

Government data-driven decision-making (DDDM) framework implementation. Test case: crisis management

Deliverable 1.5: Roadmap

Technical Support Instrument

Supporting reforms in 27 Member States



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Executive summary

Scope of the Project

This report has been developed within the Project carried out by PricewaterhouseCoopers EU Services EESV (hereinafter – PwC) on behalf of the DG REFORM, according to the specific contract No. REFORM/SC2021/076 (21EE02), signed on 14 October 2021. The report covers the items required in the Request for Service (RfS).

This report covers Outcome 1 of this Project – **Government data-driven decision-making**. Separate reports are issued for Outcome 2 and 3 which all combined comprise the complete package of deliverables.

Purpose of the Project and Report

This report has been prepared with the aim of providing an overview of the plan, or the roadmap, that has been developed for the Estonian Government. The roadmap contains specific milestones, works and contributors, in order to ensure the success of the project to promote data-driven decision-making (DDDM).

The content of this report

This report provides an overview of the roadmap, which identifies thirteen (13) milestones. For each milestone, an action plan has been created with an initial timeframe for its implementation. These milestones have been ranked in order of importance, and each milestone is accompanied by the role of various government agencies in achieving the milestone. The RACI model is used to assign roles, and the RACI responsibility matrix divides the parties into responsible, accountable, consulted, and informed - all of whom have an important role to play in the implementation of the activities.

In addition, the report outlines the expected results, and maps possible challenges for each milestone separately, as well as for the project as a whole. These challenges may have an impact on the parties involved and may hinder the completion of the roadmap.

Purpose of the roadmap

The purpose of the roadmap is to provide a clear direction and action plan for the Government to implement the data-driven decision-making process. Defined responsibilities, steps, and timeframes give structure to the project and help plan for possible challenges. It is important to note that the roadmap is a dynamic tool, rather than a fixed document, that will become more precise and detailed over time. The roadmap should be regularly reviewed and updated to ensure its continued relevance and effectiveness.

Conclusions, findings, and recommendations

The following findings summarise the insights gathered during the development of the roadmap, including technical, political, organisational, financial, and resourcing challenges, and provide steps required to reach the to-be situation.

- The “as-is” analysis **identified issues** causing challenges in data usage in the decision-making process: low proficiency in data processing, limited access to databases, limited usage of data, private sector regulations limiting data usage, data quality, difficulty of combining different data for analysis, and getting a thorough overview of the background topic to have the right context for analysis.
- As an **end solution, automated preparation** of the draft decision is expected, where related data and information are aggregated, data is being pre-processed, visualised to make it easier for people to understand the data content, and the draft decision document is prepared **without significant user intervention**.
- The system itself is **based on four pillars** (data, automation, intelligence, and reliability) that together create the foundation for a fully automated and data-driven end-to-end decision-making process.
- A **responsibility matrix** is suggested to maintain consistency and constant monitoring of the pursued milestones. **Specific roles must be discussed and approved** for each milestone and related works. It is important to note that the identification of stakeholders and responsible parties

is an **ongoing process**, and as the project progresses, new stakeholders and responsible parties may be identified and included.

- The due date for most of the milestones falls in **2024-2027**, however, the project as a whole is expected to be **finished by 2030** with full integration of previously separately developed milestones.
- The main **technical challenges** in implementing the DDDM system relate to integration with the **existing systems** (such as VIIS, KOOS, Public Data Gateway, RIHA), **data migration** in general, and **user adoption**.
- Ensuring that the users are able to effectively adopt and use the new tool will play an important role in the success of this project. Therefore, it is important to make the tool as simple and **user-friendly** as possible and automate the processes as much as possible.
- The main **political challenges** are expected to be related to the lack of political support, which may manifest in non-support of funding, as well as pressure to limit official intent.
- From the **organisational** aspect, the challenge is going to be in **communicating** and evaluating the **effectiveness** of the project since there will be multiple stakeholders with their own workflows and expectations of the system. This can lead to shifting opinions and resistance to change if one party feels left out. The recommendation is to create a **clear communication strategy** with proper and timely **training**.
- The main **financial challenges** are **budgeting** and **obtaining funding**. As the timeline for developing and implementing a DDDM system extends over several fiscal years, and the scope, including functionality needs, may expand, it is difficult to predict the actual investment needs and costs of the system (including system management and maintenance). Therefore, it is recommended to prepare a **more accurate budget** along with a **detailed analysis** during the planning stage of each milestone.
- The main **resourcing challenges** are related to the **lack of qualified and available staff**. There is a high probability, that the government will not have all the necessary personnel with the right skillsets to fully implement and maintain the new system. Therefore, it is advised to consider outsourcing some of the developments and management as a service. This, in turn, requires the creation of a competent administrative and development organisation, one of whose tasks, along with others, is to assemble a team.

Lühikokkuvõte

Aruande eesmärk ja ulatus

Aruanne on koostatud Euroopa Komisjoni struktuurireformide toe peadirektoriaadi (DG REFORM) tellimisel PricewaterhouseCoopers EU Services EESV (edaspidi PwC) poolt läbiviidud Projekti raames vastavalt 14. oktoobril 2021. aastal allkirjastatud lepingule nr REFORM/SC2021/076 (21EE02). Aruande koostamisel on lähtutud Projekti lähteülesandes esitatud nõuetest.

Aruandes kajastatakse ainult Projekti esimese tulemiga piiritletud teemasid – **andmepõhise otsustusprotsessi edendamine**. Eraldi aruanded väljastatakse Projekti teise ja kolmanda tulemi kohta, mis kokku moodustavad lepingus ettenähtud väljundid.

Käesolev aruanne on koostatud eesmärgiga anda ülevaade Vabariigi Valitsusele koostatud teekaardist andmepõhise otsustusprotsessi ja süsteemi edendamiseks, mis sisaldab arendusprojekte ja tegevusi ning eeldatavaid vastutajaid.

Aruande sisukirjeldus

Aruanne annab ülevaate teekaardist, mis hõlmab esialgu 13 arendusprojekti, millele on esitatud eeldatavad tegevused ja ajakava, oodatavad tulemused ning osalejad. Arendusprojektid on kavandatud ajalisel järjekorras, mille prioriteedi on määranud Riigikantselei. Arendusprojektide realiseerimisel osalevate riigiasutuste rollide määramiseks on välja pakutud RACI meetodika (nn vastutusmaatriks), mille alusel kannab Riigikantselei vastutavat rolli, kuid eri arendusprojektide tegevuste juurde planeeritakse teostajateks pädevad riigiasutused.

Lisaks kirjeldatakse aruandes DDDM süsteemi oodatavaid tulemusi ja kasusid, mida sellise süsteemi juurutamine taotleb saavutada. Täiendavalt on esitatud ka võimalikud väljakutsed, mida arvestada arendusprojektide elluviimisel.

Järeldused, tähelepanekud ja soovitused

Peamised järeldused, tähelepanekud ja soovitused tulenevad nii teekaardi koostamise kui ka projekti senise töö käigus kogutud arusaamistest ning on meie poolt välja toodud järgnevalt:

- "As-is" analüüsi käigus tuvastati **probleemid**, mis põhjustavad väljakutseid andmete kasutamisel otsustusprotsessis: madal andmetöötamise ja -analüüsi võimekus; piiratud juurdepääs andmetele; piiratud andmete kasutamine; regulatsioonid, mis piiravad andmekasutust, sh erasektorist; andmete madal kvaliteet; erinevate andmete kombineerimise keerulisus; analüüsiks vajaliku konteksti omandamine.
- **Lõplahendusena on oodata otsuse eelnõu automatiseeritud koostamist**, kus koondatakse seotud andmed ja info, toimub andmete eeltöötlemine, visualiseerimine, et otsustajatel oleks andmete sisust lihtsam aru saada ning otsuse eelnõu vormistamine. **Dokument kui analüüsiprojekt koostatakse ilma kasutaja olulise sekkumiseta.**
- Süsteem põhineb **neljal sambal** - andmed, automatiseeritus, intelligentsus ja usaldusväärsus; mis koos loovad vundamendi täielikult automatiseeritud ja andmepõhisele otsustusprotsessile.
- Teekaardi planeerimisel ja rakendamisel on soovitatud kasutada **vastutusmaatriksit**. Konkreetset rollid peavad olema kooskõlastatud iga arendusprojekti (*milestone*) tasemel, vajadusel ka arendusprojekti tööde tasemel. Oluline on märkida, et arendusprojektidesse panustajate väljaselgitamine on **pidev protsess** ning projekti edenedes on soovitatav tuvastada ja **kaasata vajaduspõhiselt uusi sidusrühmi**.
- Enamiku eeldatavate arendusprojektide periood jääb aastatesse **2024–2027**, kuid projekt tervikuna **peaks lõppema 2030. aastaks**, mil eraldiseisvalt arendatud lahendused moodustavad ühtse terviku.
- Peamised **tehnilised väljakutsed** DDDM süsteemi rakendamisel on seotud olemasolevate **süsteemide integreerimisega** (nt VIIS, KOOS, andmete teabevarav, RIHA), **andmete integreerimisega** ja uue süsteemi **kasutuselevõtuga** peamiste kasutajate poolt.

- DDDM süsteemi kasutuselevõtu tagamiseks on oluline see arendada võimalikult lihtsaks ja **kasutajasõbralikuks**, sh andmete tuvastamise, integreerimise, töötlemise ja analüüsimisega seotud toimingud automatiseerida.
- Peamised **poliitilised väljakutsed** on eeldatavalt seotud poliitilise toetuse puudumisega, mis võib avalduda rahastamisotsuste mitte toetamises, aga ka surves ametkondlikut kavatsust piirata.
- **Organisatsioonilisest** aspektist on väljakutseks **kommunikatsioon** ja projekti **tõhususe hindamine**. Kuna projektis on palju osapooli, kellel on antud süsteemi suhtes oma kontekst ja ootused, siis see võib tekitada arvamuste erisusi ja vastuseisu muutustele, kui üks osapooltest tunneb end kõrvalejäetuna. Soovitav on luua selge **kommunikatsiooniplaan** koos aegsasti kavandatud **koolitustega**.
- Peamine **rahanduslik väljakutse** on kogu projekti **eelarvestamine ja rahastuse saamine**. Kuna DDDM süsteemi arendamise ja rakendamise ajakava laieneb üle mitme eelarve aasta ning skoop, sh funktsionaalsuste vajadused võivad laieneda, on süsteemi tegelikke investeerimisvajadusi ja kulusid (nt süsteemi haldamine ja hooldus) raske ennustada. Seepärast on soovitatav koostada iga arendusprojekti planeerimise etapis täpne eelarve ühes detailanalüüsiga (s.o arendusprojekti detailne lähteülesanne).
- Peamised **ressurssidega** seotud väljakutsed on seotud **kvalifitseeritud** ja vabade töötajate **puudumisega**. On tõenäoline, et Vabariigi Valitsusel ei ole kõiki vajalike oskustega inimesi uue süsteemi ja/või selle osade arendamiseks, rakendamiseks ja hooldamiseks, mistõttu peaks olema valmis osa arendusi ja haldamist teenusena hankima. See omakorda eeldab pädeva haldus- ja arendusorganisatsiooni loomist, mille üheks ülesandeks teiste kõrval on meeskonna komplekteerimine.

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1. Introduction

1.1 Scope of the Report

1.1.1 Purpose of the Report

This report has been drafted for the purpose of describing the strategic plan (roadmap) to implement the already developed and documented preferred to-be scenario in the future operational environment of the Beneficiary. It includes a summary of the overall context, including current situation and the to-be situation to be achieved, as well as the pursued qualities and results that will contribute to the transformation.

This report also describes the main challenges identified in Section 3.4 to be addressed during the implementation of the to-be situation (e.g. at the technical, political, organisational, financial and resource levels).

The roadmap itself will indicate the specific milestones necessary to reach the expected results, including a description of each milestone and its related activities, the responsible authorities and other contributors, implementation recommendations and expected timelines. The potential inter-dependencies of the milestones are presented in Figure 6. Expected timeline. This report additionally includes expected results and milestone-specific challenges, that are listed in the third section Table 3. .

The approach and results of the topics are described in the respective sections.



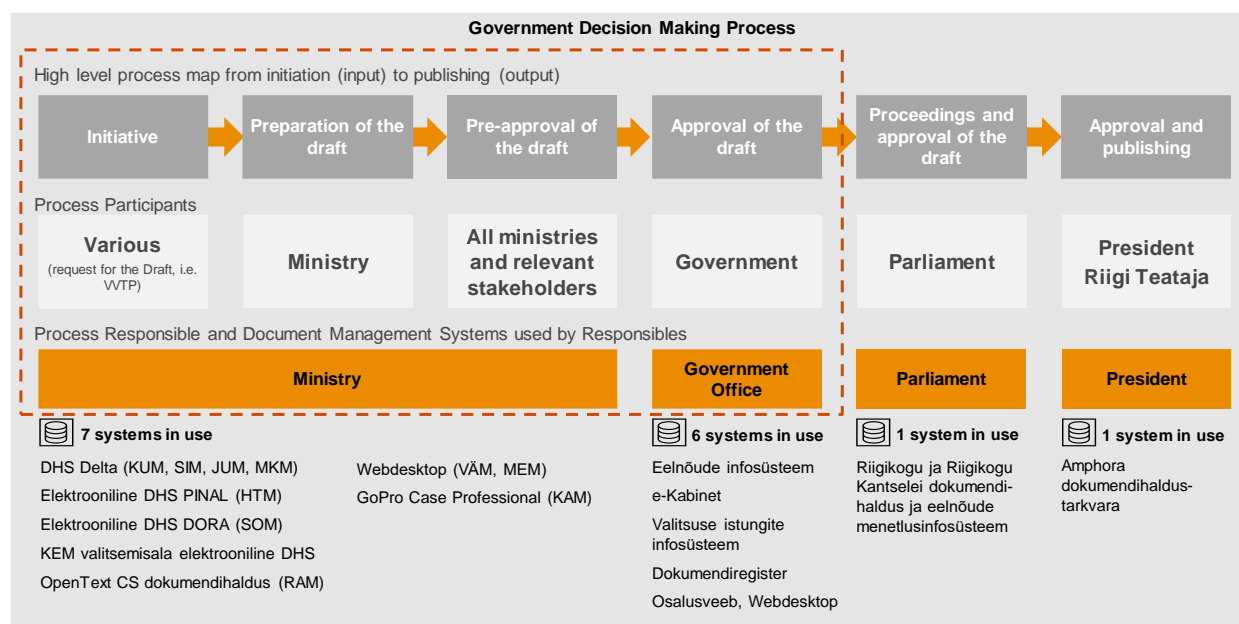
This report covers only Outcome 1 – Government data-driven decision-making framework implementation. Separate reports are issued for Outcome 2 and 3 which all combined comprise the complete package of deliverables.

1.1.2 Scope of Outcome 1

The decision-making process generally involves several institutions (Ministry, Government Office, Parliament, President) as described in Figure 1. As there are many different types of legal documents and decisions in Estonia (described in Deliverable 1.1.), the level, scope and course of the decision-making process vary.

The Project Scope approved in Deliverable 1.1. **covers the areas of responsibility of the Ministries and the Government Office** as shown in Figure 1.

Figure 1. Scope of the Project by Institutions in Outcome 1



It was acknowledged that certain types of Documents are submitted to the Parliament for proceedings and approvals, as well as Legal Drafts are submitted to the President for announcement and publication in the Riigi Teataja; however, considering the purpose of the Project, **the working process and practices of the Parliament and the President are not covered.**

In summary, the Project Scope¹ covers the following:

Table 1. Project Scope

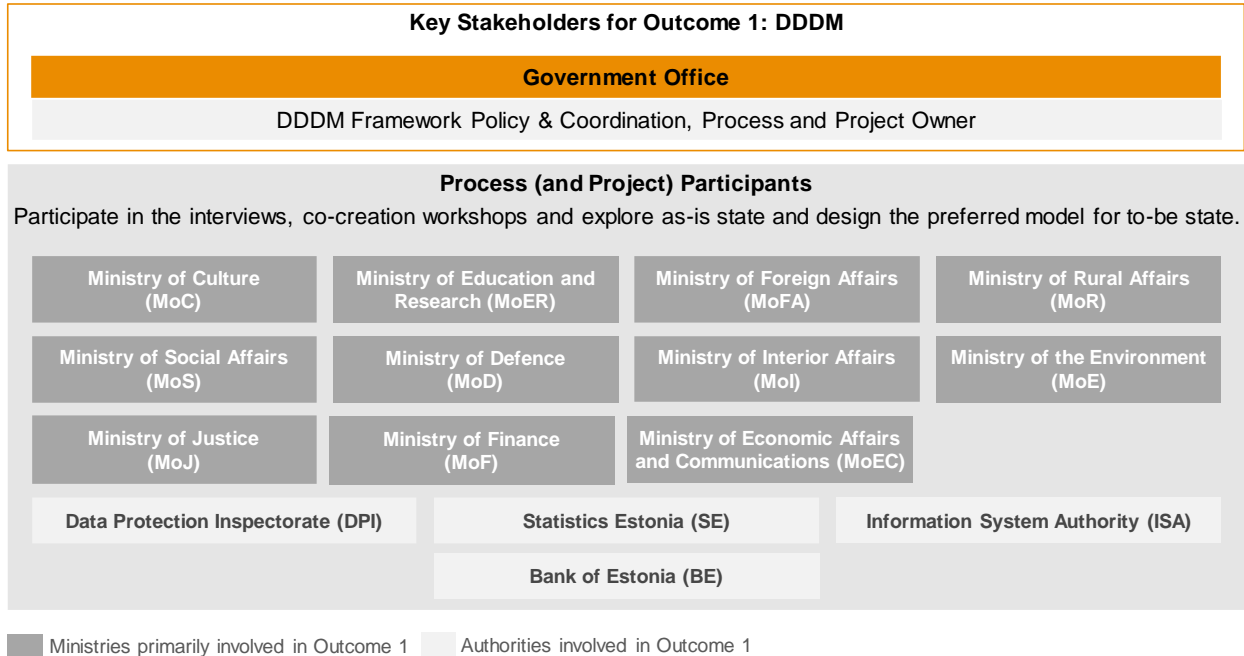
| Area | Description |
|-------------------------------|---|
| 1. Institutions | Responsible for the Process: <ul style="list-style-type: none"> Ministries Government Office |
| 2. Document Type | <ul style="list-style-type: none"> Government Memorandum |
| 3. Process | <ul style="list-style-type: none"> End-to-End process of Government Memorandum An end-to-end process describes a process that follows the steps from beginning to end and provides a complete output for Government decision-making |
| 4. Data and Technology | <ul style="list-style-type: none"> Data and Technology used in the process of Government Memorandum |
| 5. People | <ul style="list-style-type: none"> Participants and decision-makers, such as civil servants and/or third parties (i.e. subject matter experts) involved in the process of Government Memorandum |

¹ A more detailed overview can be found in the Deliverable 1.1 "Current situation report"

1.1.3 Project Stakeholders for Outcome 1

In order to conduct an effective stakeholder engagement, the following key stakeholders and process participants involved in the Project work have been identified for Outcome 1 (Figure 2).

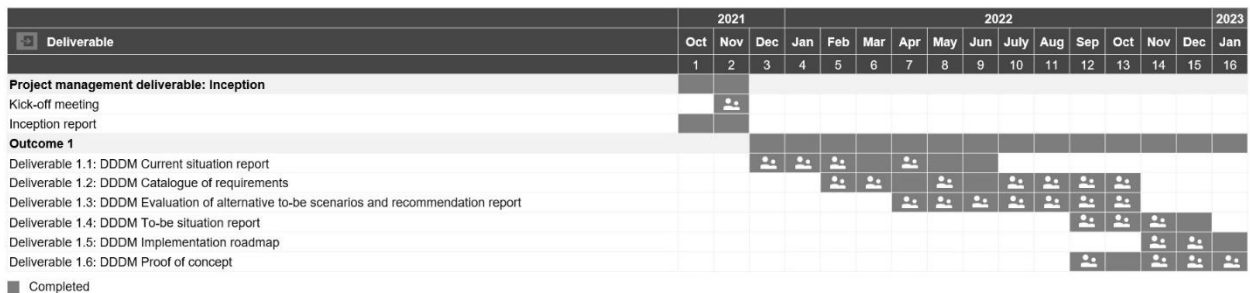
Figure 2. Outcome 1: Key Stakeholders and Project Participants



1.2 Project Timeline

Figure 3 provides a high-level overview of the project activities and timeline. The activities of the fifth deliverable took place from December 2022 to January 2023.

Figure 3. Project Activities and Timeline



The content of the roadmap is shared in a separate Excel file in Estonian language (Appendix to this deliverable) and will be used by the Beneficiary as an ongoing tool after the completion of the current project, hence it is expected to be further modified and updated.

2. Overall Context

2.1 Overview of the Situation

2.1.1 Objective

The aim of the project is to create a system of technological support for data-driven decision-making that is integrated into the processes to make the use of data in policy-making transparent, simple and fast.

2.1.2 Problem Statement

In the policy- and decision-making process, it is exceedingly difficult and time-consuming to use all potentially relevant and available information. Even if a considerable amount of information and data has been used in the preparatory phase of the decision-making, it is not always perceived and fully understood by decision makers. In practice, decision makers may be presented with a somewhat filtered set of information supporting and justifying the decision proposal that was known, available and decided to be used in the preparation of the decision proposal.

Therefore, it is possible that not all important aspects have been thoroughly considered in decision-making. There are ca. 1,500 decisions made annually at the cabinet meetings and sessions of the Estonian Government; therefore, the members of the Government may not be able to cover all the details, yet they are expected to be supported by modern solutions.

2.1.3 The Causes of the Problem

During the “as-is” analysis, the following issues were identified causing the challenges in using the data in the decision-making process:

- Skills in identifying, collecting, processing and analysing relevant data are rather low.
- Access to registers and databases is limited.
- A limited amount of data is used, only the data that is known and accessible.
- Private sector data is difficult to use, if at all allowed.
- Data quality varies and in some cases is poor.
- It is difficult to combine different datasets for the purpose of analysis.
- Getting an overview of the background of the topic (memorandums, studies, analyses, etc.) is difficult and time-consuming.

2.1.4 Expected result

The end solution is expected to be the automated preparation of a draft decision, where related data and information are aggregated, data is pre-processed, visualised to facilitate understanding of the data content, and a draft decision document is prepared without significant user intervention.

For example, the data underlying the Government Memorandum are gathered and results of the analysis are visualised automatically. The role of the user is to review the automated suggestions and, if necessary, correct, modify, and add relevant content and interpretation.

This kind of result would allow to speed up the decision-making process, reduce the inadvertent preparation of the draft decision or deliberate subjectivity and increase the transparency of the decision-making process.

The DDDM system may enable an automated solution to issue data-driven outputs (answers) to enquiries received as a result of government cabinet meetings and sessions. In the current context, getting the answer may require some time for preparation and, therefore, postpone the decision to the future. The process of achieving this result is complex, and it is reasonable to implement it in stages. Furthermore, it is crucial to have better user intervention in the early stages, especially during the DDDM testing period. because the reason for this is that without a good number of proven cases (cycles) the political risk is higher and policy management is more complex (systems trustworthiness and reliability is lower at the beginning).

In addition, a data governance tool, such as an audit system, may be implemented to increase control over the data the DDDM system uses to issue recommendations.

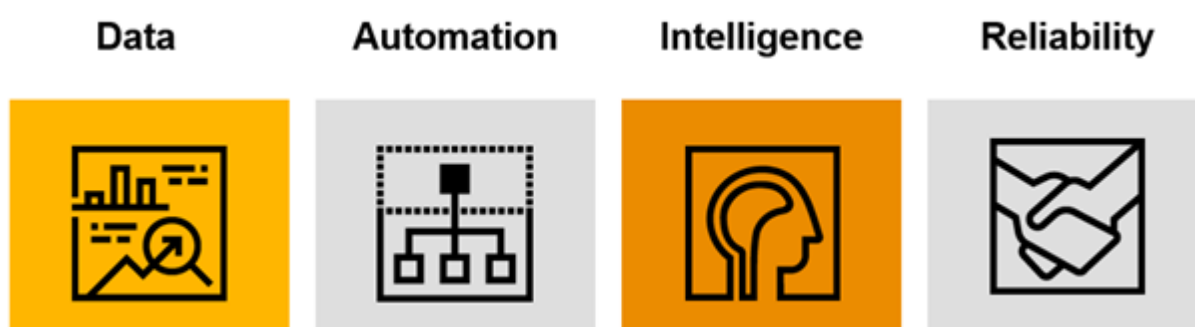
2.2 Qualities and Expected Results

The access to the tool (DDD system) would significantly reduce the time spent preparing drafts when searching for related information, supports the inclusion of all relevant data, makes the process more transparent and generates alternative solutions based on rational considerations.

At the same time, during the development and implementation phases, the DDDM system is expected to be interconnected with existing and new platforms, such as a co-creation workspace or a session information system used in the policy making.

The system itself is based on four pillars presented in Figure 4 that together form the foundation for a fully automated and data-driven end-to-end decision-making process.

Figure 4. Foundation pillars of the system



In addition to these four pillars, there is a number of desired qualities and expected results that the DDDM system aims to provide to end users and decision-makers (see Table 2):

Table 2. Qualities and Expected Results

| Nr | Quality | Expected Result |
|----|---------------|--|
| 1. | Automation | Speed of the decision-making process. |
| 2. | Intelligence | AI and machine learning capabilities are considered and implemented using the full potential of technological capabilities, users and decision-makers are better supported through automated suggestions and smart functionalities. |
| 3. | Quality data | If an error occurs in the data, it can be easily detected through visualisation and reported for correction. In addition, the amount of data input will be scalable due to better and easier access to datasets. It will also help identify and eliminate unnecessary data collection directly from citizens and businesses. |
| 4. | Reliability | The information flow will be linked to the source material, giving the user direct access to the data source material and making all material traceable for updating and further analysis/quality control. |
| 5. | Systemisation | Allows all documents to be found, categorised and stored in an orderly manner, facilitating back-end operations and freeing up resources. This potentially leads to better reuse of data. |

| Nr | Quality | Expected Result |
|-----|------------------|--|
| 6. | Standardisation | Equalises the quality of work across institutions and ministries. Creates a common framework for all parties involved, thereby improving the absorption of the information and the speed of cooperation. Helps to establish ethical and data quality frameworks. |
| 7. | Responsibility | Each user can be identified and given importance/access depending on their position and responsibility. It also helps promote ideas and projects by giving a direct ownership to a specific user or user group. |
| 8. | Engagement | Allows engaging different stakeholders and advisors in the conversation at any given stage of the process, expanding the range of published datasets and generating insights for public policy and research. |
| 9. | Foresight | Enables building a clear pipeline with document headlines, allowing for better management of potential future risks and workflow. |
| 10. | Instant feedback | The user can receive and request direct feedback on any outstanding project or datasheet before moving the process forward. This will result in a more diverse perspective and higher quality information relevance. |

Although the qualities and expected results may be minimised depending on user restrictions, it is clear that with a well-organised and standardised structure, the system will play a key role in integrating the data-driven decision-making process for the government. It will help make important decisions quickly and with a solid base of support and feedback, while downgrading the risk of error.

In addition to the above-mentioned expected results, a well-established workflow within the pipeline and automated design functions will assist civil servants in devoting less time to minor day-to-day management duties and more to serving their office and the electorate.

3. Roadmap

3.1 Framework and methodology

The framework and structure of the roadmap provides a comprehensive overview of the milestones and works needed to implement the DDDM system. It describes the milestones, indicates the expected timeline for their completion, and outlines the stakeholders involved (e.g. contributors). The roadmap is based on the goal of achieving results quickly; therefore, it is necessary to develop the DDDM functionality on a priority basis and implement the work at the relevant state institutions that have the competencies, legal basis and capabilities. The priority of the milestones is determined by the Beneficiary – the Government Office.

The roadmap itself is broken down into five main categories:

- 1) Milestone (e.g. development projects).
- 2) Description of the work (e.g. activities or works related to the milestone).
- 3) Expected result.
- 4) Expected due date.
- 5) Roles and responsibilities.

The Beneficiary has considered numerous circumstances when suggesting the order of the milestones, such as the existing competencies of the public authorities, similar development projects already being implemented or the availability of resources and funding.

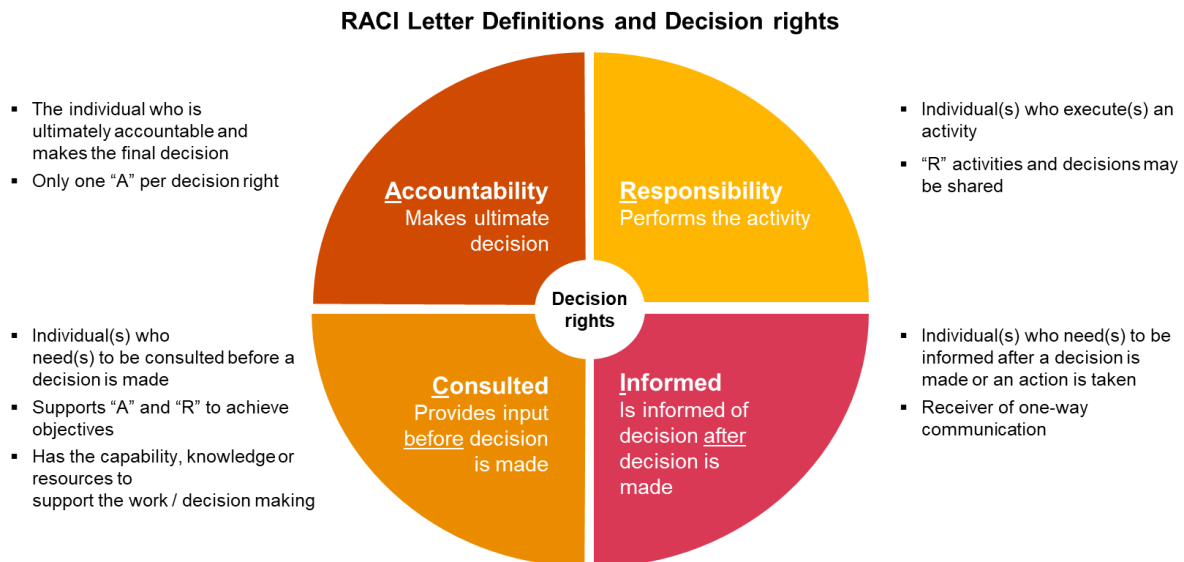
The expected result is described at the milestone level, as well as the expected due date and roles. The expected completion date of the milestones is determined at the annual and quarterly levels. Furthermore, at the time of issuing this report, not all the contributors were clearly identified; therefore, only the accountable and responsible authority is suggested to be identified at the milestone level. It is recommended that other contributors are determined later in the process of implementing each milestone.

In some cases, the activities of certain milestones may not have been described since they are either planned to be implemented in the distant future, and therefore such milestones must be revisited.

3.2 Governance

A responsibility matrix named RACI² has been suggested to coordinate the achievement of milestones and continuously monitor their implementation. RACI stands for responsible, accountable, consulted and informed. It is a responsibility assignment matrix that describes the participation of various roles in the implementation of project tasks.

Figure 5. RACI Model



The **responsible** party is also often referred to as the "process owner" and the one who conducts the actual work. There can also be more than one responsible party, but there should be at least one.

However, there can be only one **accountable** party, since the accountable party is the one who approves process exceptions and enforces decisions. **The Beneficiary (Government Office)** is accountable for most, if not all, development projects.

The **consulted** party is someone whose opinions are being sought. They usually have a strong vested interest in the process as they execute the process daily or otherwise allocate resources. They also need to be consulted prior to making a decision since the decision will affect areas under their control. The whole process is a two-way communication.

The **informed** parties receive information about the progress of the process, and once a decision has been made, they need to be informed. This is typically a one-way communication.

A RACI diagram will be added to the roadmap to delegate roles and responsibilities.

The key stakeholders who are responsible, consulted and/or informed (contributors to the development projects as a whole) include, but are not limited to, the following parties:

- Statistics Estonia.
- Information System Authority.
- Data Protection Inspectorate.
- Ministries.
- Public Authorities in the central government area.

² https://en.wikipedia.org/wiki/Responsibility_assignment_matrix

- Information Technology Centre for the Ministry of Finance.
- IT Centres for ministries, such as the Health and Welfare Information Systems Centre (TEHIK), Information Technology Centre for the Ministry of Interior (SMIT), Information Technology Centre of the Ministry of the Environment (KEMIT) and others.

Specific roles must be discussed and approved for each milestone and related work. It is recommended to assign roles at the contact level (e.g. position).

When assigning specific roles at the government level, it is also important to note that, in addition to the key stakeholders, there will be additional stakeholders involved who should also be consulted or, at a minimum, informed. These stakeholders may include the following:

- Private companies or organisations that hold relevant data for the project.
- Academic institutions or research organisations with expertise in data management or related fields.
- Professional associations or industry groups representing relevant data holders or users.
- Community organisations or advocacy groups that represent the interests of individuals or groups that may be affected by the project.
- Other government agencies or departments involved in the management or use of the data, such as those responsible for specific policies, such as healthcare or education.

Data digitalisation is a complex and multifaceted project that involves a wide range of stakeholders and responsible parties. These may include data holders and experts from various fields. Engaging with these stakeholders and responsible parties will be crucial for a successful data-driven decision-making process and achieving the ultimate goals of the project. It is important to note that identifying stakeholders and responsible parties is an ongoing process, and new stakeholders and responsible parties may be identified and engaged during the project.

3.3 Milestones

In total, there are 13 milestones described on the roadmap, listed in the order of priority. These milestones are mostly suggested by the Beneficiary and reviewed by the Consultant. These milestones have a different structure than the core and supporting functionalities of the system described in deliverable 1.4. The roadmap approach envisages the development of capabilities by legal data classification such as personal data, sensitive commercial data, international data, private sector data, etc. The Beneficiary expects that during the milestone No. 9, the components of the expected DDDM system will be integrated, creating the DDDM system.

Table 3. Roadmap

| Milestones | Description | Expected Results (R) and Challenges (C) |
|------------------------------|--|---|
| 1. Text analysis capability. | The basis of the milestone is the knowledge realisation that the capabilities of text analysis at the level of central government, including work tools, are limited, and that is why such a capability is needed. | <p>R: An aggregated corpus of texts, a text analysis tool, the ability to search a large volume of texts and obtain a systematised and tangible search result.</p> <p>C: Data – the source data is not determined (can be structured or non-structured), and access to it may be restricted. Source data can be legal acts, publications, memos or any other relevant text document that should be determined during the planning of the development project.</p> <p>Data annotation - labelling all relevant data can be time-consuming.</p> <p>Data variability - handling different data types and structures, ensuring consistency, and dealing with missing or inconsistent data.</p> <p>Indexing - the corpus size of the and the search query complexity affect indexing functionality.</p> <p>Interoperability – the wide variety of formats in which data can be received (the need to process conversions).</p> |
| 2. Search capability. | A background mapping solution is being created that does not require interfacing with any national database, searching for open data on the Internet and/or data generated from limited datasets in a non-centrally controlled manner. | <p>R: Defined sources, a search engine and a user interface for its use. The user interface is introduced in the proof of concept (Deliverable No. 1.6.)</p> <p>C: Data availability – the data needed may not be available in open data searches. Validation – open data on the Internet is often biased and may be inaccurate.</p> <p>Incomplete data coverage – there may be data gaps that lead to an incomplete mapping of the subject matter area and/or research question.</p> |

| Milestones | Description | Expected Results (R) and Challenges (C) |
|---|---|--|
| 3. Personal data processing capability. | The capability to use data linked based on personal data, cross-query data from state databases containing personal data. | <p>R: A legal framework that has been modified to allow for the use of data while ensuring privacy. A user interface for submitting requests with the possibility to receive answers to inquiries in a generalised form if the preparation of a response to a request requires the right to process personal data.</p> <p>C: Privacy and security – all data protection regulations must be followed and protected from unauthorised use.</p> <p>Ethical considerations – when working with personal data, it is important to consider how the data is used and processed.</p> |
| 4. Non-personal sensitive data processing capability. | The capability to use data containing trade secrets or data that has a restricted access for other reasons without harming the interests of the related parties of the data owners. Project scope does not include data related to state secrets. | <p>R: The possibility to receive answers to inquiries in a generalised form (without infringing the rights of data owners) if the preparation of a response to the request requires the right to process business secret or other restricted data.</p> <p>C: Data confidentiality and non-disclosure agreements – depending on the nature of the data and legal limitations, it may be necessary to establish appropriate agreements or legal basis to obtain access to the data.</p> |
| 5. Limited-use data processing capability from state databases. | The possibility of using data without a restricted (limited-use) access stamp in state databases. | <p>R: Key data relevant to the data-driven decision-making process can be defined during the mapping and published as open data and can be understood by users unfamiliar with the datasets through data descriptions and metadata.</p> <p>C: Data governance – data may be under the control of different entities, making it difficult to access quickly.</p> |
| 6. Capability to utilize data from other state datasets. | The possibility of using datasets that are used by the public sector but is not included in the available open databases/platforms or official registries at the national level. Can be random a dataset that the user considers important and has access to. | <p>R: Key data relevant to the data-driven decision-making process defined and discovered by the users are integrated to the DDDM system.</p> <p>C: Data availability – public sector hold data that is not included in the national databases is usually less standardised and less viable.</p> <p>Licensing – data may not have a clear license and may have user restrictions.</p> |
| 7. International open data capability. | Creating an interface for the international open data that are considered a priority for the DDDM system. | <p>R: The information contained in the datasets is prioritised and searchable through a single user interface, and ideally searchable in Estonian.</p> <p>The technological solution is publicly available.</p> |

| Milestones | Description | Expected Results (R) and Challenges (C) |
|---|--|--|
| | | C: Data availability/quality. |
| 8. Private sector data capability. | Mapping datasets that can be easily generalised (especially mobile positioning, data related to bank transactions, data related to the provision of transport services, etc.) and looking for opportunities to use them in the DDDM system. | <p>R: The possibility to receive answers to inquiries in a generalised form (without infringing the rights of the data subjects) if the preparation of a response to the request requires the right to process business secret or other restricted data.</p> <p>C: Data security and access – stricter terms may be required to determine how to best protect and use the data.</p> <p>Data anonymisation – data may need to be anonymised to protect the rights of data subjects; it might be necessary to anonymise the data.</p> |
| 9. Integrating the components and building the DDDM system. | The components are combined into a complete DDDM system, enabling the retrieval and use of all types of data. The primary visualisation solution can already be handled in a suitable form with the help of previous modules and can be transferred and further developed. | <p>R: A possibility to query all datasets using flexible full-text search. The result is a comprehensive, systematised and visualised overview of the data with the option of zooming into the data.</p> <p>C: Data integration – combining data from different sources and formats can be challenging, depending on the complexity and structure of the data. All data must be converted into a similar format, furthermore, visualising such large datasets requires an expert understanding of data visualisation tools and techniques.</p> |
| 10. Automation of standardised analyses. | For common tasks (cost-benefit analysis, environmental impact, impact on strategic goals), a preliminary set of analytical solutions is created that ideally work automatically on all datasets. If this is not feasible, the analytical solution can be easily adapted to the new dataset (e.g. using visual programming techniques). | <p>R: Most common analyses can be done automatically or with minimal human intervention.</p> <p>C: Flexibility – different users will have different needs and perceptions of the data. This can make it difficult for the tool to provide relevant solutions if it is fully automated.</p> <p>Domain-specific knowledge – automatically solving common tasks such as cost-benefit analysis, impact on strategic goals, etc., requires integrating domain-specific knowledge into the tool.</p> |
| 11. Code repository. | Includes standards, agreements, technical solutions, processes, etc., making every analytical solution leave a reusable trace (code) that can be automatically reused to solve a similar task. | <p>R: The ability to reuse analytical solutions will result in time and cost savings, as well as improved consistency and accuracy of results. A code repository also allows for easier and more efficient data sharing, leading to increased collaboration.</p> <p>C: Code quality – Ensuring that the code is readable, maintainable (up to date) and compliant with best practices and standards can be challenging.</p> |

| Milestones | Description | Expected Results (R) and Challenges (C) |
|------------------------------------|---|--|
| | | Upgradability – Ensuring that the code repository can be upgraded to new versions of the programming language or technology in the future. |
| 12. Scenario analysis capability. | A controlled solution for manipulating raw data, where the output “what-if” scenarios are based on different raw data, formulas or any other conditions supporting the impact analysis. | <p>R: A better understanding of the possible outcomes and trade-offs associated with different scenarios will help identify key drivers and relationships within the data.</p> <p>C: Creating different scenarios and data manipulation can lead to human errors, especially when dealing with large amounts of data, which can affect the reliability of the scenarios generated.</p> |
| 13. Automatic analyses capability. | A solution that can generate automatic analyses to find answers to questions posed in a text search. | <p>R: Improved accuracy, efficiency, and decision-making through automatisations.</p> <p>C: Understanding and interpreting the nuances of the data being processed can be a significant challenge, since the system must understand the context and intent behind the question to provide an accurate answer.</p> |

The milestones are followed by a work description that describes the nature of the milestones and provides a more detailed understanding of what steps need to be taken. For example, if the milestone is “*Building a text analysis capability*,” then the description will expand into three subsections that add to the framework:

- “*The basis of the milestone is the knowledge realisation that the capabilities of text analysis at the level of central government, including work tools, are limited, and that is why such a capability is needed*”
- “*A preliminary analysis is needed that would specify the scope of work to be developed, define the expected executor (the Estonian Language Institute is the preferred option), map the availability and location of text data in the public sector, prioritise the use of text data, and specify where and how to collect such text data centrally*”
- “*Capability mapping and selection of a technological solution for text data aggregation, and the design of workflows processes (“to-be”). Development of the technical environment, commissioning (service provision) and user support*”

The expected result category defines the expectations for the work and what it should achieve. Following the example given in the last paragraph, for building a text analysis capability, the expected result has been described as follows: “*An aggregated corpus of texts, a text analysis tool, the ability to search a large volume of texts and obtain systematised and tangible search results.*”

Most of the milestones are expected to be completed within 2024-2027; however, the project as a whole is expected to be finalised by 2030.

The timeline for the milestones is designed to be interactive and adaptable, reflecting the evolving nature of the project. It provides an overview of the key milestones and estimates their expected completion dates, allowing stakeholders to visualize the progress and adjust their plans accordingly.

The last four milestones indicated on the timeline currently lack a timetable due to their dependence on the completion of all preceding milestones, rendering them unpredictable at this time. Therefore, they are currently labeled as 'to be determined'.

A more detailed overview of the milestone's implementation can be found in Appendix 4.3 Timeline.

3.4 Challenges

When implementing any project or initiative, challenges inevitably arise. These challenges can come in many forms, including technical, political, organisational, financial and resourcing issues. In this section, each of these types of challenges will be discussed in more detail and explored how they relate to the implementation process. The ability to effectively address these challenges is crucial to successfully achieving the desired to-be situation. By proactively identifying and addressing potential challenges, the risk of a project going off track and failing to achieve its goals and objectives can be reduced.

Table 4. Potential challenges when implementing the DDDM system

| Technical |
|--|
| <ul style="list-style-type: none">• Integration with existing systems: The new solutions need to be integrated with the government's existing systems and processes, which can be a complex and time-consuming task. |
| <ul style="list-style-type: none">• Data integration: As the government moves from an existing solution to a new solution, it needs to integrate and process large amounts of data, which can be a technical and legal challenge. |
| <ul style="list-style-type: none">• Security and compliance: Ensuring that the new DDDM solution is secure and compliant with relevant regulations and standards. |
| <ul style="list-style-type: none">• The ability to adapt and learn from different phases: Some technologies to be tested and used may not be suitable for all cases; therefore, it is important to review all options with new perspectives at each phase. |
| <ul style="list-style-type: none">• Utilising user interface (UI) design at different phases: Utilising UI in a way that makes the dataset as complete as possible without distortions caused by aggregation can be challenging, especially in the early phases. |
| <ul style="list-style-type: none">• Availability of technological solutions: Some technological solutions to be used have not yet reached the level of maturity to be used for this purpose or are still under development. |
| Political |
| <ul style="list-style-type: none">• Political pressure: There is often political pressure from various quarters, including elected officials, lobby groups and the media. This pressure can make it difficult to implement changes, especially if powerful interests oppose them. |
| <ul style="list-style-type: none">• Limited resources: The government has limited resources, including financial and human resources, which can make it difficult to implement large-scale changes. |
| <ul style="list-style-type: none">• Complex bureaucracy: There are multiple levels of decision-making and a wide range of stakeholders who must be consulted and engaged in the process of change. This complexity can make it difficult to implement changes efficiently and effectively. |
| <ul style="list-style-type: none">• Legal and regulatory constraints: Government organisations are often subject to a wide range of legal and regulatory constraints that can make it difficult to implement the changes needed to achieve desired outcomes. |
| Organisational |
| <ul style="list-style-type: none">• Resistance to change: Change can be difficult for many people, and there may be resistance to the proposed changes from within. This resistance could come from civil servants who are |

comfortable with the current way of operating, or from stakeholders who are concerned about the impact of changes.

- **Communication:** Ensuring that all relevant stakeholders are aware of the proposed changes and understand how the new decision-making process will work can be challenging.
- **Training:** Providing training to officials on the new decision-making process may be necessary, which can be challenging if the process is complex or requires significant changes in the way officials work.
- **Implementation:** Implementing the new decision-making process may require changes in systems, processes and policies, which can be challenging to implement effectively.
- **Managing expectations:** Managing the expectations of stakeholders and officials during the transition to a new decision-making process can be challenging, as they may have their own expectations of how the process will work and what the outcomes will be.
- **Effective integration of the system into the data quality assurance process:** When problems arise in the data, they need to be reported to the owner of the source data, so that the necessary correction processes can be implemented. This communication can be slow and requires active management.
- **Evaluating effectiveness:** Evaluating the effectiveness of a new decision-making process and making the necessary adjustments to ensure it is working effectively can be challenging.

Financial

- **Funding:** Implementing new systems often requires a significant investment of time and money. The government may not have the necessary budget or resources to fund all the necessary projects.
- **Cost-benefit analysis:** The government should compare the costs of implementing new systems with the potential benefits they will bring. If the costs outweigh the benefits, the government may decide not to pursue the project and stop it halfway through.
- **Procurement:** The government must comply with procurement laws when purchasing new systems, which itself can be time-consuming and costly.
- **Training:** Training must be provided to officials on how to use the new systems, which can also be expensive.
- **Integration:** Integrating new systems with existing systems can be challenging and costly. Therefore, it is necessary to ensure that new systems are compatible with existing systems and processes.
- **Maintenance:** New systems require ongoing maintenance and updates, which can be costly. The government should budget for these costs before implementing new systems.

Resourcing

- **Lack of qualified personnel:** The necessary personnel might not have the right skills and expertise to implement and maintain the new systems.
- **Limited personnel availability:** There is a limited number of personnel available to work on the implementation of the new systems, which can slow down the process.

- Limited budget: There may not be enough budget to hire additional personnel or contractors to help implement the new systems.
-
- Inadequate infrastructure: The necessary infrastructure, such as servers and networking equipment, may not be available to support the smooth operation of all new systems.
-
- Dependence on external contractors: The need to rely on external contractors to implement new systems, which can be costly and may not always provide the best value for money.
-
- Time constraints: Implementing new systems can be a time-consuming process, and the government may not have the necessary time and resources to implement the project.

As stated above, various challenges can arise when implementing the DDDM system. Understanding the nature of these challenges and developing strategies to overcome them increases the chances of success. It is also important to remember to remain vigilant and proactive in identifying potential new challenges and seeking resources and support as needed. With careful planning and the right approach, any obstacle can be overcome.

4. Appendices

4.1 List of Interviews and Meetings

Table 5. List of Interviews and Capacity Building Workshops

| Date | Organisation | Participants, organisation/role |
|------------|-------------------------|--|
| 22.11.2022 | Government Office | Dmitri Burnašev , Deputy Strategy Director Erik Ernits , Head of Data Ivar Hendla , Strategy Adviser |
| 22.11.2022 | Government Office | Erik Ernits , Head of Data |
| 29.11.2022 | Government Office | Dmitri Burnašev , Deputy Strategy Director Erik Ernits , Head of Data Ivar Hendla , Strategy Adviser |
| 6.12.2022 | Government Office | Erik Ernits , Head of Data Ivar Hendla , Strategy Adviser |
| 8.12.2022 | Government Office | Erik Ernits , Head of Data |
| 12.12.2022 | Government Office | Erik Ernits , Head of Data |
| 16.12.2022 | Government Office | Erik Ernits , Head of Data |
| 10.01.2023 | Government Office | Erik Ernits , Head of Data |
| 12.01.2023 | Government Office, OECD | Arturo Rivera , OECD, Lead, Data-driven public sector & South-East Asia, Digital Government and Data Unit Cecilia Emilsson , OECD, Policy analyst Erik Ernits , Head of Data Akshay Bakhai , DG Reform, Advisor |
| 07.02.2023 | Government Office, OECD | Arturo Rivera , OECD, Lead, Data-driven public sector & South-East Asia, Digital Government and Data Unit Erik Ernits , Head of Data Akshay Bakhai , DG Reform, Advisor |

4.2 Roadmap

The roadmap in Estonian can be found in a separate MS Excel file “21EE0 D1.5. DDDM Roadmap EST.xlsx”

4.3 Timeline

Figure 6. Expected timeline



- Independent development of the milestone and the expected duration
- The integration of all previously developed milestones
- To be determined
- Integration flow



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