providing data
Modification of data	High	The solution must enable the user to modify data points.	Workflow and collaboration
Export of data	High	The solution must enable the user to export data.	Extracting and providing data
Cross-unit access	Medium	The solution must enable users from other units within the presidential department (Präsidialabteilung) to access and connect to the the solution.	Workflow and collaboration
Process all relevant data formats	High	The solution must be able to process all relevant data formats the presidential department is currently working with.	Extracting and providing data

Requirement	Priority	Description	Classification by cluster
Central cockpit view (dashboard)	Medium	The solution must offer a cockpit view (dashboard) that enables filtering of topic-specific information (i.e., information shown varies per topic).	Workflow and collaboration
Criteria-based data analysis	Medium	The solution must enable users to analyse criteria like, i.a., topic (Drucksache), department, legal aspect.	Extracting and providing data
Supplementary information	Medium	The solution may enable users from a central unit to capture supplementary information (e.g. additional analyses).	Workflow and collaboration

Source: Deloitte 2022

Business requirements for process 3 - Info boxes (Infoboxen)

The following table entails the detailed list of requirements was developed by the project team during Activity 2. Each functional requirement was categorised according to its area and (technological) focus by the project team in retrospective.

Objectives and scope

The **objectives,** which were derived in cooperation with the City of Hamburg, of the new solution that were defined during the workshops are as follows:

The new solution should:

- enable **media continuity**
- **facilitate the allocation** of the incoming documents
- enable an **integrated workflow**
- be **user-oriented** and **intuitive**
- enable an effective and efficient **monitoring**

The **scope** of the new solution was initially defined as follows:

- Technical representation of **the processes** through workflows.
- Integrate well into the current and future **IT landscape** at BUKEA and BSW

Business and functional requirements

The following table entails all business and functional requirements for the the **process info boxes.**

Table 23: Business and functional requirements for the process info boxes

Requirement	Priority	Description	Classification by cluster
Automatic forwarding / semi-automatic forwarding	High	Automatic forwarding of emails/information should be possible. In case the AI should only make a proposal, semi-automatic forwarding. The forwarding will then take place by a human being.	Workflow and collaboration
Embedding relevant email communication	Medium	It should be possible to store the email communication together with the respective documents.	Workflow and collaboration
Personally identifying	High	Ensure sensitive data is properly managed and governed. Provide fast identification and	Extracting and providing data,

Requirement	Priority	Description	Classification by cluster
information (PII) protection		anonymization for private entities to ensure General Data Protection Regulation (GDPR) conformity.	workflow and collaboration
Export of data	High	The solution must enable the user to export data.	Extracting and providing data
Recognition of key criteria	High	The solution must enable users to recognise key criteria in order to allocate the information to the respective person responsible.	Extracting and providing data

Source: Deloitte 2022

Business requirements for process 4 - Imputing procedure (Imputing-Verfahren)

The following table entails the detailed list of requirements was developed by the project team during Activity 2. Each functional requirement was categorised according to its area and (technological) focus by the project team in retrospective.

Objectives and scope

The **objectives,** which were derived in cooperation with the City of Hamburg, of the new solution that were defined during the workshops are as follows:

The new solution should:

- enable **media continuity** for imputing processes,
- reduce the **duration** of completeness checks
- **facilitate** the process
- enable an **integrated procedure**
- enable **flexibility**
- be **user-oriented** and **intuitive**,
- avoid any **duplicate and parallel actions**
- enable an effective and efficient **overview of the status of the requests and checks**
- enable further **statistical and machine learning** processing

The **scope** of the new solution could be as follows:

- Cover a **management component** to steer the completeness checks and requests
- Integrate well into the current and future **IT landscape** at BUKEA and BSW.
- A **document management system and additional features** are out-of-scope.

Business and functional requirements

The following table entails all business and functional requirements for the **imputing procedure**

Table 24: Business and functional requirements for the imputing procedure

Requirement	Priority	Description	Classification by cluster
Access rights management	Medium	The responsible unit should be able to assign access rights to the overall request or specific parts of the request to dedicated institutions or units (forwarding information will be redundant).	Administration

Requirement	Priority	Description	Classification by cluster
Integration of existing workflows of relevant subsequent/upstream processes	Medium	The integration of existing workflows that are relevant for this process should be possible.	Workflow & collaboration
Subsequent requests via workflow	High	Subsequent requests of data/information should be requested from the person responsible for the drilling via a workflow tool.	Workflow and collaboration
Benchmarking with comparable cases	Low	Benchmarking with comparable cases and their information should be possible.	Data visualisation and monitoring
Target-actual comparison	High	Comparisons and data synchronisation between the target and the actual status should be possible	Extracting and providing data
Reminder function for deadlines	Medium	The new solution should entail a reminder function for deadlines.	Workflow and collaboration
Extraction of information	High	Extraction of relevant information from the documents and data should be possible.	Extracting and providing data
Documentation of the result	Medium	A documentation (e.g. in the form of a dashboard) should be possible	Data visualisation and monitoring
Automatic data extraction from databases	High	An automatic extraction of data from all connected databases should be possible.	Extracting and providing data

Source: Deloitte 2022

Business requirements for process 5 - Senate printed matter coordination (Senatsdrucksachenabstimmung)

The following table entails the detailed list of requirements was developed by the project team during Activity 2. Each functional requirement was categorised according to its area and (technological) focus by the project team in retrospective.

Objectives and scope

The **objectives,** which were derived in cooperation with the City of Hamburg, of the new solution for the knowledge management process should aim to:

- enable **media continuity**,
- reduce the **duration** of the preparation of the printed matter
- integrate **cross-department databases**
- be **user-oriented** and **intuitive**,
- avoid any **duplicate recoding** of information
- create a **better overview** of the workflow
- enhance the **interdepartmental communication**

The **scope** of the new solution was initially defined as follows:

- Technical representation of **business processes** through workflows.

- Integrate well into the current and future **IT landscape** at BUKEA and BSW
- A **document management system** is out-of-scope.

Business and functional requirements

The following table entails all business and functional requirements for the **process senate printed matter coordination.**

Table 25: Business and functional requirements for the process senate matter printed coordination

Requirement	Priority	Description	Classification by cluster
Cross-authority access	High	The solution must allow the various authorities and Senate offices to access the requests	Workflow and collaboration
User Roles & Responsibility system	High	The solution must be able to prevent unauthorized or unauthorized persons from accessing sensitive information and to guarantee data protection and other regulations.	Administration
Modification of data	High	The solution must enable the user to modify data points.	Workflow and collaboration
Process all relevant data formats	High	The solution must be able to process all relevant data formats the presidential department is currently working with.	Extracting and providing data
Export of data	High	The solution must enable the user to export data.	Extracting and providing data
High usability	Medium	The solution must provide a FAQ, be explicit with regards to capturing data, and provide standardised categories (via drop-down menu) wherever appropriate.	User centricity
Determine required requests workflow	High	The solution must provide a workflow to determine required activities. This includes the automatic creation of activities and manual creation of activities.	Workflow and collaboration
Track workflow status	High	The solution must enable the user to track status of planning and approval process.	Workflow and collaboration
Central cockpit view (dashboard)	Medium	The solution must offer a cockpit view (dashboard) that enables filtering of topic-specific information (i.e., information shown varies per topic).	Workflow and collaboration

Source: Deloitte 2022

Business case

Executive Summary

This document elaborates and analyses three different alternatives for automation for each of the five short listed processes that were defined in Activity 2 (Elaboration of a Business Case).

Therefore, for each process, two different scenarios (alternatives) with a varying degree of automation were developed. This includes an alternative with minimum to intermediate adjustments (alternative 2) and an alternative with more advanced AI features that would contribute to considerably automate the respective process (alternative 3).

The alternatives were analysed regarding their feasibility, risks and driving and restraining forces. Furthermore, for each process, an analysis of the alternatives regarding the stakeholder demands, the technological readiness and their impacts was conducted.

Concluding from the analysis of the alternatives for each process, this document proposes a preferred alternative (business case) for each of the five short-listed processes:

- For the brief written inquiries (SKA): alternative 3
- For the senate printed matters coordination: alternative 2
- For the info boxes: alternative 3
- For the imputing procedure: alternative 3
- For the info boxes: alternative 3
- For the knowledge management: alternative 3.

The preferred alternatives constitute the business case for each process and will be specified and further worked out in Deliverables 6 and 7.

Introduction

This document elaborates and analyses three different alternatives for automation for each of the five short listed processes that were defined in Activity 2 (Elaboration of a Business Case). The aim of this assessment is to support the decision-making process of the City of Hamburg to determine the preferred alternative for each process.

Therefore, for each process, two different scenarios (alternatives) with a varying degree of automation were developed. This includes an alternative with minimum to intermediate adjustments and an alternative with more advanced AI features that would contribute to considerably automate the respective process. These alternatives are not conclusive and can continue to be adapted during implementation.

Having described the status quo (alternative 1), the alternative with medium adjustments (alternative 2) and the alternative with the largest automation potential (alternative 3), the alternatives were assessed regarding their feasibility, risks and driving and restraining forces. Furthermore, for each process, an analysis of the alternatives regarding the stakeholder demands, the technological readiness and their impacts was conducted.

As a result of the description and assessment of the alternatives, for each process, the preferred alternative is presented. This preferred alternative constitutes the business case that will be specified and further worked out in Deliverables 6 and 7.

The development of the present document is largely based on the results of Deliverables 2, 3 and 4. The analysis of the short list processes, the analysis of the IDM tool and the iterative exchange with the Free Hanseatic City of Hamburg contributed to the creation of the present business models.

In addition, five additional workshops were conducted with stakeholders in the Free Hanseatic City of Hamburg to elaborate the alternatives. The aim of these workshops was to discuss and elaborate the alternatives in the BUKEA/BSW and the City of Hamburg and, based on this, to further refine the action alternatives.

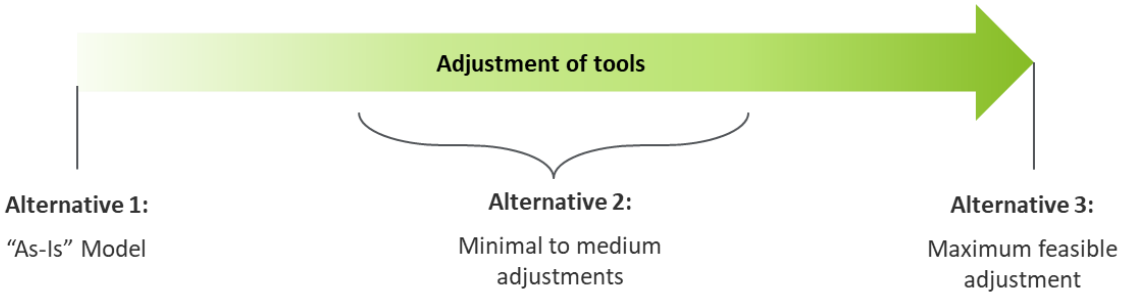
Methodology

Description of alternatives

The main purpose of this activity was to develop three possible alternatives for automation. The first alternative, the "As-Is" model, is the do-nothing scenario. This alternative serves as a comparison for the alternative scenarios as it would maintain the status quo. The second alternative is a range of scenarios, depending on the process under consideration, that would imply concrete additional features which are not already implemented in the IDM (*Intelligent Dialogue Management*) software or the current processes. Each of these features should be highly feasible for an implementation. The third alternative constitutes a high degree of digitization and utilizes a higher degree of adjustments to the current software (possibly including additional emerging technologies) or comprehensive adjustments to current processes in order to make them applicable to the existing software.

We **developed different alternatives** for each of the five processes identified.

Figure 21: Alternatives for the processes identified



Source: Deloitte (2022)

The developed alternatives for the five short-list processes were presented and discussed with the process owners during 5 workshops and the favoured alternatives were identified. The findings and preferred alternatives of the process owners were further presented and discussed with relevant stakeholders of the City of Hamburg and ultimately one favoured alternative per process was selected.

Analysis and assessment of the alternatives

Having described the three alternatives per process, the analysis of alternatives focuses on the assessment of the alternatives regarding their feasibility, impact and key restraining and driving forces that might influence the implementation and processing of the respective alternative.

The analysis **aims to support the decision-making process of the City of Hamburg** in determining the **preferred alternative** for each of the five processes. The analysis focuses on the assessment of alternatives 2 and 3 as alternative 1 of each process was analysed in detail already in Deliverables 2 and 3 of this project. We thereby apply the implicit assumption that both alternatives 2 and 3 are more preferred as compared to the status quo (alternative 1).

Acknowledging that all solutions based on alternative 2 base on the IDM workflow tool and that all solutions based on alternative 3 foresee additional and more advanced AI features and to minimise redundancy in the analysis, an **overarching assessment of the solutions based on alternative 2 against the solutions based on alternative 3** was performed. This assessment included:

- **Force-field analysis**: the force-field analysis is a tool to determine the driving and restricting forces of each alternative. For the different aspects of each solution, the driving and the restraining forces were worked out and put in contrast in a decisional balance sheet. The strength of each force was thereafter ranked according to a five-point scale. The values of the different aspects of the driving forces and the restraining forces were then added up to a total value. The analysis allows not only to determine which side of force prevails but also to provide an overview about the strength and weaknesses of these driving forces.
  Due to its complexity, the force-field analysis was only conducted for the solutions based on alternative 2 (IDM workflow tool). Key implications were, however, derived for both alternative 2 and 3.

- Feasibility assessment: the feasibility assessment was conducted to determine if the requirements of each alternative meet the given circumstances and if it is realistic that a given solution will be implemented. The feasibility assessment contained the analysis of both technical and non-technical feasibility aspects.

On the process level (for each of the five processes themselves), the following assessments were conducted:

- Impact valuation: the impact valuation assesses the effects and impacts on the organisation and culture, processes and the impacts at a technical level. This also includes potential legal, operational, organisational and technical implications at different levels.
- Assessment of stakeholder demands: the assessment of stakeholder demands examines the need, functionality and benefits for the stakeholders (including the process owners) that are involved in the respective process.
- Technological readiness: in order to determine the expected timeframe of a potential implementation and to assess the estimated adoption rate, the technological readiness, in particular related to solutions based on alternative 3, was examined.

Brief written inquiries (Schriftliche kleine Anfragen (SKA))

Brief written inquiries are inquiries on public matters, which are addressed to the Senate by members of the Parliament. These inquiries are transmitted forthwith to the Senate and are to be answered in writing by the Senate within eight days.

Alternatives for Brief written inquiries

In the following sections, the three alternatives and functionalities are explained along process graphs. Alternative 1 represents the continuation of the current solution (status quo), the so-called baseline scenario. The three alternatives are briefly presented below:

- **Alternative 1:** "As-is" model
- **Alternative 2:** IDM Workflow, tool for workflow management, including a monitoring dashboard, deadline tracking, assignment of responsibilities, archiving and more
- **Alternative 3:** Elements of alternative 2 and assisted assignment of responsibilities and an intelligent search

The following table contains a brief overview of the main functionalities of the three alternatives:

Table 26: Addressed Business requirements for the alternatives of SKAs

Functionalities	Alternative 1	Alternative 2	Alternative 3
Workflow management	-	+	+
Assignment of responsibilities (manually)	-	+	+
Archiving	-	+	+
Control/Monitoring Dashboard	-	+	+
Deadline Tracking	-	+	+
Comment and communication function	-	+	+
Assignment of responsibilities (assisted)	-	-	+
Intelligent search	-	-	+
Inter-authority access	-	-	+
Data export	+	+	+
(+) Feature available (-)Feature not available			

Source: Deloitte (2022)

Alternative 1

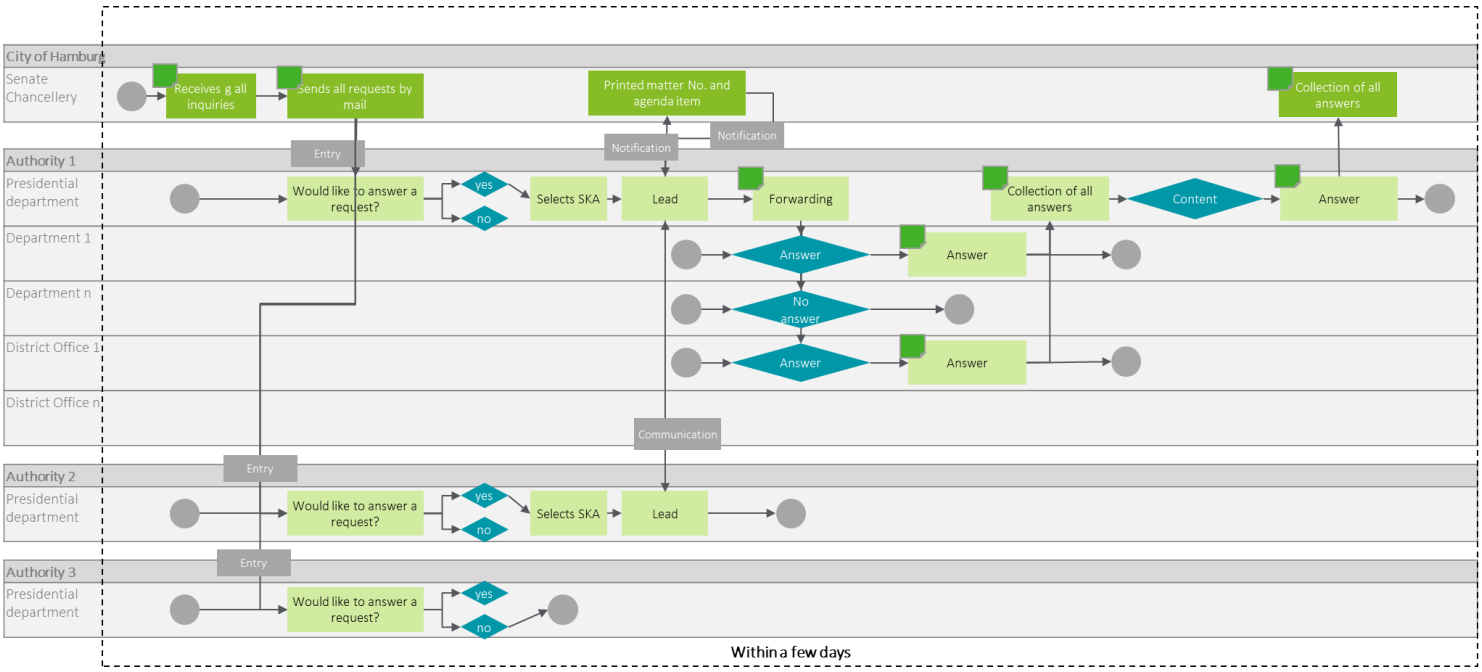
Alternative 1 refers to maintaining the status quo of the Brief written inquiries (*Schriftliche kleine Anfragen)* process unchanged. On a superordinate level, the process can be shown in the process flow chart below from the perspective of the Senate Chancellery. As an example, the process within an individual agency can be seen in the following process flow diagram. The process is briefly described below along the flowcharts.

The process involves inquiries from members of parliament to the Senate of the City of Hamburg, which is required to respond within a few days. The inquiries of the members of parliament are collected by the office of the citizenry (*Bürgerschaftskanzlei*) and transmitted to the Chancellery of the Senate (*Senatskanzlei*). The authorities decide among each other which one will take the lead in answering individual brief written inquiries and reports this to the Senate Chancellery, which forwards back the respective written inquiries number and the agenda item via the portal. After the leading authority has answered the inquiries and all other agencies involved have submitted their answers, the answer is forwarded to the Senate Chancellery, which collects all answers, and forwards them to the inquiry committee. This commission meets on Tuesdays and Fridays. Within the framework of this commission, the city councils discuss the proposals of the authorities and determine the final version of the response. The Senate Chancellery takes minutes of this meeting and incorporates the discussed changes into the answers

and finally forwards them to the office of the citizenry in bundled form. The office of the citizenry, in turn, sends the answered questions to the members of parliament.

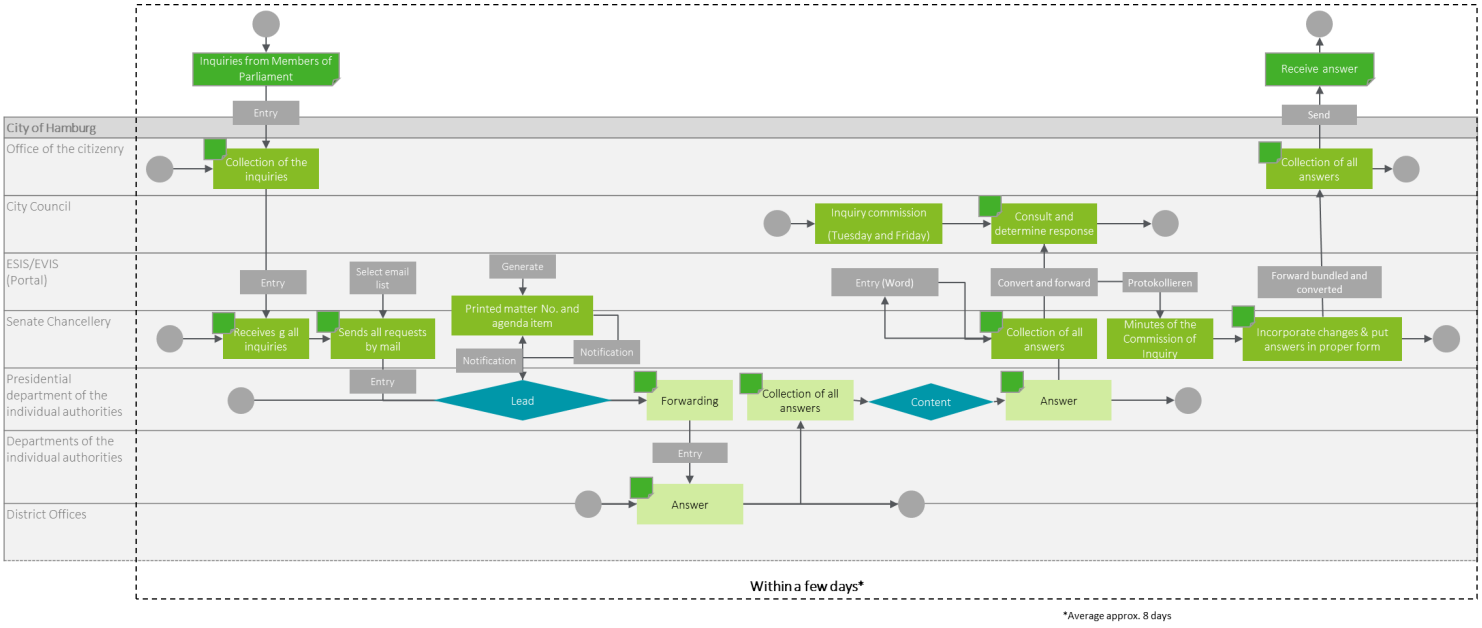
A detailed description of the status quo is provided in Report D3 (As-is Business process Model).

Figure 22: Process model Alternative 1 SKA - From the perspective of the individual presidential department



Source: Deloitte (2022)

Figure 23: Process model Alternative 1 SKA - From the perspective of the Senate Chancellery



Source: Deloitte (2022)

Alternative 2

Alternative 2 extends the as-is model of alternative 1 to include the IDM workflow management. This includes a **central access channel**, a **forwarding assistant** for determining the potentially responsible authorities and offices of the brief written inquiries, a **monitoring and deadline tracking** dashboard, a **comment and communication** function, and **archiving** of the inquiries and the process and response histories in a central database.

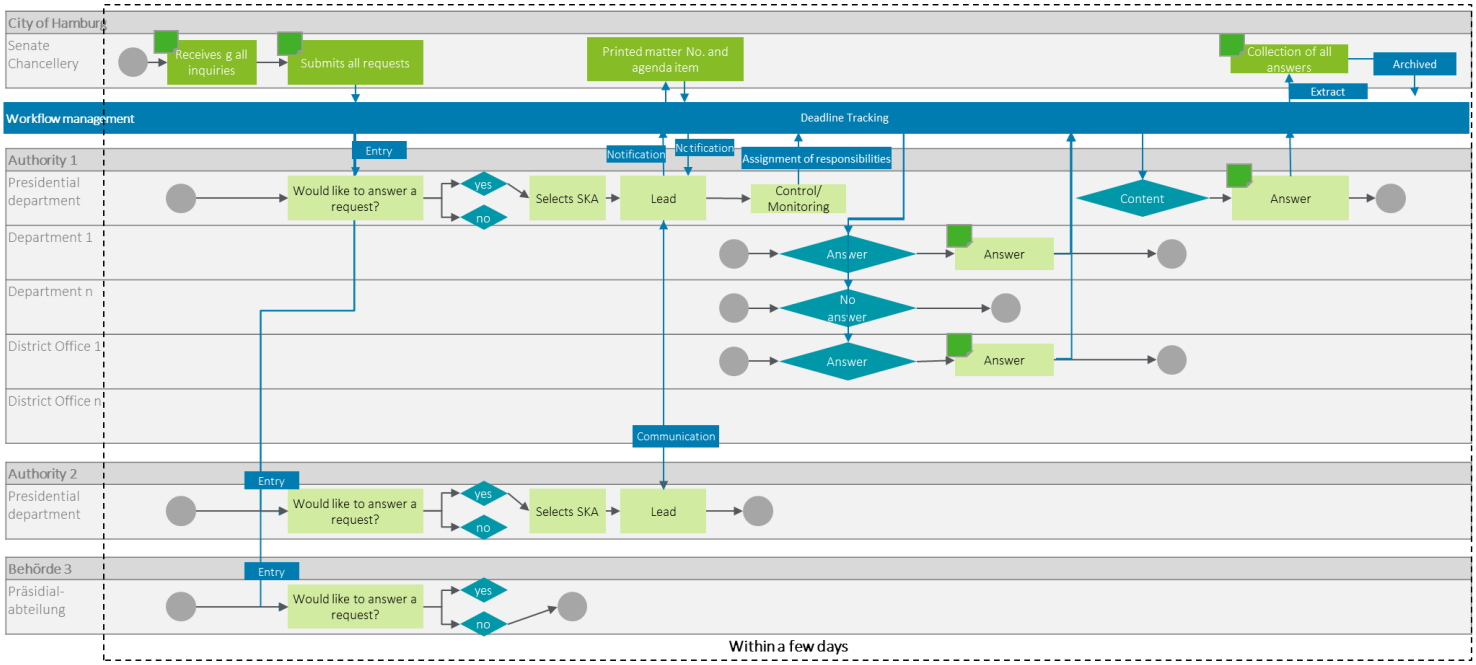
The process as such remains unchanged. The adapted process steps are shown in blue in flowcharts below, with the IDM tool as the intermediate point.

The inquiries of the members of parliament are collected by the office of the citizenry (*Bürgerschaftskanzlei*) and transmitted to the Chancellery of the Senate (*Senatskanzlei*) via the portal ESIS/EVIS.[19] The the Senate Chancellery then forwards the inquiries to all presidential departments of the authorities. This can be implemented in two ways: first, the Senate Chancellery itself can be given access to the IDM tool, thereby forwarding the requests, or an interface can be built between its existing system ESIS and the IDM tool.

The presidential departments of the authorities the receive a notification via the IDM tool that new inquiries have been received and decide whether any of the inquiries need to be answered by their authorities. The lead can be determined via the comment and communication module and reported to the Senate Chancellery via the IDM tool, which in turn reports the printed matter number and agenda item to the lead authority via the IDM tool. The presidential department manually enters the responsibilities of the individual departments and district offices, as well as the deadlines, and forwards the SKA via the IDM tool.

With the assistance of the IDM Tool, a central dashboard can be used to track the deadlines. The responses from the departments and district offices go back to the presidential department via the IDM tool. After consolidation and answering, the answer is forwarded to the Senate Chancellery via the IDM tool. After completion of the inquiry, the inquiry, the response, as well as the responsible authorities and departments and the timestamp of the processing are archived in a central database and can be retrieved by the user.

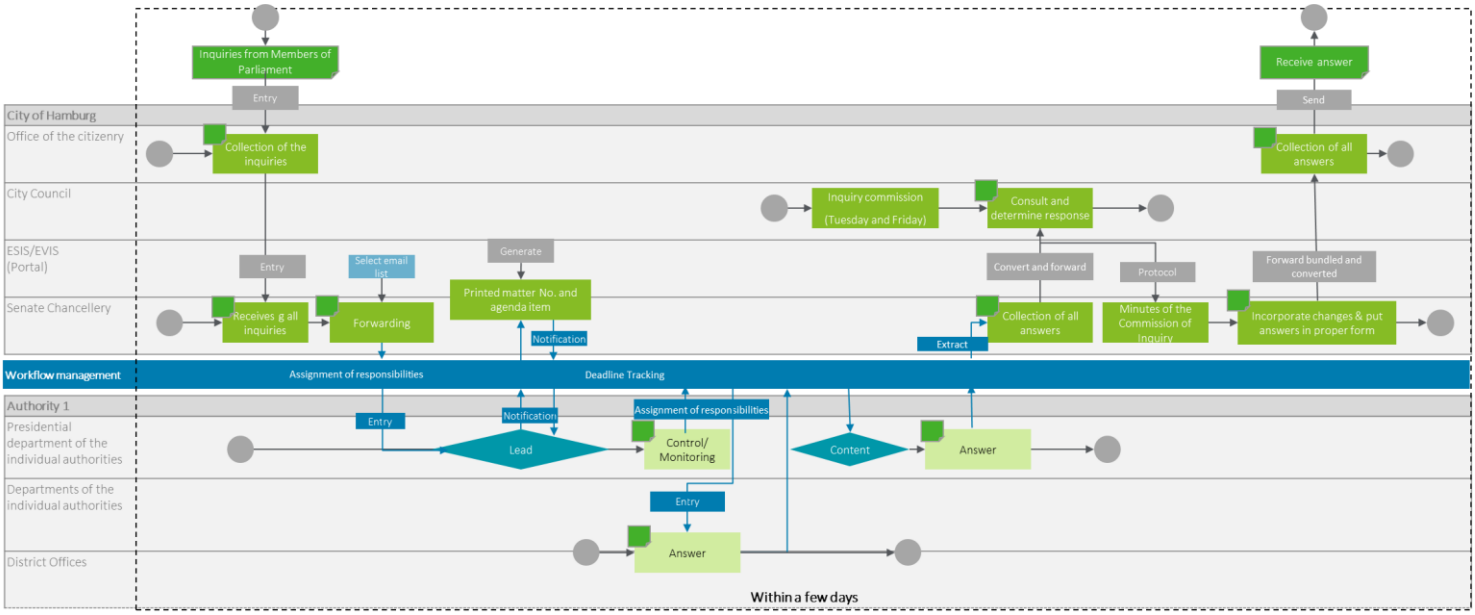
Figure 24: Process model Alternative 2 SKA - From the perspective of the individual presidential department



Source: Deloitte (2022)

[19] System and database for all SKA and meetings. The system serves as a database for all SKAs and meetings, allowing to create records with information and master data (e.g. rapporteurs, questioners, etc.). In this system, the collected requests are forwarded to the Senate Chancellery and serves as an interface between the Senate Chancellery, the office of the citizenry (Bürgerschaftskanzlei) and the City Council. The system serves the forwarding of the SKA by email, as well as the selection of different mailing lists. In addition, agendas and printed matter numbers can be generated and files can be converted into various formats (e.g. Word to PDF). The minutes are also documented in ESIS/EVIS.

Figure 25: Process model Alternative 2 SKA - From the perspective of the Senate Chancellery



Source: Deloitte (2022)

Alternative 3

Alternative 3 extends the alternative 2 to include an assisted assignment of responsibilities and an intelligent search.

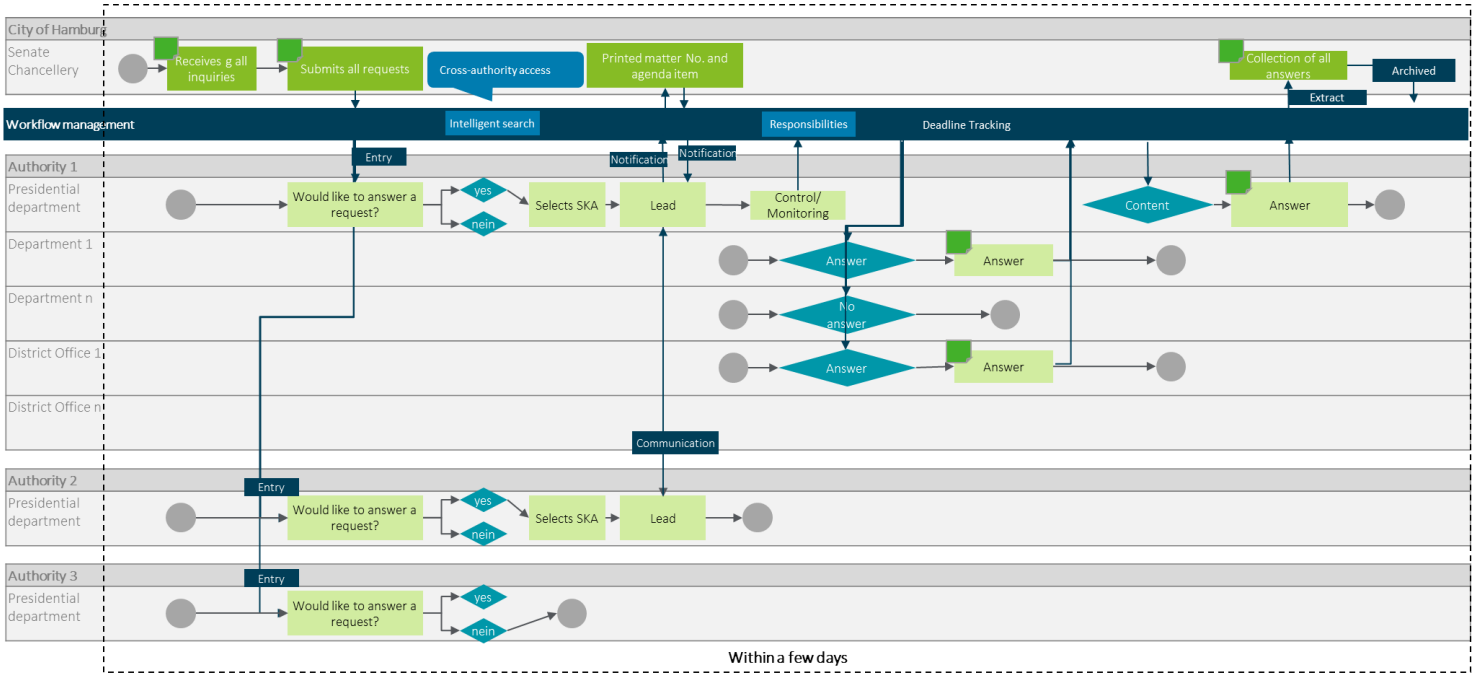
The process as such remains unchanged. The adapted process steps are shown in dark blue in flowcharts below, with the IDM tool as the intermediate point. And light blue the added functionalities of alternative 3. The functionalities of the IDM tool remain the same as described in the previous chapter. In addition, these are extended by two further AI (Artificial intelligence)-based modules: the (assisted) determination of responsibilities and an intelligent search. Both modules are explained in more detail below.

Through the module for the (assisted) **determination of responsibilities**, the user receives the potentially responsible authorities or offices determined by the forwarding assistant to answer the respective inquiry. The forwarding assistant determines the potentially responsible addressees of the inquiry by means of a machine learning system, which recognizes patterns in the responsibilities based on the continuous analysis of the inquiries received and forwarded in the past. Here, the result can consist of several potential addressees, each of which is provided with a probability about the responsibilities of the selected addressees.

The module for the **intelligent search** is based on a dense information retrieval, which in this case is an internal search engine backed by modern technologies such as AI and machine learning. It can be used asymmetrically, like a google search, by entering some keywords and finding relevant documents corresponding to the search query or symmetrically were e.g., a hole pdf document is used as search query to find similar documents. The dense information retrieval systems can be extended to search other documents as well. For example, an image can be used to find corresponding texts or video files in the internal system. Intelligent search can deliver smarter results faster and provides a single point of access to enterprise content sources, allowing data to be enhanced, searched, and analyzed in both structured and unstructured formats.

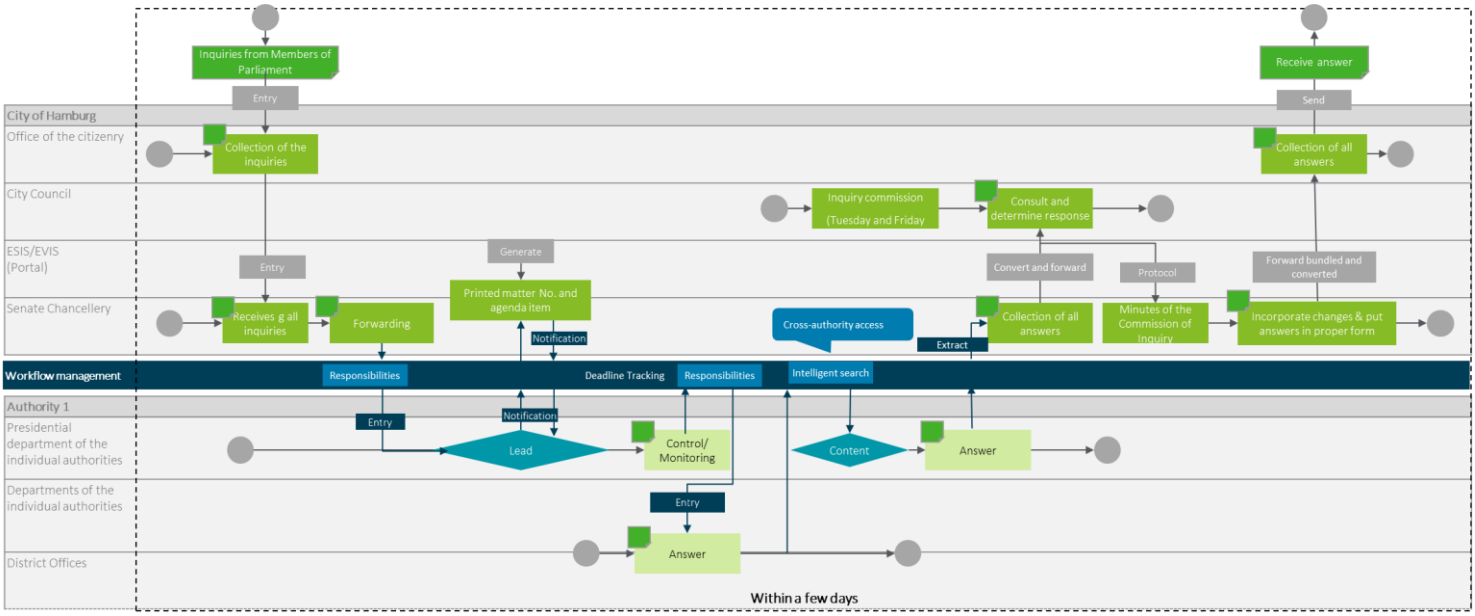
The intelligent search would allow for facilitated searches over the already answered inquiries, and thus simplify and accelerate the process, which would be advantageous in such a time-critical process. The access would be inter-agency and inter-departmental.

Figure 26: Process model Alternative 3 SKA - From the perspective of the individual presidential department



Source: Deloitte (2022)

Figure 27: Process model Alternative 3 SKA - From the perspective of the Senate Chancellery



Source: Deloitte (2022)

Analysis and assessment of alternatives

This subchapter contains the assessment of alternatives for the brief written inquiries. Therefore, three dimensions, namely the impact valuation, the stakeholder demands, and the technological readiness were examined.

Impact valuation

Regarding **organisation and culture**, alternative 2 would aim to build upon a technological solution that is currently being set up at the City of Hamburg and therefore, it can be expected that the solution based on alternative 2 will be widely accepted. However, this alternative would not induce a cultural shift towards solutions with a high degree of automation. Alternative 3, in contrast, promises a considerable improvement in the effectiveness of the process, also due to the features the intelligent search would

introduce. This could lead to spill-over effects to other departments, also considering the strategic importance and relevance of the process. However, the integration of interfaces to the already existing solution ESIS/EVIS must be assessed. This could lead in both alternatives to an enhanced coordination effort in the implementation phase.

Regarding the **process** itself, both alternatives would only foresee slight changes in the process steps itself and do not require any fundamental transformation of the scope, order or activities of the process.

Assessment of stakeholder demands

The SKA process depends on a quick and effective allocation of the SKA, implying that an efficient assignment process is crucial. Alternative 2 would not fundamentally change the assignment process but rather introduce some additional supporting features. Alternative 3, in contrast, would contribute considerably to stakeholder demands as the automation would reduce the various manual steps and reduce high coordination efforts.

Technological readiness

The technological readiness of both alternatives was determined as follows:

Table 27: Technological readiness of the alternatives of the brief written inquiries process

Alternative	Technological readiness	Details
Alternative 2: IDM Workflow tool incl. dashboard with status and tracking functionalities	**High** / medium / low	As this alternative builds on the IDM tool, which is currently being set up at the City of Hamburg, it could be implemented as soon as this tool is ready.
Alternative 3: Alternative 2 + intelligent search and assisted assignment	Intelligent search: **High** / medium / low Assisted assignment: **High-medium** / low	Intelligent search: The readiness of the intelligent search is expected to be high as pre-trained models with good results are already available. Assisted assignment: Solutions on the market are ready, but adaptions are expected to be necessary. The readiness is expected to be medium-high as good process data is available.

Source: Deloitte (2022)

Senate printed matter coordination (Senatsdrucksachenabstimmung)

Senate printed matter coordination are issues of fundamental importance, which are decided by the Senate. These issues are regulated on the Senate's Rules of Procedure (*Geschäftsordnung*) and are addressed by the respective departments of the authorities (e.g. in the case of ordinances or draft laws). This is a completely internal process.

Alternatives for Senate printed matter coordination

In the following sections, the three alternatives and functionalities are explained along process graphs. Alternative 1 represents the continuation of the current solution (status quo), the so-called baseline scenario. The three alternatives are briefly presented below:

- **Alternative 1:** "As-Is" model
- **Alternative 2:** IDM Workflow, tool for workflow management, including dashboard for mapping responsibilities, deadlines, status etc.
- **Alternative 3:** Elements of alternative 2 and assisted assignment of responsibilities and automated template filling

The following table contains a brief overview of the main functionalities of the three alternatives:

Table 28: Addressed Business requirements for the alternatives of Senate printed matter coordination

Functionalities	Alternative 1	Alternative 2	Alternative 3
Workflow management	-	+	+
Assignment of responsibilities (manually)	-	+	+
Archiving	-	+	+
Control/Monitoring Dashboard	-	+	+
Deadline Tracking	-	+	+
Comment and communication function	-	+	+
Assignment of responsibilities (assisted)	-	-	+
Automated filling of the template	-	-	+
(+) Feature available (-)Feature not available			

Source: Deloitte (2022)

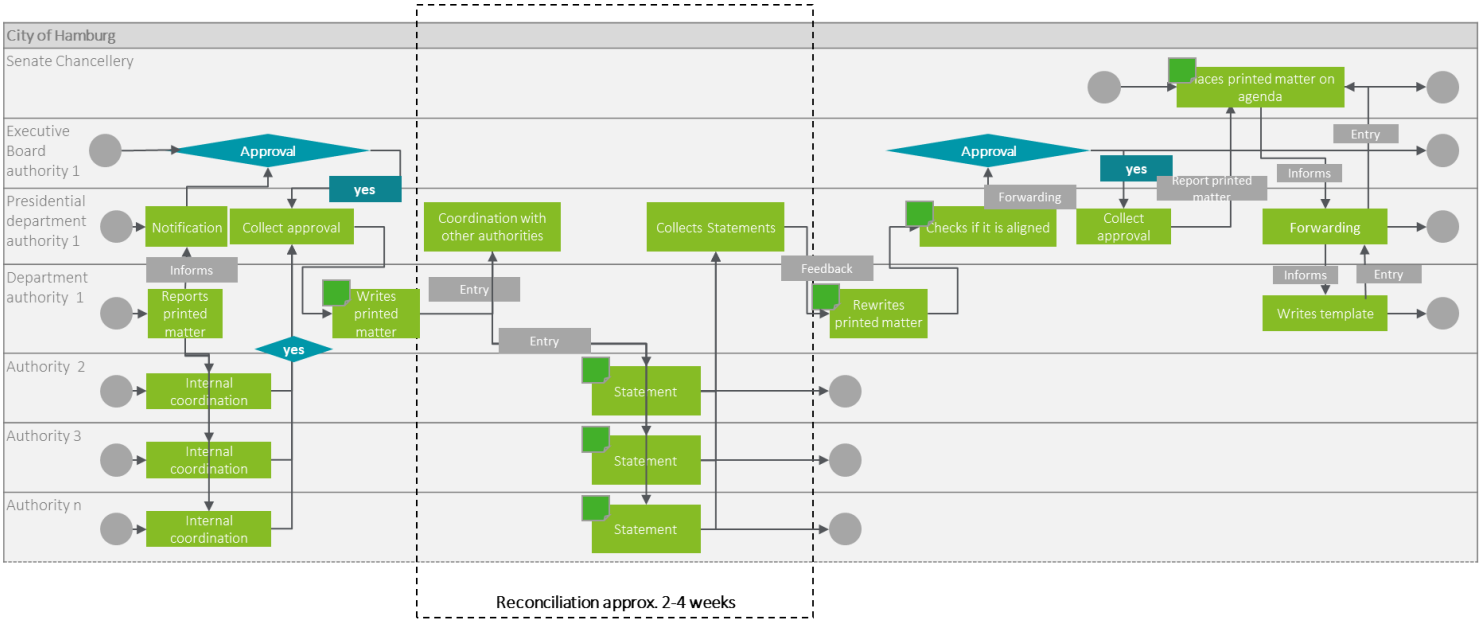
Alternative 1

Alternative 1 refers to maintaining the status quo of the Senate printed matter coordination (*Senatsdrucksachenabstimmung)* process unchanged. On a superordinate level, the process of Senate printed matter coordination can be shown in the process flow chart below. In the following, the process is briefly described along the flowchart.

Senate printed matters are items on which the Senate is to make a decision. In general, the Senate decides on items of fundamental importance, those items are regulated in the Senate's Rules of Procedure (e.g. in the case of ordinances or bills). Before the Senate votes on the printed matter, the bills are coordinated with all involved authorities and forwarded by the Presidential Department.

A detailed description of the status quo is provided in Report D3 (As-is Business process Model).

Figure 28: Process model Alternative 1 Senate printed matter coordination



Source: Deloitte (2022)

Alternative 2

Alternative 2 extends the As-Is model of alternative 1 to include the IDM workflow management. This includes a **central access channel**, a **forwarding assistant** for determining the potentially responsible authorities and offices of the printed matters, a **monitoring and deadline tracking** dashboard, a **comment and communication** function, and **archiving** of the printed matters and the process and response histories in a central database.

The process as such remains unchanged. The adapted process steps are shown in blue in the following flowchart, with the IDM tool as the intermediate point.

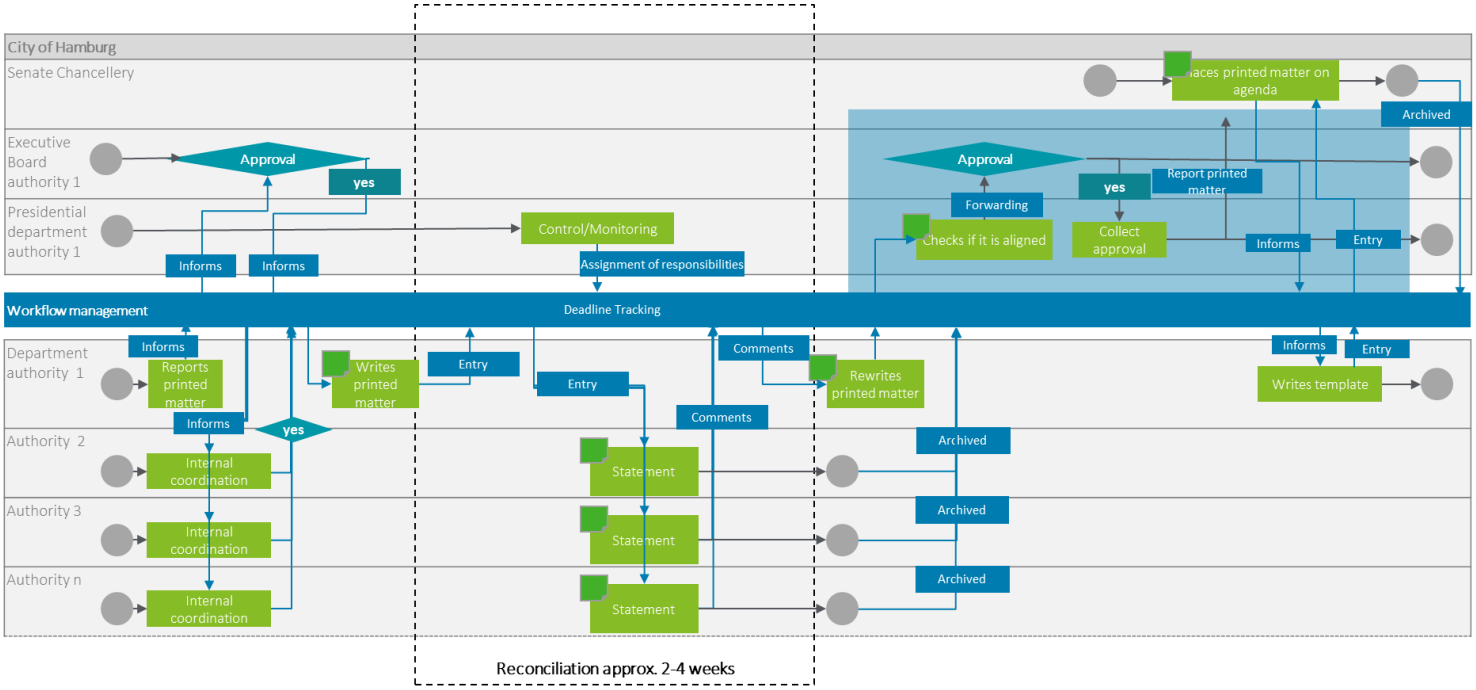
In the case of a new printed matter, the authority informs the Authority Directorate (*Behördenleitung*) via the IDM tool. The latter can grant approval via the IDM tool. As soon as the approval has been granted, the authorities involved are informed via the IDM tool, which can also enter their approval in the IDM tool. The approvals are accessible in the IDM tool and once all are submitted, the department (*Fachamt*) of the indicating authority writes the printed matter. This is forwarded via the IDM tool to collect statements from the authorities involved. The authorities involved are informed by the tool and can enter their comments in the communication and comment function. These are viewable via the IDM tool for the indicating authority, which incorporates the statement and rewrites the printed matter accordingly.

With the assistance of the IDM tool, a central dashboard can be used to track the deadlines and responsibilities.

Via the IDM tool, the finished printed matter is forwarded to the presidential department (*Präsidialabteilung*) and the Authority Directorate (*Behördenleitung*), and after its approval, the matter is reported to the Senate Chancellery. As soon as the printed matter is placed on the agenda of the Senate Chancellery (*Senatskanzlei*), the initiated authority is informed about this via the IDM tool. After the authority is informed, it writes a template (‘*Waschblatt*’) and submits it through the IDM tool in turn to the Senate Office. This template summarizes and explains the contents of the printed matter.

The statements of the involved authorities as well as the finalized printed matter are **archived** in a central database.

Figure 29: Process model Alternative 2 Senate printed matter coordination



Source: Deloitte (2022)

Alternative 3

Alternative 3 extends the alternative 2 to include an assisted assignment of responsibilities and an automated template filling.

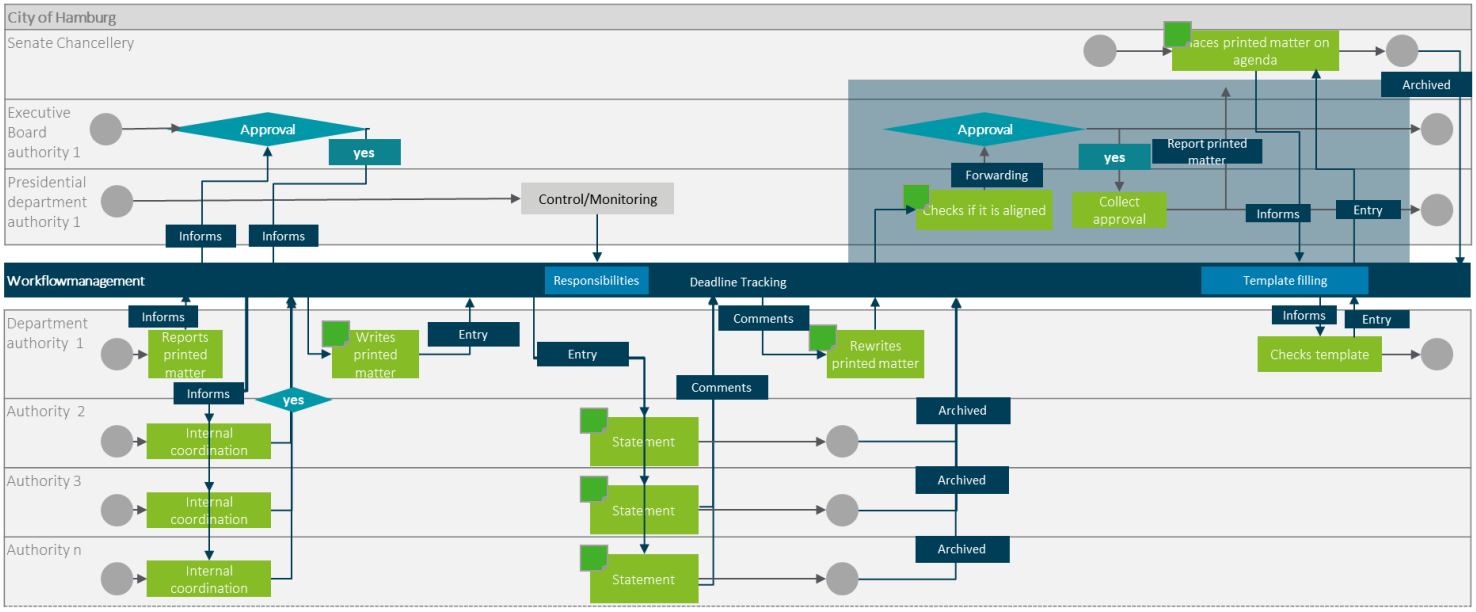
The process as such remains unchanged. The adapted process steps are shown in dark blue in flowchart below, with the IDM tool as the intermediate point. And light blue the added functionalities of alternative 3. The functionalities of the IDM tool remain the same as described in the previous chapter. In addition, these are extended by two further AI-based modules: the (assisted) determination of responsibilities and an automated template filling

Both modules are explained in more detail below.

Through the module for the (assisted) **determination of responsibilities**, the user receives the potentially responsible authorities or offices determined by the forwarding assistant to answer the respective printed matter. The forwarding assistant determines the potentially responsible addressees by means of a machine learning system, which recognizes patterns in the responsibilities based on the continuous analysis of the printed matters received and forwarded in the past. Here, the result can consist of several potential addressees, each of which is provided with a probability about the responsibilities of the selected addressees. The (assisted) determination of responsibilities enables a quicker identification of which authority should be involved in the printed matter.

The second module is used for an automated filling of the template, which is forwarded to the Senate to vote, is based on **named entity recognition/extraction**. Name entity recognition is a subtask of Natural Language Processing that seeks to locate and classify named entities mentioned in unstructured text into pre-defined categories such as person names, organizations, etc. With named entity extraction, it is possible to understand the subject or theme of a body of text and quickly group texts based on their relevancy or similarity. This technology could be used to extract from the written printed matter the information which is presented in the template.

Figure 30: Process model Alternative 3 Senate printed matter coordination



Source: Deloitte (2022)

Analysis and assessment of alternatives

This subchapter contains the assessment of alternatives for the senate printed matter coordination process. Therefore, three dimensions, namely the impact valuation, the stakeholder demands, and the technological readiness were examined.

Impact valuation

Regarding **organisation and culture**, alternative 2 would build upon the solution that is currently being developed at the City of Hamburg. Alternative 3, however, would entail considerable risks regarding its implementation given the high degree of stakeholder involvement and the importance of achieving a quick allocation. Considering the low number of senate printed matters, stakeholders might question for alternative 3, whether such changes are necessary.

Regarding the **process** of the senate printed matters, alternative 2 only foresees slight changes in the process steps. Alternative 3, in contrast, would require more adjustments as the interaction between other tools and IT solutions that are already being used for the senate printed matters must be assessed.

Assessment of stakeholder demands

As an effective and quick coordination is crucial for this process and also considering the high number of stakeholder involvement, a solution that only involves a lower degree of automation might be sufficient.

Technological readiness

The technological readiness of both alternatives was determined as follows:

Table 29: Technological readiness of the alternatives of the senate printed matter coordination process

Alternative	Technological readiness	Details
Alternative 2: IDM Workflow tool incl. dashboard for status and tracking	**High** / medium / low	As this alternative builds on the IDM tool, which is currently being set up at the City of Hamburg, it could be implemented as soon as this tool is ready.

Alternative	Technological readiness	Details
Alternative 3: Alternative 2 + assisted assignment of responsibilities and automated template filling	Assisted assignment: High / **medium** / low Automated template filling: High / **medium-low**	Assisted assignment: given that this process is not frequently used, there might be the risk that not enough data to train the models is available. Automated template filling: The automated template filling works better the more data are available. As the number of senate printed matters is not high, the automated template filling might be difficult to train and hence to implement.

Source: Deloitte (2022)

Imputing procedure (Imputing-Verfahren)

Regarding the general process "imputing procedure", the process analysis performed in activity 2 of this project found several processes that can be used to illustrate the imputing procedure. For the short list and for the purpose of illustrating this category of processes in the present deliverable, the process of drilling reports, allocated in the Geological State Office (*Geologisches Landesamt*) at BUKEA, was selected.

Alternatives for Imputing procedure

In the following sections, the three alternatives and functionalities are explained along process graphs. Alternative 1 represents the continuation of the current solution (status quo), the so-called baseline scenario. The three alternatives are briefly presented below:

- **Alternative 1:** "As-Is" model
- **Alternative 2:** IDM Workflow, tool for workflow management, including dashboard for mapping responsibilities, deadlines, status etc.
- **Alternative 3:** Elements of alternative 2 and an automated completeness and plausibility check as well as imputing of missing values

The following table contains a brief overview of the main functionalities of the three alternatives:

Table 30: Addressed Business requirements for the alternatives of Imputing procedure

Functionalities	Alternative 1	Alternative 2	Alternative 3
Workflow management	-	+	+
Assignment of responsibilities (manually)	-	+	+
Archiving	-	+	+
Control/Monitoring Dashboard	-	+	+
Deadline Tracking	-	+	+
Comment and communication function	-	+	+
Export database	-	-	+
Completeness check (automated)	-	-	+
Imputing	-	-	+
Plausibility check (automated)	-	-	+
(+) Feature available (-)Feature not available			

Source: Deloitte(2022)

Alternative 1

Alternative 1 refers to maintaining the status quo of the BohrIS process unchanged. This process consists of two interrelated sub-processes and is part of the higher-level process "edit drilling reports", which is located at the Geological State Office of BUKEA. This overarching process is already maintained in the Aris database and describes the various steps involved in processing and completing the drill listings. The first sub-process relates to checking the timely receipt and completeness of the specific drilling data, the second sub-process is a process that is required by law as part of the Geological Data Act and includes the tracking of data that has not been received.

On a superordinate level, these processes of BohrIS can be shown in the following process flow charts. The process is briefly described below along the flowcharts.

The Geological State Office operates a **database (BohrIS)** that collects various data on boreholes carried out in the City of Hamburg. Upfront to these sub-processes, the reporting party who is carrying out the drilling provides information about the planned drilling via the NoBo portal (data portal that the City of Hamburg operates together with other neighbouring Federal States) and, if necessary, uploads verification data (meta information) about the drilling via this portal to the BohrIS database. The responsible department

checks the receipt of the verification data and accompanies the drilling professionally if necessary. If it is not received, the responsible department will request the verification data from the person making the notification by email and by telephone.

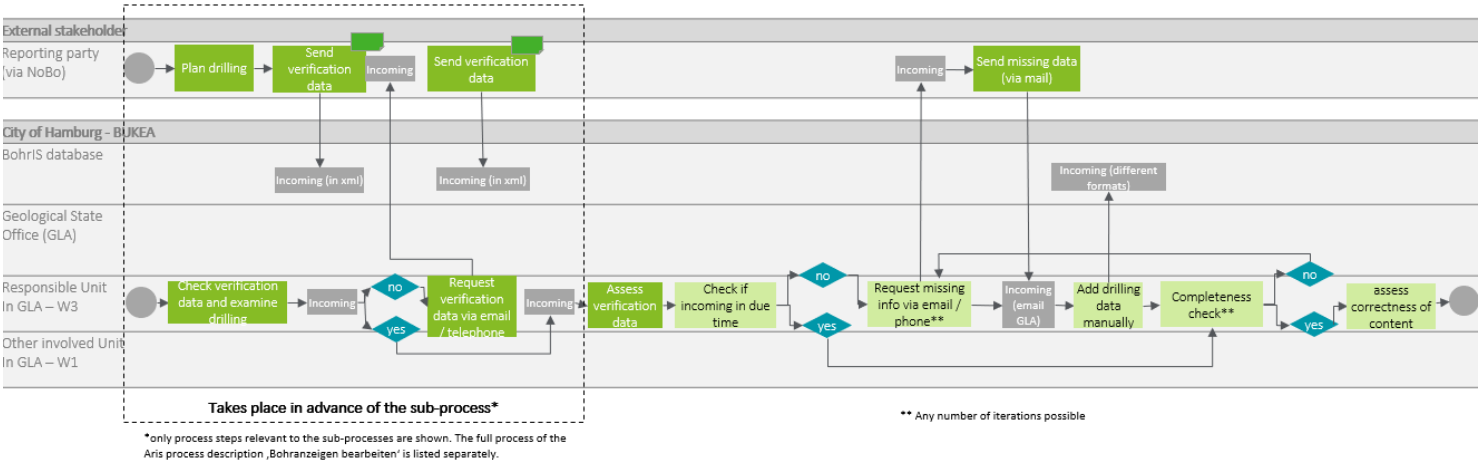
Upon receipt of the verification data, the sub-processes relevant to the scope of this project begin:

The first sub-process, **review of incoming drilling data**, begins with W3 verifying the timely receipt of verification, specialist and (where relevant) evaluation data. If the data is not received by the deadline, W3 will request this data from the person making the notification by email or telephone. The reporting party can then send the missing data to the Geological State Office (W3) by email. W3 then enters this drilling data manually into the BohrIS database. It should be noted that the datasets have different formats and a different level of detail. Thereafter, the completeness of the data records is checked. If the data is received on time, the completeness check is carried out immediately after the receipt on time. The completeness check is currently carried out manually. If W3 comes to the conclusion that the data is not complete, the applicant will be asked again by email and telephone and the subsequently incoming drilling data will be entered manually in BohrIS. This iteration continues until the data set is complete, i.e. contains all legal requirements. Once the data set is complete, the data is checked for correctness in terms of content.

The second sub-process, **tracking the incoming drilling data** starts immediately after checking for completeness. If the drilling data requested is not complete, the follow-up process will be initiated by W3. A reminder letter will manually be created by W3, which W3 sends to the person making the notification. It is then checked whether the reporting party has sent the drilling data to W3 by email within the legally stipulated period (varies depending on the type of drilling). If the data is not received within the deadline, various escalation steps such as reminders and fee notifications are initiated. If it is received within the specified period, the data received by email from W3 is entered manually in BohrIS and the data is compared again for completeness (see sub-process 1). If the data is still incomplete, the tracking process is restarted. This iteration takes place until the requested data is complete.

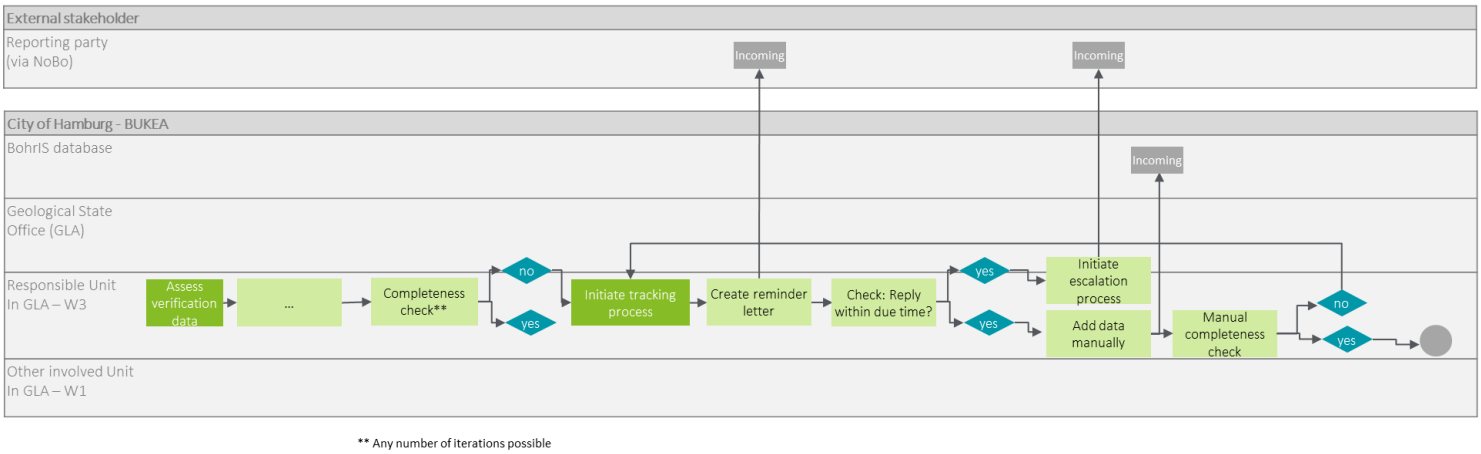
A detailed description of the status quo is provided in Report D3 (As-is Business process Model).

Figure 31: Process model Alternative 1 BohrIS completeness check



Source: Deloitte (2022)

Figure 32: Process model Alternative 1 Tracking of missing BohrIS data



Source: Deloitte (2022)

Alternative 2

Alternative 2 extends the As-Is model of alternative 1 to include the IDM workflow management. This includes a **central access channel**, a **monitoring and deadline tracking** dashboard, a **comment and communication** function, and **archiving** the process and response histories in a central database.

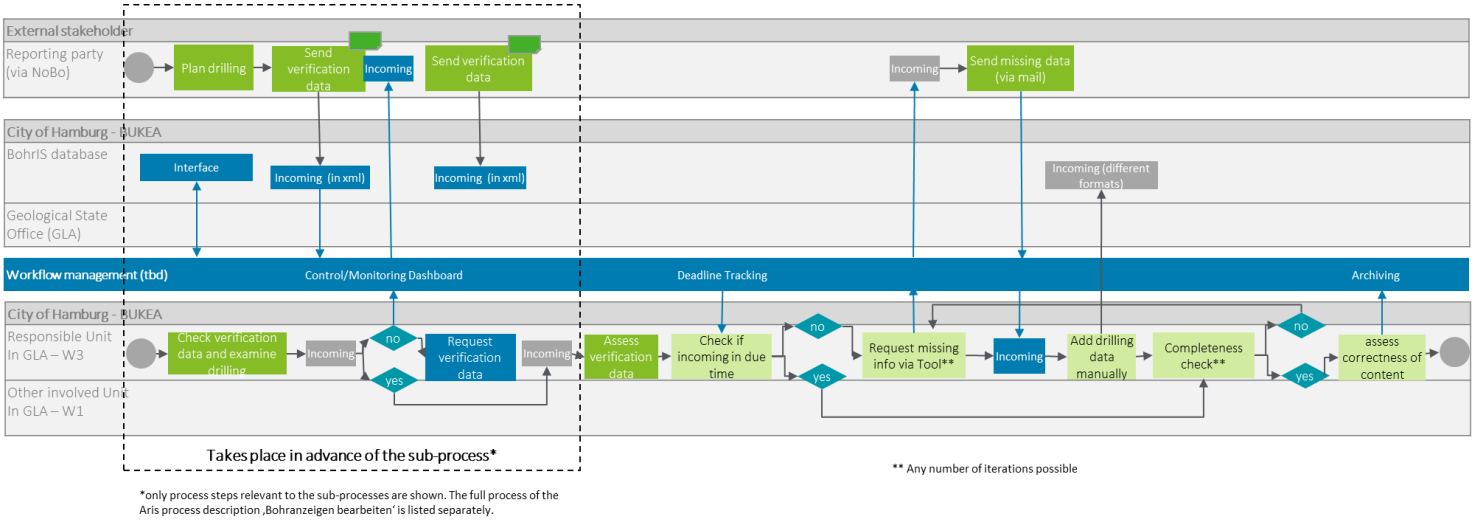
The process as such remains unchanged. The adapted process steps are shown in blue in figures below, with the IDM tool as the intermediate point.

The first sub-process, **review of incoming drilling data**, will be controlled via the IDM tool. The incoming data is imported into the BohrIS database and the responsible department is notified through the IDM tool. Using the IDM tool W3 can start the workflow process, by entering the deadlines and dates into the IDM tool, and therefore use the deadline tracking functionality. If the data is not received within the deadline, W3 will request the data from the person making the notification through the IDM. The interaction for missing data and dealine tracking is therefore covered by the IDM tool.

The second sub-process, **tracking the incoming drilling data,** will also use the IDM tool as a workflow management tool. It functions as a monitoring dashboard of the ongoing drilling data request. After checking for completeness, if the drilling data requested is not complete, the follow-up process will be initiated by W3. A reminder letter will be created through the IDM tool by W3, which will be send to the person making the notification. All information, regarding the communication and received data will be strored in the IDM tool. This allows the responsibles to set deadlines, which are tracked by the tool. If the data is not received within the deadline, various escalation steps such as reminders and fee notifications are initiated through the IDM tool. If it is received within the specified period, the data received by email from W3 is entered manually in BohrIS and the data is compared again for completeness (see sub-process 1). If the data is still incomplete, the tracking process is restarted. This iteration takes place until the requested data is complete.

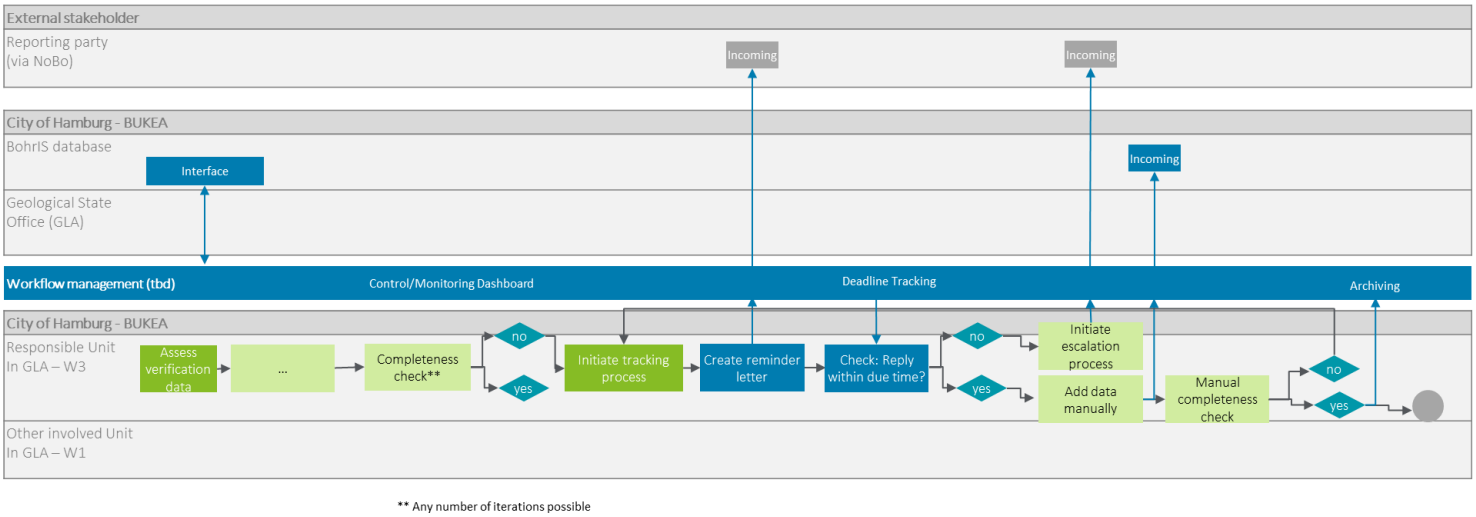
The data and notifications are **archived** in a central database.

Figure 33: Process model Alternative 2 BohrIS completeness check



Source: Deloitte (2022)

Figure 34: Process model Alternative 2 Tracking of missing BohrIS data



Source: Deloitte (2022)

Alternative 3

Alternative 3 extends the alternative 2 to include an automated completeness and plausibility check as well as imputing of missing values

The processes as such remain unchanged. The adapted process steps are shown in dark blue in figures below with the IDM tool as the intermediate point and light blue the added functionalities of alternative 3. The functionalities of the IDM tool remain the same as described in the previous chapter. In addition, these are extended by further modules: an automated completeness and plausibility check as well as imputing of missing values.

All modules are explained in more detail below.

The **completeness check** module automatically checks the received data for completeness in the two processes "Incoming Drilling Data Check" and "Incoming Drilling Data Tracking" by searching for missing values. This module can be based on a rule-based approach. If missing data is detected, the responsible person is notified via the IDM tool and can also send a follow-up request to the person responsible for the delivery.

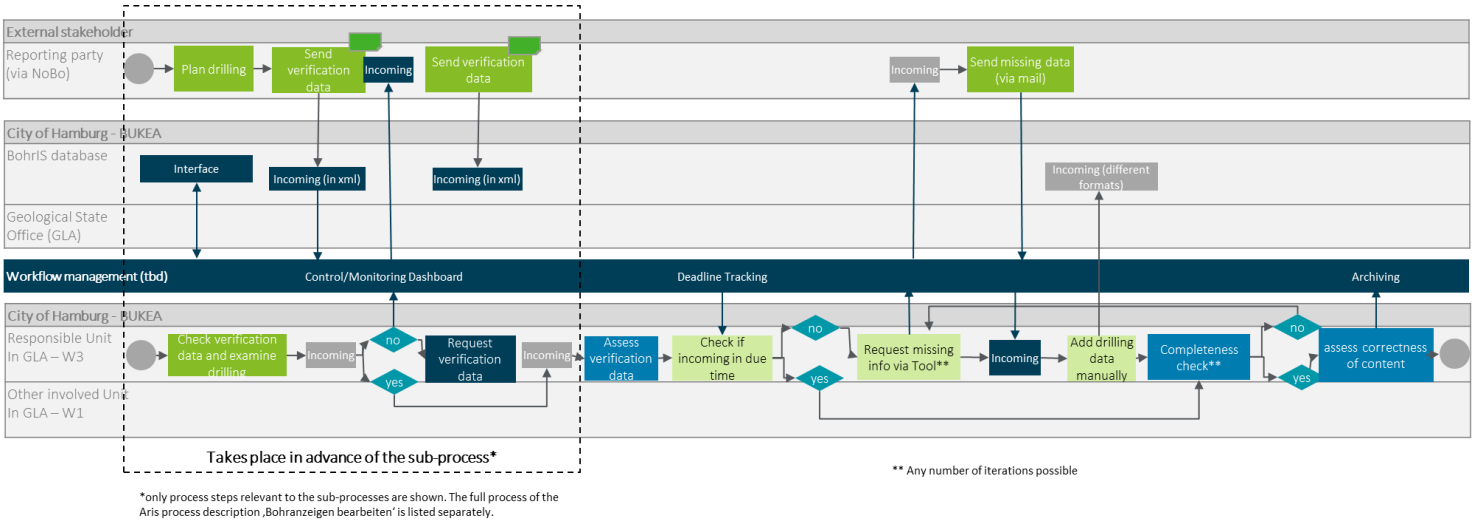
The **plausibility check** module provides the possibility to check the delivered data for plausibility. This can be done either on the basis of a rule-based approach or an AI module. Which approach is more suitable must

be checked in the context of the supplied data. The data will be checked for correctness in terms of content.

In the second process “tracking the incoming drilling data”, an unlimited number of iterations are performed until all data is delivered completely. This turns out to be a rather time-consuming process. A good alternative would be to introduce an **imputing process**: after a certain number of subsequent requests via the IDM tool, the missing data can be imputed. A popular approach to imputing data is to calculate a statistical value for each column (e.g., a mean) and replace all missing values for that column with that statistical value. The imputed values can be an estimate or an implicitly derived value with no uncertainty. This module would be introduced as an “assisted module”. This means that suggestions for the missing data are displayed, which must be checked and accepted by a responsible person.

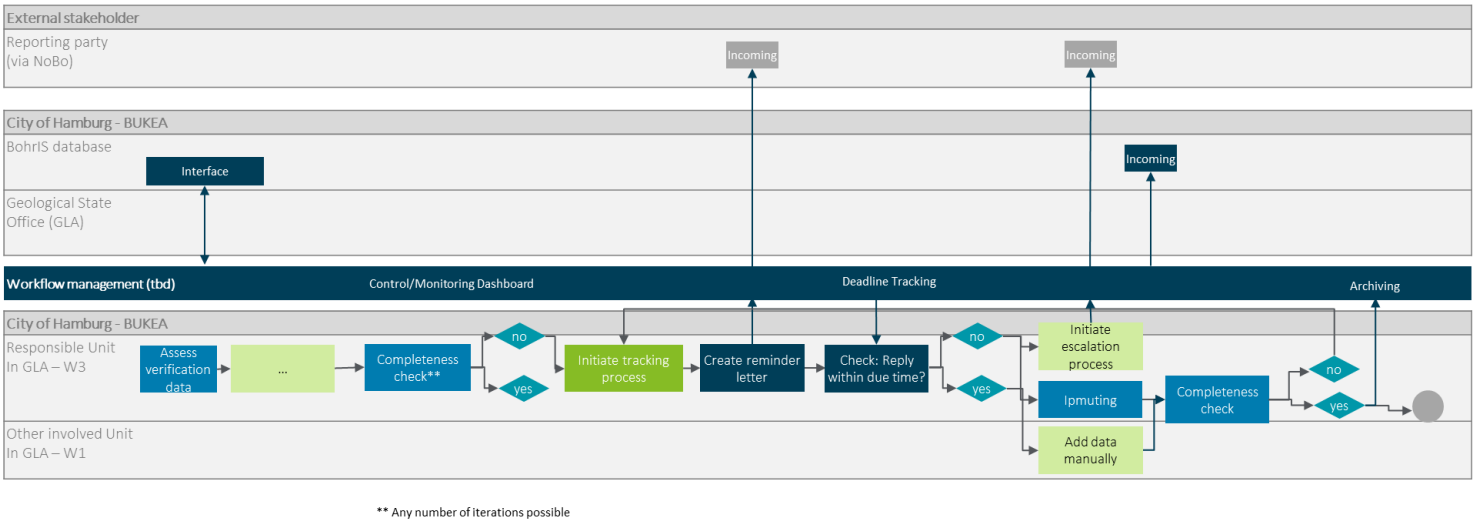
For this process, it may also be possible to deploy another Hamburg internal solution, the Module- F[20]. The possibilities of using the IDM tool and Module- F will be examined during a meeting in mid-September, for further spezification regarding the to-be process.

Figure 35: Process model Alternative 3 BohrIS completeness check



Source: Deloitte (2022)

Figure 36: Process model Alternative 3 Tracking of missing BohrIS data



Source: Deloitte (2022)

[20] MODUL-F (Modular Solution for Specialized Procedures) is a platform that provides basic building blocks for the fast and economical development of specialized procedures as well as a space for the resulting specialized procedures.

Analysis and assessment of alternatives

This subchapter contains the assessment of alternatives for imputing procedure. Therefore, three dimensions, namely the impact valuation, the stakeholder demands, and the technological readiness were examined.

Impact valuation

Regarding **organisation and culture**, alternative 2 would not manage to build upon the already quite advanced process features the GLA has already introduced and also foresees for the future. Alternative 3, in contrast, promises a high degree of effectiveness, in particular regarding the automated completeness and the plausibility checks. The introduction of such features could have spill-over effects to other departments given its clear benefits in substantially reducing manual work.

Regarding the **process** itself, alternativ 2 would only foresee slight changes of the process steps. In turn, however, no quick wins will be expected from implementing this alternative. Alternative 3 would have the advantage that it would introduce an automated solution for a (partly) new process that will be required by law. By implementing alternative 3, this process can therefore directly be set up with a highly automated solution which can unfold considerable time and efficiency savings. Hence, alternative 3 could easily pick the low-hanging fruits.

Assessment of stakeholder demands

To achieve time savings and to reduce the high degree of manual workload are crucial for this process. Alternative 2 would not lead to considerable time savings. Alternative 3, in contrast could highly contribute to the stakeholder demands as automation would reduce the time-intensive manual checks of data. Furthermore, the stakeholders at GLA highly support the solution that would be based on alternative 3.

Technological readiness

The technological readiness of both alternatives was determined as follows:

Table 31: Technological readiness of the alternatives of the imputing procedure

Alternative	Technological readiness	Details
Alternative 2: IDM Workflow tool including tracking dashboard with **status and responsibilities**	**High** / medium / low	As this alternative builds on the IDM tool, which is currently being set up at the City of Hamburg, it could be implemented as soon as this tool is ready.
Alternative 3: Alternative 2 + imputing and data export functionalities	**High-medium** / low	The readiness of the use of imputing depends on the data (and the context of the process). Following the explanations and descriptions of the stakeholders at GLA, the data at GLA would be very promising to set up quickly this alternative. The imputing of texts would however be more complex.

Source: Deloitte (2022)

Info boxes (Infoboxen)

The process 'info boxes' resides in unit V 213 (Internal Operations) at BSW and represents a collection point for a wide variety of inquiries and requests (e.g., from citizens, applications for tender procedures, awarding, EU inquiries and letters from citizens). The receipt of the inquiries is exclusively a digital receipt via an email inbox. The assignment and forwarding usually takes place on the same day.

Alternatives for Info boxes

In the following sections, the three alternatives and functionalities are explained along process graphs. Alternative 1 represents the continuation of the current solution (status quo), the so-called baseline scenario. The three alternatives are briefly presented below:

- **Alternative 1:** "As-Is" model
- **Alternative 2:** IDM Workflow, tool for workflow management, including dashboard for mapping responsibilities, deadlines, status etc.
- **Alternative 3:** Elements of alternative 2 and assisted assignment of responsibilities

The following table contains a brief overview of the main functionalities of the three alternatives:

Table 32: Addressed Business requirements for the alternatives of Info boxes

Functionalities	Alternative 1	Alternative 2	Alternative 3
Workflow management	-	+	+
Assignment of responsibilities (manual)	-	+	+
Archiving	-	+	+
Control/Monitoring Dashboard	-	+	+
Deadline Tracking	-	+	+
Comment and communication function	-	+	+
Access across authorities	-	+	+
Data export	-	+	+
Assignment of responsibilities (assisted)	-	-	+
(+) Feature available (-)Feature not available			

Source: Deloitte (2022)

Alternative 1

Alternative 1 refers to maintaining the status quo of the info boxes (*Infoboxen*) process unchanged. On a superordinate level, the process of info boxes can be shown in the process flow chart below. In the following, the process is briefly described along the flowchart.

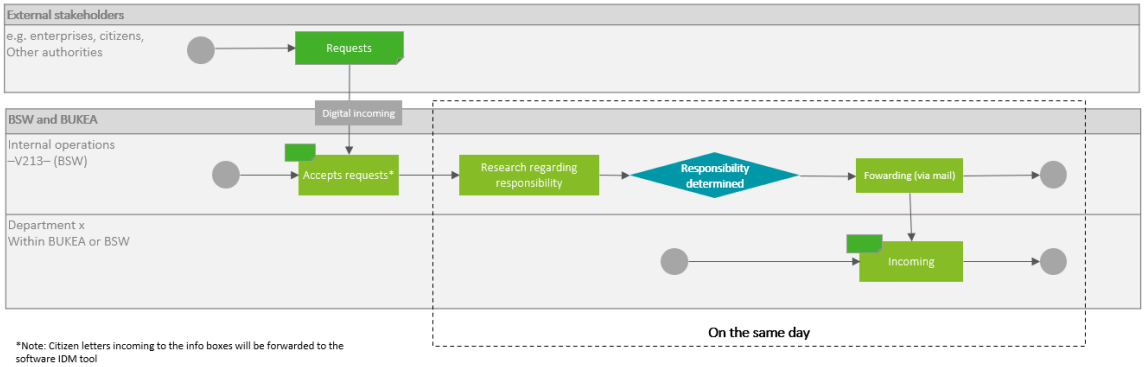
The assignment or research regarding the responsibility of the respective request within BUKEA and BSW is currently mainly carried out by using implicit knowledge and by additionally conducting research in the organizational charts of BSW and BUKEA. The process owner and employee in unit V 213 has been entrusted with this process for years and therefore has extensive experience in the assignment to the respective contact persons. The volume of inquiries varies from year to year and also depends on external factors and current events. During the corona pandemic, the number of inquiries tended to decrease somewhat and, according to V 213, amounted to around 1,000 inquiries per year (approx. 3-4 inquiries per day).

A detailed description of the status quo is provided in Report D3 (As-is Business process Model).

Figure 37: Process model Alternative 1 Info boxes

Source: Deloitte (2022)

Alternative 2

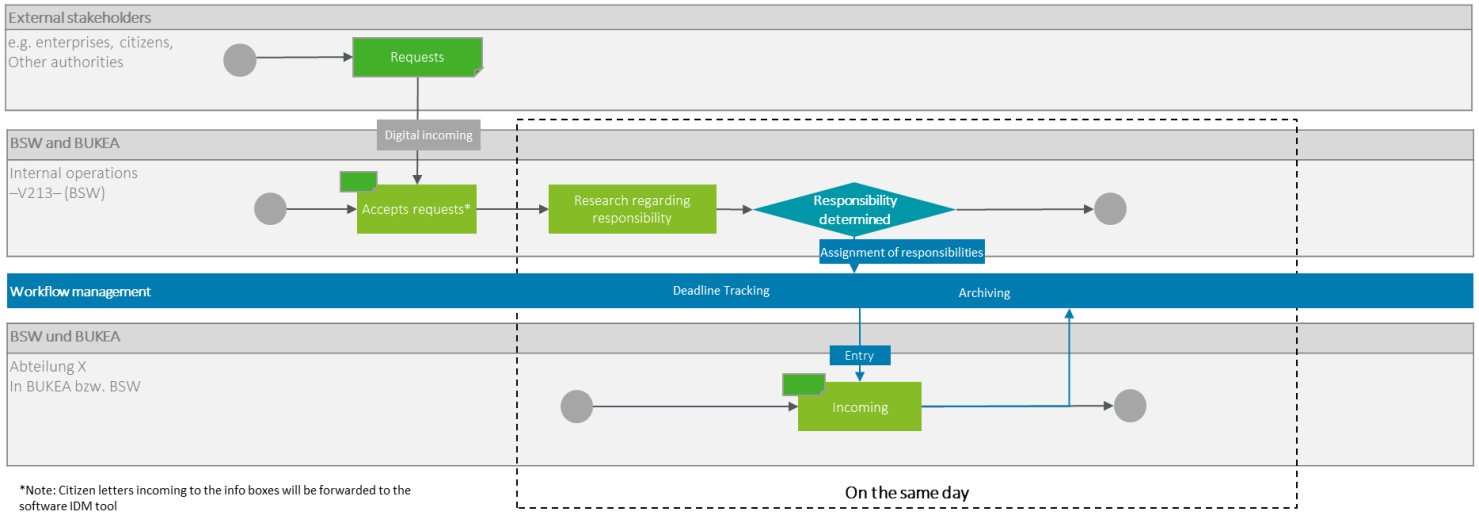


Alternative 2 extends the As-Is model of alternative 1 to include the IDM workflow management. This includes a **central access channel**, a **forwarding assistant** for determining the potentially responsible authorities and offices, a **monitoring and deadline tracking** dashboard, a **comment and communication** function, and **archiving** of the inquiries and the process and response histories in a central database.

The process as such remains unchanged. The adapted process steps are shown in blue in the flowchart below, with the IDM tool as the intermediate point.

Incoming inquiries and requests are accepted by the department V213. The assignment or research regarding the responsibility of the respective request within BUKEA and BSW is determined by the responsible through research. After a responsible department has been identified, the request or inquiry is forwarded to the department via the IDM tool. This offers the possibility of deadline tracking and archiving, as well as facilitating the use of the IDM tool for the upstream process of responding to the request within the department.

Figure 38: Process model Alternative 2 Info boxes



Source: Deloitte (2022)

Alternative 3

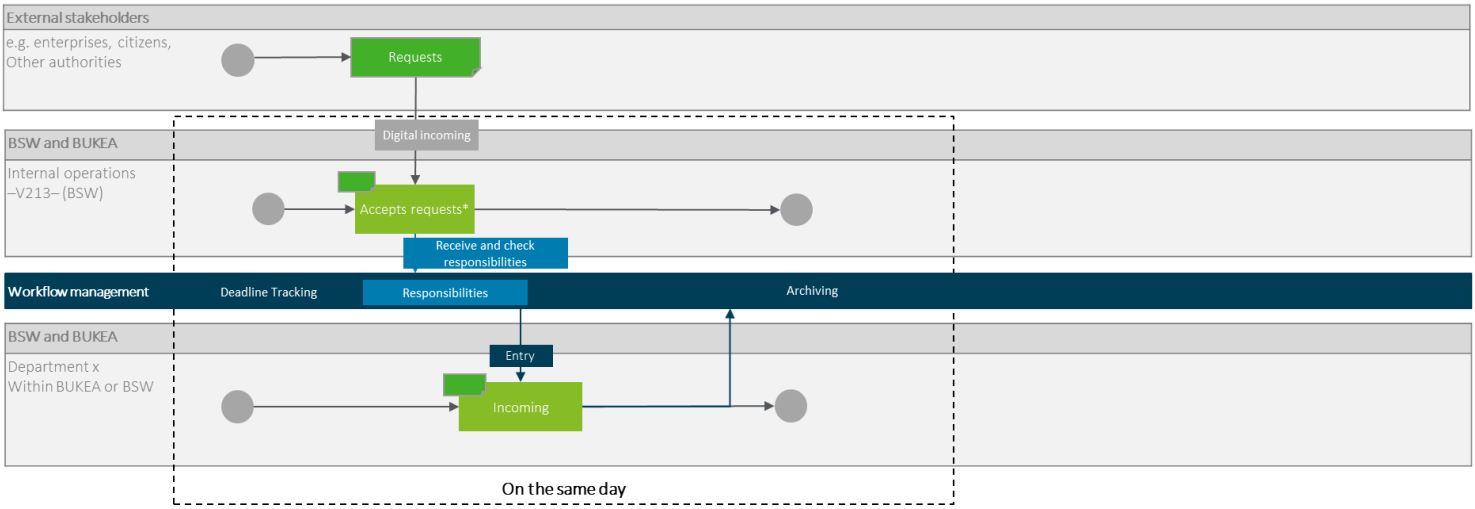
Alternative 3 extends the alternative 2 to include an assisted assignment of responsibilities.

The process as such is reduced by the steps of the manual research. The adapted process steps are shown in dark blue in figure below, with the IDM tool as the intermediate point. And light blue the added functionalities of alternative 3. The functionalities of the IDM tool remain the same as described in the

previous chapter. In addition, these are extended an AI-based module: the (assisted) determination of responsibilities. The module is explained in more detail below.

Through the module for the (assisted) **determination of responsibilities**, the user receives the potentially responsible authorities or offices determined by the forwarding assistant to answer the respective request or inquiry. The forwarding assistant determines the potentially responsible addressees of the request or inquiry by means of a machine learning system, which recognizes patterns in the responsibilities based on the continuous analysis of the requests or inquiries received and forwarded in the past. Here, the result can consist of several potential addressees, each of which is provided with a probability about the responsibilities of the selected addressees.

Figure 39: Process model Alternative 3 Info boxes



Source: Deloitte (2022)

Analysis and assessment of alternatives

This subchapter contains the assessment of alternatives for the info boxes process. Therefore, three dimensions, namely the impact valuation, the stakeholder demands, and the technological readiness were examined.

Impact valuation

Regarding **organisation and culture**, both alternatives could be quick wins, as this alternative would not introduce major disruptions into the process. Given the potentially high effectiveness of the assisted assignments, alternative 3 could in particular lead to a cultural shift towards more automation.

Both alternatives only require slight adjustments in the **process** steps and are therefore not expected to have any considerable impacts on the functioning of the process itself.

Assessment of stakeholder demands

As the process owners have pointed out, an effective and quick allocation of the incoming requests are crucial for this process. It is important to note in this context that the process owners of this process seemed reluctant regarding the implementation of both alternatives as they do not see the added value of any automated solution for this process. In this case, both alternatives would not meet the stakeholder demands for this process.

Technological readiness

The technological readiness of both alternatives was determined as follows:

Table 33: Technological readiness of the alternatives of the info boxes process

Alternative	Technological readiness	Details
Alternative 2: IDM Workflow tool incl. dashboard for status and tracking	**High** / medium / low	As this alternative builds on the IDM tool, which is currently being set up at the City of Hamburg, it could be implemented as soon as this tool is ready.
Alternative 3: Alternative 2 + assisted assignment of responsibilities	**High** / medium / low	The technological readiness is expected to be high in this case, assuming there is enough data available. As the process owners however have not provided explanations on the data, it must be assessed in further steps to which extent this assumption holds true.

Source: Deloitte (2022)

Knowledge management (Wissensmanagement)

The process 'knowledge management' describes a process of storing and accessing information and data via a drive that can be accessed within a unit. This process is allocated in the presidential departments (*Präsidialabteilungen*) at BUKEA and BSW, respectively, but can be found in many other departments of the City of Hamburg as well.

Alternatives for Knowledge management

In the following sections, the three alternatives and functionalities are explained along process graphs. Alternative 1 represents the continuation of the current solution (status quo), the so-called baseline scenario. The three alternatives are briefly presented below:

- **Alternative 1:** "As-Is" model
- **Alternative 2:** Dashboard.
- **Alternative 3:** Elements of alternative 2 and intelligent search

The following table contains a brief overview of the main functionalities of the three alternatives:

Table 34: Addressed Business requirements for the alternatives of knowledge management

Functionalities	Alternative 1	Alternative 2	Alternative 3
Search functionality (keyword search)	+	+	+
Interdepartmental access	-	+	+
Processing of all relevant data formats	-	+	+
Data export	-	+	+
Modification of data	-	+	+
Dashboard (central view)	-	+	+
Criteria-based data analysis	-	-	+
Additional analyses	-	-	+
Intelligent search	-	-	+
(+) Feature available (-)Feature not available			

Source: Deloitte (2022)

Alternative 1

Alternative 1 refers to maintaining the status quo of the knowledge management (*Wissensmanagement)* process unchanged. On a superordinate level, the process of knowledge management can be shown in the process flow chart below. In the following, the process is briefly described along the flowchart.

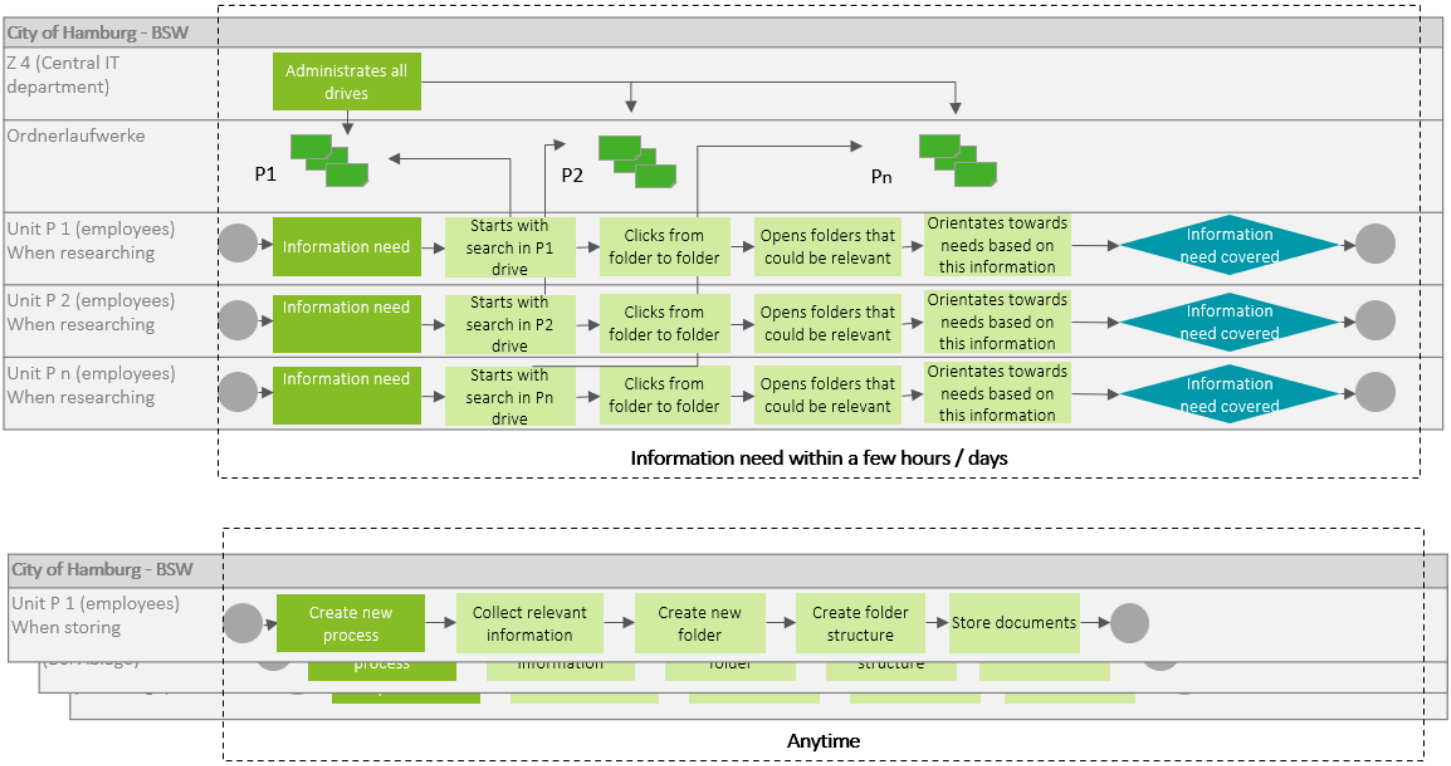
Within the as-is process knowledge management all departments of the presidential department of the BSW currently have their own folder drives, which are managed by the central IT department Z4. The folder drives have an extensive unit-specific structure and have been maintained for many years. All members of a unit have access to the department drive, external departments can only gain access under special conditions and with an application.

Each member of the department can create a new process in this folder drive at any time by compiling relevant information, creating a new folder, setting up a suitable folder structure and filing documents.

Information searches are performed on the respective drive. The information needs of an official are usually very time-critical and must be met within a few hours or days. Therefore, the user can start a search in the folder drive. The official clicks through individual folders, opens documents that may be relevant and then orients themselves further until the information requirement is covered. This ends the process. The folder drive is used regularly (approximately daily to twice a week per person) to search for data and information. There is also a large amount of implicit (unwritten) knowledge about folder structures and content that individuals have built up over the years.

A detailed description of the status quo is provided in Report D3 (As-is Business process Model).

Figure 40: Process model Alternative 1 knowledge management



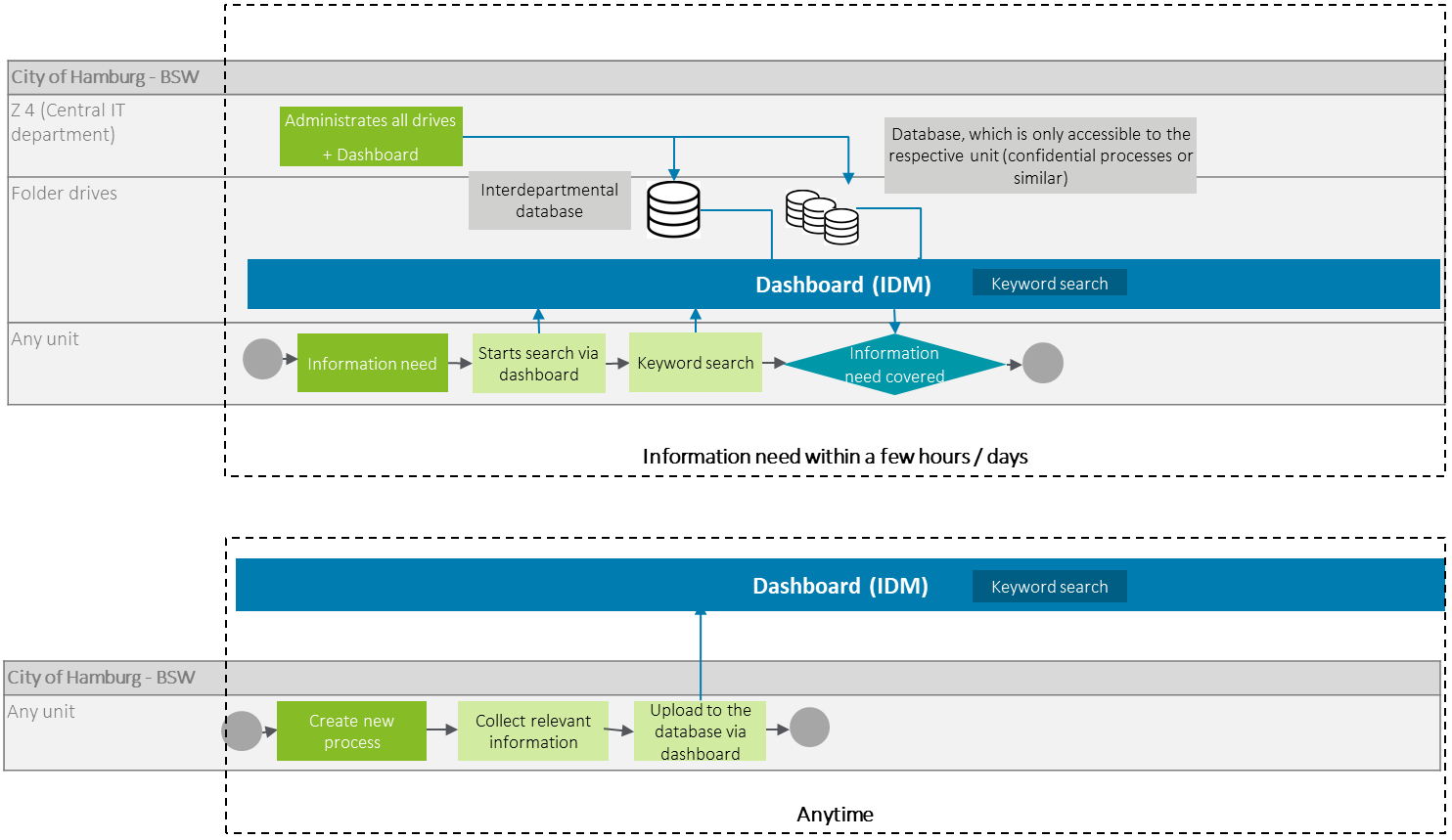
Source: Deloitte (2022)

Alternative 2

Alternative 2 extends the As-Is model of alternative 1 to include a dashboard. This makes it possible to access a **cross-departmental database** with accesses to an overall **dashboard** intended for the department. Within the dashboard, a **keyword search** can be used to facilitate information requirements. The database and dashboard are administered by Z4. The database allows the processing of all relevant data formats, the modification of data as well as the import and export of data. When new data or information is to be provided by any department, the department initiates the process, compiles the relevant information, and uploads it to the database via the dashboard.

The adapted process steps are shown in blue in the flowchart below, with the dashboard as the intermediate point.

Figure 41: Process model Alternative 2 knowledge management



Source: Deloitte (2022)

Alternative 3

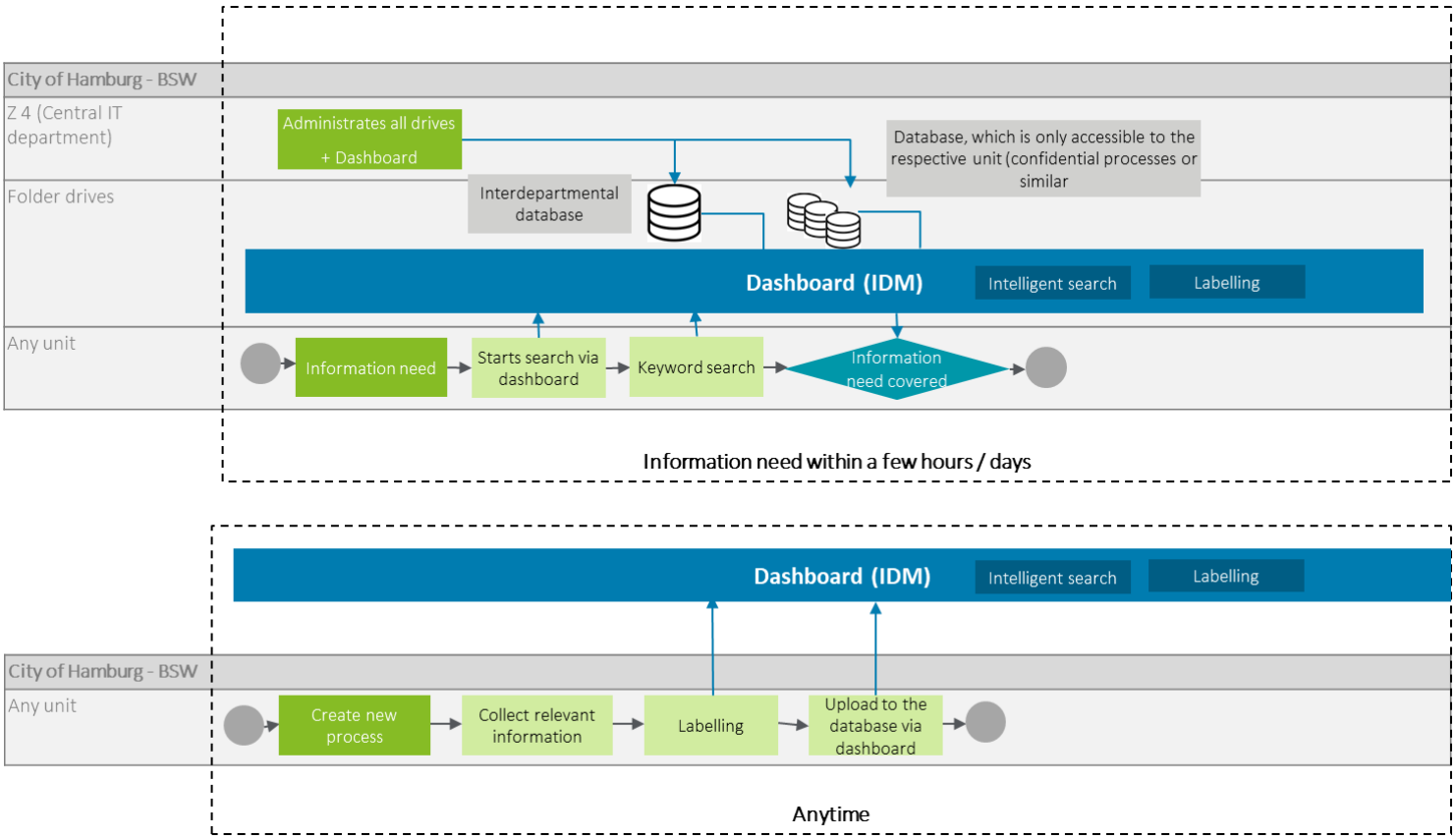
Alternative 3 extends the alternative 2 to include an intelligent search.

The process as such remains unchanged. The adapted process steps are shown in dark blue in the following flowchart, with the dashboard as the intermediate point and light blue the added functionalities of alternative 3. The functionalities of the dashboard remain the same as described in the previous chapter. In addition, the keyword search is replaced by an intelligent search.

The **intelligent search** is based on a dense information retrieval, which in this case is an internal search engine backed by modern technologies such as AI and machine learning. It can be used asymmetrically, like a google search, by entering some keywords and finding relevant documents corresponding to the search query or symmetrically were e.g., a hole pdf document is used as search query to find similar documents. The dense information retrieval systems can be extended to search other documents as well. For example, an image can be used to find correpsoning text or video files in the internal system. Intelligent search can deliver smarter results faster and provides a single point of access to enterprise content sources, allowing data to be enhanced, searched, and analyzed in both structured and unstructured formats.

The intelligent search would allow for facilitated searches over the database, and thus simplify and accelerate the process. The access would be inter-agency and inter-departmental.

Figure 42: Process model Alternative 3 knowledge management



Source: Deloitte (2022)

Analysis and assessment of alternatives

This subchapter contains the assessment of alternatives for knowledge management process. Therefore, three dimensions, namely the impact valuation, the stakeholder demands, and the technological readiness were examined.

Impact valuation

Regarding the **organisation and culture**, alternative 2 would build on already available solutions but would not manage to achieve a considerable improvement as compared to the status quo. Alternative 3, in contrast, could effectively reorganise and improve the search functionalities. As this process is a fundamental process for many other processes and therefore has a particular relevance for the City of Hamburg, it is important to leverage any efficiency gains. Alternative 3 could highly contribute to leverage these gains.

Regarding the **process**, alternative 2 only foresees slight changes to the process steps, major adjustments would only be necessary regarding the introduction of a dashboard. Alternative 3 also only introduces slight changes and is expected to work intuitively. However, the labeling of data would require additional efforts. A clarification of who would be responsible for the labeling of existing documents must take place for alternative 3 in order to ensure an effective implementation.

Assessment of stakeholder demands

Stakeholders aim to get targeted information with this process. Alternative 2 woud therefore only partially meet stakeholder demands as some crucial search functionalities are not available with this solution. Alternative 3, in contrast, is expected to considerably contribute to stakeholder demands as the intelligent search enables a more targeted and quicker search, also across various departments. Process owners highly support this alterative as it also foresees an easy and intuitive handling, similar to a Google search. Therefore, a low threshold for the introduction of this alternative can be expected.

Technological readiness

The technological readiness of both alternatives was determined as follows:

Table 35: Technological readiness of the alternatives of the knowledge management process

Alternative	Technological readiness	Details
Alternative 2: Dashboard	**High** / medium / low	As this alternative builds on the IDM tool, which is currently being set up at the City of Hamburg, it could be implemented as soon as this tool is ready.
Alternative 3: Alternative 2 + intelligent search	**High** / medium / low	The criteria-based data analysis and the intelligent search are technologically ready to use. Process owners confirmed that there is an extensive database available which ensures that the model can be trained for an effective use.

Source: Deloitte (2022)

Overarching analysis of alternatives

For all solutions based on alternative 2 and 3 respectively, their feasibility and their restraining and driving forces within a force-field-analysis were analysed.

Feasibility analysis

Technical feasibility

Technical feasibility of the solutions based on alternative 2

As this alternative is built on existing IT infrastructure and processes, the structural IT changes will not be as substantial as compared to the shared solution. However, an increased cooperation between the process owners and the IT departments will be necessary in order to customise and adapt parts of the IT infrastructure and processes, especially regarding the commonly used process steps and data needs. This, in turn, contributes to the technical feasibility of the individual solution which is expected to be slightly higher as the technical feasibility of solutions based on alternative 3.

Technical feasibility of the solutions based on alternative 3

A technical solution that (almost) fully integrates the databases, workflows and processes and provides advanced automated solutions would require an enhanced IT management to ensure the technical implementation and adequate use of the respective solutions. As most of the components will be newly implemented in terms of the technology, the feasibility from an infrastructural perspective must be assessed at a later stage.

Non-technical feasibility

Non-technical feasibility of the solutions based on alternative 2

For the solutions based on alternative 2, the business process itself and a procedure for the maintenance and governance of the data exchange must be implemented. Therefore, a coordination between the IT and the process owners must take place especially in the implementing phase. Thereafter, the IT department needs to more closely manage and administer relevant changes regarding the process and the exchange of data.

Non-technical feasibility of the solutions based on alternative 3

From a non-technical perspective, the solutions based on alternative 3 need a more thorough strategic management decision to reorganise (at least parts of the) process. Therefore, more stakeholders are involved and need to agree on or at least accept the solution. This agreement depends on structural and political factors, among others, in both BUKEA and BSW. The considerable advantages of the solutions based on alternative 3 such as the increased effectiveness and the high degree of automation can favour such a strategic consensus. However, budget constraints, differing strategic agendas and the management and administration of the new processes have the potential to impede the non-technical feasibility. Furthermore, an external service provider might be needed to implement or at least consult regarding the implementation of parts of the solution. This setup might increase the overall efforts and time spent on changes and operations.

Overall feasibility

Overall feasibility of solutions based on alternative 2

Solutions based on alternative 2 mostly build on existing IT infrastructure components which can more easily be customised. Coordination efforts are mostly needed to agree on data exchanges, databases and other functionalities.

Given that fewer IT infrastructure components and applications must be implemented, and fewer strategic alignments must be made, the feasibility of solutions based on alternative 2 is expected to be higher as compared to the shared solution.

Overall feasibility of solutions based on alternative 3

Overall, solutions based on alternative 3 require a deeper integration of IT and business processes.An automated process with reduced complexity that enables a close cooperation of involved process stakeholders has the potential to improve the effectiveness of the processes. However, considerable commitments, mostly from the IT departments, must be claimed. This, in turn, reduces the overall feasibility of this alternative.

Summary

Considering the technical and non-technical feasibility, the **result of the feasibility analysis** falls slightly in favour of the **solutions based on alternative 2**. While the solutions based on alternative 3 have more advanced features, the technological introduction such as the gathering of data to train the underlying AI is more complex, which, in turn, reduces the technical and non-technical feasibility of these alternatives.

Force-field analysis

The force-field analysis was carried out for solutions based on alternative 2. As described in chapter "Description of alternatives", these solutions mostly rely on already existing infrastructure but integrate features that contribute to an automation of the respective process.

For solutions based on alternative 2, the following driving and restraining forces were determined and evaluated:

Driving forces

Table 36: Driving forces for solutions based on alternative 2 (partly automated solutions)

Driving force	Valuation	Explanation
Build up on existing infrastructure components and applications	4	The solutions of alternative 2 are mostly based on existing infrastructure and applications (or infrastructure and applications that are already in development, such as Modul F and the IDM tool), which grants the advantage of already existing know-how and experience, both on the setup and the maintenance. This could reduce the implementation costs and time significantly.
Possibility of meeting individual needs of users and departments	3	The development, set up time and costs are reduced as compared to alternative 3. This might increase users' acceptance.
Flexibility in the design of the solutions	2	Different components that will partly automate the process can be implemented in the processes. This introduces flexibility with regard to the design of the solutions, also in terms of the infrastructure components.
Reduced implementation effort	5	By using existing infrastructure components and applications, the effort for the implementation is significantly reduced due to already existing skills and knowledge (e.g. from Modul F and the IDM tool), which has not to be gathered as it would be by implementing completely new technology, especially in the onboarding and governance.

Restraining forces

Table 37: Restraining forces for solutions based on alternative 2 (partly automated solutions)

Restraining force	Valuation	Explanation
Potentially higher coordination effort in single process steps as not all steps are automated	4	As not all process steps with automation potential are automated, media breaks and lags could occur. This could lead to inconsistencies in the process itself.

Remaining on existing processes and infrastructure can prevent disruptive changes	3	The usage of already existing technology has it's pros and cons. On the one hand, it reduces the implementation effort and is a proven way of running and maintaining similar processes. On the other hand, the implementation of best of breed solutions as it is used for example in other comparable foreign peer authorities can significantly increase efficiency and generate disruptive changes in collaboration.
Maintaining existing silos within the process	5	This setup maintains existing processual and technological silos, because of the individual setup as described in the respective alternatives 2 of the five processes.
Overarching traceability is connected with increased efforts (e.g., approvals, documentation)	3	The traceability as one of the process obstacles in the existing as-is state is just partly increased and due to the decentralized setup linked to an increased effort and complexity when it comes to documentation, approval history etc..

Summary

Based on the force field analysis and according to the overall sum, the solutions based on alternative 2 have **restraining forces that slightly overweigh the driving forces** (i.e. the positive aspects) of the solution.

Figure 43: Main driving forces and restraining forces of solutions based on alternative 2

Driving force (positive)		Force strength	Restraining force (negative)
		5 4 3 2 1 0 1 2 3 4 5	
Build on existing infrastructure components and applications	3		4 Potentially higher coordination effort in single process steps
Possibility of meeting individual needs of users and departments	3		3 Remaining on existing processes can prevent disruptive changes
Flexibility in the design of the solutions	2		5 Maintaining existing silos within the process
Reduced implementation effort	4		3 Increased efforts to reach overarching traceability
Total Score	**12**		**15** **Total Score**

Source: Deloitte (2022)

As the result is ambiguous regarding the **solutions based on alternative 2**, it was concluded the following:

- In case there are **quick wins** that can be achieved with alternative 2, this alternative might be suitable
- in circumstances **where stakeholders have considerable doubts or are reluctant towards (fully) automated solutions**, solutions based on alternative 2 could be an initial cornerstone to create confidence among employees

However, **where the automation of processes has a clear advantage**, in particular regarding:

- **lifting information silos** in the process
- considerably **improve time and efficiency** of the process
- reach an **increased overall traceability** of the processed data,

solutions based on **alternative 3** that have a high degree of automation should be **favoured**.

The results of the analysis will further be taken into consideration when it comes to the development of the technical to-be models in Deliverables 6 and 7.

Summary and presentation of the business cases

Based on the workshops conducted as well as the analysis performed to compare the different alternatives of each process, the following alternatives were determined as the preferred solution:

Table 38: Summary of the description, analysis and results of the alternatives and business cases

#	Process	Description of alternative 2	Description of alternative 3	Hamburg-internal Steering Commitee	Results of the analysis of Deliverable 5	Decision and business case
1	Brief written inquiries	IDM Workflow • Dashboard (status, deadlines, etc.) • Assignment of responsibilities (manual) • Deadline tracking • Comment and communication function	IDM Workflow + AI module • Intelligent search (answer finding) • Assisted assignment of responsibilities	**Alternative 3** • Iterative implementation • Focus on Intelligent Search	• Assisted assignment of responsibilities as foreseen in alternative 3 could considerably reduce coordination efforts • Assumption that good data available, which facilitates automation	Alternative 3
2	Senate printed matter coordination	IDM Workflow • Dashboard (status, deadlines, etc.) • Assignment of responsibilities (manual) • Deadline tracking • Comment and communication function	IDM Workflow + AI module • Assisted assignment of responsibilities • Automatic template filling	**Alternative 2** • Provides more advantages • Easier to implement	• As process is not used frequently, alternative 2 would meet stakeholder demands and still introduce efficiency gains (quick win) • Database and interaction with other IT features need to be assessed	Alternative 2
3	Imputing Procedure	IDM Workflow • Dashboard (status, deadlines, etc.) • Deadline tracking • Archiving	IDM Workflow + AI module • Imputing • Completeness check- automated • Plausibility check-automated	**Alternative 3** Check possibilities of Module-F and IDM	• Considerable efficiency gains and reduction of manual work with alternative 3 • Stakeholders highly support alternative 3	Alternative 3
4	Info boxes	IDM Workflow • Dashboard (status, deadlines, etc.) • Assignment of responsibilities (manual) • Archiving	IDM Workflow + AI module Assisted assignment of responsibilities	**Alternative 3** Start with alternative 2, the extend to alternative 3	• Comparably easy implementation of both alternatives • Stakeholders, however, reluctant regarding both alternatives	Alternative 3
5	Knowledge Management	Dashboard • Search functionality (keyword search) • Cross-unit access	Dashboard + AI module • Intelligent search • Criteria-based data analysis • Additional analyses	**Alternative 3** Extended search functions imaginable (e.g. FHH portal)	• Considerable efficiency gains with alternative 3 to be expected • Intuitive handling and good database favours alternative 3	Alternative 3

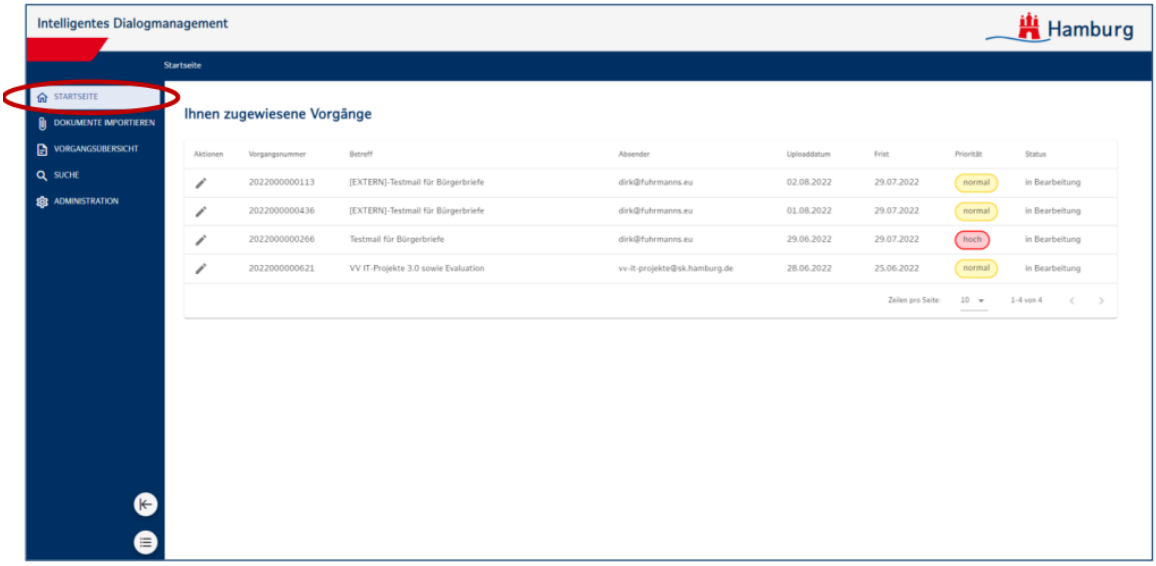
Source: Deloitte (2022)

Annex

Screenshots of the IDM tool

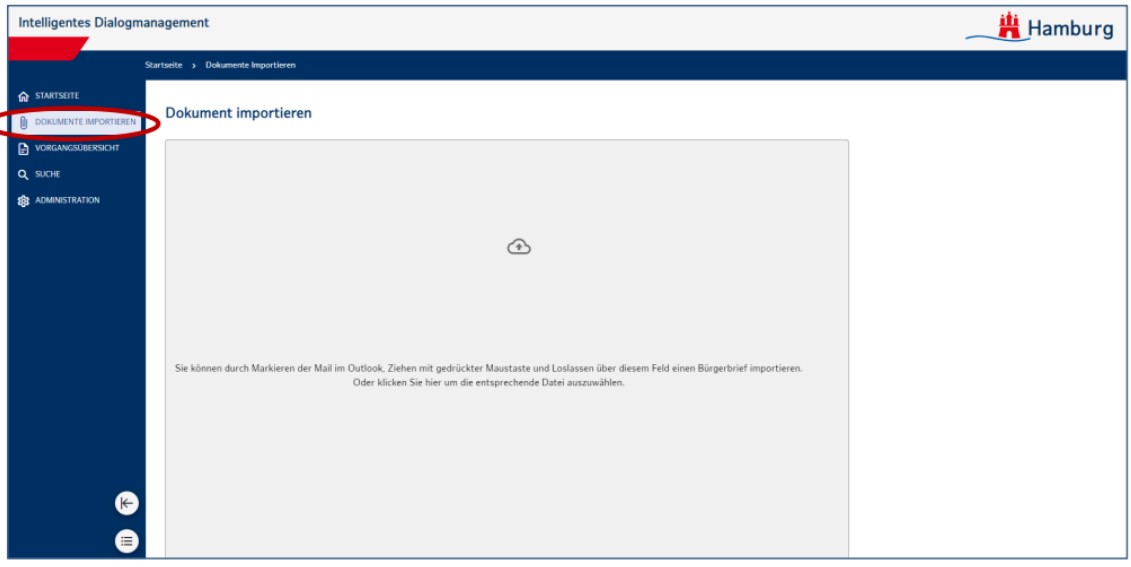
The following screenshots provide an overview of the functions of the IDM tool, which are currently developed. Due to the fact that the application language of the IDM tool is German, the screenshots are only available in the German language.

Figure 44: IDM tool: Main menu - home page



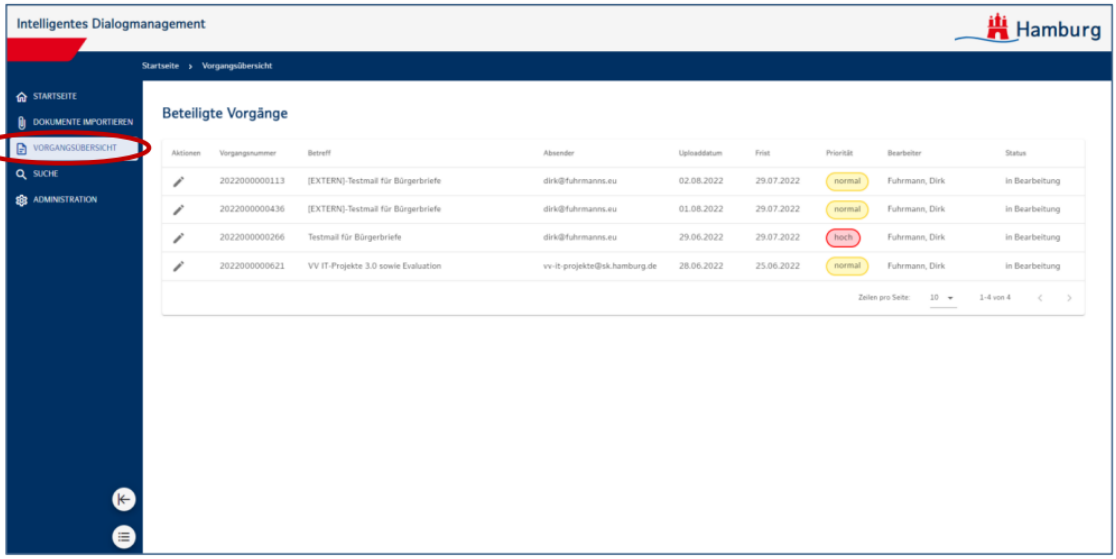
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 45: IDM tool: Main menu - import documents



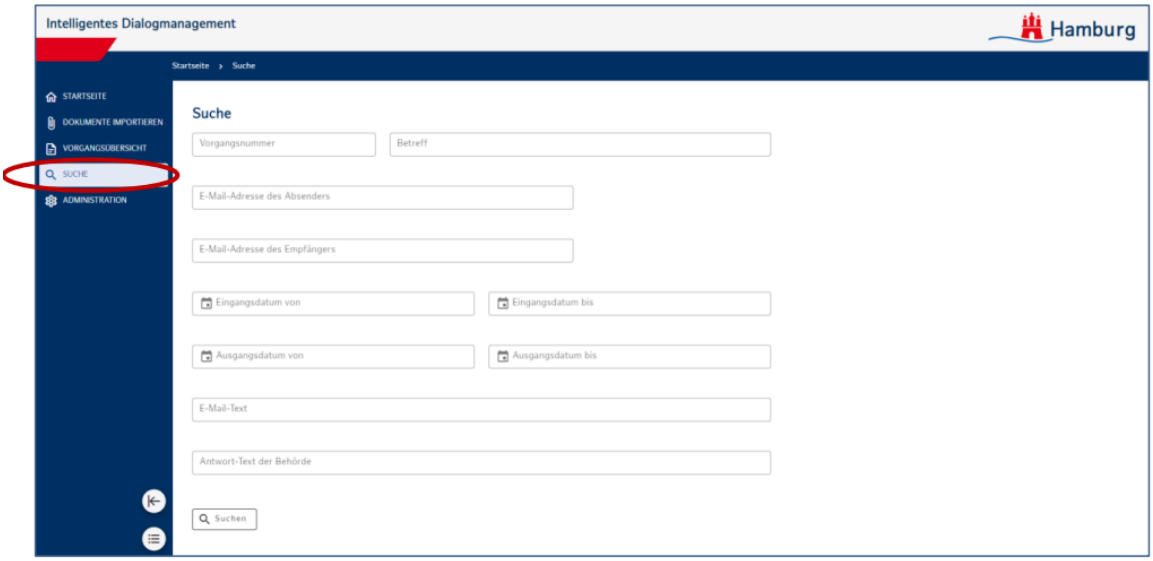
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 46: IDM tool: Main menu - process overview



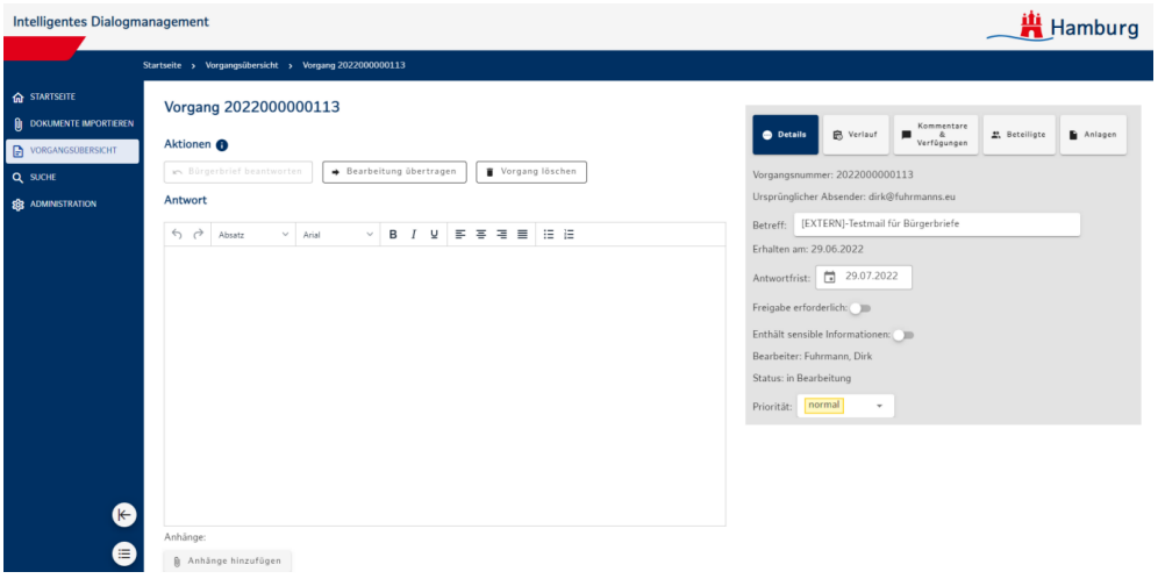
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 47: IDM tool: Main menu - search



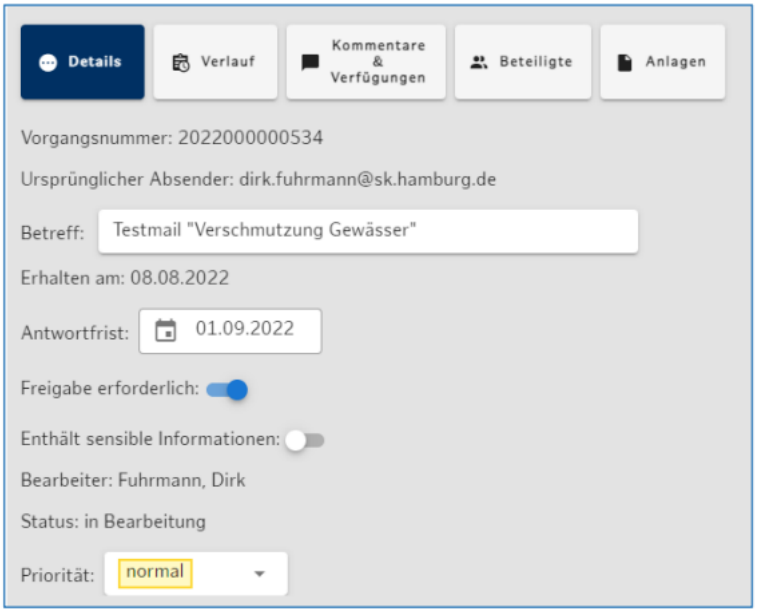
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 48: IDM tool: Create new process - edit view (1/2)



Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 49: IDM tool: edit view - details



Source: Screenshots IDM, provided by the City of Hamburg (2022)

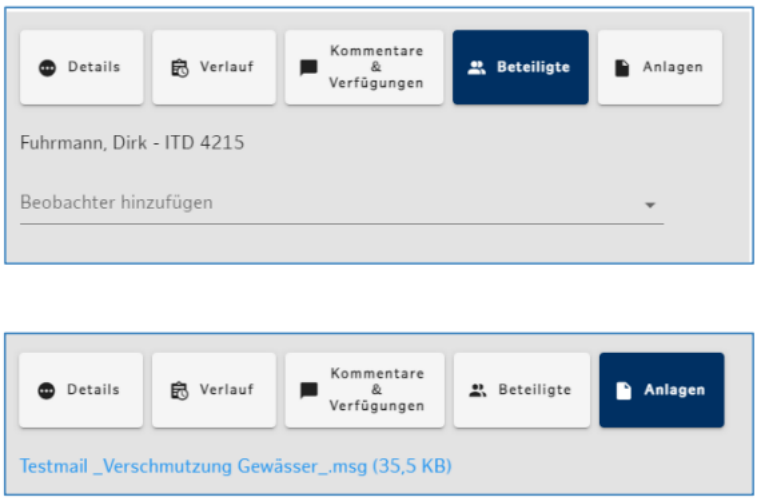
Figure 50: IDM tool: edit view - history

Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 51: IDM tool: edit view - comments & availabilities

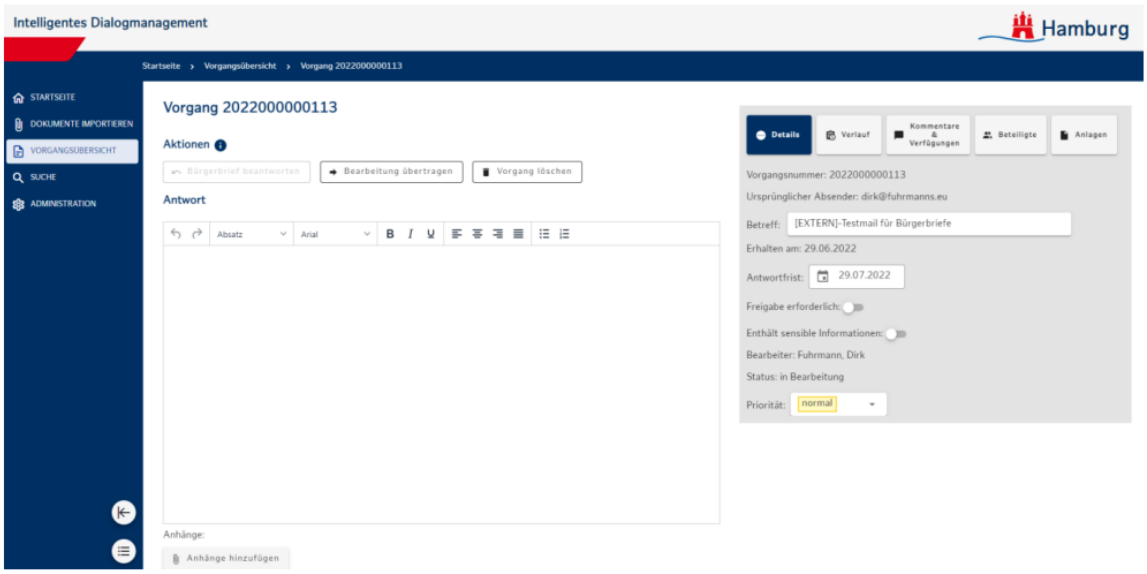
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 52: IDM tool: edit view - participants & appendices



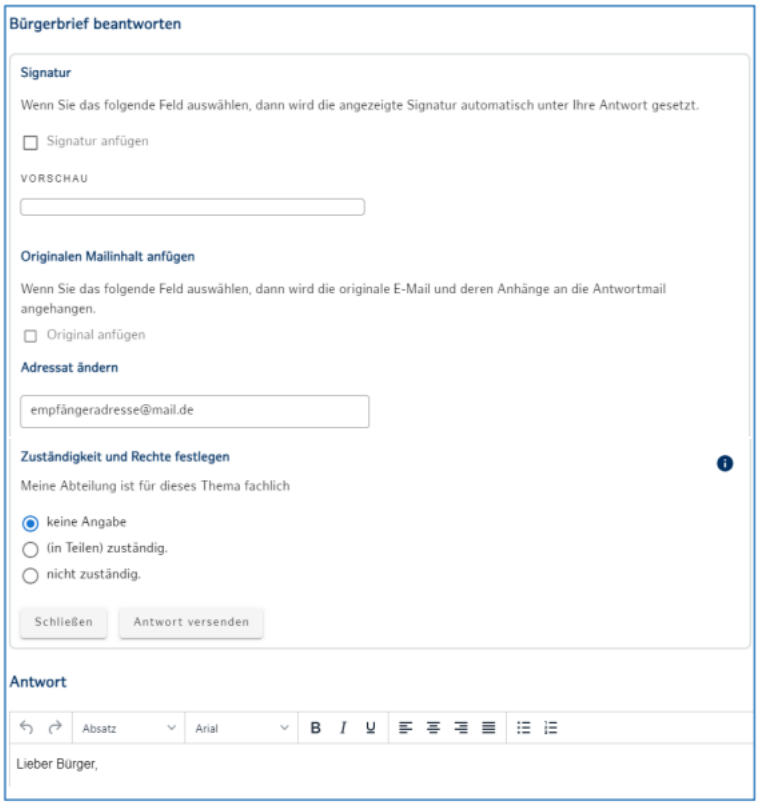
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 53: IDM tool: Create new process - edit view (2/2)



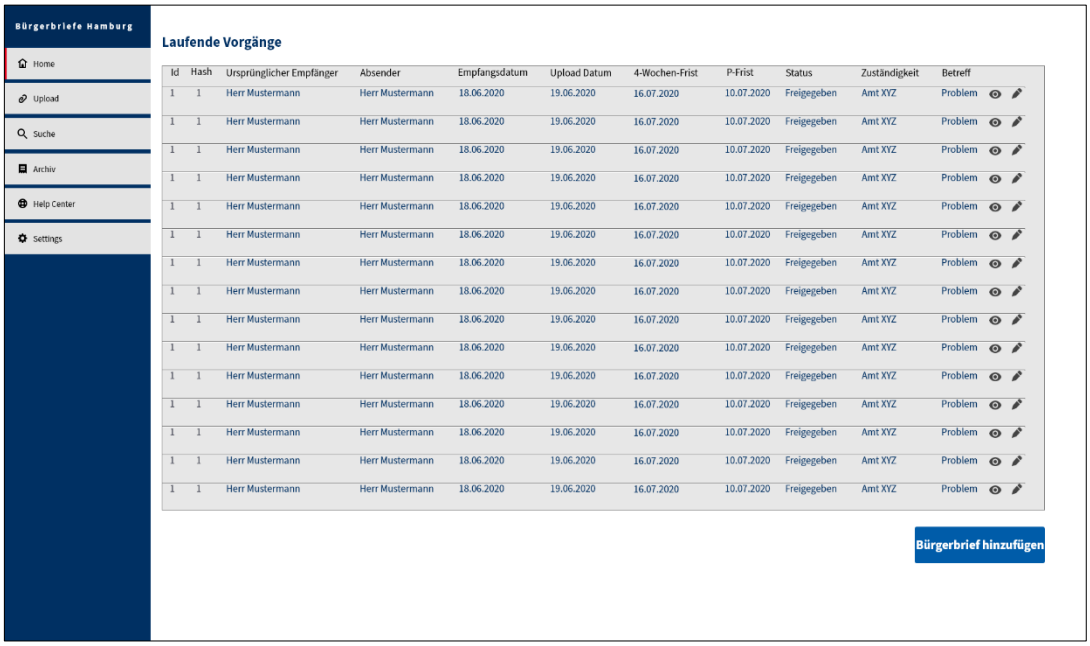
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 54: IDM tool: edit view - actions



Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 55: IDM tool: Monitoring/Deadline Tracking



Source: Screenshots IDM, provided by the City of Hamburg (2022)

To-be situation analysis

This Deliverable presents the to-be situation analysis of the five selected to-be processes, thereby focussing on the legal, technical and organisational implications. It further entails the IT architecture for each to-be process including a description of the respective modules the IT architecture contains.

Executive Summary

This deliverable outlines the **to-be situation analysis for the five selected to-be processes** brief written inquiries (Schriftliche Kleine Anfragen), senate printed matter coordination (Senatsdrucksachenabstimmung), the imputing procedure (BohrIS process), info boxes (Infoboxen) and the knowledge management process (Wissensmanagement) for the respective selected alternatives as of deliverable 5 (Business Case).

This entails an overarching description of the technical, legal, organisational and operational implications of the different technologies that would be implemented. Furthermore, the overarching conceptual considerations for the technological IT architecture will be outlined.

Thereafter, for each to-be process, the foreseen IT infrastructure and its components will be described and analysed in detail.

The detailed analysis regarding specific legal, organisational and technical implications for the five selected to-be processes shows that the **four processes** brief written inquiries (Schriftliche Kleine Anfragen), senate printed matter coordination (Senatsdrucksachenabstimmung), the imputing procedure (BohrIS process) and the knowledge management process (Wissensmanagement) **have good preconditions to implement the respective to-be models**. This entails the implementation of the IDM workflow management tool (or, in the case of the imputing procedure BohrIS, the "Modul F") with several core functions and, depending on the process, several microservices, e.g., interfaces to existing databases and/or solutions and features such as the completeness check, plausibility check, intelligent search and more.

Given the fact that **for the process info boxes**, no data is currently stored, the foreseen assignment of responsibilities with a supporting AI forwarding assistant cannot be trained with state of the art (SOTA) models yet. At the model and data level, this function, could be trained with traditional natural language processing algorithms or few shot learning[21] algorithms like SetFit[22] with multiclass or multilabel predictions. The **data necessary to create the assignment of responsibilities (assisted)** is, however, **not sufficient to train the SOTA models with a fine-tuning approach like DeBERTa**[23]. Hence, in this case, incoming data (emails from external stakeholders) must first be collected and stored before conducting the data analysis and the deployment and training of the foreseen AI forwarding assistant. A phased approach could be taken, implementing the IDM tool first and after sufficient data has been collected, the assignment of responsibilities (assisted).

[21] https://www.analyticsvidhya.com/blog/2021/05/an-introduction-to-few-shot-learning/
[22] https://arxiv.org/abs/2209.11055 - Efficient Few-Shot Learning Without Prompts
[23] https://arxiv.org/abs/2006.03654 - DeBERTa: Decoding-enhanced BERT with Disentangled Attention

Introduction

This deliverable outlines the to-be situation analysis for the five selected to-be processes brief written inquiries (Schriftliche Kleine Anfragen), senate printed matter coordination (Senatsdrucksachenabstimmung), the imputing procedure (BohrIS process), info boxes (Infoboxen) and the knowledge management process (Wissensmanagement) for the respective selected alternatives as of deliverable 5 (Business Case).

This entails an overarching description of the technical, legal, organisational and operational implications of the different technologies that would be implemented. Furthermore, the overarching conceptual considerations for the technological IT architecture will be outlined.

Thereafter, for each to-be process, the foreseen IT infrastructure and its components will be described and analysed in detail.

Please note that all described to-be models in this deliverable are considered to be suggestions. Before the implementation of the five to-be process models, further alignments and consultations should be made with the process owners, although they are not authorized to make the final decisions regarding the to-be processes.

To-be situation: overarching implications and aspects

The to-be situation that would foresee an implementation of the five to-be processes entail different implications at a technical, legal, organisational and operational level.

Technical implications refer to those aspects that need to be changed/adapted or introduced from a technical point of view to the existing processes, **legal implications** outline the consequences that need to be addressed from a legal point of view. Regarding legal aspects, the Hamburg Data Protection Act ("Hamburgisches Datenschutzgesetz (HmbDSG) of May 18, 2018, in particular the second section thereof (§§ 4 – 8) on the principles of the processing of personal data must be considered. It is further recommended to involve the Office of the Hamburg Commissioner for Data Protection and Freedom of Information (HmbBfDI) when implementing the to-be processes. **Operational implications** directly result from the implementation of the respective to-be process, i.e., new/adapted process steps, additional efforts etc. at the process level. These implications per to-be process will be further detailed in Deliverable 7 (To-be process models in BPMN format). **Organisational implications** refer to those implications that result from the operational to-be situation at the organisational level.

Overview of overarching implications of the to-be technologies

These overarching implications are summarised in the table below, thereby structured along the technologies to be introduced. The use of the respective technologies in the individual to-be processes is described in the following chapters.

Table 39: Overarching technical, legal, organizational and operational implications of the to-be technologies

Technology	Technical implications	Legal implications	Organisational implications	Operational implications
Workflow management (IDM tool) and correspondin g features/tools	• The workflow of each new case within every to-be process is controlled by an frontend that can be accessed from the browser, it is no longer necessary to use the Office Suite, but you can use Office applications.	• Restricted access to several functions of the dashboard, depending on the process and person, must be considered. • Data protection regulations must be complied with, in particular when dealing with information/data from external stakeholders • When archiving data and requests, data protection regulations must be complied with, e.g.	• Given the experience with IDM and the initial development of the solution, it can be expected that the introduction of this IDM tool has a low threshold and can easily be implemented in other departments/authorities and expanded to other use cases • Communication improvements are expected given the use of a central platform • Reduction of media breaks given the bundling of	• For users/process owners, a central platform where they can manage the steps of the process enhances transparency and communication and ensures compactness • The platform facilitates/supports various process steps with its features (e.g., deadline tracking, control/monitoring dashboard) and thereby ensures a clear overview.

Technology	Technical implications	Legal implications	Organisational implications	Operational implications
		duration of archiving or blackening of personal information.	communication/information and data exchange in one workflow management • Positive synergy effects are expected to increase the more interfaces are connected and the more authorities/departments/units use this tool.	
Assisted assignment of responsibilities	• The assignment of responsibilities is supported by suggestions from an artificial intelligence (AI) or machine learning (ML) model. The final assignment is still in the power of a human. The AI only supports the assignment with proposals. • The utilized AI or ML models will improve in performance over time based on the increasing number data.	• When forwarding data/information, data protection regulation must be complied with, in particular concerning sensitive and personal information.	• Given the experience in the assignment of responsibilities within the process 'citizen letters', synergies regarding the implementation and adaption to other processes as well as the mitigation of technological challenges can be generated. • Depending on the availability and quality of data, further assessments regarding the applicability of this AI solution to other processes must be determined. This also includes the adaption and training of the AI model.	• For process owners, an assisted assignment of responsibilities can reduce time efforts needed to allocate an email/request/… to the responsible person. • In time-critical situations, a traceable and quick allocation of assignment can be ensured.
Labelling	• Consistent and correct labelling of the training data is key for yielding performant models, therefore the labelling takes place in a prepared environment by experts of the department. • A labelling tool will be implemented for labelling data for all use-cases.	• Procedure regarding labelling of sensitive information/data must be established in accordance with data protection regulation. • Restricted access procedure as well as storage of documents to train AI model must be agreed on with involved departments/units and the data protection.	• Cross-authority and cross-department use is possible once the labelling process is implemented given the low thresholds to introduce the labelling to other departments/units. • Even higher positive synergies can be generated if the labelled data is stored centrally (complying with certain security and data protection restrictions accordingly) and the more data will be labelled. • Labelling also improves intelligent searches and assignment of responsibilities.	• Initial time efforts at the time of implementation are expected given the need to label existing data – depending on the amount of data to be labelled. • Additional recurring efforts when storing new data/information in the databases occur (employees must label documents accordingly). • Additional one-off coordination efforts occur as departments/units must agree on the procedure of how to label (e.g. terminology).
Intelligent search	• The Intelligent search will serve as an individual search engine not mandatory coupled to the process. Staff is free to use the search to fulfil a task. The	• Restricted access to protected documents and information must be ensured. • Compliance with data protection regulation must be ensured, in particular concerning	• Given the existence of pre-trained models, comparably large and quick positive synergy effects can be expected. • Once the model is trained, it can be expanded to other departments/authorities,	• Given a more precise search due to a better coverage of available information, improved and faster search results can be expected. • This, in turn, could significantly reduce the

Technology	Technical implications	Legal implications	Organisational implications	Operational implications
	intelligent search would allow for facilitated searches over the historic database, and thus simplify and accelerate the process, which would be advantageous in time efficiency and output consistency. • The intelligent search will be executed on a specialized database of all historic data.	sensitive and personal information. • The need-to-know principle should be followed, i.e. sensitive information should only be accessed by those who have been authorized accordingly.	thereby also benefitting from the fact that the respective departments within BUKEA and BSW work with similar topics which facilitates a genre-specific training of the AI model. • As a consequence, and given the fact that searches are a part of almost every employee at BUKEA and BSW, a reduction in workload and an improvement of quality can be expected.	workload of those employees using an intelligent search function.
Imputing	• Some data fields can be imputed by calculating statistical figures, thereby selecting the most probable category. Other data fields only allow this deduction by applying more sophisticated machine learning imputation algorithms.	• Accuracy of data must be verified/checked manually. • Sensitive information and personal data cannot be imputed.	• First experiences of the imputing process can be gained and can be transferred to other tabular data and processes outside the BohrIS process.	• Reduces time efforts resulting from tracing loops for units that need certain data e.g. from external stakeholders or other internal units. • In turn, employees can allocate their resources to content-related (instead of administrative) activities.
Completeness Check	• Instead of manually tracking missing fields of information, the completeness check automatically checks for missing relevant fields.	• The accuracy of the check itself must be verified and checked manually.	• Could contribute to yield a reduction in administrative workload and thereby disburden employees from time-consuming manual data reconciliations. • This, in turn, frees up capacity for technical reviews and content-related work.	• Reduces the manual time that was required to double check for missing fields. • The completeness check must be reviewed manually to ensure that the completeness checks are current and accurate.
Plausibility Check	• Instead of checking the values manually, the plausibility check reads the data and ensures that the values entered are the expected ones. • Ranging from simple type checks to statistically.	• The accuracy of the completeness check needs to be manually checked and inspected.	• Could contribute to yield a reduction in administrative workload and thereby disburden employees from time-consuming manual data reconciliations. • This, in turn, frees up capacity for technical reviews and content-related work.	• Minimizes the time spent checking the plausibility of the data entered. • Checks for plausibility must be checked to ensure that they are up to date and correct.

Source: Deloitte (2022)

Overarching conceptual considerations

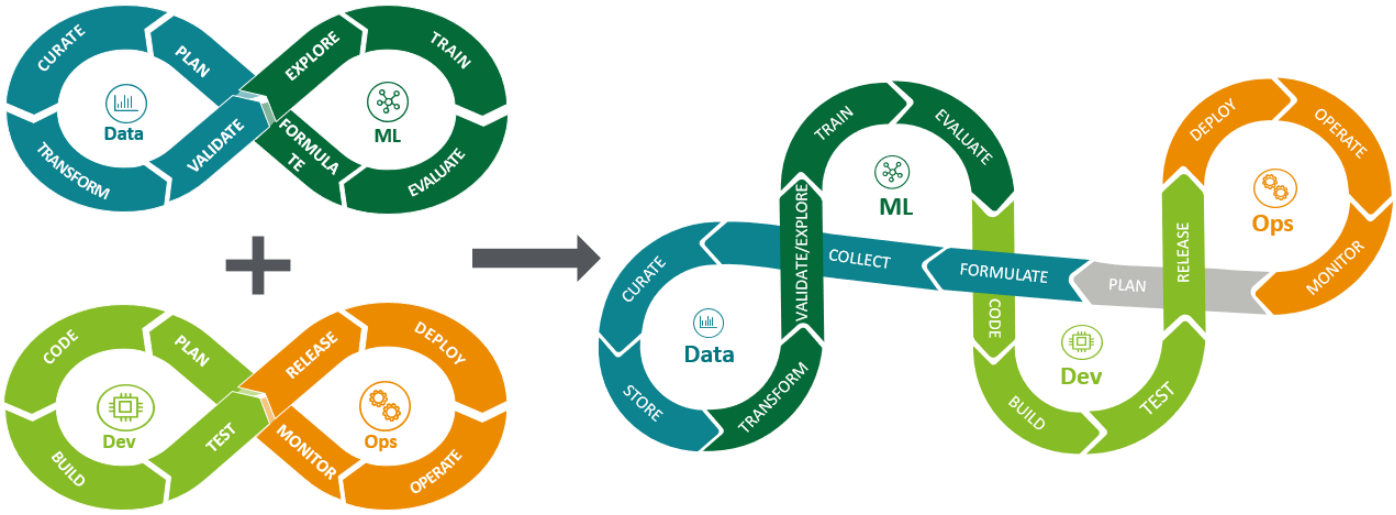
This subchapter outlines the overarching conceptual considerations that are relevant in the context of the implementation of the to-be processes.

The double infinite loop and the concepts of model-centric vs. data-centric

In particular, the **concepts of a model-centric vs a data-centric approach** will be explained and how these approaches relate to alternative 2 and 3 (see Deliverable 5 – Business Case).

The following figure provides an overview of the double infinite loop concept that combines the DevOps loop and the DataML loop. This concept is preferred for all software projects with a machine learning or deep learning component because it allows partitioners to extract the most value from the available data and has the highest probability of success.

Figure 56: Double infinite loop Machine Learning Operations (MLOps), a combination of Data and Machine Learning (ML) and Development and Operations



Source: https://www.ml4devs.com/articles/mlops-machine-learning-life-cycle/

Project implementations with machine learning components **should be implemented with iterative cycles**, although traditional software projects also support this approach.

Since the to-be processes brief written inquiries (Schriftliche Kleine Anfragen), imputing procedure (BohrIS process), info boxes (Infoboxen) and knowledge management process (Wissensmanagement) (**processes** for which **alternative 3** was determined as preferred alternative – see Deliverable 5 Business Case) include **either a machine learning or a deep learning component**, the **approach using an iterative life cycle should be followed** for the overarching process architecture of these to-be processes. Hence, the DEV / OPS[24] infinite loop should be used for those shortlist processes where alternative 2 is selected (without machine learning or deep learning components) – the senate printed matter coordination (Senatsdrucksachenabstimmung). For all other processes with alternative 3 as preferred alternative, the process architecture should be extended to the double infinite loop with DEV / OPS & DATA / ML (MLOPs)[25].

This **iterative life cycle approach is referred to as data-centric approach**, as great importance is attached to the collection and quality of the data to improve the machine learning models. In contrast, the **model-centric approach** tries to improve the machine learning models by changing the model itself, for example by hyperparameter tuning. Deeplearning.ai[26], an initiative started by Stanford professor Andrew NG[27], shows

[24] https://en.wikipedia.org/wiki/DevOps - DevOps is a set of practices that combines software development and IT operations. It aims to shorten the systems development life cycle and provide continuous delivery with high software quality.
[25] https://en.wikipedia.org/wiki/MLOps - MLOps or ML Ops is a set of practices that aims to deploy and maintain machine learning models in production reliably and efficiently. The word is a compound of "machine learning" and the continuous development practice of DevOps in the software field.
[26] https://www.deeplearning.ai/
[27] https://hai.stanford.edu/people/andrew-ng

in different conferences indications for the **superiority of the data-centric approach over the model-centric approach in terms of performance improvement**.

The table below provides a summary of the performance change over specific tasks. The Zero-Shot-Learning (ZSL) Text-Classifier[28], matches in large parts our assignment of responsibilities (assisted) functionality, integrated in brief written inquiries and info boxes to-be processes within alternative 3 and shows the advantage over a model-centric approach.

Table 40: Overview of the performance change for specific tasks with various approaches

Approach	Steal defect detection	Solar Panel	ZSL Text-Classifier
Base Model	76,2%*	75,68%*	67%*
Model-centric approach	+0% (76,2%)	+0,04% (75,72%)	+0% (67%)
Data-centric approach	+16,9% (93,1%)	+3,06% (78,74%)	+15% (82%)

Source: Data-centric AI conference hosted by Deeplearning.ai[29], own illustration
*Base Performance Metric e.g. Accuracy[30]

Process steps of the double infinite loop in detail

The individual process architecture steps are explained below using the double infinite loop.

This Data / ML infinite loop is not linear. At every stage, you don't always move forward to the next stage. Upon discovering problems, you go back to the relevant previous stage to fit them. Hence, there are implicit edges from each stage to previous stages.

This is similar to the DEV / OPS loop which developers follow. Not every code that goes to the test stage progresses to the release stage. If the tests fail, it goes back to the code (sometimes even to plan) stage for problems to be rectified. Therefore, **the whole planning** cannot be finalized upfront in a separate digitization project but **must be adapted in an agile manner within an implementation project.**

Planning
The first phase for each to-be process is **planning**. Discussing the business goals and key business metrics, as well as the product features that can help achieve those goals stands in the center of this stage. Drilling down the end-user problems and debate about user journeys to address those problems and collect required data to assess how a new digital process is changing and improving things. This phase is already covered to a large extent, but not in full, by the deliverables 6 (to-be-analysis), deliverables 7 (to-be process models in BPMN) and deliverable 8 (roadmap) of the Deloitte project REFORM SC2021/064.

Formulate
The second phase is called **formulate**, which is also already covered to a large extent by the project REFORM SC2021/064 with City of Hamburg and Deloitte. This phase starts the Data / ML loop of the to-be process. Data scientists translate a business objective into a machine learning problem. There are several factors that you may need to consider:

- **Business Objective (covered by the project REFORM SC2021/064):** Narrow it down to a small set of machine learning problems that can serve the business objective
- **Cost of Mistakes (to be covered upon implementation of the to-be processes**): No machine learning model will be 100% accurate. What is the cost of false negatives and false positives? For

[28] https://arxiv.org/abs/1707.00600 - Zero-Shot Learning -- A Comprehensive Evaluation of the Good, the Bad and the Ugly
[29] See the following videos of the conference for more information: https://www.youtube.com/watch?v=06-AZXmwHjo&t=400s, https://www.youtube.com/watch?v=Yqj7Kyjznh4&t=3340s
[30] https://en.wikipedia.org/wiki/Accuracy_and_precision

example, if an image classification model wrongly predicts a lethal disease in a healthy person, further tests will rectify it. But if the model fails to diagnose this disease in a patient, then it can turn out to be fatal due to late detection.

- Data Availability (partly covered by the Deloitte project REFORM SC2021/064): It may come as a surprise, but you may start with no or very few data. As the data becomes richer (into later cycles), it may make more types of models viable. For example, if you were to do anomaly detection[31] with no labeled data, you may start with various kinds of unsupervised clustering algorithms[32] and mark points that are not in any cluster as anomalies. But as you collect user reactions to your model, you will have a labeled dataset. Then you may want to try if a supervised classification[33] model will perform better. Another example, with respect to our functionality assignment of responsibilities (assisted), would be to first use few-shot-learning algorithms (will be discussed in more detail in the individual chapters of the shortlist processes) and after collecting enough data in the following cycles switching to a traditional fine-tuning[34] method.
- Evaluation Metrics (covered by the Deloitte project REFORM SC2021/064): Depending upon problem formulation, specifying a model performance metric to optimize for, which should align with the business metric for your business objective and with the data distribution of the data is important. For example, evaluating the assignment of responsibilities (assisted) with an accuracy[35] metric, will not lead to satisfactory models, if the data distribution contains many underrepresented district offices and departments. This is called imbalance datasets[36] in machine learning and is conquered by evaluation metrics like F1-Score[37] or Matthews Correlation Coefficient[38].

For both phases planning and formulate full coverage will only be achieved upon the first implementation cycle, not within this project REFORM SC2021/064, which should give a decision template which short list process should be implemented first.

Collect

The collect phase within the Data / ML subloop covers the necessary data collection from internal applications as well as external sources. It may be by scraping[39] the web, capturing event streams from mobile apps or web service, or simply collecting data from windows folder structures. This stage invokes data versioning tools like DVC[40].

Curate / Store

After collecting the data, we enter the curate stage. The data collected is almost never pristine. You need clean it, fill in missing values, remove duplicates, and store it in a data warehouse, data lake or other suitable places. If a supervised learning task is contemplated for the to be model the data has to be annotated and in machine learning language this is called labelling. Some tasks like simple text classification tasks, e.g. assignment of responsibilities (assisted), can be labelled with Excel, but it is beneficial to implement a central labelling and annotation environment, which can be used across all projects where machine learning or deep learning is involved and leverage synergies. With professional labelling environments like Label Studio[41] and Kerni.ai[42] the workflow of labelling gets more efficient, and the data is more reliable and of higher quality because they enable control mechanisms within the labelling process like review loops or annotating one example by more than one labeler at the same time to measure inter

[31] http://scikit-learn.org/stable/modules/outlier_detection.html
[32] https://scikit-learn.org/stable/modules/clustering.html#overview-of-clustering-method
[33] https://en.wikipedia.org/wiki/Statistical_classification
[34] https://arxiv.org/abs/1801.06146 - Universal Language Model Fine-tuning for Text Classification
[35] https://en.wikipedia.org/wiki/Accuracy_and_precision#In_classification
[36] https://www.analyticsvidhya.com/blog/2021/06/5-techniques-to-handle-imbalanced-data-for-a-classification-problem/
[37] https://en.wikipedia.org/wiki/F-score
[38] https://en.wikipedia.org/wiki/Phi_coefficient
[39] Web scraping is the process of using computer programs to extract content and data from a website.
[40] https://dvc.org/
[41] https://labelstud.io/
[42] https://www.kern.ai/

rater reliability[43]. Also, cataloging the data, so that it can be easily discovered and correctly understood is advantageous.

Transform

The curate stage is followed by the transform phase. Once data has been cleaned, and labelled a transformation is needed to suit the analytics and machine learning modeling. It may require changing the structure, joining with other tables, aggregating or summarizing along important dimensions (dimensionality reduction[44]), computing additional features[45], etc. Data Engineers will automate all of it in the data pipeline with tools like pandas [46] and scikit-learn[47] preferred in a python[48] programming environment.

Validation / Explore

The validation stage implements quality checks, maintain logs of statistical distributions from the data over time, and create triggers to alert when any of the checks fail or the distribution sways beyond expected limits. Data Engineers in consultation with data scientists implement these validations in the data pipeline with tools like Pytest[49] and Pandera[50]. The downstream step Explore is an important step in machine learning pipelines. Especially in cases without deep learning algorithms involved like in our Imputing shortlist process. Data scientists perform Exploratory Data Analysis (EDA)[51] to understand the relationships between various features and the target value they want the model to predict. They also do Feature Engineering[52], which is likely to lead to adding more curation and transformation (the previous two stages). This stage invokes the use of various python libraries like Pandas Profiling [53]or Sweetviz[54] for running a comprehensive analysis of every variable in the data. There are also special toolkits for feature selection and feature engineering. The library getML[55] offers the functionality of an automated feature selection as well as feature engineering, which considerably reduces the effort of the datascientist for this part of the analysis.

Train

The train stage is straightforward. Data scientists run multiple experiments (i.e. train the models), compare model performance, tune hyper-parameters, and select a couple of best-performing models.

Evaluate

Afterwards we enter the final DATA / ML infinite loop stage called evaluate. Which is evaluating the model characteristics against business objectives and metrics. Some feedback may result in even tweaking and formulating the ML problem differently and repeating the whole subprocess loop all over again.

Code

The code stage is the first DEV / OPS subloop part in the process architecture. This phase is for designing and developing the software or application. Especially frontend and backend functions are implemented. User reactions feedback and insights of the evaluation phase will be integrated. It is very important to get developers, data engineers, and data scientists on the same page regarding the coding. This stage invokes software version control systems like git[56] as well as agile workflow tools like Jira[57] or Gitlab[58] to control the workflow in combination of agile management like scrum[59].

[43] https://en.wikipedia.org/wiki/Inter-rater_reliability
[44] https://en.wikipedia.org/wiki/Dimensionality_reduction
[45] https://en.wikipedia.org/wiki/Feature_engineering
[46] https://pandas.pydata.org/
[47] https://scikit-learn.org/stable/
[48] https://www.python.org/
[49] https://docs.pytest.org/en/
[50] https://pandera.readthedocs.io/en/stable/
[51] https://en.wikipedia.org/wiki/Exploratory_data_analysis
[52] https://en.wikipedia.org/wiki/Feature_engineering
[53] https://pandas-profiling.ydata.ai/docs/master/index.html
[54] https://github.com/fbdesignpro/sweetviz
[55] https://getml.com/
[56] https://git-scm.com/
[57] https://www.atlassian.com/software/jira
[58] https://about.gitlab.com/
[59] https://www.scrum.org/resources/what-is-scrum

Build

The **build** stage is the next downstream step. This stage fuels the continuous integration (CI)[60] of various parts as they evolve and package into a form that will be released. It can be a library or a software development kit (SDK)[61], a docker image[62], a web service, an API[63] or an application binary. In our case it will most likely be a docker image, a web service and an API.

Test

In the **test** phase unit tests, integration tests, coverage tests, performance tests, load tests, privacy tests, security tests, and bias tests are taking place. Testing should be done on a staging environment[64] that is similar to the targeted production environment but not designed for a similar scale. It may have dummy, artificial, or anonymized data to test the software system end-to-end. For general tests the Python internal test library Unittest[65] can be used. Alternatively, there are also external libraries such as Pytest[66], which can also be used to perform comparable tests with much less code. It is also possible to have these tests automated by tools. For example, with Smartbear[67] it is possible to thoroughly test scripts of different programming languages without manual coding. In addition, automated repository tests are feasible with the software docker[68], which can be connected to the continuous integration pipeline.

Release

The Test stage is followed by the **release** phase. Once all automated tests pass and, in some cases, test results are manually inspected, the software code or models are approved for release. Just like code, models should also be versioned and necessary metadata automatically captured. Just as the docker images are versioned in a docker repository, the model should also be persisted in a model repository. If models are packaged along with the code for the microservice that serves the model, then the docker image has the model image too. This is where Continuous Integration ends, and Continuous Deployment takes over[69]. Continuous deployment can be integrated using various tools, based on the decision of whether or not to self-host the pipeline. For example, the previously mentioned docker framework is well suited for outsourced hosting of the pipeline. For self-hosted solutions, Rancher[70] or Kubernetes[71] can be a suitable alternative.

Deploy

The next phase called **deploy** is picking the released artifacts from the docker repository or model store and deploying it on production infrastructure. Depending on the need, different infrastructures e.g. infrastructure as a service (IaaS)[72], container as a service (CaaS)[73], platform as a service (PaaS)[74] or on-premise[75] can be chosen.

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[60] https://en.wikipedia.org/wiki/Continuous_integration
[61] https://en.wikipedia.org/wiki/Software_development_kit
[62] https://ieeexplore.ieee.org/document/7883438 - A Docker image is a file used to execute code in a Docker container. Docker images act as a set of instructions to build a Docker container, like a template. Docker images also act as the starting point when using Docker. An image is comparable to a snapshot in virtual machine (VM) environments. A Docker container image is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings.
[63] https://en.wikipedia.org/wiki/API
[64] https://www.techtarget.com/searchsoftwarequality/definition/staging-environment
[65] https://docs.python.org/3/library/unittest.html
[66] https://docs.pytest.org/en/7.1.x/
[67] https://smartbear.com/
[68] https://docs.docker.com/
[69] https://www.xenonstack.com/insights/continuous-integration-vs-continuous-deployment
[70] https://www.rancher.com/ - Rancher is an open source software platform that enables organizations to run containers in production. With Rancher, organizations no longer have to build a container services platform from scratch using a distinct set of open source technologies.
[71] https://kubernetes.io/ - Kubernetes is an open-source container orchestration system for automating software deployment, scaling, and management. Google originally designed Kubernetes, but the Cloud Native Computing Foundation now maintains the project.
[72] https://en.wikipedia.org/wiki/Infrastructure_as_a_service
[73] https://en.wikipedia.org/wiki/Content_as_a_service
[74] https://en.wikipedia.org/wiki/Platform_as_a_service
[75] https://en.wikipedia.org/wiki/On_Premises

The shortlist processes in our case would encourage a container as a service (CaaS) or On-Premise structure. Whereby the CaaS implementation brings some advantages with it, such as scalability, faster provision of the infrastructure and high transparency of the costs through a utilization-based billing model. This stage invokes software for managing containers such as docker. Choosing CaaS implies the need of a service provider, of which there are many. One possibility is amazon EC2 container service[76], which is particularly suitable if other AWS services are also used. Comparable services are also available from all common competitors of AWS, with Google Kubernetes Engine[77] or Azure Kubernetes Service[78]. Docker itself also offers CaaS and furthermore can also be used with on-premise solutions.

Operate
After deployment we enter the operate stage. Once the services are deployed, one could decide to send a small percentage of the traffic first. Canary deployment[79] is common tactic to update in phases (e.g. only 25% of the processes will be handled with the new digitized form, in the next step 50% and so on). In case of a problem, unexpected behavior, or a drop in metrics, you can roll back to the old process. The canary deployment is not mandatory.

Monitor
The last stage and circular connection to start a new cycle with a new planning phase is the Monitor stage. This involves an automatic and constant monitoring of the health of services, errors, latencies, model predictions, outliers and distribution of input model features, collect user feedback etc. In case a problem arises, depending upon the severity and diagnosis, you may roll back the system to an older version, release a hotfix, trigger model re-training, or carry out any other actions that may be required. User feedback and other monitoring insights should be used in the next cycle planning phase to improve the model. Monitoring container-based infrastructures is most suitable in the environment of the service provider of the container service. For example, when using the AWS EC2 container service, the application of AWS container monitoring[80] is best suited. Other alternatives may be Google cloud monitoring[81] or Azure monitor log analytics[82], for instance.

Prevailing potential for synergies

We expect synergy effects to be particularly high in the following three areas:

- On the one hand, the implementation of the IDM tool becomes significantly faster due to high similarity in follow-up implementation projects, in which the IDM tool is also set up.
- Furthermore, after legal examination, data can be shared among the individual projects for the pre-training of models. This approach improves the foundation of the Deep Learning models used, whereby anonymization of personal identifiable information (PII)[83] can be applied using tools such as presidio[84] to comply with data protection guidelines. The merging of data would be applied, for example, to the functionalities assisted assignment of responsibilities for the processes brief written inquiries, senate printed matter coordination and info boxes. For the functionalities intelligent search, the data of the processes brief written inquiries and knowledge management could share their data.
- The usage of an annotation or labelling environment e.g., Label Studio[85] offers the most synergies, because a large part of machine-learning and deep-learning applications fall into the group of supervised learning[86] and require labels or annotations. Whether a computer vision[87], natural

[76] https://aws.amazon.com/blogs/aws/cloud-container-management/
[77] https://cloud.google.com/kubernetes-engine/
[78] https://learn.microsoft.com/en-us/azure/aks/intro-kubernetes
[79] https://semaphoreci.com/blog/what-is-canary-deployment
[80] https://aws.amazon.com/cloudwatch/container-monitoring/
[81] https://cloud.google.com/monitoring/
[82] https://learn.microsoft.com/en-us/azure/container-apps/log-monitoring
[83] https://gdpr.eu/eu-gdpr-personal-data/
[84] https://github.com/microsoft/presidio
[85] https://labelstud.io/
[86] https://en.wikipedia.org/wiki/Supervised_learning
[87] https://en.wikipedia.org/wiki/Computer_vision

language processing (NLP)[88], or tabular problem is to be solved using artificial intelligence, such an annotation environment will always be used when the annotation complexity exceeds simple classifiers[89] or regressions[90].

[88] https://en.wikipedia.org/wiki/Natural_language_processing
[89] https://en.wikipedia.org/wiki/Statistical_classification
[90] https://en.wikipedia.org/wiki/Regression_analysis

Brief written inquiries (Schriftliche Kleine Anfragen, SKA)

This chapter describes the technical to-be situation and its underlying components as well as their technical implications for the to-be process brief written inquiries (Schriftliche Kleine Anfragen).

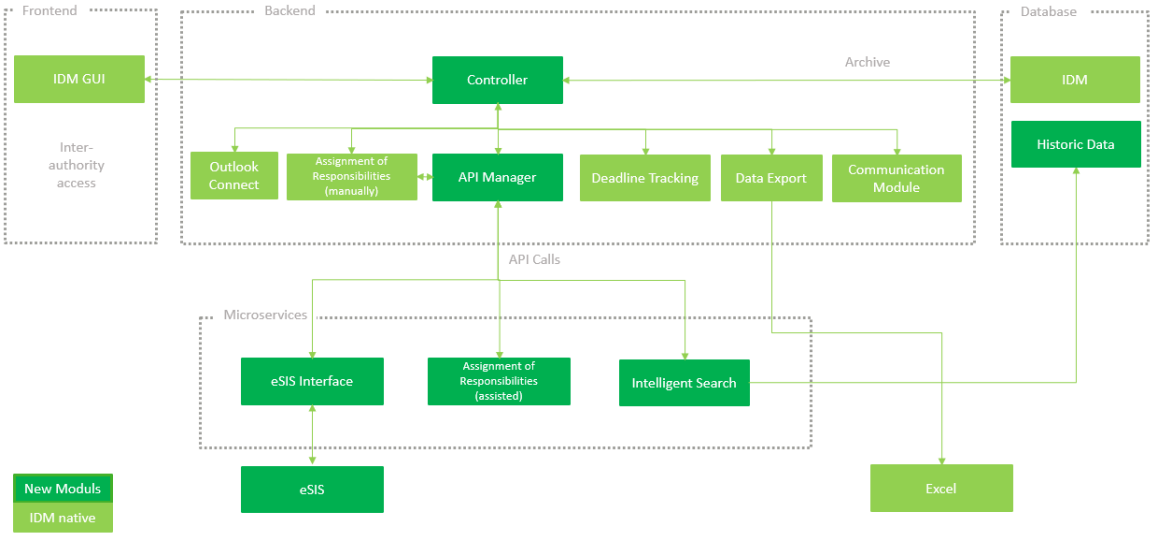
For the brief written inquiries, the preferred alternative that resulted from the Business Case analysis (see Deliverable 5) is alternative 3. This alternative foresees that the process is restructured with the help of an already existing process management tool, the IDM tool (Intelligent Dialogue Management), whereby the tool is equipped with further functionalities, including artificial intelligence. The following functionalities have been agreed upon:

- A **central access channel (dashboard)**
- **Assignment of responsibilities (manually)** and
- **Assignment of responsibilities (assisted**; supported by a AI forwarding assistant**)**
- **Archiving** of the inquiries and the process and response histories in a central database
- **Monitoring** and
- **Deadline tracking**
- **Comment and communication** functions
- **Inter-authority access**
- **Data export**
- **Intelligent search**
- **eSIS Interface**

To-be infrastructure

The following figure provides an overview of the to-be technical infrastructure for the process brief written inquiries.

Figure 57: To-be infrastructure for the process brief written inquiries



Source: Deloitte (2022)

The existing IDM tool is primarily extended by a controller, which manages the various existing and new functionalities. The database of the IDM tool, an adapted version of the IDM frontend, the manual assignment of responsibility module, the deadline tracking module, the data export module, and the communication module will remain and are called main functions.

IDM main functions

There are no **model and data levels** and no **dataset** layer is involved for the IDM main functionalities because the main functions do not include artificial intelligence.

On the **hardware layer** side the IDM backend and frontend can be served with a 2 Core CPU with 32 GB of RAM and a SSD hard drive with 8 TB of space and a redundant array of independent disks RAID level of 1.

The **software layer** includes a Windows or Ubuntu operating system with a Nginx[91] web server to server the IDM tool. The Single-Sign-On (SSO)[92] functionality is severed with the Active Directory Federation Services (ADFS)[93] with additional active directory processes for nightly updates regarding extended user data of the employees. The frontend is developed with Vue.js[94].

At the **staffing level,** the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Special Matter Expert: Is a person who has accumulated knowledge in a particular fields or topics of interest (e.g. brief written inquiries) and is familiar with the process and information processed and are responsible for labeling the data and giving business feedback
- Frontend/backend Developer: Is usually responsible for writing APIs and the necessary extensions in the IDM front- and backend. The frontend developer needs to have JavaScript[95] especially Vue.js skills.

At **data architecture level** a PostgreSQL 13[96] database is used and will be further extended.

Newly provided functionalities will be the **inter-authority access** for the IDM frontend, which takes over user authorizations and access rights management. Furthermore, a newly introduced **API manager** is controlled by the **backend controller**, which ensures that all AI applications and interfaces to external tools such as eSIS can be provided. This backend controller should preferably be implemented in the backend language of choice, for example in Python. The API Manager can either be developed in-house to be perfectly integrated into the environment, or a commercial API management tools can be used. Among others, there is the AWS internal Amazon API Gateway[97], or alternatively Microsoft's Azure API Management[98]. IBM API Connect [99]is also an API management service that can manage APIs across the entire business ecosystem.

The interfaces and AI applications are integrated via **microservice** approach[100], which means they are standalone services and receive a request for example per POST[101] or GET[102] method with a corresponding payload from the API manager, triggered by a user action in the frontend and returns a structured predefined data format such as JSON[103] or XML[104], which can be further processed by the receiver. Preferred here would be microservices with python based on FastAPI[105], which fulfills the REST architecture[106].

The microservice approach is preferred for machine learning and deep learning modules because of several advantages:

➔ Scalable — Each microservice is an independent component that runs its own process and is deployed independently. As each service is deployed independently, a particular microservice can be scaled independently of the entire application.

[91] https://www.nginx.com/ - Nginx is a web server that can also be used as a reverse proxy, load balancer, mail proxy and HTTP cache.
[92] https://en.wikipedia.org/wiki/Single_sign-on - Single sign-on is an authentication scheme that allows a user to log in with a single ID to any of several related, yet independent, software systems. True single sign-on allows the user to log in once and access services without re-entering authentication factors.
[93] https://en.wikipedia.org/wiki/Active_Directory_Federation_Services - Active Directory Federation Services, a software component developed by Microsoft, can run on Windows Server operating systems to provide users with single sign-on access to systems and applications located across organizational boundaries.
[94] https://vuejs.org/ - Vue.js is an open-source model–view–viewmodel front end JavaScript framework for building user interfaces and single-page applications. It was created by Evan You, and is maintained by him and the rest of the active core team members.
[95] https://www.javascript.com/ - JavaScript, often abbreviated as JS, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS.
[96] https://www.postgresql.org/ - PostgreSQL, also known as Postgres, is a free and open-source relational database management system emphasizing extensibility and SQL compliance. It was originally named POSTGRES, referring to its origins as a successor to the Ingres database developed at the University of California, Berkeley.
[97] https://aws.amazon.com/api-gateway/api-management/
[98] https://learn.microsoft.com/en-us/azure/api-management/
[99] https://www.ibm.com/products/api-connect
[100] https://en.wikipedia.org/wiki/Microservices
[101] https://en.wikipedia.org/wiki/POST_(HTTP)
[102] https://en.wikipedia.org/wiki/GET_(HTTP)
[103] https://en.wikipedia.org/wiki/JSON
[104] https://en.wikipedia.org/wiki/XML
[105] https://fastapi.tiangolo.com/
[106] https://en.wikipedia.org/wiki/Representational_state_transfer

- ➔ Agility — Failure in a microservice application only affects a particular service instead of the entire application. Therefore, fixing and debugging will be done on that particular microservice instead of pausing and fix the entire application.
- ➔ Flexibility — Team members are not limited by the programming languages or tools used to create and deploy the microservice and can have different frameworks for each microservice. In addition, if there are codes developed previously, team members can leverage those codes instead of re-building them again.
- ➔ Autonomy — Developing using a microservice architecture approach allows more team autonomy as each member can focus on developing a specific microservice that focuses on a particular functionality for example each member build a microservice that focuses on a particular task in the machine learning deployment process such as — data ingestion, feature engineering, data validation, model scoring, etc.
- ➔ Easy to Understand — As things are being split up into smaller components, a single microservice application is easier to understand and managed as usually, one microservice focuses on a particular task.

Microservice - Assignment of responsibilities (assisted)

At the **model and data level**, the function assignment of responsibilities (assisted) is a classical natural language processing[107] text classification[108] algorithm with multiclass[109] or multi label[110] predictions. The current state of the art models in this segment have a transformer architecture[111]. If only few labeled data is available (e.g. from 8 up to 64 samples) the setfit methodology is preferred over fine-tuning. As soon as more labeled data becomes available (>100 labels per class) traditional fine-tuning methodologies, for example the DeBERTa[112] model, can easily take over and replace setfit. These models are trained with python[113] using the packages Huggingface[114] and Pytorch[115].

In our interviews we discovered that the **dataset** for BUKEA and BSW holds more than 700 brief written inquiries each. The data has different formats. The brief written inquiries are stored in PDF, Word and Excel format whereas the answers are saved in PDF format. This implies a certain amount of data preparation before labeling can be started and will most likely not be automated, instead it will only be possible to process the data manually or semi-automatically. To train the classifier the extracted texts have to be labeled in a labeling iteration by subject matter experts. To conclude, the fundamental dataset is available to train an assisted assignment of responsibilities model.

At the **hardware level**, we need to distinguish between two environments. On the one hand, the training environment in which the transformer models are trained, and on the other hand, the productive environment that is connected to the API Manager for classification tasks as a microservice. The training environment needs a graphics card with at least 24 GB vRam from nvidia[116] (e.g. K80, RTX 3090 TI, etc…), since the models are trained on these graphics cards. Furthermore, at least 128 Gb Ram and 8 cores are seen as minimum requirements. The productive environment should have the same configuration, but can work with smaller graphics cards if necessary, because the models can be optimized beforehand with quantization[117] or pruning[118], to run on smaller computers. As an alternative to on-prem procurement of hardware, it is also possible to rent this hardware as required. This is possible with various service providers such as AWS, Azure or Google. But there is also a wide range of other service providers in addition to these.

[107] https://en.wikipedia.org/wiki/Natural_language_processing
[108] https://paperswithcode.com/task/text-classification
[109] https://en.wikipedia.org/wiki/Multiclass_classification
[110] https://en.wikipedia.org/wiki/Multi-label_classification
[111] https://en.wikipedia.org/wiki/Transformer_(machine_learning_model)
[112] https://arxiv.org/abs/2006.03654
[113] https://www.python.org/
[114] https://huggingface.co/
[115] https://pytorch.org/
[116] https://www.nvidia.com/en-us/
[117] https://arxiv.org/abs/2106.08295
[118] Pruning is a technique in deep learning that aids in the development of smaller and more efficient neural networks. It's a model optimization technique that involves eliminating unnecessary values in the weight tensor.

At the **software level** the training environment should be setup with an Ubuntu 20.04 LTS[119] or Ubuntu 18.04 LTS [120] operating system with anaconda[121] environment installed and with internet access. The microservice should run with a docker[122] container.

At the **staffing level** the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Data Scientist: Main area of expertise is the training of the models, with a focus on developing appropriate statistical models and algorithms
- Data Analyst: Data analysts specialize in the pre-processing and collection of data. They usually have a good understanding of databases and data visualization
- Special Matter Expert: Is a person who has accumulated knowledge in a particular field or topic and is familiar with the process and information processed and is responsible for labeling the data and giving business feedback
- Machine Learning Engineer: Focuses on deploying machine learning products, test set-up, releases and monitoring
- Frontend/backend Developer: Is usually responsible for writing APIs and the necessary extensions in the IDM front- and backend

Microservice - Intelligent search

At the **model and data level** the state of the art AI driven intelligent search is based on vector search algorithms. To describe it a bit more detailed, one uses SentenceTransformer[123] deep learning models to generate so called text embeddings[124] from documents and texts. These embeddings can then be compared similarity or distance metrics like cosine-similarity[125] to find texts with a similar meaning. This is the state of the art technique[126] for semantic textual similarity[127] (find similar documents from other documents) and semantic search[128] (find interesting documents from a search query). The framework SBERT[129], who can handle this, is based on PyTorch and Huggingface Transformers and offers a large collection of pre-trained models tuned for various tasks. Further, it is easy to fine-tune own models. Different wrapper libraries can be chosen to leverage SBERT like FAISS[130], Pinecone[131] and Haystack[132]. The tuning is done in two steps per adaptive pretraining[133]. First, the pre-trained models, such as "paraphrase-multilingual-mpnet-base-v2"[134], are pre-trained again with an unsupervised learning algorithm[135] like TSDAE[136]. This is done purely with the texts of the brief written inquiries with no labels being added. Then the so-called fine-tuning follows with the help of labeled data, wherein there are different types of labeling. The currently preferred way is with the help of a Contrastive Loss[137]. For a Contrastive Loss two texts and a label of either 0 or 1 is given. 1 if the two texts belong to the same cluster (same brief written inquiry) and 0 otherwise.

The **dataset** for BUKEA and BSW which holds more than 700 brief written inquiries each is considered to be sufficiently large to follow an adaptive pretraining approach and come up with an operational intelligent search.

[119] https://releases.ubuntu.com/20.04/
[120] https://releases.ubuntu.com/18.04/
[121] https://www.anaconda.com/products/distribution
[122] https://www.docker.com/
[123] https://arxiv.org/abs/1908.10084
[124] https://en.wikipedia.org/wiki/Word_embedding
[125] https://en.wikipedia.org/wiki/Cosine_similarity
[126] https://haystackconf.com/files/slides/haystack2022/Scalable-Semantic-Search-at-Course-Hero-Kazem-Jahanbakhsh.pdf
[127] https://www.sbert.net/docs/usage/semantic_textual_similarity.html
[128] Semantic search seeks to improve search accuracy by understanding the content of the search query. In contrast to traditional search engines which only find documents based on lexical matches, semantic search can also find synonyms. https://www.sbert.net/examples/applications/semantic-search/README.html
[129] https://www.sbert.net/
[130] https://github.com/facebookresearch/faiss
[131] https://www.pinecone.io/
[132] https://haystack.deepset.ai/overview/intro
[133] https://www.sbert.net/examples/domain_adaptation/README.html#adaptive-pre-training
[134] https://huggingface.co/sentence-transformers/paraphrase-multilingual-mpnet-base-v2
[135] https://en.wikipedia.org/wiki/Unsupervised_learning
[136] https://arxiv.org/abs/2104.06979
[137] http://yann.lecun.com/exdb/publis/pdf/hadsell-chopra-lecun-06.pdf

Hardware, Software and Staffing level are not subject to fundamental changes compared to the microservice assisted assignment of responsibilities and can be implemented in the same way.

At the data architecture level, the objective is to support the data-centric approach with the help of the architecture. This means, for example, that there is only one single source of truth (SSOT) in which all data is always up to date. The SSOT involves the creation of a single data model that is used by all users and associated information systems. Using a single project-wide data source eliminates isolated data repositories created by information systems and their associated data sources and structures, thus avoiding multiple data instances. An appropriate infrastructure for realizing the data-architecture is provided by the hosting platforms mentioned above, such as Amazon Webservices, Microsoft Azure or Google. With the flexible solutions of these service providers, all different data requirements can be handled individually. Structured data that changes little has different requirements than frequently changing data with many accesses. All of these service providers have a repertoire of extensive database systems, to handle these different requirements[138]. If the demand for on-premise solutions is desired, the free PostgreSQL[139] management system, which is a community-based open source database management system, should be considered. With PostgreSQL all SQL related requirements can be realized without leaving the in-house hardware.

Microservice - eSIS Interface

The eSIS Interface is a simple interface to provide the necessary data from the presidential department to the senate chancellery and vice versa. This includes notifications from the presidential department to the senate chancellery and in return as well as submitting the final answer and additional information to the senate chancellery.

Because three are no models backing up this microservice, we don't need to define a model and data level for this microservice.

At hardware level this microservice is satisfied with low requirements, since only database queries and forwarding take place. The productive environment should be useable with a two Core CPU and 32 GB of RAM with no graphic card.

At the software level the microservice should run with a docker container and python installed.

At the staffing level the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Special Matter Expert: Is a person who has accumulated knowledge in a particular field or topic and is familiar with the process and information processed and is responsible for labeling the data and giving business feedback
- Backend Developer: To extend IDM backend. PostgreSQL and Python skills are required

At the data architecture level, the SSOT would be the IDM database and IDM archive database. The eSIS Interface will pull and push information from and to the SSOT.

[138] https://aws.amazon.com/de/products/databases/
[139] https://www.postgresql.org

Senate printed matter coordination (Senatsdrucksachenabstimmung)

This chapter describes the technical to-be situation and its underlying components as well as their technical implications for the to-be process senate printed matter coordination (Senatsdrucksachenabstimmung).

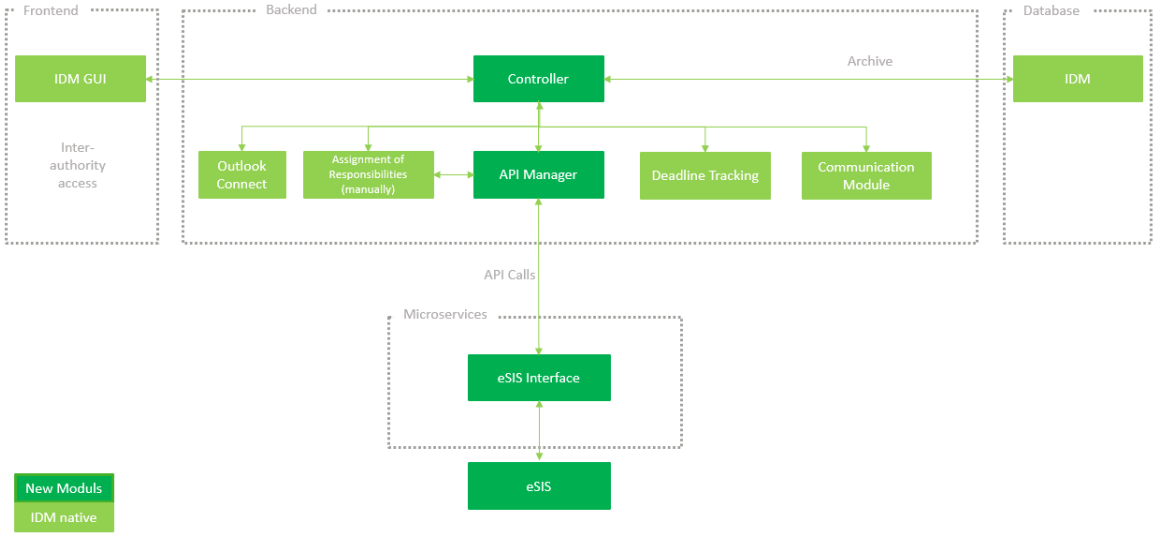
For the brief written inquiries, the preferred alternative that resulted from the Business Case analysis (see Deliverable 5) is alternative 2. This alternative foresees the implementation of an already existing process management tool, the IDM tool (Intelligent Dialogue Management), whereby the tool is equipped with further functionalities. Hamburg's internal steering group decided against the use of artificial intelligence in this use case. The following functionalities have been agreed upon:

- A **central access channel (dashboard)**
- **Assignment of responsibilities (manually)**
- **Archiving functionality** of information that arise within the process (e.g. statements of the involved authorities, finalized printed matter and process meta information)
- **Monitoring** and
- **Deadline tracking**
- **Comment and communication** functions
- **Inter-authority access**
- **eSIS Interface**

To-be infrastructure

The following figure provides an overview of the to-be technical infrastructure for the process brief written inquiries.

Figure 58: To-be infrastructure for the process senate printed matter coordination



Source: Deloitte (2022)

Like in the brief written inquiries use case the senate printed matter coordination use case also build on the existing IDM tool. This is extended in particular by a controller that manages the various existing and new functionalities. The IDM tool database, an adapted version of the IDM frontend, the manual assignment of responsibilities module, the deadline tracking module and the communication module will remain and are called main functions.

IDM main functions

The IDM main functions are the same as those of the process brief written inquiries. A detailed list of the **hardware, software, data architecture and staffing layers** can be found in the respective chapterIDM main functions.

Analogous to the brief written inquiries, **inter-authority access** for the IDM frontend will be added as a new functionality, as well as the previously elaborated **API manager** and a **backend controller**, which in the case of the senate print matter coordination will serve the e**SIS interface** instead of multiple microservices. The backend controller should preferably be implemented in the backend language of choice, for example in Python. The API Manager can either be developed in-house to be perfectly integrated into the

environment, or a commercial API management tool can be used. For further technical details and advantages of the microservice approach please look at the previous chapter brief written inquiries in which this is explained in more detail and analog in this use case.

Microservice - eSIS Interface

The eSIS Interface is a simple interface to provide the necessary data from the presidential department to the senate chancellery and vice versa. This includes the report of the printed matter from the presidential department to the senate chancellery as well as the other way around . E.g. as soon as the printed matter is placed on the agenda of the Senate Chancellery (Senatskanzlei), the initiated authority is informed about this via the IDM tool interface.

Because there are no models backing up this microservice, we don't need to define a **model and data level** for this microservice.

The **hardware level** this microservice is satisfied with low requirements, since only database queries and forwarding take place. The productive environment should be useable with a two Core CPU and 32 GB of RAM with no graphic card.

At the **software level** the microservice should run with a docker container and python installed.

At the **staffing level** the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Special Matter Expert: Is a person who has accumulated knowledge in a particular field or topic and is familiar with the process and information processed and is responsible for labeling the data and giving business feedback
- Backend Developer: To extend IDM backend. PostgreSQL and Python skills are required

At the **data architecture level** the SSOT would be the IDM database. The eSIS Interface will pull and push information from and to the SSOT.

Imputing procedure (Imputing-Verfahren) - BohrIS

This chapter describes the technical to-be situation and its underlying components as well as their technical implications for the to-be process BohrIS.

For the process BohrIS, the preferred alternative that resulted from the Business Case analysis (see Deliverable 5) is alternative 3. This alternative foresees a workflow management tool such as the DM tool (Intelligent Dialogue Management) or "Modul F", whereby the tool is equipped with further functionalities, including imputing, completeness, and plausibility checks with artificial intelligence support. The following functionalities have been agreed upon:

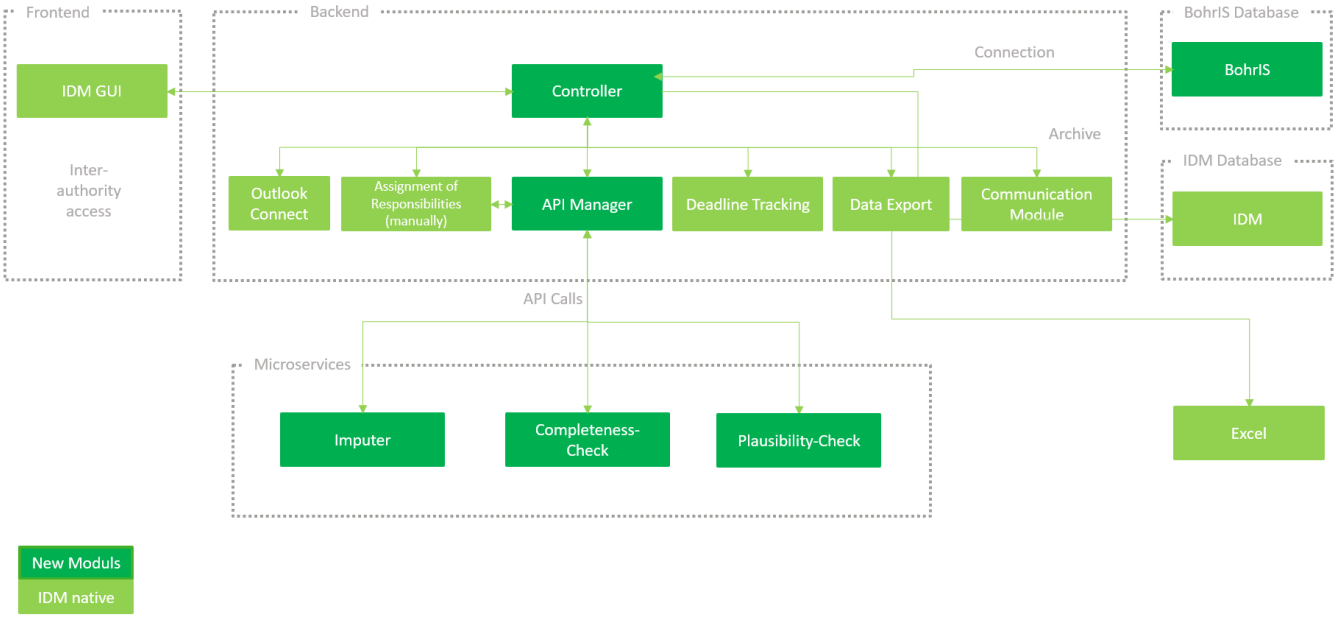
- A **central access channel (dashboard)**
- **Assignment of responsibilities (manually)**
- **Archiving functionality** of information that arise within the process (e.g., Drilling notification according to §§50, 127 Federal Mining Act, §8 Geological Data Act and §49 Federal Water Act; Drilling log, drilling profile and bore log for the technical data as well as location plan as well as process meta information like deadlines etc.)
- **Monitoring**
- **Deadline tracking**
- **Comment and communication** functions
- **Inter-authority access**
- **Imputer**
- **Completeness check**
- **Plausibility check**

To-be infrastructure

The following figure provides an overview of the to-be technical infrastructure for the BohrIS process.

Like in the two use cases before the imputing procedure use case also build upon the existing IDM tool or "Modul F". The workflow management tool will then be extended by a controller that manages the various existing and new functionalities. The IDM tool database, an adapted version of the IDM frontend, the manual assignment of responsibilities module, the deadline tracking module and the communication module.

Figure 59: To-be infrastructure for BohrIS (imputing procedure)



Source: Deloitte (2022)

IDM main functions

The IDM main functions are the same as those of the previous two procedures process brief written inquiries and senate printed matter coordination. A detailed list of the **hardware, software, data architecture and staffing layers** can be found in the chapter brief written inquiries IDM main functions.

Analogously to the brief written inquiries, **inter-authority access** for the IDM frontend will be added as a new functionality. Furthermore, a newly introduced **API manager** is controlled by the **backend controller**, which ensures that all interfaces (the imputer, completeness check and the plausibility check) can be provided. The backend controller should preferably be implemented in the backend language of choice, for example in Python. The API Manager can either be developed in-house to be perfectly integrated into the environment, or a commercial API management tools can be used.

For further technical details and advantages of the microservice approach please look at the previous chapter brief written inquiries in which this is explained in more detail and analog to this use case.

Microservice – completeness check

The completeness check verifies that no entries in the submission process steps are missing. An example is the automated standard mail sent to the mailbox bohranzeigen@bukea.hamburg.de from Norddeutsche Bohranzeige (NOBO). Here, basic information about new drilling projects is transmitted using PDF, XML and XSD format. Typical data fields would be the BID (drilling identification), the location of the drill, the district, the parcel, drilling start date as well as coordinates, etc. In the picture below an example PDF of a NOBO transmission is shown. In the first drilling project the parcel (Flurstück) is not specified and in the second drilling project the parcel is specified. Such missing values would be targeted by the completeness check and raise a notification.

Figure 60: Screenshot 1 of a data extract from the BohrIS database

BID (Bohrungsidentifikation):	2325H10050
Blattnummer der TK25:	2325
Standort - Straße, Hausnr.:	Brückwiesenstraße 8
Standort - PLZ, Ort:	22453 Hamburg
Gemarkung:	Groß-Borstel
Flurstück:	
Gemeinde:	Hamburg, Freie und Hansestadt
Landkreis:	Hamburg, Freie und Hansestadt
Koordinaten (EPSG: 4647):	32564048,34 / 5940238,82
Bohrungsname:	Groß Borstel-1
Bohrstrecke [m]:	100
Bohrbeginn:	04.11.2020
Art des Vorhabens:	Erdwärmesonde
Bohrverfahren:	Drehspülbohrung [Rotationsspülbohrung]
Bohrzweck:	Erdwärmegewinnung
Bohrdurchmesser [mm]:	160
Bemerkung:	

Vertraulichkeit:	Die Bohrergebnisse sind für Dritte unmittelbar freigegeben.

BID (Bohrungsidentifikation):	2325H10051
Blattnummer der TK25:	2325
Standort - Straße, Hausnr.:	Brückwiesenstraße 8
Standort - PLZ, Ort:	22453 Hamburg
Gemarkung:	Groß-Borstel
Flurstück:	1073
Gemeinde:	Hamburg, Freie und Hansestadt
Landkreis:	Hamburg, Freie und Hansestadt
Koordinaten (EPSG: 4647):	32564044,46 / 5940234,26
Bohrungsname:	Groß Borstel-2
Bohrstrecke [m]:	100
Bohrbeginn:	05.11.2020
Art des Vorhabens:	Erdwärmesonde
Bohrverfahren:	Drehspülbohrung [Rotationsspülbohrung]
Bohrzweck:	Erdwärmegewinnung
Bohrdurchmesser [mm]:	160
Bemerkung:	

Source: Geological State Office, City of Hamburg (2022)

At the **model level**, we are in a rule-based system. If a previously defined field is missing, a definition would be made as to whether it is optional or mandatory. If optional fields are missing, a yellow notification would follow, if mandatory fields are missing, a red notification would occur. The **data** necessary to create the

completeness checks are more than adequately fulfilled by the **dataset**. The database contains several thousand entries of wells and about 5000 new records are added annually.

Microservice – plausibility check

The plausibility check module provides the possibility to check the delivered data for plausibility. This can be done either based on a rule-based approach or an AI module (**model level**). Which approach is more suitable must be checked in the context of the supplied data. For a first implementation rule-based models will do fine and can be extended by AI modules. Both methodologies can also be used simultaneously side by side for different checks. The **data** will also be checked manually for correctness afterwards in terms of content. The data necessary to create the plausibility-checks is more than adequately fulfilled by the **dataset** with several thousand records in the database.

To give an example, the automated submission to the mailbox bohranzeigen@bukea.hamburg.de from Norddeutsche Bohranzeige (NOBO) contains a PDF and an XML file that has the following information, shown in the figure below, in it. One can see that the E-mail address for the "Auftraggeber", highlighted in yellow, is a dummy E-mail. The completeness check will pass with no notification, but the plausibility check can raise a notification based on rules detecting dummy E-mail addresses. Other examples could be, that the address is no valid address because the zip code doesn't align with the city name or the "Bohrdurchmesser" of 160 millimeters and the "Bohrstrecke" of 100 meters in figure 6 doesn't lie in the expected range.

Figure 61: Screenshot 2 of a data extract from the BohrIS database

Anzeige eines Bohrvorhabens
- Pdf-Ausdruck für die Unterlagen des Anzeigenden -

erstellt durch
Norddeutsche
Bohranzeige Online

07.10.2020

Bohrfirma:

Name:	CST-Erdenergie, Carsten Stawaritsch
Straße:	Steinweg 5
PLZ, Ort:	27801 Dötlingen
Telefon:	04432 / 918630
E-Mail:	info@cst-erdenergie.de

Auftraggeber:

Name:	Markwardt, Ulrike und Kaufholt, Jochen
Straße:	Straßenbahnring 37
PLZ, Ort:	20251 Hamburg
Telefon:	04261 848801
E-Mail:	unbekannt@unbekannt.de

Beratende Firma:

Name:	CST-Erdenergie, Carsten Stawaritsch
Straße:	Steinweg 5
PLZ, Ort:	27801 Dötlingen

Source: Geological State Office, City of Hamburg (2022)

Microservice – Imputer

The imputer module provides the possibility to impute missing values recognized from the completeness check or annotated as missing manually by hand. To give an example, the missing value for "Flurstück" in the first drilling project in figure 6 can be filled / imputed by a rule-based imputer because the address information in conjunction with a cadaster can automatically derive this information. Another example would be to impute a missing "Bohrdurchmesser" based on other information given like "Bohrstrecke" or "Bohrverfahren" with a machine learning based imputing method.

Within the **model layer** of the imputer we can use rule based imputing and imputing based on machine learning. The methods used to impute via machine learning are the multivariate imputation by chained equations (MICE) [140]imputer and the KNN Imputer[141], both implementable in python with the package

[140] https://arxiv.org/abs/2203.00087 - Using Multivariate Imputation by Chained Equations to Predict Redshifts of Active Galactic Nuclei
[141] Olga Troyanskaya, Michael Cantor, Gavin Sherlock, Pat Brown, Trevor Hastie, Robert Tibshirani, David Botstein and Russ B. Altman, Missing value estimation methods for DNA microarrays, BIOINFORMATICS Vol. 17 no. 6, 2001 Pages 520-525.

scikit-learn. The **data** necessary to create the machine learning based imputation is more than adequately fulfilled by the **dataset** with several thousand records in the database.

The **data architecture layer** as well as **the hardware layer, the software layer and the staffing** can be described aggregated for all microservices.

The **data architecture layer** from BohrIS is driven by an Oracle database[142]. Also, a PostGIS[143] implementation is added to support geographic objects to the object-relational database. The BohrIS database can be connected to the IDM tool via interface to pull and push information. The main IDM Tool database, like in previous procedures, can be a SQL based database and powers all microservices.

The **hardware layer** for all three microservices can be handled with one machine with 6 CPU Cores (~3.3 GHz), 64 GB RAM with no graphic card.

At the **software layer a** setup with an Ubuntu 20.04 LTS or Ubuntu 18.04 LTS as operating system with anaconda environment, docker and python installed and with internet access is required. The microservice should run on docker containers on one machine.

At the **staffing level** the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Data Scientist: Main area of expertise is the training of the models, with a focus on developing appropriate statistical models and algorithms
- Data Analyst: Data analysts specialize in the pre-processing and collection of data. They usually have a good understanding of databases and data visualization
- Special Matter Expert: Is a person who has accumulated knowledge in a particular field or topic and is familiar with the process and information processed and is responsible for labeling the data and giving business feedback
- Machine Learning engineer focuses on deploying machine learning products, test set-up, releases and monitoring
- Frontend/backend Developer: Is responsible for writing APIs and the necessary extensions in the IDM front- and backend

[142] Oracle Database is a multi-model database management system produced and marketed by Oracle Corporation. It is a database commonly used for running online transaction processing, data warehousing and mixed database workloads.
[143] PostGIS is an open source software program that adds support for geographic objects to the PostgreSQL object-relational database. PostGIS follows the simple features for SQL specification from the Open Geospatial Consortium. Technically PostGIS was implemented as a PostgreSQL external extension.

Info boxes (Infoboxen)

This chapter describes the technical to-be situation and its underlying components as well as their technical implications for the to-be process info boxes (Infoboxen).

For the process info boxes, the preferred alternative that resulted from the Business Case analysis (see Deliverable 5) is alternative 3. This alternative foresees the IDM workflow management tool, whereby the tool is equipped with further functionalities, including artificial intelligence. The following functionalities have been agreed upon:

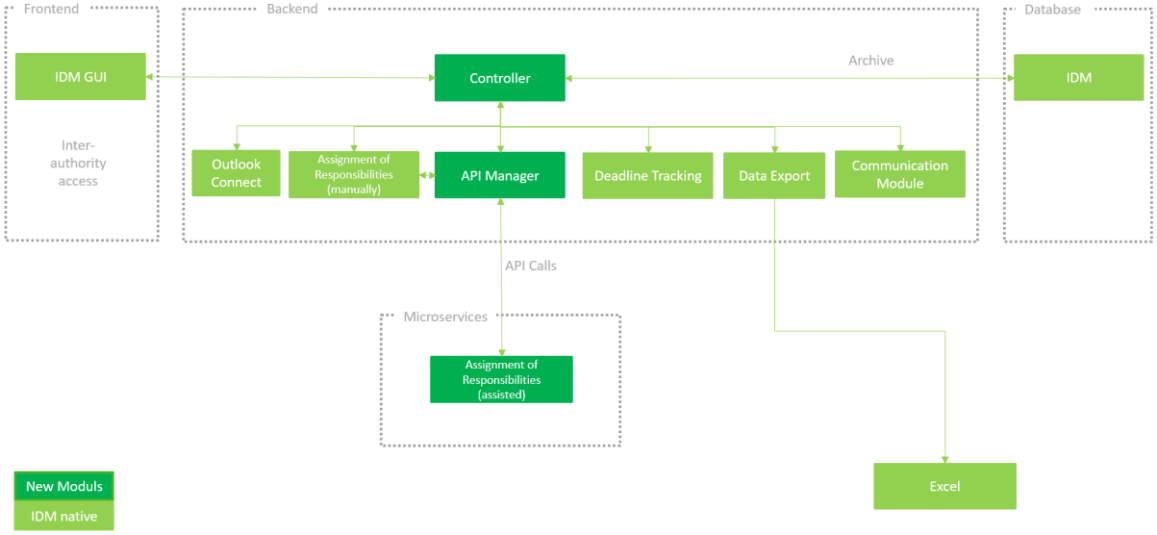
- A **central access channel (dashboard)**
- **Assignment of responsibilities (manually)** and
- **Assignment of responsibilities (assisted**; supported by a AI forwarding assistant**)**
- **Archiving** the received messages
- **Monitoring** and
- **Deadline tracking**
- **Comment and communication** functions
- **Inter-authority access**
- **Data export**

To-be infrastructure

The following figure provides an overview of the to-be technical infrastructure for the info boxen.

Like in the previous use cases the info boxes use case also builds on the existing IDM tool. This is extended by a controller that manages the various existing and new functionalities. The IDM tool database, an adapted version of the IDM frontend, the manual as well as the assisted assignment of responsibilities module, the deadline tracking module and the communication module.

Figure 62: To-be infrastructure for the process info boxes (Infoboxen)



Source: Deloitte (2022)

IDM main functions

The IDM main functions are similar to the previously described use cases. A detailed list of the **hardware, software, data architecture and staffing layers** can be found in the respective chapters.

Analogous to the previously described use cases**, inter-authority access** for the IDM frontend is added as a new functionality, as well as the already elaborated **API manager** and a **backend controller** serving the **assisted assignment module** instead of multiple microservices in the case of info boxes. The backend control should preferably be implemented in the backend language of choice, e.g. Python. The API manager can either be developed in-house to integrate perfectly into the environment, or a commercial API management tools can be used. More technical details and benefits of the microservice approach can be

found in the previous chapter brief written inquiries, where this is further explained and analogous to this use case.

Microservice – Assignment of responsibilities (assisted)

At the **model and data level**, function assignment of responsibilities (assisted) is a traditional algorithm for classifying text in natural language processing with multiclass predictions, where the current state of the art is models with transformer architecture that can yield great results with limited labeled data. The **data** available to create the assignment of responsibilities (assisted) is not sufficient to train the models. Due to General Data Protection Regulation (GDPR)[144] right now there is no permanent storage and no archive of the data in place. All data is stored only temporarily for one month. This leads to the conclusion, that traditional state of the art models like DeBERTa can only be trained after collecting more data. The preferred solution could be to train few shot learning models like setfit, which achieve better results with less labeled data and start collecting more data under GDPR conform circumstances.

Further elaboration of the respective **software level**, **hardware level**, as well as the **staffing label** can be found in the preceding chapter of the brief written inquiries use case.

[144] https://gdpr-info.eu/

Knowledge management (Wissensmanagement)

This chapter describes the technical to-be situation and its underlying components as well as their technical implications for the to-be process knowledge management (Wissensmanagement).

For the knowledge management process, the preferred alternative that resulted from the Business Case analysis (see Deliverable 5) is alternative 3. This alternative foresees the IDM workflow management tool, whereby the tool is equipped with further functionalities, including artificial intelligence. The following functionalities have been agreed upon:

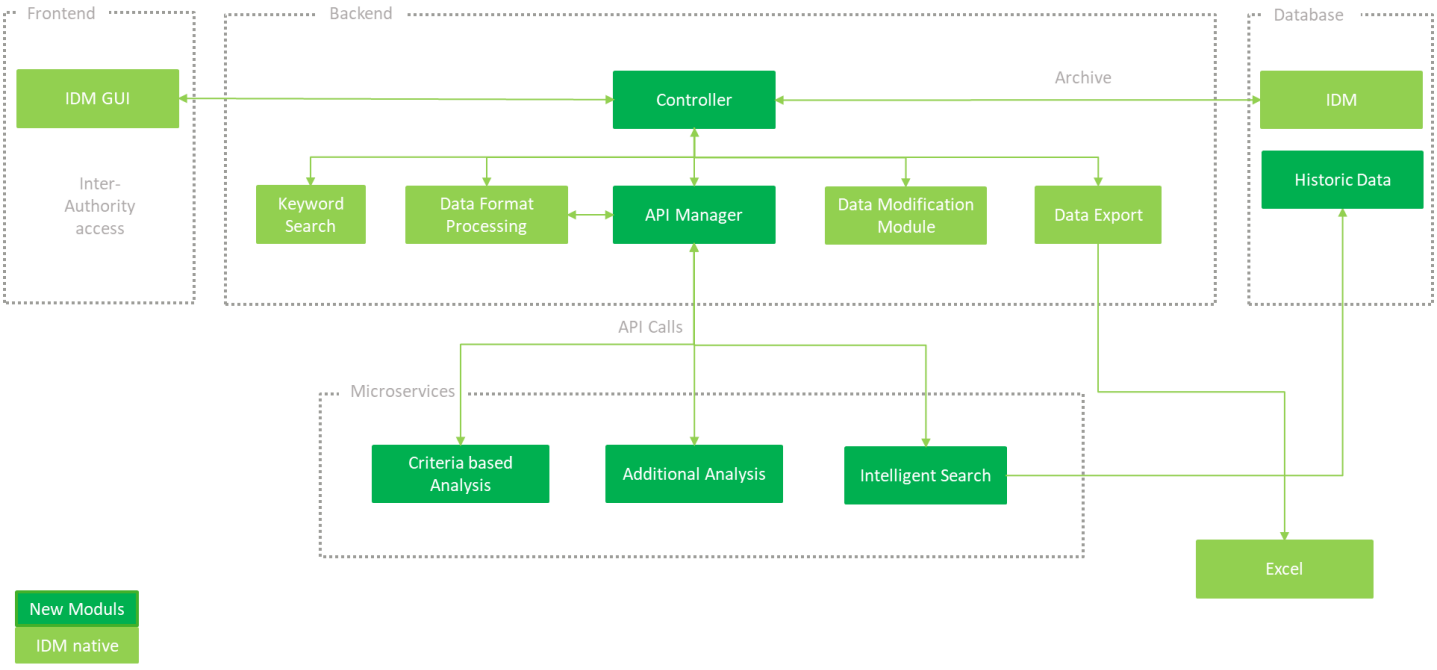
- A **central access channel (dashboard)**
- **Data format processing**
- **A data modification module**
- **Archiving** of all data provided by any department
- **Inter-authority access**
- **Data export**
- **Intelligent search**
- **Criteria based analysis and additional analysis**

To-be infrastructure

The following figure provides an overview of the to-be technical infrastructure for the knowledge management process.

Like in all previous use cases the knowledge management use case also builds on the existing IDM tool. This is extended by a controller that manages the various existing and new functionalities. The expanded functionalities are a customized version of the IDM frontend, keyword search, the data format processing module, the data modification module, and the microservice-based modules for criteria-based analysis, additional analysis, and intelligent similarity search.

Figure 63: To-be infrastructure for the knowledge management process



Source: Deloitte (2022)

IDM main functions

The IDM main functions are similar to the previously described use cases. A detailed list of the **hardware, software, data architecture and staffing layers** can be found in the respective chapters.

Analogous to the previously described use cases**, inter-authority access** for the IDM frontend is added as a new functionality, as well as the already elaborated **API manager** and a **backend controller** serving the **assisted assignment module** instead of multiple microservices in the case of info boxes. Similar to the previously described use cases, the backend controller should preferably be implemented in the chosen

backend language, for example, python. The detailed preference of the API manager is described in more detail in the previous chapters.

Microservice – Intelligent Search

Intelligent search has also been elaborated in considerable depth in the use cases described previously and should be implemented accordingly when realizing the knowledge management use case.

Microservice – Criteria Based Analysis & Additional Analysis

The **criteria-based and additional analysis** module provides the possibility to create further analyses based on the historical database of the knowledge management process. These analyses can contain, for example, clustering of text documents based on topics via topic modelling[145] (models would be BERTopic[146] and HDBSCAN[147]) and exploratory data analysis (EDA)[148] about the size of the stored documents, the extensions (*.pdf, *.xlsx, *.docx, *.jpeg etc.) or meta data of the files. Through these analyses, an overview of the use and data basis of the knowledge management process can be obtained and are presented in a graphical or a tabular form. Illustrative analyses could be a distribution analysis via histograms[149] of the extensions or a time series analysis of the added documents over time.

These additional analyses will not be deployed directly for the time being but can be added to the dashboard afterwards at any time.

The **data architecture layer** as well as **the hardware layer, the software layer and the staffing** can be described aggregated for all microservices.

The **data architecture layer** from the knowledge management process is driven by an Oracle database. Also, a PostGIS implementation is added to support geographic objects to the object-relational database. The database can be connected to the IDM tool via an interface to pull and push information. The main IDM Tool database, like in previous procedures, could be an SQL based database and powers all microservices.

The **hardware layer** for all microservices can be handled with one machine with 6 CPU Cores (~3.3 GHz), 64 GB RAM with no graphic card.

At the **software layer** a setup with an Ubuntu 20.04 LTS or Ubuntu 18.04 LTS as operating system with anaconda environment, docker and python installed and with internet access is required. The microservice should run on docker containers on one machine.

At the **staffing level** the following profiles are needed (they are not disjunct, so one person can unite different profiles):

- Data Scientist: Main area of expertise is the training of the models, with a focus on developing appropriate statistical models and algorithms
- Data Analyst: Data analysts specialize in the pre-processing and collection of data. They usually have a good understanding of databases and data visualization
- Special Matter Expert: Is a person who has accumulated knowledge in a particular field or topic and is familiar with the process and information processed and is responsible for labeling the data and giving business feedback
- Machine Learning Engineer: Focuses on deploying machine learning products, test set-up, releases and monitoring
- Frontend/backend Developer: Is responsible for writing APIs and the necessary extensions in the IDM front- and backend

Conclusion

The detailed analysis regarding specific legal, organisational and technical implications for the five selected to-be processes shows that the **four processes** brief written inquiries (Schriftliche Kleine Anfragen), senate

[145] In statistics and natural language processing, a topic model is a type of statistical model for discovering the abstract "topics" that occur in a collection of documents. Topic modeling is a frequently used text-mining tool for discovery of hidden semantic structures in a text body.
[146] https://github.com/MaartenGr/BERTopic
[147] https://arxiv.org/abs/1911.02282 - A Hybrid Approach To Hierarchical Density-based Cluster Selection
[148] Exploratory Data Analysis (EDA) is an approach to analyze the data using visual techniques. It is used to discover trends, patterns, or to check assumptions with the help of statistical summary and graphical representations.
[149] https://en.wikipedia.org/wiki/Histogram - A histogram is an approximate representation of the distribution of numerical data.

printed matter coordination (Senatsdrucksachenabstimmung), the imputing procedure (BohrIS process) and the knowledge management process (Wissensmanagement) have good preconditions to implement the respective to-be models. This entails the implementation of the IDM workflow management tool (or, in the case of the imputing procedure BohrIS, the “Modul F”) with several core functions and, depending on the process, several microservices, e.g. interfaces to existing databases and/or solutions and features such as the completeness check.

Given the fact that for the process info boxes, no or only a few data samples are currently stored, the foreseen AI forwarding assistant (assignment of responsibilities (assisted)) cannot be trained with traditional methods yet, but the function could be trained with a few shot learning algorithm like setfit. The data necessary to create the assignment of responsibilities (assisted) is, however, not sufficient to train a state of the art model like DeBERTa. Hence, in this case, incoming data (emails from external stakeholders) must in the first place be collected and stored. A phased approach could be taken, implementing the IDM tool first and after sufficient data has been collected, the assignment of responsibilities (assisted) can be trained and implemented. This is under the assumption, that all incoming data is saved in accordance with GDPR compliance.

To-be process models in BPMN format

Executive summary

This document presents the to-be process models in BPMN format as well as their operational implications of the five selected to-be processes:

- Brief written inquiries
- Senate printed matter coordination
- BohrIs (imputing procedure)
- Info boxes
- Knowledge management.

In order to obtain and specify the information for the to-be process models, five stakeholder workshops with the respective process owners were conducted as part of this deliverable. As part of these workshops, details regarding the respective to-be process models and additional aspects regarding the IT architecture were discussed.

Introduction

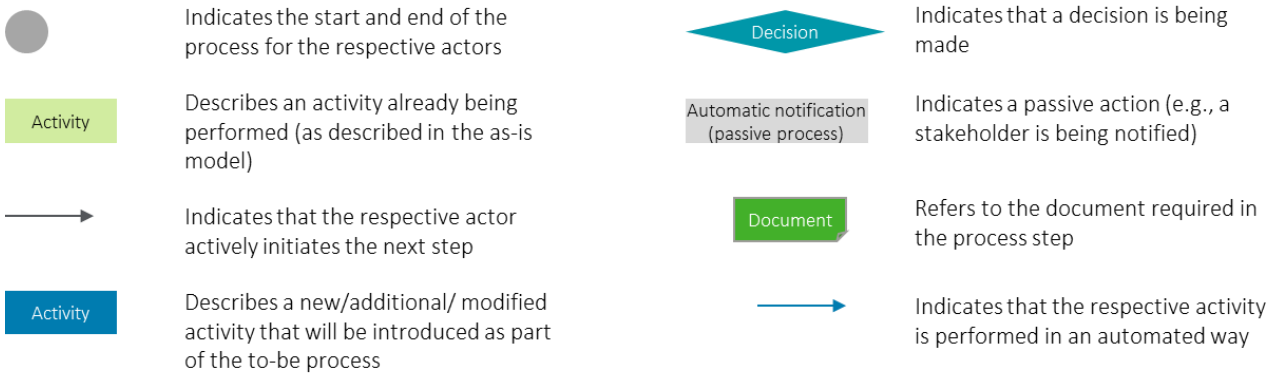
The structure of this document is as follows: for each of the five below-listed processes, the to-be process description including the to-be process model in BPMN format is presented. Thereafter, the respective operational implications for each process are characterised.

The five to-be processes are as follows:

- Brief written inquiries
- Senate printed matter coordination
- BohrIs (imputing procedure)
- Info boxes
- Knowledge management.

The following figure provides an overview of the icons and boxes that were used in this Deliverable to illustrate the to-be process models.

Figure 64: Legend of the to-be BPMN process models



Source: Deloitte (2022)

Please note that all described to-be models in this Deliverable are considered to be suggestions. Before the implementation of the five to-be process models, **further alignments and consultations** should be made with the process owners, although the process owners are not authorised to make the final decisions regarding the to-be processes.

Brief written inquiries (Schriftliche kleine Anfragen (SKA))

Brief written inquiries are inquiries on public matters, which are addressed to the Senate by members of the Parliament. These inquiries are transmitted forthwith to the Senate and are to be answered in writing by the Senate within eight days.

To-be process model

The to-be model of the brief written inquiries correspond to the presented alternative 3 in Deliverable 5 (“Business Case”). This includes the following elements:

- IDM workflow management system (IDM)
- a central access channel
- a forwarding assistant for determining the potentially responsible authorities and offices of the inquiries
- a monitoring and deadline tracking dashboard
- a comment and communication function
- an archive function
- an intelligent search
- inter-authority access
- interface to the eSIS system
- interface to E-mail

The to-be model process steps are shown in blue in the following flowchart, with the IDM tool as the intermediate point. The process steps are described below on the basis of the drawn-in phases. On a superordinate level, the process can be shown in the process flow chart below from the perspective of the

Senate Chancellery (*Senatskanzlei*). As an example, the process within an individual agency can be seen in the following process flow diagram. The process of an individual agency is briefly described below along the following flowchart and phases.

The module of the intelligent search allows for facilitated searches over the already answered inquiries, and thus simplify and accelerate the process, which would be advantageous in such a time-critical process. The access would be implemented as an inter-agency and inter-departmental.

Phase I: Determination of leading authority

The process involves inquiries from members of parliament to the Senate of the City of Hamburg, which is required to respond within a few days. The inquiries of the members of parliament are collected by the office of the citizenry (*Bürgerschaftskanzlei*) and transmitted to the Chancellery of the Senate (*Senatskanzlei*). The latter sends all inquiries to the authorities. The IDM tool notifies the authorities via E-mail of new requests and each presidential department of the authorities decides, which request they would like or need to answer. The objective of this first phase is to decide which authority will take the lead in answering the individual brief written inquiry. The authorities decide among each other via the communication and comment function of the IDM tool and report the outcome to the Senate Chancellery (*Senatskanzlei*), which forwards back the respective written inquiries number and the agenda item via the portal.

Phase II: Response and archiving

The leading presidential department of the authority can submit the responsibilities and deadlines to answer the request and track them via the IDM tool. Through the module for the (assisted) determination of responsibilities, the user receives the potentially responsible authorities or offices determined by the forwarding assistant to answer the respective inquiry.

After collecting the individual answers of the IDM tool, which are transmitted and archived in the IDM tool, the answer of the brief written inquiry is written, the answer is forwarded to the Senate Chancellery (*Senatskanzlei*), which collects all answers, and forwards them to the inquiry committee (*Anfragenkommission*). This commission (*Kommission*)meets on Tuesdays and Fridays. Within the framework of this commission, the state councils (*Staatsräte*) discuss the proposals of the authorities and determine the final version of the response. The Senate Chancellery (*Senatskanzlei*) takes minutes of this meeting and incorporates the discussed changes into the answers and finally forwards them to the office of the citizenry (*Bürgerschaftskanzlei*) in bundled form. The office of the citizenry (*Bürgerschaftskanzlei*), in turn, sends the answered questions to the members of parliament.

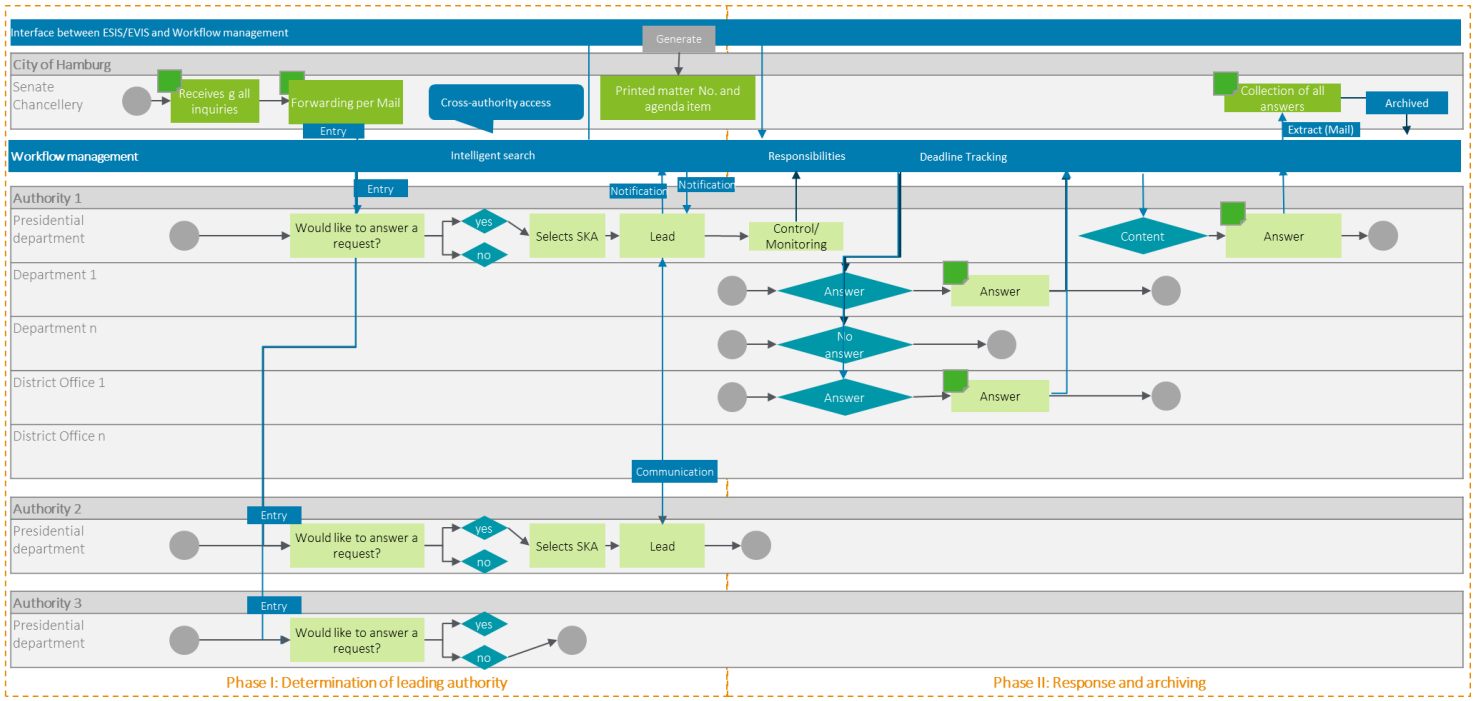
From the perspective of the Senate Chancellery

Currently, the Senate Chancellery (*Senatskanzlei*) is already working with a system for processing such requests. The system currently in place is the eSIS system. The system serves as a database for all SKAs and meetings, allowing to create records with information and master data (e.g. rapporteurs, questioners, etc.). In this system, the collected requests are forwarded to the Senate Chancellery (*Senatskanzlei*) and serves as an interface between the Senate Chancellery (*Senatskanzlei*), the office of the citizenry (*Bürgerschaftskanzlei*) and the City Council (*Bürgerschaft*). The system is used for forwarding the SKA by e-mail, as well as the selection of various mailing lists. In addition, agendas and printed matter numbers can be generated and files can be converted into various formats (e.g. Word to PDF). The minutes are also documented in eSIS.

As part of the to be model, an interface to the IDM tool is established. The Senate Chancellery (*Senatskanzlei*) will continue to work with the eSIS tool, which will transmit requests directly to the IDM tool and vice versa.

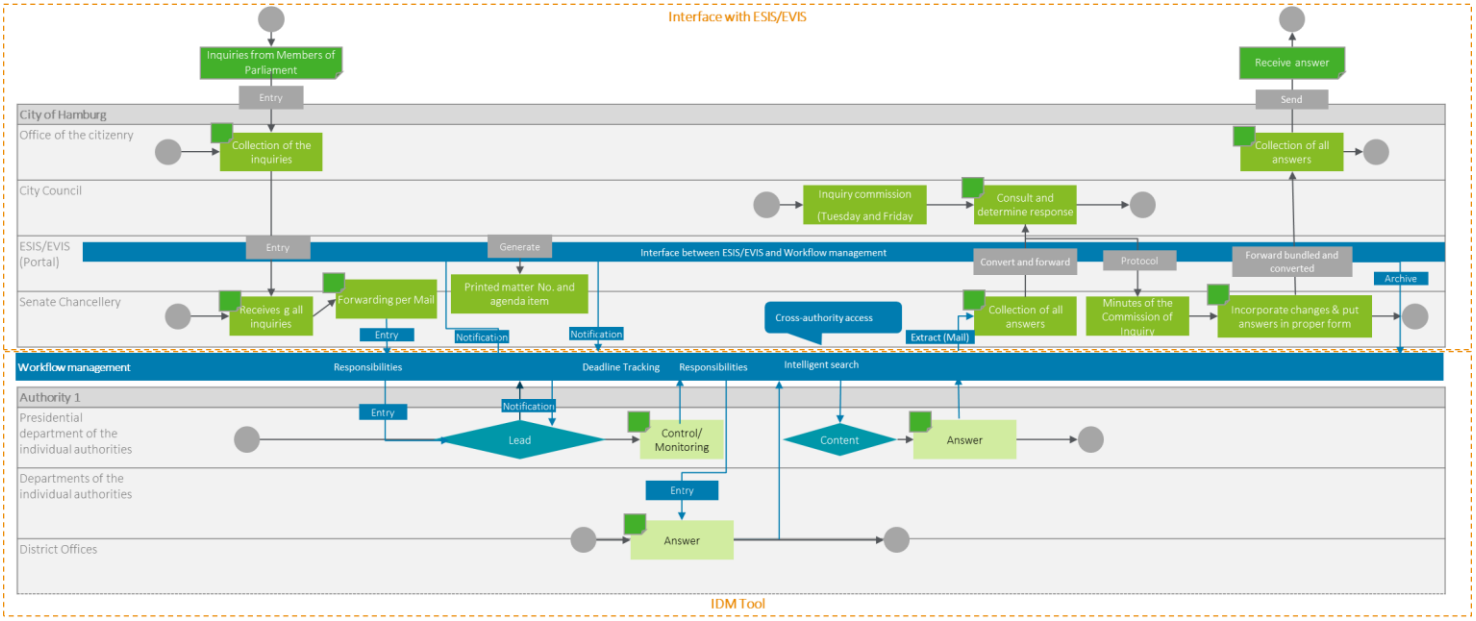
The flowchart shows the differentiation between the use of eSIS and the IDM tool.

Figure 65: To-be business process model SKA - From the perspective of the individual presidential department



Source: Deloitte (2022)

Figure 66: To-be business process model SKA - From the perspective of the Senate Chancellery



Source: Deloitte (2022)

Operational implications

On a process level, the implementation of the to-be process model of the Brief Written Inquiries (Schriftliche kleine Anfragen) would have the following operational implications:

- Given the fact that the SKA process would be processed from the beginning in the workflow management tool – the IDM tool – (excluding the process steps that are processed in the eSIS system and relate to the Senate Chancellery, "*Senatskanzlei*"), the process allows for a **clear overview and transparency**, especially with the dashboard functions.
- The central storage of documents and information as well as their access via the IDM tool allow for a **better and easier cross-authority and cross-department information exchange and coordination**.

The IDM tool further allows to easily integrate additional authorities/departments/units, which, in turn, facilitates the determination of the authority/department/unit that is leading the SKA (has the "*Federführung*") and the coordination between involved authorities (also via the dashboard overview).

- The to-be process model foresees a facilitated forwarding, thereby **streamlining the as-is process for more efficient procedures** (e.g., internal research will be discontinued).
- The intelligent search combined with the assisted assignment of responsibilities allows for a faster determination of the leading authority/department/unit (with "Federführung") as well as of the other involved units. Given the time-criticality of SKAs, a **quick allocation of responsibilities** is particularly important. As a consequence, involved units/departments/authorities have more response time.
- Via an access management (assigning different rights to different involved authorities/departments/units), **sensitive information and personal data can be restricted** to those officers in charge.
- In the best-case scenario and as far as legally possible, forwarded SKAs could be archived in a central storage, thereby **creating a labelled database**[150]which, in turn, can improve the AI model for the assisted assignment of responsibilities. This labelled database can have, as a consequence, **synergy effects on an organisational level given its relevance for other processes** with assisted assignment (e.g. the process Info Boxes).

[150] https://en.wikipedia.org/wiki/Labeled_data - Labeled data is a group of samples that have been tagged with one or more labels. Labeling typically takes a set of unlabeled data and augments each piece of it with informative tags. For example, a data label might indicate whether a text was assigned to person A for an answer.

Senate printed matter coordination (Senatsdrucksachenabstimmung)

Senate printed matters generally deal with matters of principle that are to be regulated by the Senate and require written form. These printed matters are regulated in accordance with the rules of procedure of the Senate of the City of Hamburg and are processed at the working level by the respective responsible departments or units of the authorities of the City of Hamburg. The Senate printed matter coordination process is an exclusively internal administrative process.[151]

For completeness and better understanding we have included the revised as-is process in German in the appendix.

To-be process model

The to-be model for the senate printed matter coordination corresponds to the presented alternative 2 in Deliverable 5 (“Business Case”). This includes the following elements:

- IDM workflow management system (IDM)
- assignment of responsibilities (manually)
- a central access channels
- a monitoring and deadline tracking dashboard
- a comment and communication function
- archiving
- inter-authority access
- interface to E-mail

The to-be model process steps are shown in blue in the following flowchart, with the IDM tool as the intermediate point. The process steps are described below on the basis of the drawn-in phases.

Phase I: Internal coordination of the authority and preparation of the key points of the printed matter

A printed matter is prepared at the request of the respective Authority Directorate (*Behördenleitung*) or the City Council (*Bürgerschaft*), which turns to the respective competent specialized authority within the framework of a citizenship request. The department (or unit) responsible in the respective authority prepares a draft according to this request. In this draft, the contents of the printed matter are outlined/described. In parallel, a so-called "printed matter notice" is sent to the Authority Directorate and the other offices concerned via the IDM tool, with which the contents are roughly outlined and the deadline is communicated and documented in the IDM tool.

Subsequently, the printed matter is first coordinated internally with the other offices concerned or their units / departments via the IDM tool. In suitable cases, the content of the printed matter is also discussed by the lead unit with other authorities and other stakeholders at this stage in the form of key points or in general terms or on specific individual points.

Phase 1 is completed as soon as the draft printed matter has been agreed internally within the authority.

Phase II: Coordination of the printed matter across authorities (statements of other authorities)

When the printed matter has reached a status that it can be coordinated with other authorities, this internally coordinated draft is submitted to the Authority Directorate (*Behördenleitung*) and a request is made to forward this draft, including a deadline for comments, to the other authorities to be involved via the IDM tool

All authorities invited to comment submit their comments via the IDM tool within this deadline.

After receiving the draft with a request for comments, the responsible authority/department checks whether the comments (e.g. in the form of requests for changes) of the authorities involved are incorporated. Thereupon, the unit/department within the responsible authority revises the printed matter.

If the revised version leads to fundamental changes, a second coordination with the authorities involved takes place (however, this is rather the exception).

Subsequently, the revised version of the printed matter is submitted to the responsible Authority Directorate (*Behördenleitung*) via the IDM tool with the request to be allowed to notify this version for

[151] A process description of this process in German can be found in the Annex to this document.

referral to the Senate. The individual statements and comments of the involved authorities are archived in a central database.

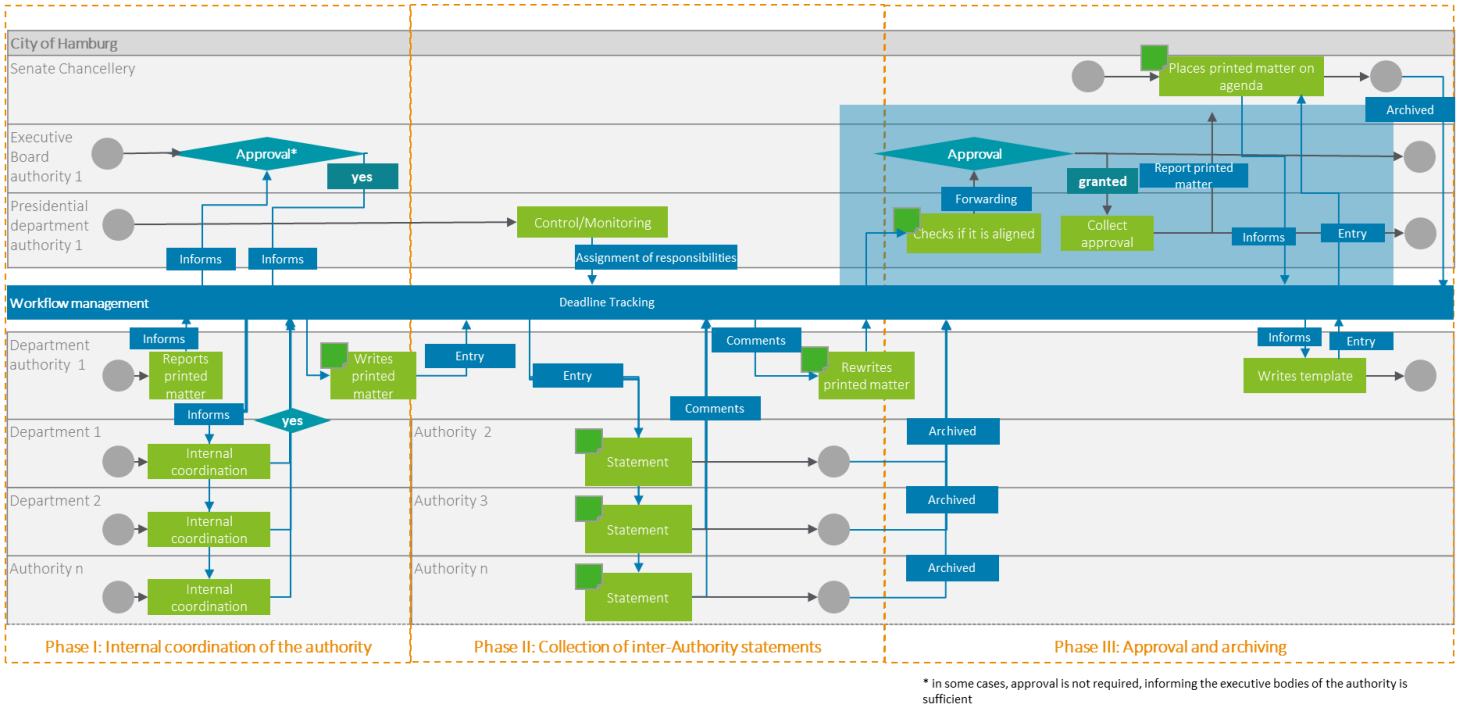
With the assistance of the IDM tool, a central dashboard can be used to track the deadlines and responsibilities.

Phase III: Forwarding to the Senate Chancellery and resolution in the Senate

The presidential department (*Präsidialabteilung*) registers the printed matter with the Senate Chancellery (*Senatskanzlei*), for a meeting date of the Senate. The Senate Chancellery (*Senatskanzlei*), places this printed matter on the Senate agenda. A so-called "wash sheet" (*Waschzettel*) (brief information for the Senate meeting on the printed matter) is then requested from the responsible authority in order to inform the responsible authority management internally about the essential contents of the printed matter.

The statements of the involved authorities as well as the finalized printed matter are **archived** in a central database.

Figure 67: To-be business process model Senate printed matter coordination



Source: Deloitte (2022)

Operational implications

On a process level, the implementation of the to-be process model of the Senate Printed Matter Coordination ("Senatsdrucksachenabstimmung") would have the following operational implications:

- Given the fact that the Senate Printed Matter Coordination process would be processed from the beginning in the workflow management tool – the IDM tool –, the process allows for a **clear overview and transparency**, especially with the dashboard functions. For example, old senate printed matters can be accessed via the dashboard.
- The central storage of documents and information as well as their access via the IDM tool allow for a **better and easier cross-authority and cross-department information exchange and coordination**. The IDM tool further allows to easily integrate additional authorities/departments/units, which, in turn, facilitates the determination of the authority/department/unit that is leading the senate printed matter (has the "*Federführung*") and the coordination between involved authorities (also via the dashboard overview).

- Via an access management (assigning different rights to different involved authorities/departments/units), sensitive information and personal data can be restricted to those officers in charge.

Imputing procedure (Imputing-Verfahren) – BohrIS

The process "Bohranzeigen bearbeiten" (processing of drilling data) is a process that is allocated in the Geological State Office (*Geologisches Landesamt, GLA*) at BUKEA. The responsible unit of the main parts of this process is unit W3 at the GLA. Three process activities are of particular relevance regarding the imputing procedure and will therefore be described in detail in this to-be model, namely

- the completeness check (phase IIa)
- the tracking of incoming drilling data (phase IIb)
- the imputing of missing values (phase III)

These phases are surrounded by the preceding phase 0 and I, the technical review of the drilling data, and the subsequent archiving (part of phase III). Phase 0, phase I and the archiving are the same for both subprocesses.

To-be process model

Substantial parts of this process, in particular those process steps prior to the tracking of incoming drilling data and the completeness check, largely remain unchanged. Therefore, only those process steps of the process "Bohranzeigen bearbeiten" (processing of drilling data) are described in the following that are relevant to the tracking of incoming drilling data and the completeness check. The entire process description can be obtained in Aris ("Bohranzeigen bearbeiten").

The to-be model for the processing of drilling data corresponds to the alternative 3 presented in deliverable 5 ("Business models"). This includes the following elements:

- a workflow management tool (IDM or 'Modul F')*
- an interface between the BohrIS database and the workflow management including export function into the workflow management system
- access of W1 (Wasseramt) to the workflow management (to facilitate the information exchange with W3 regarding specific drillings that involve W1 participation)
- the manual assignment of responsibilities
- a control/monitoring dashboard
- a deadline tracking dashboard
- a comment and communication function
- archiving of the inquiries and the process and response histories in a central database
- an automated completeness check
- imputing of missing values
- an automated plausibility check

*For this process, it may also be possible to deploy another Hamburg internal solution, the "Modul F"[152] instead of using the IDM tool. The possibilities of using the IDM tool and "Modul F" should be examined in-depth in the implementation phase of this project (see Deliverable 8: Roadmap).

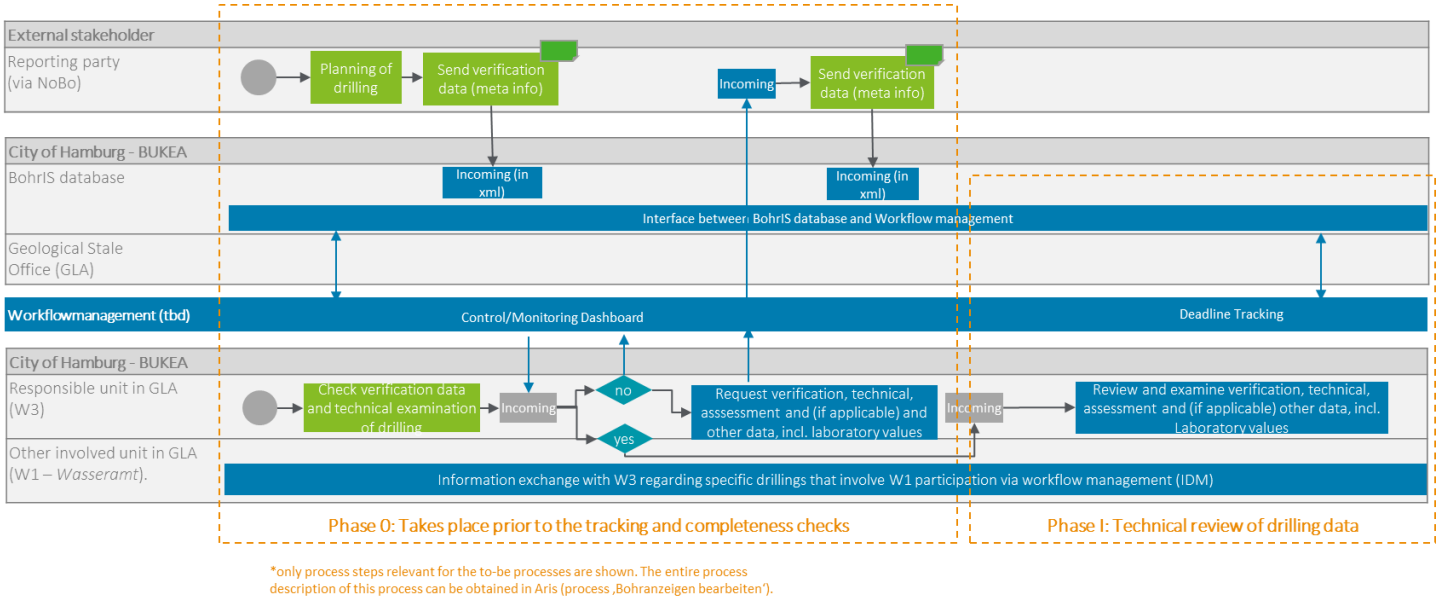
In the process flowcharts below, those activities, functionalities and arrows that are marked in blue are steps/features that will be new as compared to the as-is process (see Deliverable 2).

Phase 0

The Geological State Office operates a database (BohrIS) that collects various data on boreholes carried out in the City of Hamburg. Upfront to these sub-processes, the reporting party who is carrying out the drilling **provides information about the planned drilling via the NoBo portal** (data portal that the City of Hamburg operates together with other neighbouring Federal States) and, if necessary, uploads verification data (meta information) about the drilling via this portal to the BohrIS database. The **responsible department W3 checks the receipt of the verification data and accompanies the drilling professionally** if necessary. If it is not received, the responsible department will request the verification data from the person making the notification via the workflow management.

[152] MODUL-F (Modular Solution for Specialized Procedures) is a platform that provides basic building blocks for the fast and economic development of specialized procedures as well as a space for the resulting specialized procedures.

Figure 68: To-be process model BohrIS process prior to the tracking and completeness check



Source: Deloitte (2022)

Phase I: Technical review of drilling data

After having obtained the drilling data, the first **technical review of the drilling data performed by W3** begins. This entails a review and an examination of the verification (*Nachverfolgungs*-), technical (*Fach*-), assessment data (*Bewertungsdaten*) and (depending on the type of drilling) laboratory values (*Labordaten*). W3 thereby accesses the BohrIS database via the workflow management. In case the drilling data are incomplete and/or values are missing, phases IIa and IIb start.

BohrIS completeness check

This subchapter describes the to-be process of the subprocess completeness check.

Phase IIa: Completeness check

In the case the drilling data are not complete, Phase IIa is initiated. Phase IIa entails a completeness check, i.e. a check whether the drilling data to be handed in is complete and in due time. According to the regulation concerning Geological Data ("Geologiedatengesetz")[153], the deadline for the verification data is 3 months after the end of the drilling, the deadline for technical and assessment data is 6 months after the end of the drilling. With the **deadline tracking** function, an automated comparison of the data to be received and the end date of the drilling based on the indications of the drilling application (*Bohrantrag*) is performed. In case the applicant has indicated via NoBo another end date of the drilling, this date will be taken as a basis for the automated comparison of the deadline.

In the case all data was submitted in due time, the completeness check starts directly. In the case of missing data, W3 can send a **request of the missing data via the workflow management to the applicant**. The applicant then receives a notification and a deadline to deliver the missing data (either upload via NoBo or via email to W3). In case W3 receives this missing data via e-mail, it can upload this data into the BohrIS database.

Thereafter, an **automated completeness check** of the drilling data takes place. The completeness check module automatically checks the received data for completeness by searching for missing values. This module is based on a rule-based approach (see Deliverable 6). In the case missing data is detected, the responsible person in W3 is notified via the IDM tool and can then send a follow-up request to the person

[153] See Bundesministerium der Justiz, Gesetz zur staatlichen geologischen Landesaufnahme sowie Übermittlung, Sicherung und öffentlichen Bereitstellung geologischer Daten und zur Zurverfügungstellung geologischer Daten zur Erfüllung öffentlicher Aufgaben (Geologiedatengesetz). GeoIDG - nichtamtliches Inhaltsverzeichnis (gesetze-im-internet.de)

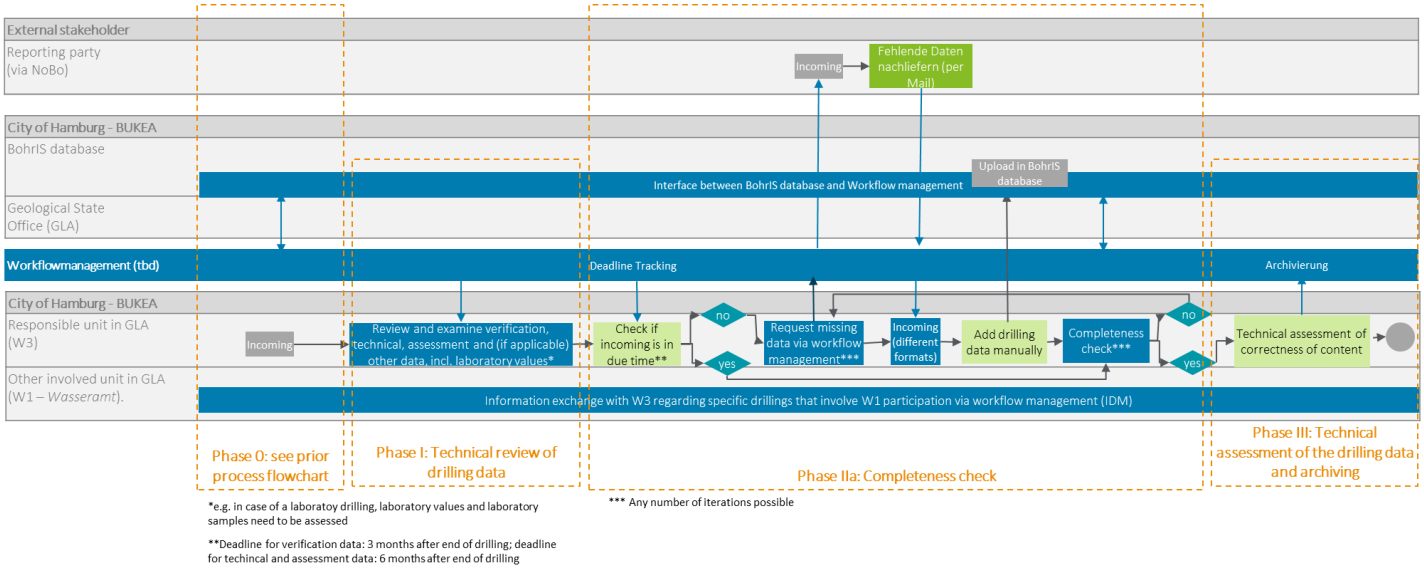
responsible for the data delivery (the applicant). This completeness check can have any number of iterations possible.

Phase III: Technical assessment of the drilling data and archiving

As soon as the completeness check succeeds (all drilling data completed), W3 starts with the **technical assessment**, i.e. the correctness and the technical examination of the drilling data (see also Aris flowchart "Bohranzeigen bearbeiten"). After having completed the technical assessment, W3 can **archive** the drilling data via the workflow management.

The figure below describes the to-be process steps of the completeness check as part of the process "Bohranzeigen bearbeiten".

Figure 69: To-be process BohrIS – completeness check



Source: Deloitte (2022)

BohrIS tracking of incoming drilling data

This subchapter describes the to-be subprocess tracking of the incoming drilling data.

Phase IIb: Tracking of incoming drilling data

In case the drilling data is not complete, the **tracking of incoming drilling data must be initiated according to the Regulation concerning Geological Data ("Geologiedatengesetz")**.[154] The procedure entails a comparison of incoming data with the data prescribed by law, a verification of these data, different escalation levels including reminder writing and sanctioning as well as a manual access to the data.

According to the requirements prescribed in this regulation, the tracking process will **be initiated if the prescribed drilling data are not complete**. Hence, this tracking process takes place largely simultaneously with the completeness check (Phase IIa) as these activities are deeply intertwined.

In case the completeness check reveals that data is missing, W3 initiates the tracking process. In the workflow management, a reminder letter will be created that is sent to the reporting party (applicant) indicating a deadline for the provision of the missing information. With the **deadline tracking** function an automated comparison of the data be received within this deadline is performed.

In case the reporting party does not reply in due time, W3 initiates the **escalation process** that includes various levels of reminder letters and sanctioning via the workflow management.

[154] See City of Hamburg, Geologisches Landesamt, Geologiedatengesetz (GeolDG), Geologiedatengesetz - hamburg.de, for more information.

As soon as the missing data is sent via mail, **W3 can add the data manually into the BohrIS database**. In case the reporting party enters the missing data via NoBo, W3 will be **notified via the workflow management**.

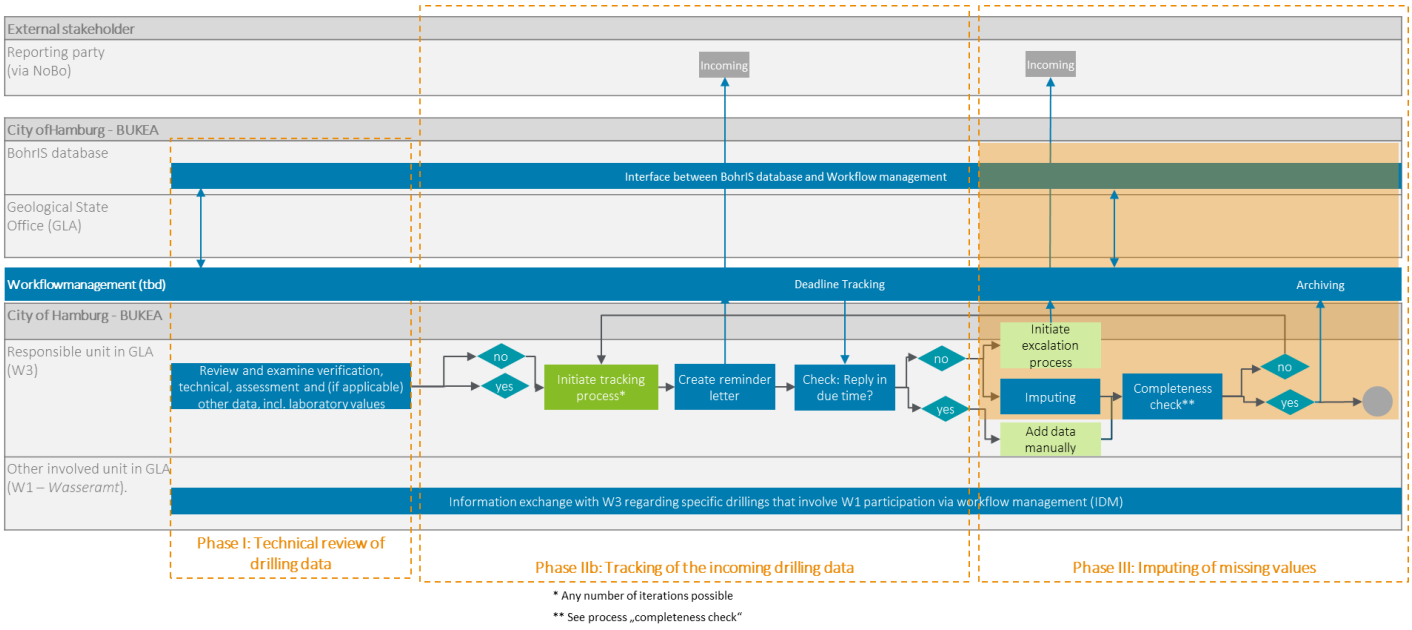
Phase III: Imputing of missing values and archiving

In parallel (or after a certain number of unsuccessful requests to the reporting party), the **missing data can be imputed**. A popular approach to imputing data is to calculate a statistical value for each column (e.g., a mean) and replace all missing values for that column with that statistical value. The imputed values can be an estimate or an implicitly derived value with no uncertainty. This module would be introduced as an **"assisted module".** This means that suggestions for the missing data are displayed, which must be checked and accepted by a responsible person. The **plausibility check** module provides the possibility to check the delivered data for plausibility. This can be done either on the basis of a rule-based approach or an AI module. Which approach is more suitable must be checked in the context of the supplied data. Both methodologies can also be used simultaneously side by side for different checks. The data will be checked manually for correctness in terms of content.

As soon as the completeness check succeeds (all drilling data completed), the process follows as described under phase III: technical assessment of the drilling data and archiving: W3 starts with the **technical assessment**, i.e., the correctness and the technical examination of the drilling data (see also Aris flowchart "Bohranzeigen bearbeiten"). After having completed the technical assessment, W3 can **archive** the drilling data via the workflow management.

The figure below describes the to-be process steps of the tracking of the incoming drilling data as part of the process "Bohranzeigen bearbeiten".

Figure 70: To-be process BohrIS – tracking of the incoming drilling data



Source: Deloitte (2022)

Operational implications

On a process level, the implementation of the to-be process model of the BohrIS process ("*Bohranzeigen bearbeiten*") would have the following operational implications:

- Given the fact that the BohrIS process would be processed from the beginning in the workflow management tool, the process allows for a **central and clear overview and transparency**, especially regarding the **interface to the BohrIS database** via the workflow management tool, the **archiving functionality,** and the **status overview** regarding drillings to be processed.
- The implementation of the to-be process would lead to a **reduction of media breaks** as both the BohrIS database and e-mails from external stakeholders (the reporting parties) can be accessed and processed via the workflow management, thereby increasing efficiency of the overall process.

- The **access of both units W3 and W1 to the workflow management** leads to a quicker information exchange, thereby leading to an **earlier and more prompt initiation of the processing of drillings**. Moreover, any information exchange regarding a particular drilling can be reported and communicated via the workflow management, thereby ensuring **traceability**.
- The **automated comparison of data**, e.g., regarding whether data is handed in in due time or whether drilling data is complete, **substantially increases the efficiency of the overall process and accelerates the workflow**, thereby significantly reducing manual administrative work and freeing up resources for technical assessments and reviews of drilling data.
- Via an access management (assigning different rights to different involved authorities/departments/units), **sensitive information and personal data can be restricted** to those officers in charge.
- The use of imputing can **significantly reduce iterations with the reporting party** (i.e. request for missing values and data) and thereby contributes to facilitate the workflow and reduce overall workload.
- The more the imputing procedures will be used, the better the Machine Learning model, in this case the iterative imputer based on a multivariate imputation by chained equations (MICE) or the KNN Imputer (see descriptions in Deliverable 6) will be trained and the **more effective the imputing results** will be, thereby even more contributing to reduce the overall organisational workload.

Info boxes (Infoboxen)

The process 'info boxes' resides in unit V 213 (Internal Operations) at BSW and represents a collection point for a wide variety of inquiries and requests (e.g. from citizens, applications for tender procedures, awarding, EU inquiries and letters from citizens). The receipt of the inquiries is exclusively a digital receipt via an e-mail inbox. The assignment and forwarding usually takes place on the same day.

To-be process model

The to-be model for the info boxes process corresponds to the alternative 3 presented in deliverable 5 ("Business Case"). This includes the following elements:

- IDM workflow management system (IDM)
- assignment of responsibilities (assisted)
- a central access channels
- a monitoring and deadline tracking dashboard
- a comment and communication function
- archiving
- inter-authority access
- interface to e-mail

Phase I: Inbox and forwarding

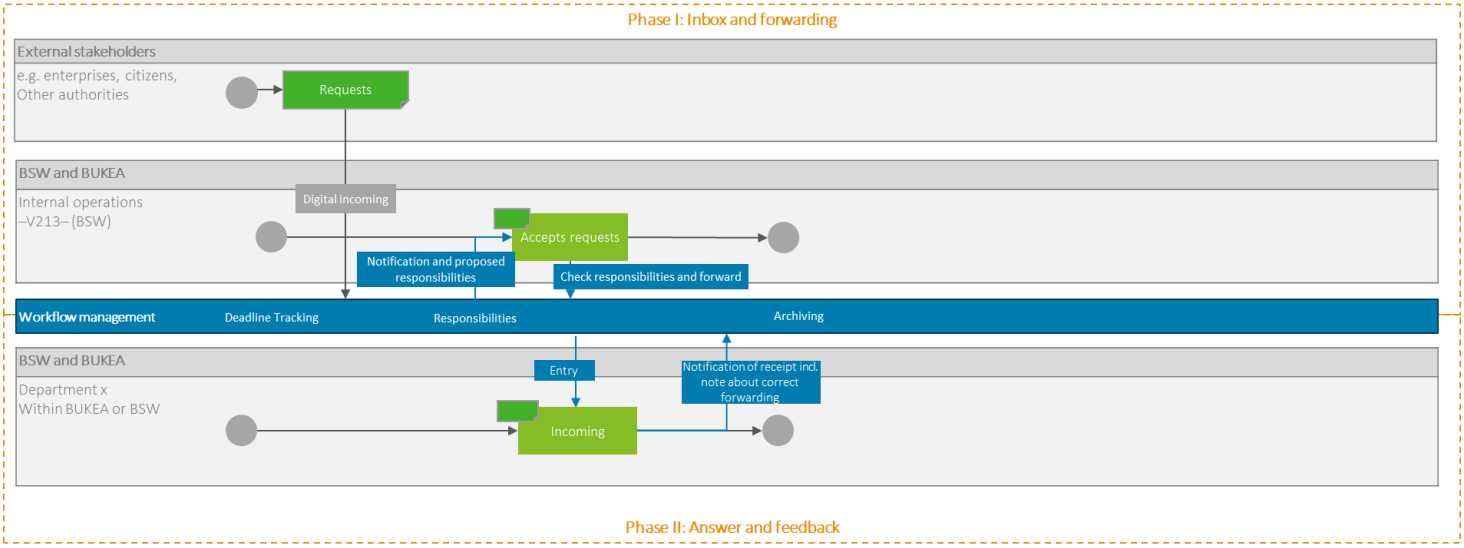
Incoming inquiries and requests are sent to a general e-mail inbox and transmitted to the IDM tool. The IDM tool notifies the administrator of the email inbox in the department V213 with a suggestion for a responsible person to answer the request. The department V213 accepts the request and check the suggested responsibilities. After a responsible department has been identified, the request or inquiry is forwarded to the department via the IDM tool. This offers the possibility of deadline tracking and archiving, as well as facilitating the use of the IDM tool for the upstream process of responding to the request within the department.

Phase II: Answer and feedback

The IDM tool notifies the responsible department of a new incoming request via e-mail. From this point on, the responsible authority can process the request with the help of the IDM tool. In addition, it can be stored in the IDM tool whether the request was forwarded correctly and archive this information together with the request.

Note: Currently, the received and forwarded requests are not archived, which makes it unfeasible to train such a module. The first step would therefore be to create a sufficient database by storing the forwarded emails (see Deliverable 8).

Figure 71: To-be business process model Info boxes



Source: Deloitte (2022)

Operational implications

On a process level, the implementation of the to-be process model of the Info Boxes ("*Infoboxen*") would have the following operational implications:

- Given the fact that the info boxes process would be processed from the beginning in the workflow management tool – the IDM tool – , the process allows for a **clear overview and transparency**, in particular related to the notification of the correct forwarding and the archiving of forwarded incoming requests.
- The central storage of documents and information as well as their access via the IDM tool allow for a **better and easier cross-authority and cross-department information exchange and coordination**. The IDM tool further allows to easily integrate additional authorities/departments/units.
- The to-be process model foresees a facilitated forwarding, thereby **streamlining the as-is process for more efficient procedures** (e.g., internal research will be discontinued).
- Via an access management (assigning different rights to different involved authorities/departments/units), **sensitive information and personal data can be restricted** to those officers in charge.
- In the best-case scenario and as far as legally possible, forwarded incoming requests from external stakeholders could be archived in a central storage, thereby **creating a labelled database** which, in turn, can improve the AI model for the assisted assignment of responsibilities. This labelled database can have, as a consequence, **synergy effects on an organisational level given its relevance for other processes** with assisted assignment (e.g. the process Brief Written Inquiries).

Knowledge management (Wissensmanagement)

The process 'knowledge management' describes a process of storing and accessing information and data via a drive that can be accessed within a unit. This process is allocated in the presidential departments (*Präsidialabteilungen*) at BUKEA and BSW, respectively, but can be found in many other departments of the City of Hamburg as well.

To-be process model

The to-be model for the knowledge management process corresponds to the alternative 3 presented in deliverable 5 ("Business Case"). This includes the following elements:

- Dashboard
- Intelligent search
- archiving
- Inter-authority access

It includes a Dashboard and an intelligent search module. The adapted process steps are shown in blue in the following flowchart and phases, with the dashboard as the intermediate point and the intelligent search module.

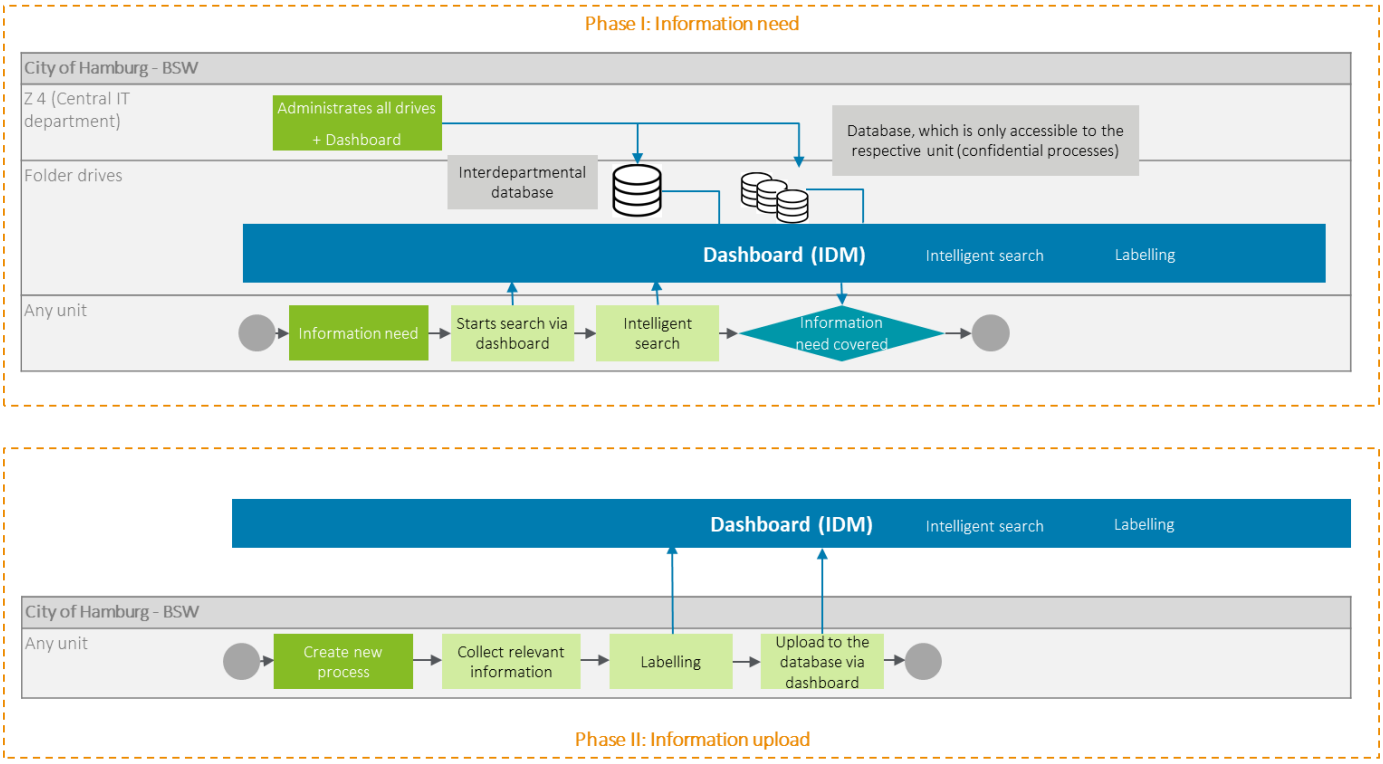
Phase I: Information need

The database and dashboard are administered by Z4. The database allows the processing of all relevant data formats, the modification of data as well as the import and export of data. For confidential processes or information various authorizations and accesses can be assigned. All other information and files can be accessed cross-departmental. In the event of a need for information, the searcher can start the search via the dashboard and the intelligent search, which facilitates and accelerates the search.

Phase II: Information upload

When new data or information is to be provided by any department, the department initiates the process, compiles the relevant information, and uploads it to the database via the dashboard. An important step in this process is the labeling of the data, which allows the intelligent search to be further expanded. This step is done in a specialized labelling environment (see Deliverable 6), where the label can be easily added.

Figure 72: To-be business process model knowledge management



Source: Deloitte (2022)

Operational implications

On a process level, the implementation of the to-be process model of the Knowledge Management ("*Wissensmanagement*") would have the following operational implications:

- Given the fact that the knowledge management process would be processed from the beginning in the workflow management tool – the IDM tool –, the process allows for a **clear overview and transparency**, especially regarding the **central access to the database** via the IDM tool.
- The central storage of documents and information – with different levels of access management rights – as well as their access via the IDM tool allow for a **better and easier cross-authority and cross-department information exchange and coordination**. The IDM tool further allows to easily integrate additional authorities/departments/units and their respective databases.
- The intelligent search allows for a **faster and improved access (in terms of quality and quantity) to required information,** thereby expecting to reduce overall workload of employees that use the intelligent search functionalities.
- Via an access management (assigning different rights to different involved authorities/departments/units), **sensitive information and personal data can be restricted** to those officers in charge.
- It is expected that given the fact that the existing database must be labelled, an **initial one-off workload, depending on the amount of data to be labelled**, would occur.
- Regarding the procedure of labelling, **additional one-off coordination efforts** are expected as departments/units must furthermore **agree internally on the way and modus operandi of labelling** data and documents, e.g., regarding the terminology used, the scope, the quantity of terms used per document.
- When storing new documents, **recurring additional time-efforts related to the labelling** of these documents occur for those employees that create and store these documents.
- The more units/departments use the intelligent search and label their documents/data, the better the AI model will be trained and the more effective the search results will be, thereby even more contributing to reduce the overall organisational workload. In the best-case scenario and as far as legally possible, data from different departments could be stored in a central storage, thereby **creating step by step a labelled database** which, in turn, can improve the AI model (see Deliverable 6).

Annex

Process description Senate Printed Matter Coordination (in German)

Senatsdrucksachenabstimmung

Senatsdrucksachen behandeln in der Regel Grundsatzfragen, die vom Senat zu regeln sind und der Schriftform bedürfen. Diese Drucksachen sind gemäß der Geschäftsordnung des Senats der Stadt Hamburg geregelt und werden auf Arbeitsebene von den jeweils zuständigen Abteilungen bzw. Referaten der Behörden der Stadt Hamburg bearbeitet. Der Prozess Senatsdrucksachenabstimmung ist ein ausschließlich verwaltungsinterner Prozess.

Phase 1: Behördeninterne Koordination und Erstellung der Eckpunkte der Drucksache

Eine Drucksache wird auf Ersuchen der jeweiligen Behördenleitung oder der Bürgerschaft, welche sich an die jeweils zuständige Fachbehörde im Rahmen eines bürgerschaftlichen Ersuchens wendet, erstellt. Die in der jeweiligen Behörde zuständige Abteilung (bzw. das Referat) erstellt nach diesem Ersuchen einen Entwurf. In diesem Entwurf werden die Inhalte der Drucksache umrissen/beschrieben. Parallel geht eine sogenannte „Drucksachenanzeige“ an die Behördenleitung und die anderen betroffenen Ämter, mit der die Inhalte grob umrissen werden und ein Zeitplan mitgeteilt wird.

Anschließend wird die Drucksache zunächst behördenintern mit den anderen betroffenen Ämtern bzw. deren Referaten / Abteilungen abgestimmt. In geeigneten Fällen wird der Inhalt der Drucksache durch das federführende Referat auch bereits in dieser Phase mit anderen Behörden und anderen Stakeholdern in Form von Eckpunkten bzw. allgemeiner Form oder zu bestimmten Einzelpunkten besprochen.

Phase 1 ist abgeschlossen, sobald der Drucksachenentwurf behördenintern abgestimmt wurde.

Phase 2: Behördenübergreifende Abstimmung der Drucksache (Stellungnahmen anderer Behörden)

Wenn die Drucksache einen Stand erreicht hat, dass sie mit anderen Behörden abgestimmt werden kann, dann wird dieser intern abgestimmte Entwurf der Behördenleitung vorgelegt und darum gebeten, diesen Entwurf inklusive einer Fristsetzung um Stellungnahme über ein Funktionspostfach den anderen zu beteiligenden Behörden weiterleiten zu dürfen.

Alle zur Stellungnahme aufgeforderten Behörden legen innerhalb dieser gesetzten Frist ihre Stellungnahme über das Funktionspostfach der zuständigen Behörde vor.

Nach Eingang des Entwurfs mit Aufforderung zur Stellungnahme prüft die zuständige Behörde/das zuständige Amt, ob die Stellungnahmen (z.B. in Form von Änderungswünschen) der beteiligten Behörden eingearbeitet werden. Hieraufhin überarbeitet das Referat/die Abteilung innerhalb der zuständigen Behörde die Drucksachenanzeige.

Sollte die überarbeitete Version zu grundlegenden Änderungen führen, findet eine zweite Abstimmung mit den beteiligten Behörden statt (dies ist jedoch eher die Ausnahme).

Anschließend wird die überarbeitete Fassung der Drucksache der zuständigen Behördenleitung vorgelegt mit der Bitte, diese Fassung zur Befassung des Senats anmelden zu dürfen.

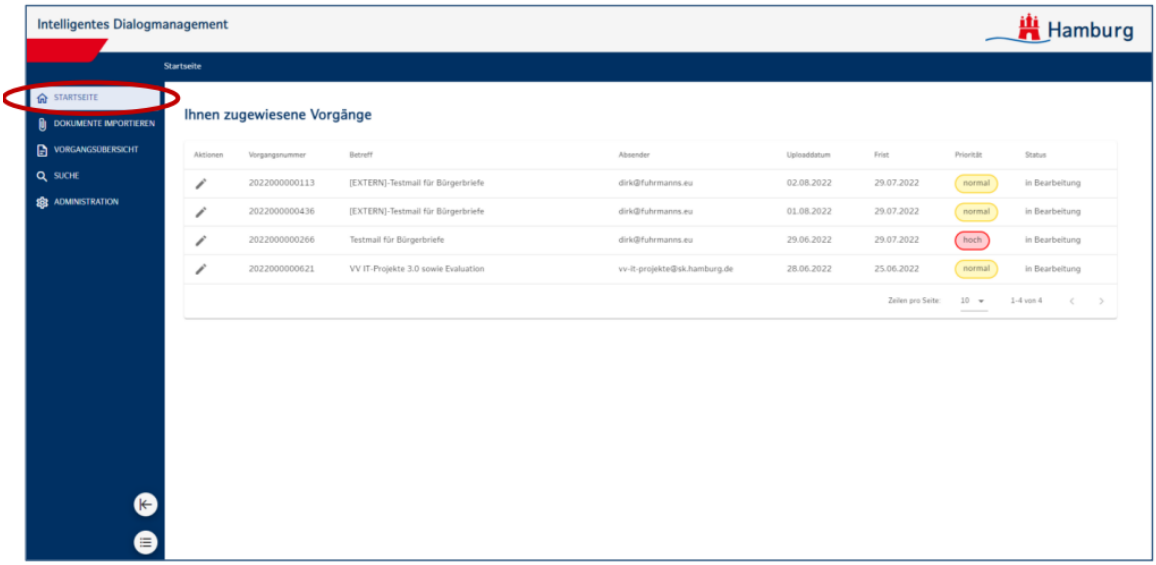
Phase 3: Weiterleitung an die Senatskanzlei und Beschlussfassung im Senat

Die Präsidialabteilung meldet die Drucksache bei der Senatskanzlei für einen Sitzungstermin des Senats an. Die Senatskanzlei setzt diese Drucksache auf die Tagesordnung des Senats. In der zuständigen Behörde wird daraufhin ein sogenannter „Waschzettel“ (Kurzinformation für die Senatssitzung zur Drucksache) abgefordert, um die zuständige Behördenleitung intern über die wesentlichen Inhalte zur Drucksache zu informieren.

Screenshots of the IDM tool

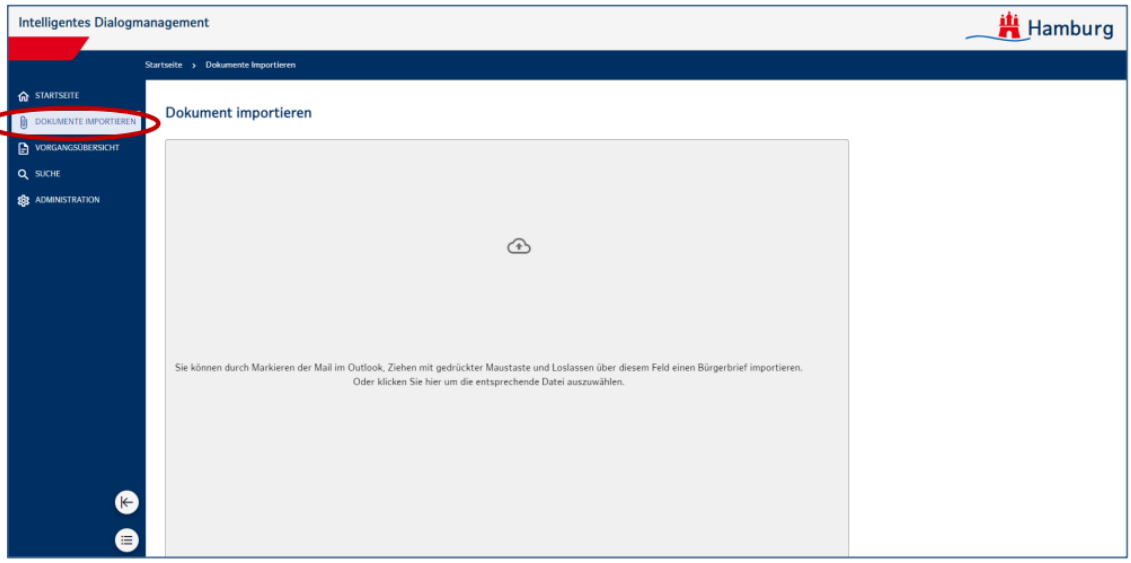
The following screenshots provide an overview of the functions of the IDM tool, which are currently developed. Due to the fact that the application language of the IDM tool is German, the screenshots are only available in the German language.

Figure 73: IDM tool: Main menu - home page



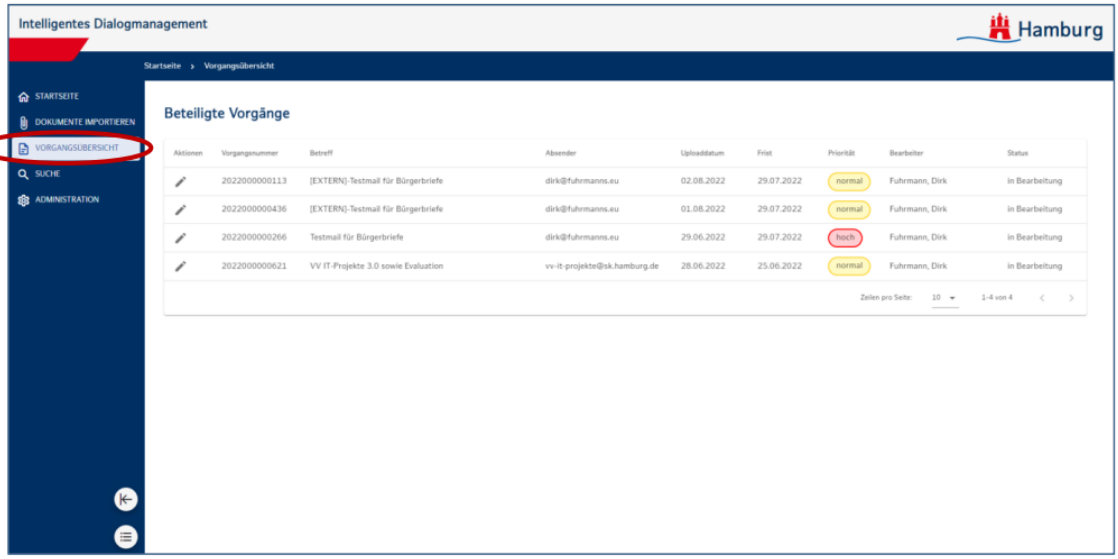
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 74: IDM tool: Main menu - import documents



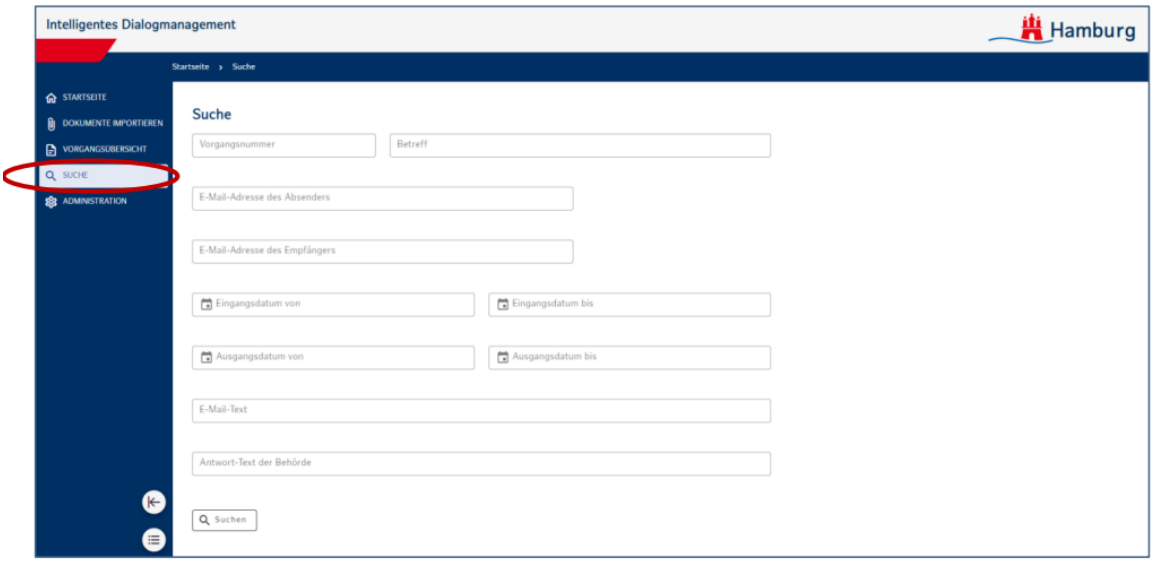
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 75: IDM tool: Main menu - process overview



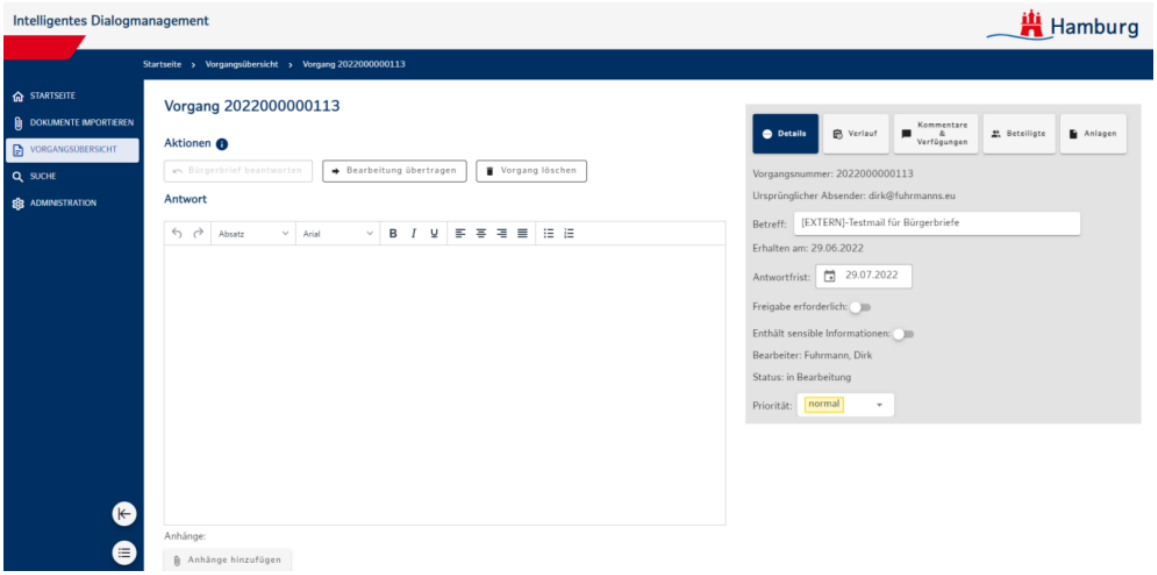
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 76: IDM tool: Main menu - search



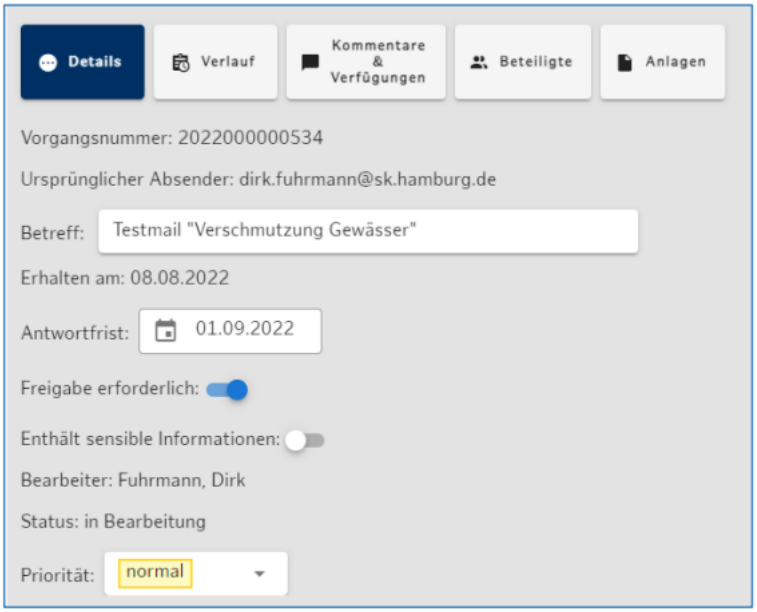
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 77: IDM tool: Create new process - edit view (1/2)



Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 78: IDM tool: edit view - details

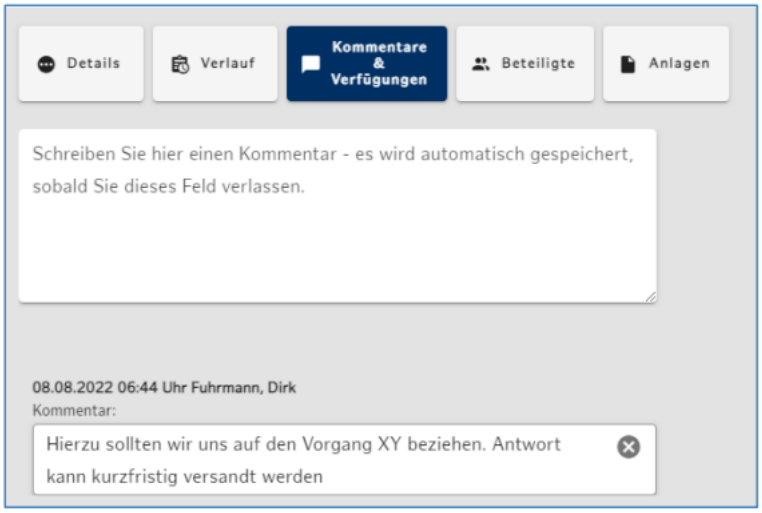


Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 79: IDM tool: edit view - history

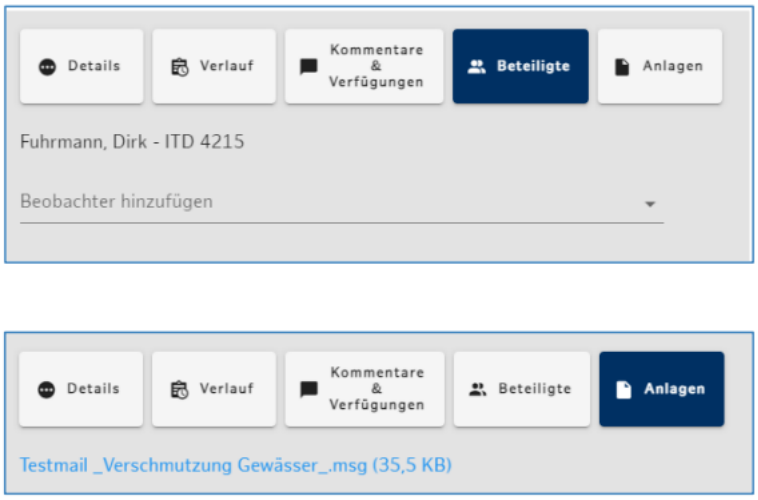
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 80: IDM tool: edit view - comments & availabilities



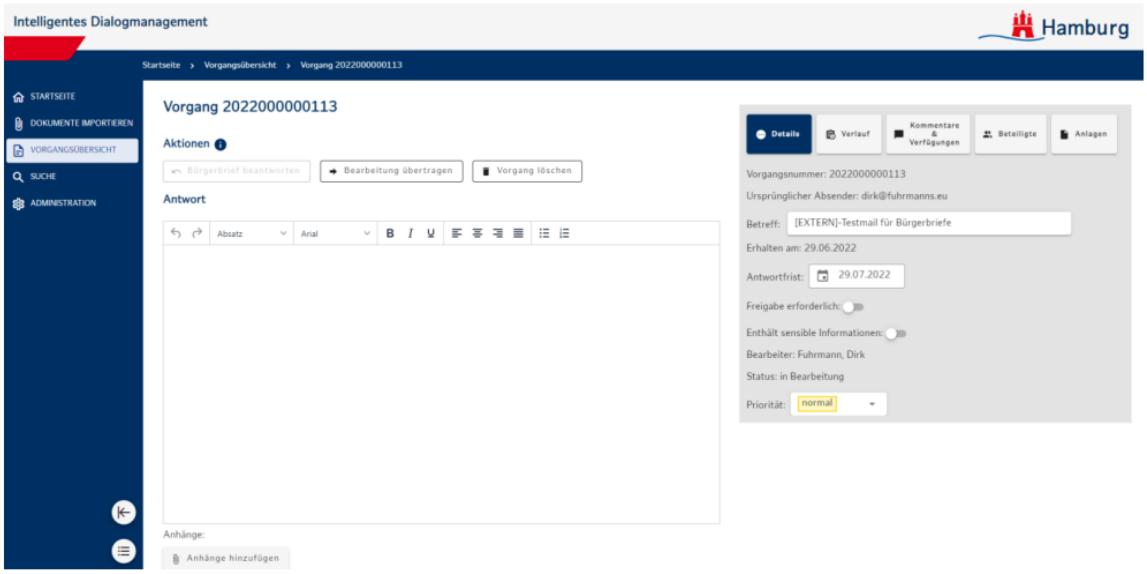
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 81: IDM tool: edit view - participants & appendices



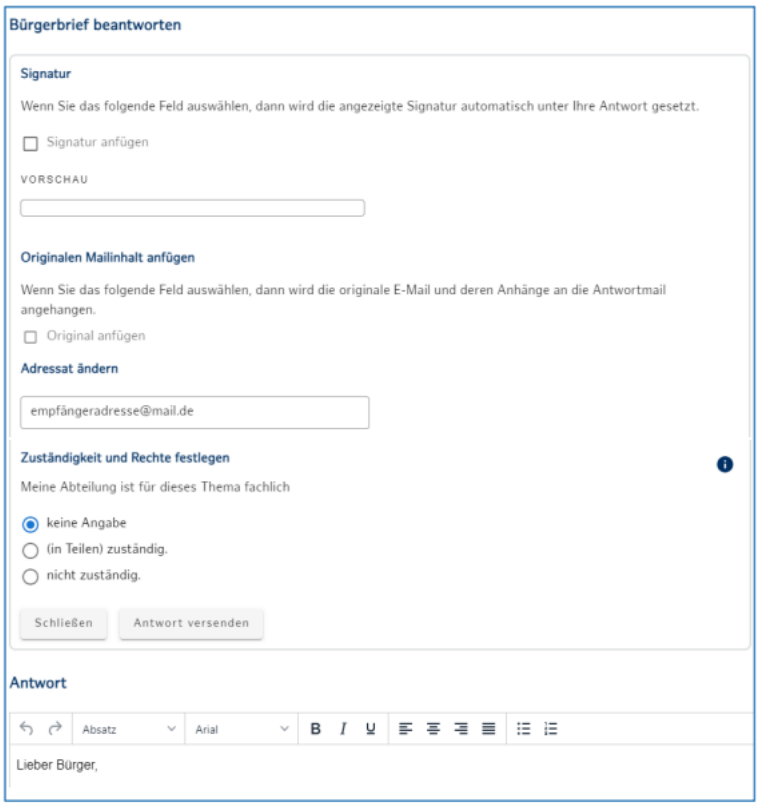
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 82: IDM tool: Create new process - edit view (2/2)



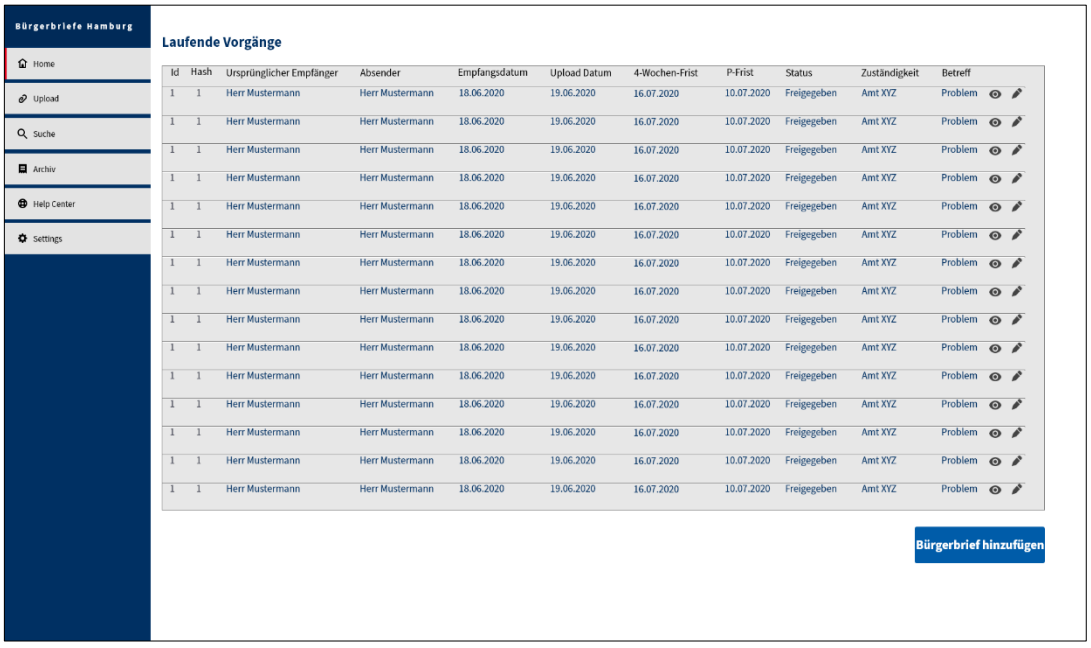
Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 83: IDM tool: edit view - actions



Source: Screenshots IDM, provided by the City of Hamburg (2022)

Figure 84: IDM tool: Monitoring/Deadline Tracking



Source: Screenshots IDM, provided by the City of Hamburg (2022)

Roadmap

This deliverable is the roadmap for the implementation of the to-be business processes and provides guidance on the specific steps needed in order to achieve this outcome.

Executive summary

This deliverable provides an overview of the indicative project implementation plans for the five to-be models with the result to develop a Minimum Viable Product (MVP) for each of the five processes.

The timeline of the different activities to be carried out is foreseen with a start in January 2023 (after the finalisation of the REFORM 2021/064 Deloitte project). For the implementation of the respective MVPs, it is suggested that the City of Hamburg and an external service provider with knowledge and project references regarding the building, testing, release and deployment of AI models work together in close collaboration.

An implementation of all five to-be processes in parallel could yield synergies regarding budget and resource allocation and efficiency gains through project organisation (e.g. following an agile project, labelling of different processes, development of components that could be used for more than one process).

The project implementation plan for the five to-be models (brief written inquiries, senate printed matter coordination, imputing procedure (BohrIS), info boxes and knowledge management) foresees an expected 546 person days (PT) for the City of Hamburg and 959 PT for an external service provider.The timeline and the person day estimates in order to realise the implementation of the five to-be process models are based on assumptions, which have been derived following the indications that were provided by the different stakeholders and process owners during the workshops. All roles and FTE assumptions are split into external person days delivered by external service providers and person days provided by the City of Hamburg. The efforts are indicative and must be verified depending on more detailed planning regarding the implementation.

Furthermore, a change management plan that lists possible process obstacles that have been identified by the project team was developed. All identified obstacles, clustered according to their relation to the respective to-be process are listed in the table below. For each obstacle, the corresponding risks and its impact as well as a mitigation strategy to address and mitigate these risks is provided.

Introduction

This Deliverable provides a roadmap for the implementation of the five to-be business processes and gives guidance on the specific steps, risks and mitigation measures in order to achieve this outcome.

As an overview, an indicative implementation plan of the different steps per to-be process to be executed is presented. Thereafter, the main activities to be undertaken by the City of Hamburg and its relevant stakeholders that result from this indicative implementation plan are detailed. This also includes the allocation of responsibilities for these activities to different stakeholders.

As a last step, the main obstacles to implement each action per process are presented as well as suggestions in order to tackle them are presented (change management plan).

Please note that all described activities and responsibilities of the to-be models in this deliverable are **considered to be suggestions**. Before the implementation of the five to-be process models, **further alignments and consultations should be made with the process owners**, although they are not authorized to make the final decisions regarding the to-be processes.

Indicative implementation plan for the five MVPs

This chapter provides an overview of the indicative project implementation plan for the five to-be models with the result to develop a Minimum Viable Product (MVP) for each of the five processes.

The timeline of the different activities to be carried out is foreseen with a **start in January 2023** (after the finalisation of the REFORM 2021/064 Deloitte project). For the implementation of the respective MVPs, it is suggested that the **City of Hamburg and an external service provider** with knowledge and project references regarding the building, testing, release and deployment of AI models **work together in close collaboration**.

An **implementation of all five to-be processes in parallel could yield synergies** regarding budget and resource allocation and efficiency gains through project organisation (e.g. following an agile project, labelling of different processes, development of components that could be used for more than one process).

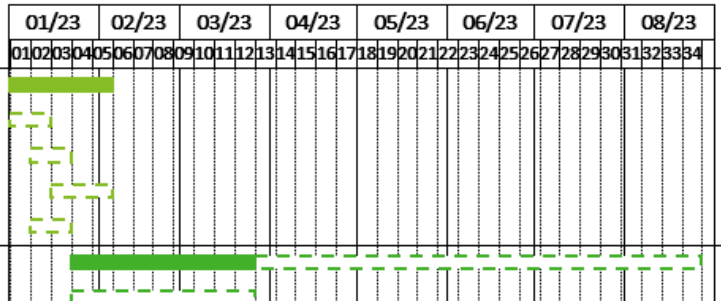
Please note that all project plans and its **timelines and the indications regarding person day estimates** in order to realise the implementation of the five to-be process models are **based on assumptions**, which have been derived following the indications that were provided by the different stakeholders and process owners during the workshops. All roles and FTE are split into external person days delivered by external service providers and person days provided by the City of Hamburg. The efforts are indicative and must be verified depending on more detailed planning regarding the implementation. It important to note that this indicative action plan needs to be further verified before taken into consideration through internal budgeting and procurement.

Please also note that an **MVP is considered as an initial stand-alone and productive version of the end product**. However, there can still be expansion stages and regular (e.g. once a year) re-trainings of the models within the entire life cycle of the AI product even after the MVP phase has been completed. This re-training and expansion of the models is common for AI products. The implementation of the MVPs depends substantially on the assumption that the person days allocated to the City of Hamburg can be provided by the City of Hamburg and that the designing of the IDM tool is completed before the start of the implementation of the MVPs.

Overarching implementation plan for the five MVPs

The following figure shows the **project implementation plan for the five to-be models** (brief written inquiries, senate printed matter coordination, imputing procedure (BohrIS), info boxes and knowledge management) that foresees an expected 759 person days (PT) for the City of Hamburg and 987 PT for an external service provider.

Figure 85: Overall implementation plan for the five MVPs (brief written inquiries (SKA), senate printed matter coordination, imputing procedure (BohrIS), info boxes and knowledge management)



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the projects with the business requirements	External	0	50
1.2 Check integration into existing IDM tool	External	0	120
1.3 Short analysis of the IT architectures	External	0	75
1.4 Set-up of agile project management	City of HH	10	5
2. Planning			
2.1 Acquisition and analysis of data	External	42	176
3. Set-up of Labelling Environment			
3.1 Set-up of Labelling Environment infrastructure	External	0	60
3.2 Build I Test I Release I Deploy of Labelling Environment	External	60	60
4. Development of microservices			
4.1 Conception of models	External	0	80
4.2 Iteration of labelling	City of HH	138	38,5
4.3 Training and evaluation of models	External	11	95
5. Implementation of toolset extensions			
5.1 Setup of workflow management basis infrastructure	City of HH	168	28
5.2 Adjustment of dashboard	City of HH	113	33
5.3 Adaption of documentation (e.g. operating manuals)	External	14,5	38,5
5.4 Build I Test I Release I Deploy	City of HH	157,5	50,5
6. Project management			
6.1 Quality assurance	External	15	15
6.2 Communication and coordination	City of HH	30	30
Sum		**759**	**987**

Source: Deloitte (2022)

Activities in blue (such as the set-up of an agile project management and communication and coordination) are expected to unfold **substantial efficiency gains** if all five to-be processes are implemented at the same time. The numbers in blue referring to the corresponding person days is therefore expected to be lower than the sum of all person days for the implementation of each individual process.

Please note that it is expected that for the acquisition and analysis of data in the case of the to-be process info boxes more time needs to be planned as currently, no data are stored. This is indicated by the dashed bar in Activity 2 (Planning) for the months April to August.

Overall activities and responsibilities for the five MVPs

The project schedules of the processes are each oriented along the following five phases and the project management. However, there can be a different number of phases depending on the process:

Table 41: Overall activities and responsibilities of the implementation project for the five MVPs

Phase	Indicative timeframe	Overall lead	Description
7. **Warm-up**	January – February 2023 (5-6 weeks)	External service provider	The warm-up phase covers a period of approximately 5-6 weeks and includes the **harmonisation of the projects with the business requirements** formulated in this project, the check of the integration into the existing IDM tool and a **short analysis of the IT architecture**. Key aspects here are to ensure that the software and hardware conditions, as well as interfaces, necessary computing capacity, data protection and similar topics are given. It is particularly important that these points are defined and coordinated at an early stage, if possible, directly after the start of the project. In addition, an **agile project management** will be set up, led by the City of Hamburg.
8. **Planning**	End of January – end of March 2023	External service provider	The objective of this phase is to **define the structure of the database** and to **analyse the corresponding data** that is needed to train the models. Depending on the data format, a certain amount of effort for data preparation must be planned before labelling can begin. For the info boxes, this phase is expected to take six months given the fact that currently, data are not stored and therefore, a data basis needs to be built up in these six months.
9. **Set-up of labelling environment (only for some to-be processes)**	Beginning of February – beginning of May 2023	External service provider	After the analysis of data, phase 3 starts with the **implementation of a labelling and annotation environment**, as well as the infrastructure. This is planned over a course of approximately two months, depending on the quantity and quality of data. Subsequently, this labelling environment will **be built, tested, released and deployed** another three weeks, completing the entire third phase within several weeks.
10. **Development of microservices (only for some to-be processes)**	Mid of March – mid of June 2023	External service provider	Phase 4 includes the **conception of the models**, several **iterations of labelling**, as well as the **training and evaluation of the models**. This phase is planned over approximately three months, depending on the respective to-be process, with several iterations of labelling, training and evaluation iterations of the models following the labelling iterations.
11. **Implementation of toolset extensions**	End of March – mid of August 2023	City of Hamburg	Throughout the development of the microservices, the implementation of toolset extensions will be started. Throughout the duration of this phase, **changes to the dashboard are made** depending on the development status and the documentation is developed at cyclical intervals and iteratively adapted and completed. In addition, the **developed microservices are iteratively built, tested, released and deployed**. Within the test phase, **performance tests** and the interaction of all components are tested in a first step. Furthermore, speed optimisations for the model components and feedback from user tests are obtained. The latter, user feedback, is a crucial point in the agile development of software products and is intended to prevent software from being developed for years only to find that it does not meet user requirements. Thereafter, (final) acceptance tests by the respective process owners after each sprint and before the go

Phase	Indicative timeframe	Overall lead	Description
			live should be conducted and specific training for the process users in the respective business departments should be prepared.
12. **Project management**	January – August 2023	City of Hamburg	The project management, led by the City of Hamburg, includes the **coordination and communication with all involved stakeholders** throughout the entire duration of the project as outlined in the change management plan (see chapter Change Management Plan) to ensure a proper collaboration between all parties. Furthermore, a **detailed quality assurance** should take place, in particular via continuous testing activities conducted by dedicated experts within the City of Hamburg. This quality assurance also entails to flag any upcoming obstacles in a timely manner. At the beginning of the project, a **detailed project planning and specification of the core contents** of the project based on the results from the Deloitte concept development project (REFORM SC2021/064) is recommended. **The budgeting and procurement of services** that will be performed by external service providers needs to be conducted **prior to the start** of this implementation project.

Source: Deloitte (2022)

Phases 1, 2, 5 and 6 are included in each implementation plan of the to-be processes, while phase 3 is not relevant for the senate printed matter coordination and the imputing process and phase 4 is not relevant for the senate printed matter coordination.

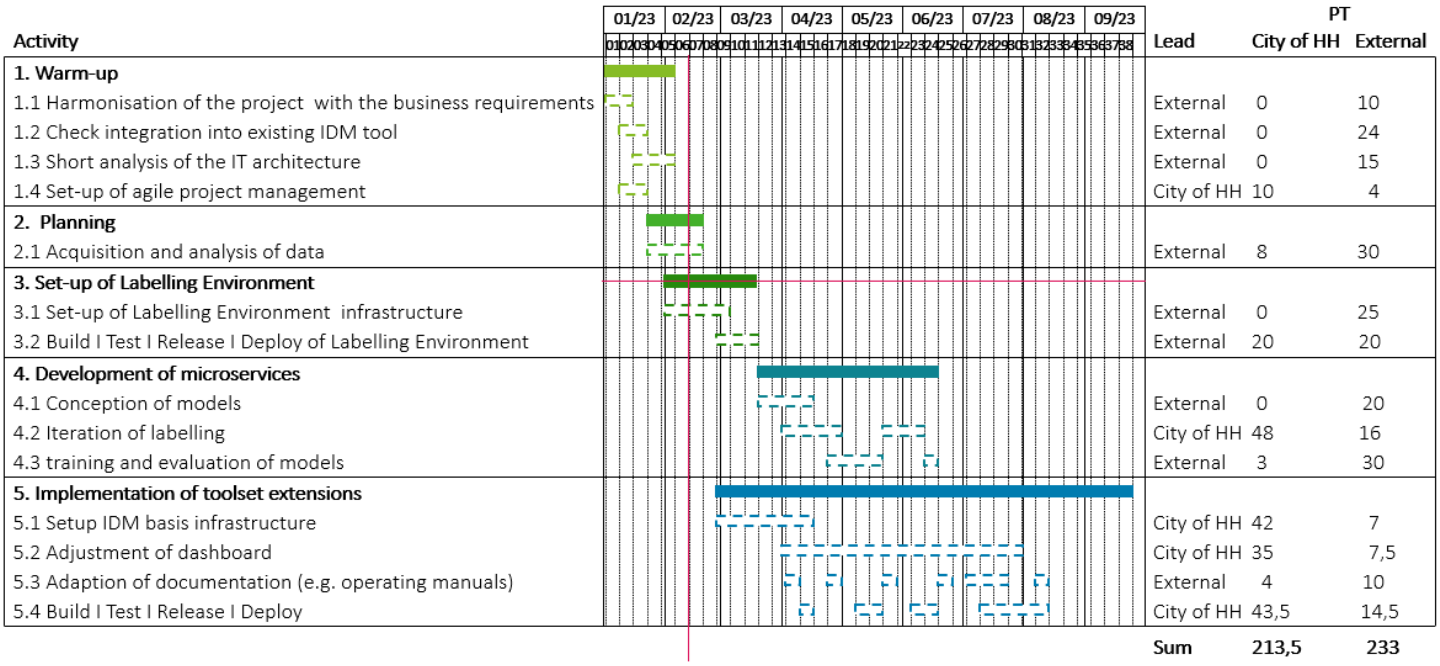
Activities and responsibilities for the brief written inquiries

This subchapter presents the project plan to implement the Minimum Viable Product (MVP) of the to-be process for the brief written inquiries (as described in Deliverable 6 and 7).

The implementation of the MVP has a foreseen duration of approximately eight months and should be started immediately following the termination of this REFORM SC2021/064 project of Deloitte regarding the conceptualization of the to-be process. The start of the implementation phase would then be in January 2023. A later start is possible, but it is recommended to not postpone the start too long to benefit from the current stakeholder attention and to take up from the already contacted funding opportunities.

The following figures show the project implementation plan for the brief written inquiries that foresees an expected 213.5 person days (PT) for the City of Hamburg and 233 PT for an external service provider.

Figure 86: Project implementation plan for MVP of the brief written inquiries (SKA)



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the project with the business requirements	External	0	10
1.2 Check integration into existing IDM tool	External	0	24
1.3 Short analysis of the IT architecture	External	0	15
1.4 Set-up of agile project management	City of HH	10	4
2. Planning			
2.1 Acquisition and analysis of data	External	8	30
3. Set-up of Labelling Environment			
3.1 Set-up of Labelling Environment infrastructure	External	0	25
3.2 Build I Test I Release I Deploy of Labelling Environment	External	20	20
4. Development of microservices			
4.1 Conception of models	External	0	20
4.2 Iteration of labelling	City of HH	48	16
4.3 training and evaluation of models	External	3	30
5. Implementation of toolset extensions			
5.1 Setup IDM basis infrastructure	City of HH	42	7
5.2 Adjustment of dashboard	City of HH	35	7,5
5.3 Adaption of documentation (e.g. operating manuals)	External	4	10
5.4 Build I Test I Release I Deploy	City of HH	43,5	14,5
	Sum	**213,5**	**233**

Source: Deloitte (2022)

The roadmap is divided into five implementation phases, the achievement of which is key to the implementation of the MVP. This roadmap contains the following steps:

1. Warm-up
   Phase 1 is planned to be carried out in this process as previously described. In total, phase 1 is expected to require 10 PT for the City of Hamburg and 53 PT for an external service provider.
2. Planning
   The core objective in this phase is to follow up on existing brief written inquiries from the system at authority and department level, as well as to collect new data at all levels during ongoing processes and make it accessible for further processing. It must be further noted here that the time horizon for collecting enough data at the unit level may well be longer than the project horizon. The brief written inquiries are stored in PDF, Word and Excel format whereas the answers are saved in PDF format, which implies a certain amount of data preparation before labelling can be started. This phase begins end of January and ends end of February. In total, phase 2 is expected to require 8 PT for the City of Hamburg and 30 PT for an external service provider.
3. Set-up of Labelling Environment
   Phase 3 is planned to be employed in this process as previously described. In total, phase 3 is expected to require 20 PT for the City of Hamburg and 45 PT for an external service provider.
4. Development of microservices
   Phase 4 includes the conception of the models, several iterations of labelling, as well as the training and evaluation of the models. This phase is planned over a three-month period, with two

iterations of labelling and two training and evaluation iterations of the models following the labelling iterations. Both functions, the assignment of responsibilities (assisted) and the intelligent search benefit from the same database, which is why labelling and data collection can be done simultaneously for both functions. To train the classifier and the finetuning for the similarity search the extracted texts have to be labeled in various labelling iteration by subject matter experts, which have to be provided by the city of Hamburg. In total, phase 4 is expected to require 51 PT for the City of Hamburg and 66 PT for an external service provider.

5. Implementation of toolset extensions

   Phase 5 is planned to be carried out in this process as previously described. Overall, phase 5 is planned to be completed within 4 1/2 months and is expected to require 124.5 PT for the City of Hamburg and 39 PT for an external service provider.

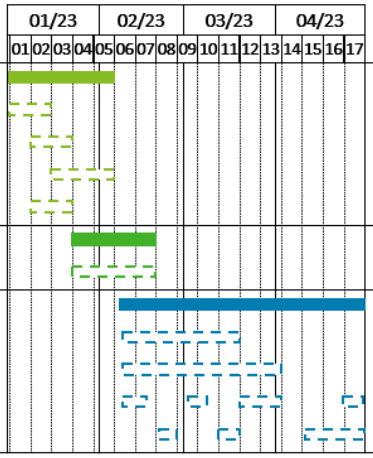
Activities and responsibilities for the senate printed matter coordination

This subchapter presents the project plan to implement the Minimum Viable Product (MVP) of the to-be process for the senate printed matter coordination (as described in Deliverable 6 and 7).

The implementation of the MVP has a foreseen duration of approximately four months and should be started immediately following the termination of this REFORM SC2021/064 project of Deloitte regarding the conceptualization of the to-be process. The start of the implementation phase would then be in January 2023. A later start is possible, but it is recommended to not postpone the start too long to benefit from the current stakeholder attention and to take up from potential funding opportunities and synergies with the implementation of the other to-be processes.

The following figure shows the project implementation plan for the senate printed matter coordination that foresees an expected 109.5 person days (PT) for the City of Hamburg and 90 PT for an external service provider.

Figure 87: Project implementation plan for MVP of the senate printed matter coordination



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the project with the business requirements	External	0	10
1.2 Check integration into existing IDM tool	External	0	24
1.3 Short analysis of the IT architecture	External	0	15
1.4 Set-up of agile project management	City of HH	10	4
2. Planning			
2.1 Acquisition and analysis of data	External	4	8
3. Implementation of toolset extensions			
3.1 Setup IDM basis infrastructure	City of HH	42	7
3.2 Adjustment of dashboard	City of HH	24	8
3.3 Adaption of documentation (e.g. operating manuals)	External	2,5	7
3.4 Build I Test I Release I Deploy	City of HH	27	7
	Sum	**109,5**	**90**

Source: Deloitte (2022)

The roadmap is divided into three implementation modules, the achievement of which is key to the implementation of the MVP. This roadmap contains the following steps:

1. Warm-up
   Phase 1 is planned to be carried out in this process as previously described. In total, phase 1 is expected to require 10 PT for the City of Hamburg and 53 PT for an external service provider.
2. Planning
   The aim of this phase is to examine in detail the data base and information of the senate printed matter in order to determine the interfaces and the possibility of archiving as well as processing the data. This will include further discussions with process and system owners, as well as expanded desk research. The core objective is to follow up on existing printed matters from the system at authority and department level, as well as to collect new data at all levels during ongoing processes and make it accessible for further processing. This phase begins end of January and ends end of February. In total, module 2 is expected to require 4 PT for the City of Hamburg and 8 PT for an external service provider.
3. Implementation of toolset extensions
   Phase 3 is planned to be carried out in this process as previously described. The IDM tool will be implemented adding further functionalities, an adapted version of the IDM frontend, the manual assignment of responsibilities module, the deadline tracking module, the communication module, and the interface to the eSIS system. Overall, phase 3 is planned to be completed within three months and is expected to require 95.5 PT for the City of Hamburg and 29 PT for an external service provider.

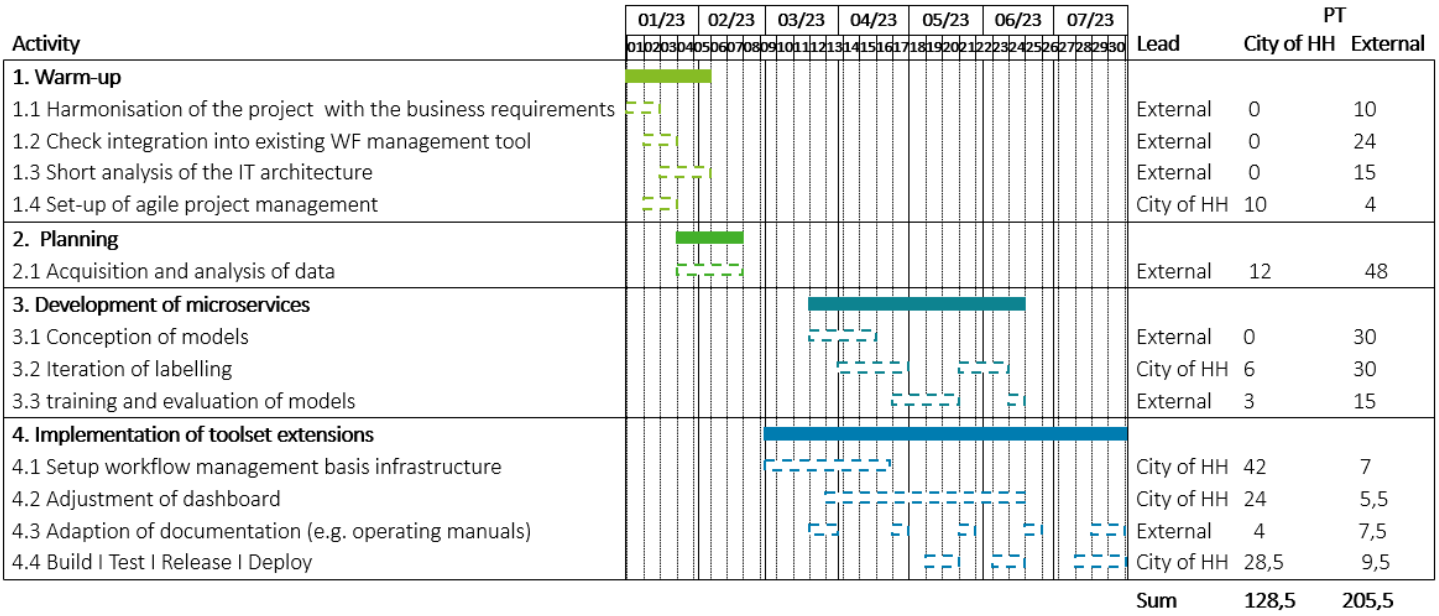
Activities and responsibilities for the imputing procedure (BohrIS)

This subchapter presents the project plan to implement the Minimum Viable Product (MVP) of the to-be process for the BohrIS process (as described in Deliverable 6 and 7).

The implementation of the MVP has a foreseen duration of approximately seven months and should be started immediately following the termination of this REFORM SC2021/064 project of Deloitte regarding the conceptualization of the to-be process. The start of the implementation phase would then be in January 2023. A later start is possible, but it is recommended to not postpone the start too long to benefit from the current stakeholder attention, the need for immediate workload reduction and synergies with the implementation of the other to-be processes.

The following figures show the project implementation plan for the BohrIS process that foresees an expected 128.5 person days (PT) for the City of Hamburg and 205.5 PT for an external service provider.

Figure 88: Project implementation plan for MVP of the imputing procedure (BohrIS process)



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the project with the business requirements	External	0	10
1.2 Check integration into existing WF management tool	External	0	24
1.3 Short analysis of the IT architecture	External	0	15
1.4 Set-up of agile project management	City of HH	10	4
2. Planning			
2.1 Acquisition and analysis of data	External	12	48
3. Development of microservices			
3.1 Conception of models	External	0	30
3.2 Iteration of labelling	City of HH	6	30
3.3 training and evaluation of models	External	3	15
4. Implementation of toolset extensions			
4.1 Setup workflow management basis infrastructure	City of HH	42	7
4.2 Adjustment of dashboard	City of HH	24	5,5
4.3 Adaption of documentation (e.g. operating manuals)	External	4	7,5
4.4 Build I Test I Release I Deploy	City of HH	28,5	9,5
	Sum	**128,5**	**205,5**

Please note that the workflow management tool for the process “BohrIS” could be either “Modul F” or the IDM tool.

Source: Deloitte (2022)

The roadmap is divided into four implementation modules, the achievement of which is key to the implementation of the MVP. This roadmap contains the following steps:

1. Warm-up
   Phase 1 is planned to be carried out in this process as previously described. In total, phase 1 is expected to require 10 PT for the City of Hamburg and 53 PT for an external service provider.
2. Planning
   This phase defines the structure and analysis of the database used to train the models. The core objective is to follow up on existing drilling information from the system, as well as to collect new data during ongoing processes and make it accessible for further processing. The basic information about new drilling projects is transmitted using PDF, XML and XSD format.
   This phase begins end of January and ends end of February. In total, phase 2 is expected to require 12 PT for the City of Hamburg and 48 PT for an external service provider.
3. Development of microservices
   Phase 3 includes the conception of the models, several iterations of labelling, as well as the training and evaluation of the models. This module is planned over a three-month period, with two iterations of labelling and two training and evaluation iterations of the models following the labelling iterations. All functions, the completeness check, the plausibility check and the imputing benefit from the same database, which is why labelling and data collection can be done

simultaneously for all functions. In total, module 3 is expected to require 9 PT for the City of Hamburg and 75 PT for an external service provider.

4. Implementation of toolset extensions

   Phase 4 is planned to be carried out in this process as previously described. The IDM tool will be implemented, whereby the tool is equipped with further functionalities, including imputing, completeness, and plausibility checks with artificial intelligence support. Overall, module 4 is planned to be completed within 4 1/2 months and is expected to require 98.5 PT for the City of Hamburg and 29.5 PT for an external service provider.

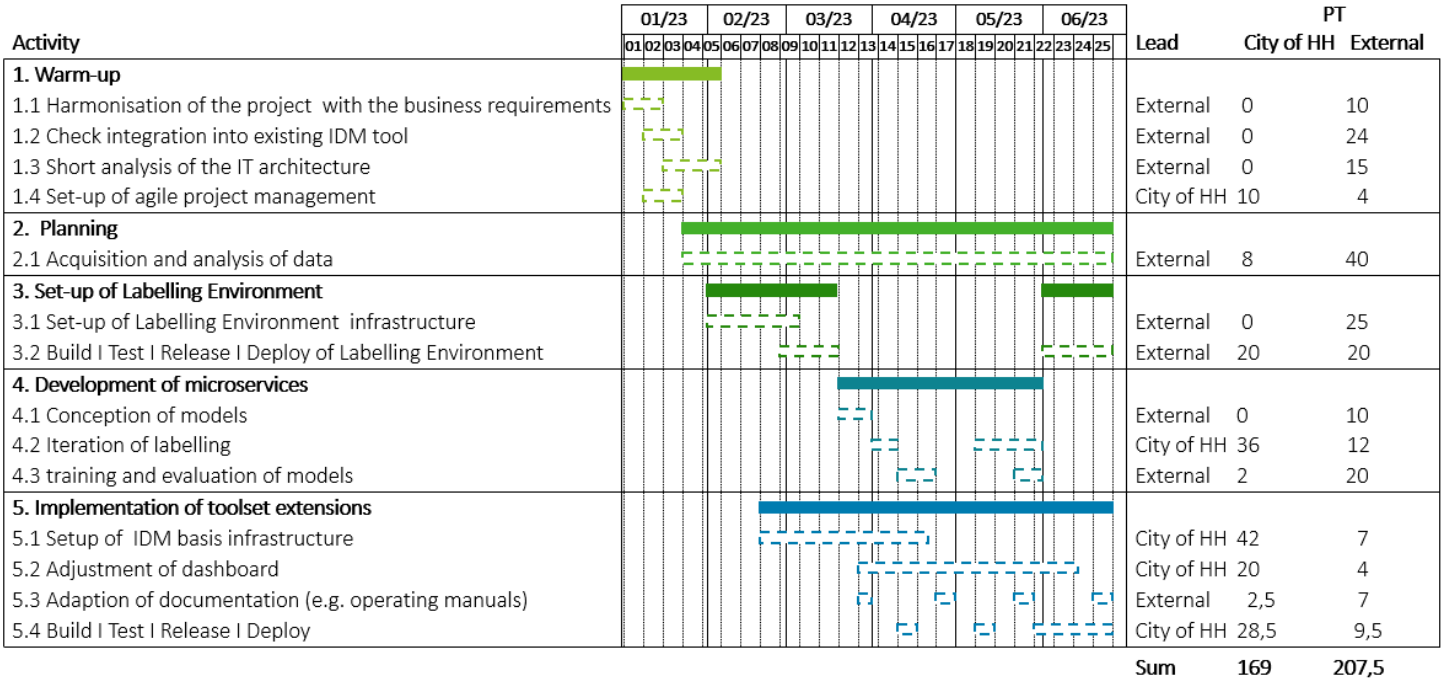
Activities and responsibilities for the info boxes

This subchapter presents the project plan to implement the Minimum Viable Product (MVP) of the to-be process for the info boxes (as described in Deliverable 6 and 7).

The implementation of the MVP has a foreseen duration of approximately six months and should be started immediately following the termination of this REFORM SC2021/064 project of Deloitte regarding the conceptualization of the to-be process. The start of the implementation phase would then be in January 2023. A later start is possible, but it is recommended to not postpone the start too long to benefit from the current stakeholder attention and to take advantage from potential funding opportunities and synergies with the implementation of the other to-be processes.

The following figures show the project implementation plan for the senate printed matter coordination that foresees an expected 169 person days (PT) for the City of Hamburg and 207.5 PT for an external service provider.

Figure 89: Project implementation plan for MVP of the info boxes



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the project with the business requirements	External	0	10
1.2 Check integration into existing IDM tool	External	0	24
1.3 Short analysis of the IT architecture	External	0	15
1.4 Set-up of agile project management	City of HH	10	4
2. Planning			
2.1 Acquisition and analysis of data	External	8	40
3. Set-up of Labelling Environment			
3.1 Set-up of Labelling Environment infrastructure	External	0	25
3.2 Build I Test I Release I Deploy of Labelling Environment	External	20	20
4. Development of microservices			
4.1 Conception of models	External	0	10
4.2 Iteration of labelling	City of HH	36	12
4.3 training and evaluation of models	External	2	20
5. Implementation of toolset extensions			
5.1 Setup of IDM basis infrastructure	City of HH	42	7
5.2 Adjustment of dashboard	City of HH	20	4
5.3 Adaption of documentation (e.g. operating manuals)	External	2,5	7
5.4 Build I Test I Release I Deploy	City of HH	28,5	9,5
	Sum	**169**	**207,5**

Source: Deloitte (2022)

The roadmap is divided into five implementation phases, the achievement of which is key to the implementation of the MVP. This roadmap contains the following steps:

1. Warm-up
   Phase 1 is planned to be carried out in this process as previously described. In total, phase 1 is expected to require 10 PT for the City of Hamburg and 53 PT for an external service provider.
2. Planning
   The core objective in this phase is to collect new data, since currently, data are not stored and therefore, a data basis need to be built up during phase 2. Therefore, this phase is expected to take six months and will run in parallel with the implementation of the IDM tool. It must be further noted here that the time horizon for collecting enough data at the unit level may well be longer than the project horizon. The incoming requests are sent by mail, but can have different attachment formats, which implies a certain amount of data preparation before labelling can be started. This phase begins end of January and ends end of June. In total, phase 2 is expected to require 8 PT for the City of Hamburg and 40 PT for an external service provider.
3. Set-up of Labelling Environment
   Phase 3 is planned in this process as previously described. Due to the missing database in this process, the set-up will be rolled out in two phases, first at the beginning of March and the second

iteration in June. In total, phase 3 is expected to require 20 PT for the City of Hamburg and 45 PT for an external service provider.

4. Development of microservices
   Phase 4 includes the conception of the model, several iterations of labelling, as well as the training and evaluation of the model. This phase is planned over a two-month period, with two iterations of labelling and two training and evaluation iterations of the model following the labelling iterations, which can start while collecting and setting up the new data basis. To train the classifier for the function of the assignment of responsibilities (assisted), the extracted texts have to be labeled in various labelling iteration by subject matter experts, which have to be provided by the city of Hamburg. In total, phase 4 is planned to require 38 PT for the City of Hamburg and 42 PT for an external service provider.
5. Implementation of toolset extensions
   Phase 5 is planned to be carried out in this process as previously described. Overall, phase 5 is planned to be completed within 3 1/2 months and is expected to require 93 PT for the City of Hamburg and 27.5 PT for an external service provider.

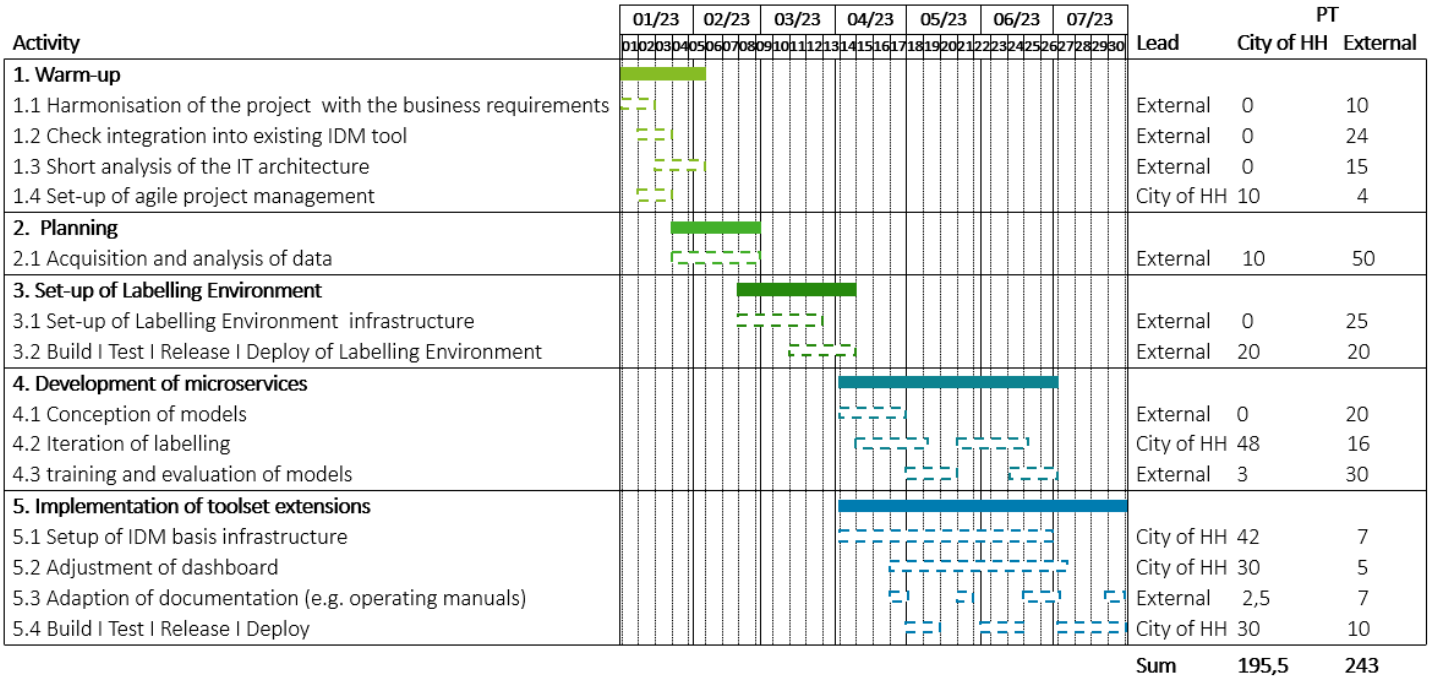
Activities and responsibilities for the knowledge management process

This subchapter presents the project plan to implement the Minimum Viable Product (MVP) of the to-be process for knowledge management (as described in Deliverable 6 and 7).

The implementation of the MVP has a foreseen duration of approximately seven months and should be started immediately following the termination of this REFORM SC2021/064 project of Deloitte regarding the conceptualization of the to-be process. The start of the implementation phase would then be in January 2023. A later start is possible, but it is recommended to not postpone the start too long to benefit from the current stakeholder attention and its strategic importance for the City of Hamburg, the need for immediate workload reduction and synergies with the implementation of the other to-be processes.

The following figures show the project implementation plan for the knowledge management process that foresees an expected 195.5 person days (PT) for the City of Hamburg and 243 PT for an external service provider.

Figure 90: Project implementation plan for MVP of the process knowledge management



Activity	Lead	PT City of HH	PT External
1. Warm-up			
1.1 Harmonisation of the project with the business requirements	External	0	10
1.2 Check integration into existing IDM tool	External	0	24
1.3 Short analysis of the IT architecture	External	0	15
1.4 Set-up of agile project management	City of HH	10	4
2. Planning			
2.1 Acquisition and analysis of data	External	10	50
3. Set-up of Labelling Environment			
3.1 Set-up of Labelling Environment infrastructure	External	0	25
3.2 Build I Test I Release I Deploy of Labelling Environment	External	20	20
4. Development of microservices			
4.1 Conception of models	External	0	20
4.2 Iteration of labelling	City of HH	48	16
4.3 training and evaluation of models	External	3	30
5. Implementation of toolset extensions			
5.1 Setup of IDM basis infrastructure	City of HH	42	7
5.2 Adjustment of dashboard	City of HH	30	5
5.3 Adaption of documentation (e.g. operating manuals)	External	2,5	7
5.4 Build I Test I Release I Deploy	City of HH	30	10
	Sum	**195,5**	**243**

Source: Deloitte (2022)

The roadmap is divided into five implementation phases, the achievement of which is key to the implementation of the MVP. This roadmap contains the following steps:

1. Warm-up
   Phase 1 is planned to be carried out in this process as previously described. In total, phase 1 is expected to require 10 PT for the City of Hamburg and 53 PT for an external service provider.
2. Planning
   The core objective in this phase is to examine the already existing database in the folder structure and prioritize the usage of the files for a tiered labelling approach, since there are already many documents in the existing folders, which must first be labeled in order to gradually distribute the workload. The documents are stored in PDF, Word and Excel format, which implies a certain amount of data preparation before labelling can be started. This phase starts end of January and ends end of February. In total, phase 2 is expected to require 10 PT for the City of Hamburg and 50 PT for an external service provider.
3. Set-up of Labelling Environment
   Phase 3 is planned to be employed in this process as previously described. In total, phase 3 is expected to require 20 PT for the City of Hamburg and 45 PT for an external service provider.
4. Development of microservices

Phase 4 includes the conception of the models, several iterations of labelling, as well as the training and evaluation of the models. This phase is planned over a three-month period, with two iterations of labelling and two training and evaluation iterations of the models following the labelling iterations. The function for the criteria-based and additional analysis, as well as the intelligent search benefit from the same database, which is why labelling and data collection can be done simultaneously for both functions. For the finetuning for the similarity search the extracted texts have to be labeled in various labelling iteration by subject matter experts, which have to be provided by the city of Hamburg. In addition, the process must be set up in which the documents can be labeled when uploading new documents in order to expand the database. In total, phase 4 is planned to require 51 PT for the City of Hamburg and 66 PT for an external service provider.

5. Implementation of toolset extensions

   Phase 5 is planned to be carried out in this process as previously described. Overall, phase 5 is planned to be completed within 3 1/2 months and is expected to require 74.5 PT for the City of Hamburg and 29 PT for an external service provider.

Change management plan

During our workshops and document analysis, several process obstacles have been identified by the project team.

These obstacles, clustered according to their relation to the respective to-be process are listed in the table below. For each obstacle, the corresponding risks and its impact as well as a mitigation strategy to address and mitigate these risks is provided.

Table 42: Change management plan

Related to process	Obstacle	Risk	Mitigation strategy
All processes	**System integration** Various systems and tools need to be integrated (Outlook, IDM, eSIS)	Information loss or efficiency loss can occur when switching between different systems	• Interfaces are programmed between the individual systems
	Content-related process changes In general, the processes remain unchanged, but the introduction of the system can add new process steps or eliminate some of them.	New or missing process steps can lead to confusion among process participants	• The process owners were involved in the design of the to-be model from the very beginning. • All process participants should be involved in the implementation of the to-be model • Preparation of documentation and information on the new processes
Info boxes	**Training of the AI model** Data not (yet) available to train AI model	Since the already sent requests are currently not stored, there is no data basis to train the model.	• Gradual implementation of the new system • During the implementation of the workflow management system, the requests including the addresses are stored centrally until enough data is available
	Stakeholder reluctance The process owner appeared highly reluctant regarding any potential automation and/or change of this process	Difficulties in further collaborations and implementation of a new system	• Explain the benefits for the daily work for the employees • Transparent communication • Gradual implementation of the new system
	Data storage/- exchange No commonly used data storage for exchange of data. The exchange of data currently takes place through mails.	The risk of inconsistencies arises. Changes in the data can be done after sending the system extract. Increased time expenditure due to the necessity of additional controls.	• Usage of a unitary data storage for documents which are currently in use • Exchange of data will take place in a unitary system (IDM tool)
	Data protection For data protection reasons, not all requests can be stored, or only for a limited time.	An incomplete data basis can lead to deficits of the model	• Anonymization and redaction of data can allow to process the relevant information
Brief written inquiries	**Training of the AI models** Insufficient data per authority/department to train the model	A precise suggestion for the responsibilities is not possible	• Gradual implementation of the new system • During the implementation of the workflow management

Related to process	Obstacle	Risk	Mitigation strategy
			system, the inquiries including the responsibilities are stored centrally until enough data is available
	Time criticality The process is very time-critical and allows for a very low error tolerance	Especially in the beginning, when the data volume is small, the suggested responsibility can still be inaccurate, which requires increased manual controls	• Through the workflow management tool, the responsibilities can still be assigned manually, which can lead to the improvement of the model
Senate printed matter coordination	**Media discontinuity** Since the printed matters are coordinated across several authorities	The introduction of the IDM tool is planned inside BUKEA and BSW as a first instance, which may cause system discontinuities with other authorities.	• Interfaces to other systems and to email system • Evaluation of the introduction of the IDM tool for other authorities
Knowledge management	**Initial high effort** Especially for labelling the already existing documents, to implement intelligent search	Employees familiar with the content must initially process the documents, which leads to a temporary increased workload	• Not all stored documents are used on the same regular basis, so prioritization allows for a graduated workload • Gradual implementation of the new system
	Inconsistent syntax When storing and labelling new information, care should be taken to use a uniform syntax. Since everyone can store new information, variations can occur	Disparate storage and labelling of information can lead to complexity and inaccuracies.	• Mandatory fields and instructions for uploading new data • Additional training materials and information about the uploading process
Imputing procedure	**Correctness of the data** Insurance of the correctness of the imputed data can only take place in controls afterwards.	Increased need of coordination. Time loss within the process. Ongoing adjustments of data within the process possible	• Inclusion of additional manual controls in the workflow management system

Source: Deloitte (2022)

Communication Material

This report is the Deliverable 10 of the project “Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg”.

Introduction and executive summary

Deliverable 10 provides communication material for the purpose of presenting the project to third parties. Therefore, a project description summarising the project and the context, as well as the support delivered, and results achieved in text format, two drafted social media text and visual materials have been created. The communication material furthermore entails a PowerPoint presentation summarising the technical content of the project as well as its context, approach, deliverables, activities, key findings and lessons learned.

Project description (250 words)

The following table provides a project description of maximum 250 words summarising the project and the context.

Table 43: Project description

Title	Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg
Summary	The project " Determination of the potential for digitisation and harmonisation of processes of the City of Hamburg", examined administrative processes of the City of Hamburg (BSW and BUKEA) and developed five to-be processes with different degrees of automation.
Context	In order to further advance the digital transformation in line with the 'Digital Strategy for Hamburg', further processes are to be examined with regard to potential automation. Building on the results of a previous project (‘citizen letters’) with DG REFORM, this project should examine other administrative processes with automation potential.
Support delivered	The project provided a thorough analysis of the as-is situation of administrative processes within the two authorities BSW and BUKEA , selecting 5 processes with high automation potential from a three-digit number of processes. For these processes, to-be models with corresponding AI (*Artificial intelligence*) technologies, IT architectures and roadmaps were developed, thereby conducting desk research, interviews and workshops with the respective process owners.
Results achieved	With the development of five to-be process with several AI features, the project lays the foundation for the reduction of administrative burden, the improvement of the quality for citizen services and the achievement of efficiency gains. Furthermore, possibilities to roll out these AI technologies to other administrative processes within other departments or authorities of the City of Hamburg were showed.
Mention of EU Assistance	This project is funded by the European Union via the Structural Reform Support Programme and was implemented by Deloitte, in cooperation with the European Commission.

Source: Deloitte

Social media texts

Two unpublished social media texts were prepared to be used as communication material:

- The city of Hamburg (BSW and BUKEA) set the stage for the digitalization of further administrative processes to improve efficiency and reduce workload, building on the results of a previous project ('citizen letters').
- The city of Hamburg in cooperation with the European Commission set the stage for the digitalization of further administrative to specifically address and improve existing structural and process challenges.

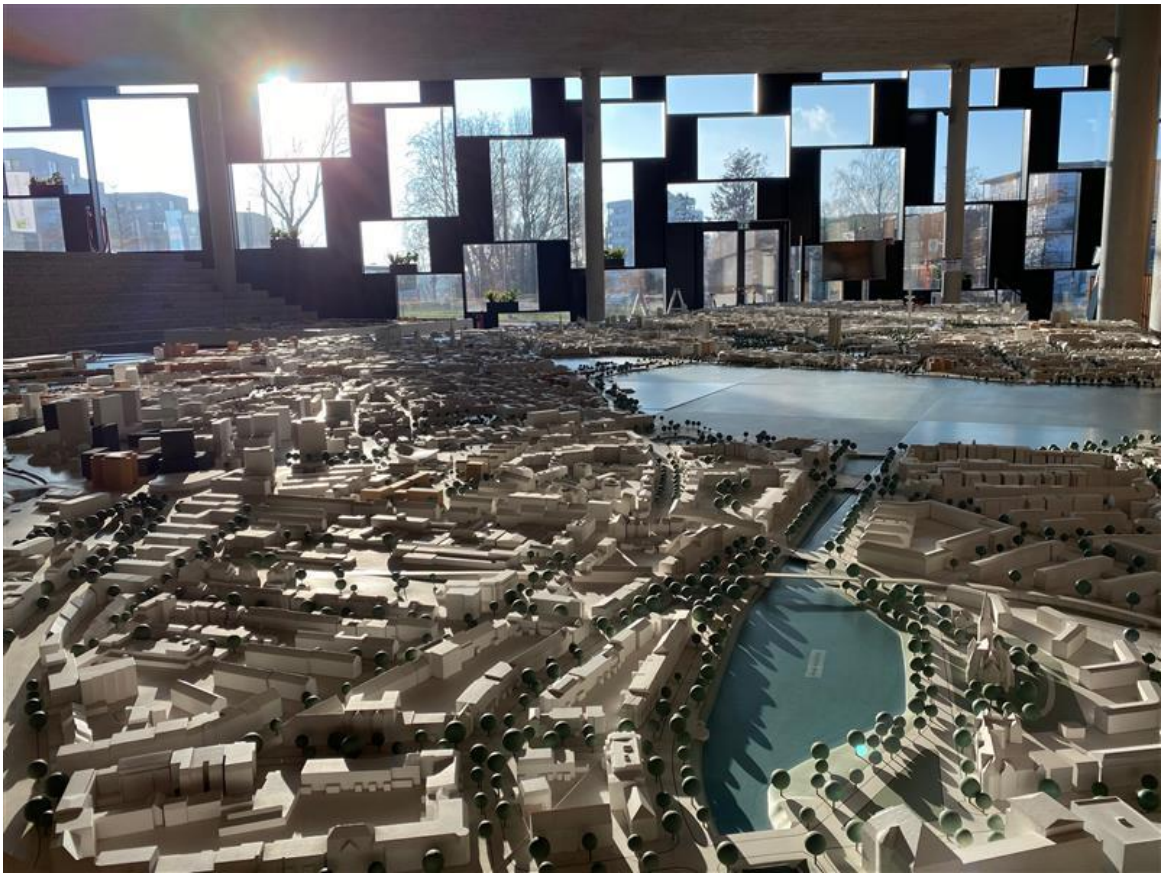
Visual materials

Two photos from a workshop with stakeholders from the City of Hamburg were selected for visual representation. For privacy reasons, the people in the photo have been blurred.

Figure 91: Screenshot workshop with stakeholders from the City of Hamburg

Source: Deloitte

Figure 92: Model of the City of Hamburg (entrance hall in BSW, City of Hamburg)



Source: Deloitte

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