

**A Report for
DIGIT**

**OSS Catalogue Benchmark Final
Report D01.05 - D03 - D04**

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Executive Summary

Open source software (OSS) usage has become nearly universal, Gartner research shows. The vast majority of organisations use OSS within mission-critical IT workloads, whether they are aware of it or not. Confirming the global trend, the Commission's Open Source Strategy 2020-2023 aims to encourage sharing and reuse of software and applications as progress towards digital autonomy. The 2020 Berlin Declaration calls for European institutions to promote "the development, sharing and re-use of open source standards, solutions and specifications across borders."

Across the EU, Member States have put in place legal and political OSS initiatives. Most concretely are their catalogues of open source solutions, which differ in scope, maturity and approach to classification. This situation hinders cross-border reuse, creating the opportunity for a European-level catalogue. Gartner was commissioned by DIGIT – manager of the Joinup collaboration platform - to investigate the best ways to provide such a catalogue including the metadata standard.

The study has four objectives:

- Analyse the landscape of these catalogues,
- Create a target benchmark and propose steps to build the catalogue at EU level,
- Propose a data model,
- Benchmark the Joinup platform against the proposed target.

The benchmarking approach uses the ISO Software Quality Standard as best practice. It studies more than 10 catalogues with a variety of maturity, geographical spread, ownership and standard data model usage.

The landscape analysis shows the EU catalogue can maximise its impact by scaling the goal of these catalogues. These focus either on sharing or on reuse. Gartner identifies two scenarios:

- The Cross-border Bridge aims to scale sharing across the existing OSS catalogues by federating them,
- The EU OS Solution Reuse Promoter hosts EU and cross-border solutions and focuses on reusability.

These are developed as the target benchmark based on discussions with stakeholders. It comprises governance and requirements that focus on usability, discoverability and completeness of information. In support of the scenarios, Gartner proposes the Minimal Interoperability Data Model (MIDM). It provides minimal requirements to make solutions discoverable. The study shows that existing standards used in catalogues - publiccode.yml and ADMS - can be easily readied to align with this common list of description fields.

It is important that the EU OSS Catalogue first sets up its governance and then implements the MIDM by making ADMS and publiccode.yml compatible and upgrading the catalogues to support it. This could take 6 to 12 months. Then the implementation of the Catalogue can take place, including the federation. Gartner recommends to time the launch with the proposal for Interoperable Europe Act to create momentum.

The analysis shows that there is a significant gap to fill if Joinup were to be used for the EU OSS Catalogue. Gartner recommends considering other options. Alternatives are Software Heritage and catalogue solutions from Member States available as open source. This requires a more in-depth analysis.

Introduction and approach

1.0 Introduction

1.1 Context

1.1.1 Open Source usage across European Public Services

The significance of open source software¹ in public sector across Europe has been affirmed by governments increasingly incorporating open source software as part of their country's ICT and political and legal frameworks. Out of the 28 European countries studied in 2020 by the Commission's Open Source Observatory², 26 countries had put in place legal and political initiatives either referring to OSS directly or embedding the open source-related initiatives in the broader digitalisation initiatives within their policy and legal frameworks.

This political support for open source in public services was confirmed and strengthened by the 2020 Berlin Declaration³, which recognises open source software as one of the facilitators for deploying and developing strategic digital tools and capacities in the public sector and to ensure interoperability. Moreover, the importance of open source, digital government, and interoperability has been put in the strategic perspective of digital sovereignty. The Declaration states that open source software, together with common standards and modular architectures, are "facilitators for deploying and developing strategic digital tools and capacities." All underlying digital components – be they hardware, software, or services – must not only meet European requirements, but in developing these, the Declaration signatories aim to establish a wide selection of high-performing digital solutions to allow the possibility to freely choose and change IT modules when needed.

The declaration also calls for European institutions to promote "the development, sharing and re-use of open source standards, solutions and specifications across borders." The Commission's Open Source Strategy 2020-2023⁴ aims to encourage sharing and reuse of software and applications as well as data, information, and knowledge as progress towards digital autonomy of Europe's own independent digital approach is a priority objective of the strategy.

1.1.2 The need for a European Open Source Solutions Catalogue

For a public administration to reuse another administration's IT solution, it should first know that the solution exists, where it is located, and then trust that it is safe, technically mature, and documented enough to be reused. There are several existing national initiatives which aim to aggregate open source solutions for public use such via catalogues, repositories or registries. However, they differ in scope and maturity – some have a national focus and some of them are developer-oriented with complex APIs to contribute data, some include software code and other publish the code on external common code repositories such as GitHub or GitLab (managed by private companies). Also, different metadata standards are used to describe the solutions aggregated in these catalogues. They often lack comprehensive use cases and a clear categorisation that can help both technical and non-technical users find open source solutions that meet their needs.

¹ Both terms open source solutions and open source software are used in this study; the European commission uses the term "open source solution catalogue", abbreviated as OSS Catalogue. The term open source software is abbreviated to "open source".

² <https://joinup.ec.europa.eu/collection/open-source-observatory-osor>

³ <https://digital-strategy.ec.europa.eu/en/news/berlin-declaration-digital-society-and-value-based-digital-government>

⁴ https://ec.europa.eu/info/departments/informatics/open-source-software-strategy_en

This situation hinders cross-border reuse of open source solutions in the public sector, and there is a clear need for a European-level open source solutions catalogue (EU OSS Catalogue) that fulfils the needs of public administrations.

DG DIGIT has commissioned Gartner to run a benchmarking study to develop a view on the current landscape of open source solutions catalogues and to propose a target benchmark for an EU catalogue of open source solutions.

1.1.3 Joinup as a potential hosting platform for the EU OSS Catalogue

The Joinup collaborative platform, created by the European Commission and funded by the European Union interoperability programmes, has the potential to host a bespoke catalogue. Among several services that Joinup offers to help eGovernment professionals share their experience with each other, there is a catalogue of ICT interoperability solutions, providing a central place for interoperability solutions which could be (re)used in the public sector across Europe. However, this catalogue lacks certain features and functionalities to meet all the needs of EU public administrations looking for a comprehensive and easy-to-search open source solution catalogue. The study analyses the catalogue offered by the Joinup collaborative platform against the target benchmark in order to perform a gap analysis.

1.2 Gartner point of view

According to Gartner research, open source software usage has become nearly universal. The vast majority of organisations use open source software within mission-critical IT workloads, whether they are aware of it or not. A Gartner survey two years ago showed that OSS was used by over 90% of enterprises, and Gartner inquiry trends indicate that this percentage has grown in the years since then. The number of open source software components in an average application has more than doubled in the last five years to 528.

Open source software adoption across the enterprise varies widely by technology area, with infrastructure software, application development, DevOps toolchains, databases and analytics — including artificial intelligence (AI) — the most common areas of usage.

In 2020, 60 million new open source software repositories were created on GitHub by 56 million developers on the platform.

Most software innovation starts in open-source communities, and vendors and development teams routinely use open source in the products they build. Many organizations choose open source because they expect it to be less expensive than its closed-source alternatives (although actual savings can vary dramatically). Open source also affords more flexibility to customise solutions.

The significance of open source software in public sector across Europe has been affirmed by governments increasingly incorporating open source as part of their country's ICT and political and legal frameworks. There is a true opportunity to tap into the potential of open source for public administrations, not only in the overall perspective described above, but also in the strategic perspective of digital sovereignty. With the 2020 Berlin Declaration calling for European institutions to promote sharing and re-use, and the various initiatives in Member States to share open source solutions for public administrations⁵ via catalogues, repositories or registries, Gartner recognises the need for a European Open Source Solutions Catalogue, anchored in the ecosystem of existing catalogues.

Defining a benchmark for such a catalogue entails understanding the current landscape and analysing the various best practices, taking into account their diversity of scope with the

⁵ For example: www.ict-reuse.be, developers.italia.it, comptoir-du-libre.org or code.etalab.gouv.fr

advantages and challenges that they provide. Building on such a rich landscape is an opportunity for innovating at European level.

1.3 Aim and content of this report

The objectives of the benchmark study are:

- **Objective 1:** Study the landscape of catalogues of open source solutions run/used by public bodies in the EU Member States.
- **Objective 2:** Create a target benchmark based on identified best practices, and propose steps to build an EU Open Source Solution Catalogue along with its governance, sponsorship, business and functional requirements.
- **Objective 3:** Propose a data model of the Catalogue.
- **Objective 4:** Benchmark the Joinup platform against the proposed target benchmark and perform a gap analysis.

This is the Final Report of the study – D01.05. It details the main findings and provides the following sections:

- An introduction to the context and aim of this report – this section,
- The approach for carrying out the benchmark,
- The target benchmark for an EU OSS Catalogue, including the proposed data model for an EU OSS Catalogue - which is deliverable D04,
- The gap analysis of the usage of the Joinup platform against the target benchmark - which is deliverable D05.

2.0 Approach

This section details the scope, important definitions, and the steps followed to ensure the research questions and the data analysis meet the objectives.

2.1 Scope

- For this study, the European Commission recognises the definition of open source as established by the open source initiative⁶.
- For the purpose of the study, 'catalogue of open source solutions' is understood as a platform, directory, or repository that serves as a common space where one can share, reuse, or work together on open source solutions.
- This benchmarking study aims to primarily examine the catalogues maintained by the EU public sector organisations. It is undertaken to benchmark the catalogues' governance, sponsorship, and business and functional requirement. A target benchmark with specification of a data model of the European Open Source Solutions Catalogue is proposed. The technical implementation and the architecture of the catalogue are beyond the scope of this study.
- The following stakeholder categories for this study were identified:
 - European Commission
 - DIGIT D2 – Interoperability unit in charge of the Open Source Observatory (OSOR) and JOINUP platform

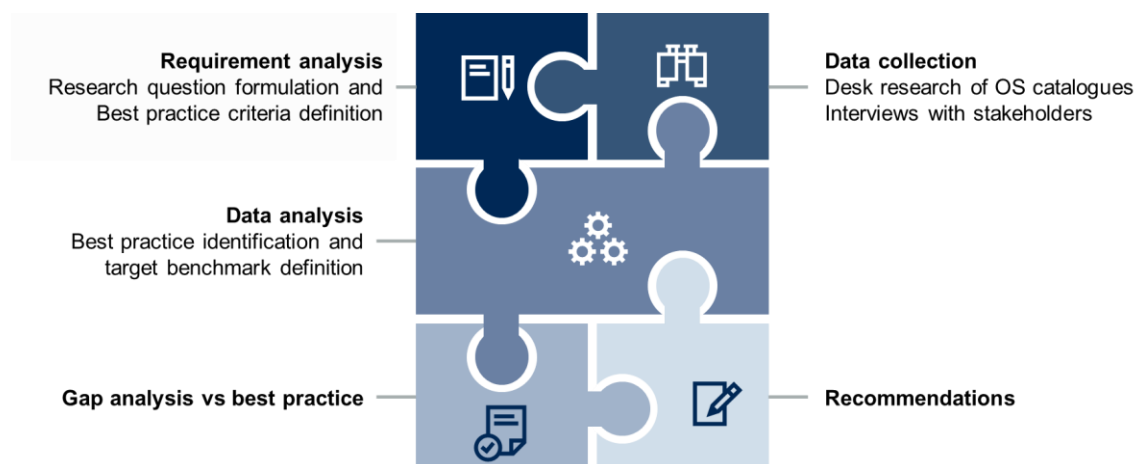
⁶ <https://opensource.org/osd>

- DIGIT B3 and the Open Source Programme Office in charge of the Commission Open Source Strategy
- JRC.I4 – Intellectual Property and Technology Transfer Unit in charge of Central IP Service of the European Commission
- CNECT.E2 Cloud and Software
- CNECT.H4 eGovernment and Trust
- Member States
 - Public Administrations of EU countries (and possibly non-EU countries if relevant for best practices) and their OSPO's or other entities responsible for implementation of open source policy and/or maintaining the open source solution catalogues
 - Providers of open source solutions for public sector
 - Non-for-profit -organisations promoting open technologies

2.2 Methodology

The study is developed along five steps, presented in Figure 1 and detailed in this section.

Figure 1. Steps for developing the study



Source: author's own elaboration (January 2022)

2.2.1 Requirement analysis

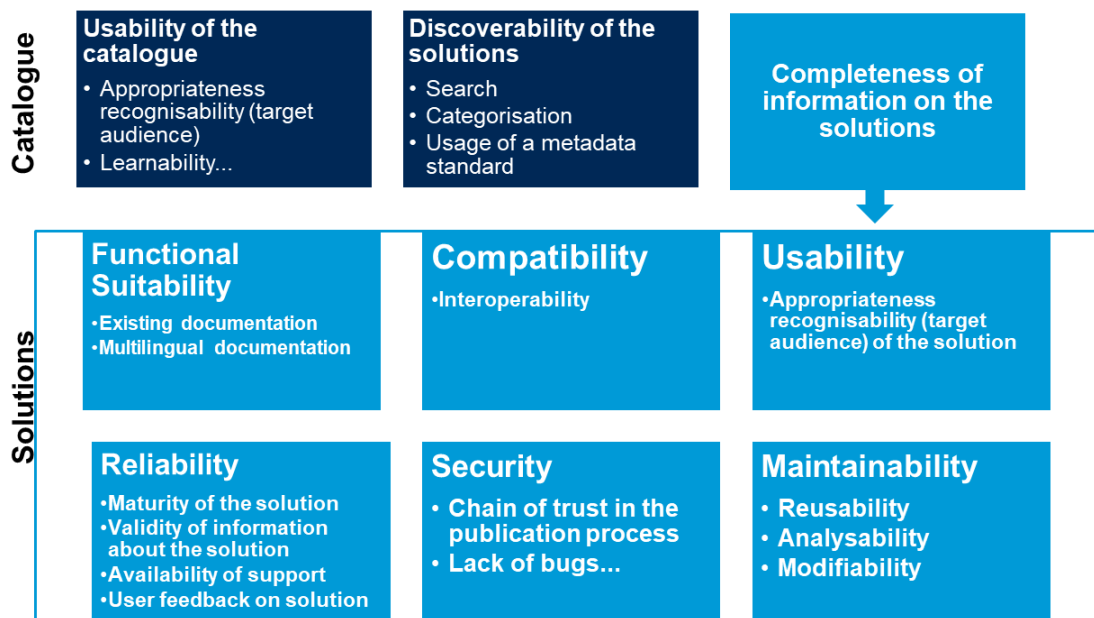
The study requirements analysis aimed to develop the research questions ensuring the data collection and analysis met the objectives of the study.

- Framework on software quality

The ISO Software Quality Standard⁷ was used as framework for identifying best practices for the catalogue and the solution description features, it inspired several of the research questions. Figure 2 shows the elements from the ISO standard that are used as the best practice framework.

⁷ <https://iso25000.com/index.php/en/iso-25000-standards/iso-25010>

Figure 2. Best practice criteria framework based on the ISO Software Quality Standard



Source: author’s elaboration on the ISO Software Quality Standard (January 2022)

The framework provides the main characteristics of a catalogue and of its solutions:

A catalogue should ensure:

- usability for its target audience, and
- discoverability of its solutions with appropriate search, categorisation and usage of a metadata standard.

The solutions should provide complete information. This information should allow potential users to decide if they are appropriate for reuse, for example:

- availability of the documentation on functionality,
- information about interoperability – which standards are implemented by the solution, information about availability of support and user feedback
- Research questions

The tables below detail the research questions developed for collecting data in order to meet the four study objectives. Several of these research questions focus on the best practices identified in the framework above.

Table 1. Research questions relating to objective 1

Research question for objective 1: Study the landscape of catalogues of open source solutions run/used by public bodies in the EU Member States
What are the main types of Open Source Catalogues for Public Sector Code in Europe and beyond?
What is their scope?
What types of projects do the catalogues host?
What are their functionality?

Research question for objective 1: Study the landscape of catalogues of open source solutions run/used by public bodies in the EU Member States

How diverse is the landscape of public sector open source catalogues?
 What are the commonalities and main differences in these scopes?

What are the target audiences?

- Developers working for/in the public sector (the catalogue can be an open source repository)
- Business owners (the catalogue provides an interface with the repositories, providing project information understandable by a non-developer)
- Other

What is the sponsorship and how is the governance of these catalogues ensured?

In which political context/ sponsorship is the catalogue provided?

How is the contribution of solutions managed? What are the responsibilities (e.g. making sure the latest version of the software is there)? Who maintains the catalogue?

Source: author’s own elaboration (January 2022)

Table 2. Research questions relating to objective 2

Research question for objective 2: Create a target benchmark based on identified best practices, and propose steps to build an EU Open Source Solution Catalogue along with its governance, sponsorship, business and functional requirements

If the EC were to set up an open source solution catalogue at EU level, including a “federation” of existing ones and a space for public sector organisations to share their solutions, what would good look like (target benchmark)?

The answer to this question will be derived from the analysis of the answers to the questions below, as well as from the analysis of the landscape in objective 1 which provided a proposition of three scenarios for an EU OSS Catalogue added value in the EU OSSC ecosystem.

Which existing catalogues are identified as covering a strong range of features and capabilities, aligned with best practices, which would inspire an EC catalogue?

What functionality, considered best practice, is available in these catalogues, including those aimed at targeting various audiences and those ensuring high discoverability of the solutions?

How is functional suitability of the solution communicated? How does the catalogue inform about compatibility? How does the catalogue inform about interoperability?

Is there a chain of trust and reliability?

Which existing catalogues have a high up-take? How is uptake measured? What are the reasons (maturity, dissemination, ...)? What user satisfaction feedback is collected, and what are the outcomes?

What governance models could cater to an EU-level catalogue (federation of catalogues) and could be reused in this context?

What governance models are considered efficient (based on experience in Member States)?

Source: author’s own elaboration (January 2022)

Table 3. Research questions relating to objective 3

Research question for objective 3: Propose a data model of the catalogue

What is the level of commonality between categorisations used across the catalogue landscape?

How do the catalogues provide discoverability and how do they facilitate searchability? How do they cater for the different target audiences in these areas?

Research question for objective 3: Propose a data model of the catalogue
Where do taxonomies and ontologies exist and how do they align / differ across catalogues (scope, granularity etc.)?
What are the key subjects (geography, development status, category of applications) for which ontologies / taxonomies exist?
What degrees of freedom are used / supported in assigning characteristics to OS applications? This can range from fixed characteristics and reference lists to free tagging systems.
How did the data models of the catalogues evolve and why were these changes applied?
How is the quality and validity of the information maintained, such as information on how fresh the catalogue data is?
What processes and incentives are applied to keep it fresh and hence relevant for end users?
What would it take for these catalogues to be part of an EU catalogue?

Source: author's own elaboration (January 2022)

Table 4. Research questions relating to objective 4

Research question for objective 4: Benchmark the Joinup platform against the proposed target benchmark and perform a gap analysis
Would Joinup be a solution for the EC to provide discoverability of the existing catalogues and solutions at EU level, ensuring cross-border re-use?
How wide is the gap between Joinup and the target benchmark in terms of functionality, features for governance support, features supporting the data model and categorisation?

Source: author's own elaboration (January 2022)

2.2.2 Data collection

The approach followed for the data collection aims at identifying the data sources and developing the interview grids in order to provide responses to the research questions listed in the previous section. The data collection is based on:

- Identifying a set of 11 OSS catalogues for a detailed analysis,
- Identifying relevant best practices for developing the data model, including categorisation means,
- Conducting detailed interviews and desk research for the OSS catalogues and data models identified, along a structured data collection grid.

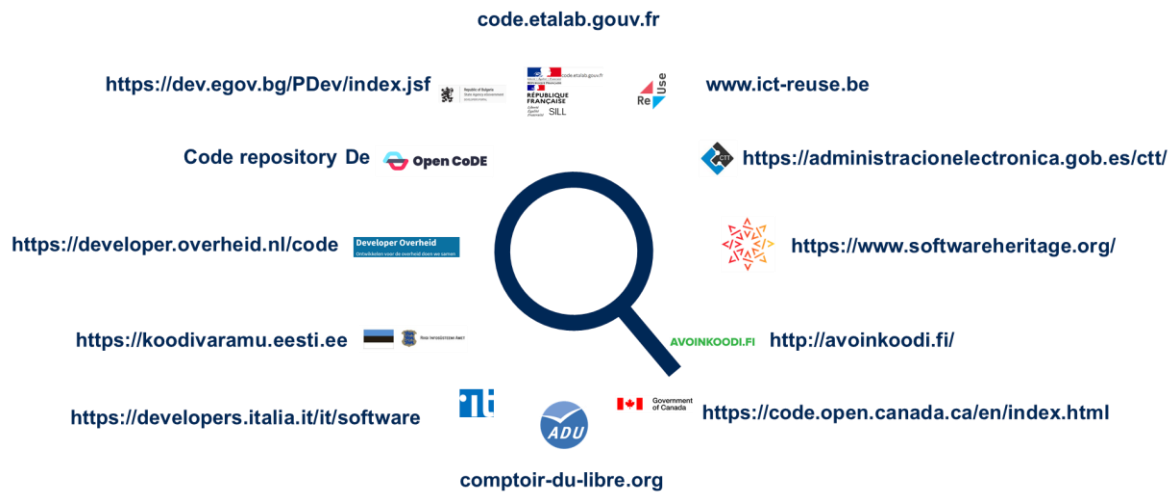
2.2.2.1 OSS catalogues

The list of OSS catalogues analysed in detail is based on the bid request to include:

- Mature open source catalogues maintained by national public bodies in the EU, as well as catalogues in the development phase and the ones maintained at other level of public administrations or by designated associations (minimum 5),
- Open source catalogues sustained by not-for-profit or private-sector organisations (minimum 2).

The study has identified 12 OSS catalogues⁸ that provide relevant insight, due to their variety in maturity, geographical spread, footprint, and backgrounds, as well as experience for some in usage of standard data models. Detailed interviews were performed on all these catalogues except the Estonian one for which insight from the webinar was used⁹. Figure 3 presents these 12 catalogues.

Figure 3. Data collection – list of catalogues




Source: author's own elaboration and logos from the catalogue websites

The tables below provide a description of the catalogues that were analysed in depth.

⁸ Due to the nature of the study - fixed price and specified time range - the target number of catalogues to be analysed overall was set to 10, but Gartner included an 11th with high relevance for an analysis of the federation mechanisms and the data models (Software Heritage)


⁹ <https://Joinup.ec.europa.eu/collection/open-source-observatory-osor/news/sharing-and-reuse-open-source-webinar-takeaways>

Table 5. Catalogue description administracionelectronica.gob.es/ctt

administracionelectronica.gob.es/ctt	
	
Catalogue description	
<p>The catalogue of Spain’s technology transfer center (Centro de Transferencia de Tecnología or CTT) lists solutions from the repositories of Spanish public services. The catalogue, which is federated by Joinup, concentrates on the sharing of code. Reuse is done mainly through services. It targets all of Spain’s public services designers and developers.</p> <p>The CTT provides insight from one of the oldest government repositories, experience with linking to Joinup and feedback on one of the standard metadata models.</p>	
Background	Footprint
<p>The CTT catalogue was launched in 2007 (Article 46 of the 11/2007 Law for Citizens Electronic Access to Public Services). The law obliges public administrations to provide digital services for citizens, and CTT aims to make these available across the “complex landscape of a federal state”. The importance of the CTT catalogue has been expanded in follow-up legislation, including the 1 October 2015 law on Spain’s public sector and the 8 January 2010 law on interoperability of eGovernment services.</p> <p>The catalogue is maintained by the CTT, part of and funded by the Ministry of Territorial Policy and Public Function (Ministerio Política Territorial y portavoz del Gobierno).</p>	<p>Solutions</p> <p>The CTT catalogue currently lists 348 solutions, 249 of which are federated to Joinup. On GitHub CTT provides access to 37 code repositories.</p> <p>Community size / number of users</p> <p>CTT reports that some 16,000 users from public services access the solutions. It has annually some 2 million downloads of information about the solutions. The CTT newsletter goes to about 16,000 users.</p>



Source: Elaboration from the catalogue websites, Joinup website and interview notes (January 2022)

Table 6. Catalogue description avoinkoodi.fi

avoinkoodi.fi	
	
Catalogue description	
<p>The catalogue provides a list of open source solutions shared by Finish public sector. It aims to showcase open source in public administrations. The catalogue targets municipal public services, national government organisations as well as education (schools, universities).</p>	
Background	Footprint
<p>The portal is managed by the Finnish non-profit open systems centre (Suomen avoimien tietojärjestelmien keskus or COSS). The centre has no links to the Finnish government.</p> <p>When a public service or government agency develops an open source code projects, they call COSS, who then include it in the repository.</p> <p>The portal was created on 10 March 2016.</p>	<p>Solutions</p> <p>Currently the catalogue lists approx. 50 open source projects from national public services, and another 20 developed for or by municipalities.</p> <p>Community size / number of users</p> <p>The catalogue gets about 9000 visitors per year.</p>


Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 7. Catalogue description code.etalab.gouv.fr

code.etalab.gouv.fr	
 	
Catalogue description	
<p>The catalogue lists and allows to search all the repositories of government agencies that publish their source code. In France, all source code bought or developed by public agencies are considered administrative documents, due to be opened as open data.</p> <p>Additional insight was collected during the interview on:</p> <ul style="list-style-type: none"> the SILL catalogue of recommended free software for the public sector https://sill.etalab.gouv.fr/en/software to a lesser extent on the Catalogue.numerique.gouv.fr which allows OS & non-OS solution companies advertise their solutions and services to public administrations 	
Background	Footprint
<p>The catalogue was created in 2019 following France’s action plan for open source software and digital commons, supported by the Direction Interministerielle du Numérique https://www.numerique.gouv.fr/. It is maintained by the free software unit at Etalab, part of the interministerial Digital Directorate (La direction interministérielle du numérique, or DINUM).</p>	<p>Solutions</p> <p>The catalogue currently lists 9077 source code repositories.</p> <p>Community size / number of users</p> <p>The catalogue currently list code from 1022 ‘groups or organisations’.</p>


Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 8. Catalogue description code.open.canada.ca

code.open.canada.ca	
	
Catalogue description	
<p>The Open Resource Exchange (ORE) serves as a platform for the sharing of innovative ideas across all levels of government in Canada, creating a space for open source solutions shared by government agencies. The catalogue targets all public administrations.</p>	
Background	Footprint
<p>The catalogue is created by the Municipal Innovation Pilot Project (MIPP), an initiative aiming to support research and development of ‘open source solutions’ for all levels of government within Canada and beyond. The vision is to enable and support the pooling of investment for collective impact.</p> <p>The portal was created in January 2018, and was more widely announced one year later, when it was still in beta.</p>	<p>Solutions</p> <p>The catalogue currently shows 57 open source development projects developed or being developed by or for public services in Canada, 95 open source solutions used by Canadian public services.</p> <p>Community size / number of users</p> <p>The Municipal Innovation Pilot Project currently includes the Cities of Montreal, Edmonton, Guelph and Sarnia, the Regions of Durham, Niagara, a municipality association of Ontario, and the Government of Canada.</p>


Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 9. Catalogue description comptoir-du-libre.org

comptoir-du-libre.org 	
Catalogue description	
<p>The Comptoir du Libre is a ‘collaborative platform’ which aims to make it easy to find reusable software tools, share experiences, and contact partner organisations. The catalogue supports public services to implement open source solutions: it lists free software tools that are useful to public services, the users of these tools and their IT service providers. Main target audiences are municipal public services, departments and syndicates.</p>	
Background	Footprint
<p>The Comptoir du Libre is a service of Adullact. This non-profit was founded in 2002 to support and coordinate the action of local public services promoting, developing and maintaining a heritage of free software useful for public service missions. Adullact unveiled the Comptoir on 24 June 2016.</p>	<p>Solutions The catalogue currently lists 416 open source software solutions.</p> <p>Community size / number of users The catalogue currently has 730 users.</p>


Source: Elaboration from the catalogue websites, Joinup website and interview notes (January 2022)

Table 10. Catalogue description DE Catalogue Open Code

DE Catalogue Open Code 	
Catalogue description	
<p>In a cross-level project (federal and state authorities), a joint public administration platform and catalogue are being set up for the exchange of open source software. The central storage of open source code is intended to promote reuse and joint work on software solutions in public administrations. The catalogue is in pilot phase, currently not available publicly.</p> <p>It targets open source developers in public services and any person or company interested in contributing to the improvement of open source software of public services.</p>	
Background	Footprint
<p>The drivers of the platform are: 1/ strengthening digital sovereignty (resolution in the IT planning council of the federal, state and local governments in Germany) and 2/ promoting open source software in Public administration (coalition agreement of the new German government).</p> <p>The catalogue will be managed by the center of digital sovereignty, which is part of the Federal Government Commissioner for Information Technology.</p>	<p>Solutions The GitLab-based pilot version of the catalogue was created in August 2021. Linking to other open source repositories such as Github is planned for 2022. The solutions available will be based on open standards, open interfaces and a modular architecture.</p> <p>Community size / number of users For now, the platform is in a pilot phase (around 130 users are testing it), with the GitLab code repository managed by Komm one, the IT service provider of the state of Baden-Württemberg, in cooperation with the state of Nordrhein-Westfalen and Germany’s Interior Ministry.</p>

Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 11. Catalogue description dev.egov.bg/Pdev/index.jsf

dev.egov.bg/Pdev/index.jsf	
 Republic of Bulgaria State Agency eGovernment DEVELOPER'S PORTAL	
Catalogue description	
<p>The dev.egov.bg portal provides and manages access to resources for the development of e-government software and services. The catalogue - developers' portal - enables the re-use of software source code and components, and the sharing of knowledge. It targets all of Bulgaria's public services and their IT service providers, as well as any others interested in the public code repository.</p>	
Background	Footprint
<p>The portal is managed by Bulgaria's eGovernment agency and co-funded by the European Social Fund. The catalogue is a legally established instrument aiming for a centralised control of the cost, quality, usability and interoperability of the software developed for public administrations.</p> <p>Its legal origin is a change made in June 2016 to the country's 2007 eGovernment act (article 18), calling for a public, national source repository and revision control system for source code and technical documentations of information systems in public services.</p>	<p>Solutions</p> <p>The https://dev.egov.bg/PDev/index.jsf repository currently lists 25 projects, and the code is shared through https://git.egov.bg/explore/projects .</p> <p>Community size / number of users</p> <p>The catalogue currently has 16 partner organisations.</p>

Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 12. Catalogue description developers.italia.it

developers.italia.it	
Catalogue description	
<p>The aim of the catalogue is to provide solutions that can be reused by public administrations. It also aims to create a community of software developers who design and code Italian digital public services. In principle, it should be consulted by all 23000 public services in the country.</p>	
Background	Footprint
<p>The catalogue helps users comply with Articles 68 and 69 of the Italian Codice dell'Amministrazione Digitale (adopted in 2011). These articles oblige Italy's public services to release software developed by or for them using an open source license.</p> <p>The developers.italia.it portal was unveiled on 24 March 2017. It started as a general developer portal for platforms and APIs, aiming to create a central platform and one-stop shop for resources to build software for the public good. It is funded by the federal government.</p>	<p>Solutions</p> <p>The software catalogue currently lists 249 software projects, at least 13 APIs, as well as 10 large-scale national and local 'enabling platforms' offering eID, eInvoicing, ePayments, open data and other services.</p> <p>It also links to 315 code repositories on GitHub.</p> <p>The number of times solutions are reused so far: 2000.</p> <p>Community size / number of users</p> <p>The community has about 200 members.</p>

Source: Elaboration from the catalogue websites, Joinup website and interview notes (January 2022)

Table 13. Catalogue description developer.overheid.nl/code

developer.overheid.nl/code		Developer Overheid <small>Ontwikkelen voor de overheid doen we samen</small>
Catalogue description		
The catalogue provides a list of solutions that are implementing application programming interface (APIs) used in the public sector. The aim of sharing source code is to exemplify how these APIs can be implemented. It is a knowledge platform for APIs, which includes the software that is intended to test these.		
Background	Footprint	
It is an initiative of the Ministry of the Interior and Kingdom Relations in cooperation with the Association of Netherlands Municipalities (Vereniging van Nederlandse Gemeenten or VNG). The portal went online in early 2019. The GitLab repository was created on 15 February 2019.	Solutions The portal currently links to 109 APIs, and 13 open source solutions. Community size / number of users The catalogue gets about 9000 visitors per year.	

Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 14. Catalogue description ICTReuse.be

ICTReuse.be	
<p>Catalogue description</p> <p>The catalogue aims to encourage the reuse of software components. It promotes the ‘develop only once’ principle. In the long term the catalogue should help bring about a common architecture across systems.</p> <p>It targets all of Belgium’s government organisations and their (IT) service providers (software developers). The initiative is open to project managers, developers and business users in all federal institutions, regional and municipal organisations, and all system integrators that are active in these public sector organisations.</p> <p>The catalogue provides access to APIs, services, and libraries, and as such, it is not limited to open source.</p>	
Background	Footprint
<p>The catalogue is created and managed by the Belgian social services and its ICT service provider SMALS. It was created in 2018 following a benchmark showing that software projects based on reusable components lower costs by at least 13%.</p>	<p>Solutions</p> <p>The catalogue links to approx.. 100 components related communication, interfaces, access & authentication, security, and document management.</p> <p>Community size / number of users</p> <p>The catalogue currently has 16 partner organisations.</p>

Source: Elaboration from the catalogue websites and interview notes (January 2022)

Table 15. Catalogue description softwareheritage.org

softwareheritage.org	
Catalogue description	
<p>The ambition of Software Heritage is to collect, preserve, and share all software that is publicly available in source code form. It intends to be a universal catalogue of all existing source code, that is publicly available, including non-open source.</p>	
Background	Footprint
<p>The Software Heritage project was unveiled on 30 June 2016, having been under preparation for a year. The project was launched by France’s national computer science institute Inria. It is funded by the private sector and by public institutions, as well as by individual sponsors.</p>	<p>Solutions In 2021 the Software Heritage had archived 11 billion unique source files.</p> <p>Community size / number of users In 2021, the project was supported by 20 organisations across the world.</p>

Source: Elaboration from the catalogue websites, the Joinup website, YouTube and interview notes (January 2022)


The interviews with owners of these catalogues were structured along the data collection grid further described in 2.2.2.3, and provided insight on existing practices that were analysed to develop the target benchmark – see 2.2.3.

2.2.2.2 Data models and categorisation practices

Data model and categorisation practices were collected during the interviews with OSS catalogue owners and further research based on references from Gartner and catalogue owners. Table 16 lists these practices collected.

Two of these are standard data models used in several catalogues to describe solutions: the Asset Description Metadata Schema (ADMS) and publiccode.yml. The Canadian repository provides its own data model. The other entries in the table refer to initiatives providing means of categorising software solutions.

Table 16. Best Practices of the data model and categorisations

Data model / categorisation	Description
	<p>The Asset Description Metadata Schema (ADMS)²² is a vocabulary to describe reusable solutions, such as data models and specifications, reference data and open source software.</p> <p>Examples of usage: Joinup and federation of the CTT repository with Joinup https://administracionelectronica.gob.es/ctt</p>

²² <https://Joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/solution/asset-description-metadata-schema-adms/release/20>

Data model / categorisation	Description
publiccode.yml	<p>publiccode.yml is a metadata standard for repositories containing software developed or acquired by the Public Administration, aimed at making them easily discoverable and thus reusable.</p> <p>https://github.com/publiccodeyaml/publiccode.yml#the-publiccodeyaml-standard</p> <p>Examples of usage: developers.italia.it, DE Code repository, Examples of catalogues considering its use: comptoir-du-libre.org, developer.overheid.nl/code.</p>
Canada ORE	<p>The Open Resource Exchange of Canada proposes a data model for classifying its software resources.</p> <p>https://github.com/canada-ca/ore-ero</p>
Digital Impact Alliance Catalog of Digital Solutions	<p>Digital Impact Alliance Digital catalogue presenting categorisations of solutions along Government Building Blocks and Products categorisation.</p> <p>https://solutions.dial.community/</p>
GovStack	<p>The GovStack initiative aims to build a common understanding and technical practice on fundamental reusable and interoperable digital components, which are referred to as Building Blocks.</p> <p>https://www.govstack.global/building-blocks/</p>
Gartner	<p>Gartner provides a general categorisation of technology solutions that is used by technology research to qualify the software market.</p>
OSSPal	<p>OSSPal is a community site aimed at helping people find open source software. It categorises open source software through a fixed list called project categories.</p> <p>https://www.ossPAL.org/</p>
Classification of the Functions of Government (COFOG)	<p>COFOG is the standard classification of the purposes of government. It is provided by the OECD and used across several international organisations.</p> <p>ec.europa.eu/eurostat/Classification_of_the_functions_of_government_(COFOG)</p>
Next Generation Internet innovator solution catalogue	<p>The categorisation approach is based on a long list of keywords which are searchable.</p> <p>https://www.ngi.eu/discover-ngi-solutions/</p>
Codemeta Crosswalk	<p>The Crosswalk initiative provides a listing and explicit mapping between the metadata fields used by a broad range of software repositories, registries and archives.</p> <p>https://codemeta.github.io/crosswalk/</p>

Source: Elaboration from the various websites (January 2022)

2.2.2.3 Data collection grid

The data collection is done through desk research and interviews using a data collection grid, detailing three areas: catalogue description (features, scope, target audience), governance and data models/ categorisation aspects, presented in Table 17.

Table 17. Data collection grid overview

Catalogue description	Governance	Data model/ Categorisation
<ul style="list-style-type: none"> ▪ Scope, target audience, types of OS projects ▪ Features, functionality for end users, administrators and contributors ▪ Information about the solutions ▪ Federation linkage to other catalogues ▪ Main building blocks and use of open standards for integration with other catalogues 	<ul style="list-style-type: none"> ▪ Governance model ▪ Management of solution contribution ▪ User satisfaction assessment ▪ Security, maintaining a chain of trust and quality of the solution descriptions ▪ Sponsorship and cost models ▪ Engagement of the user and contributor community 	<ul style="list-style-type: none"> ▪ Key categorisations for OS solutions ▪ Taxonomies, ontologies and tagging systems used ▪ Information about interoperability of the solutions ▪ Quality, validity maintenance of the data model ▪ Usage of a standard metadata model ▪ Usage of a unique identifier ▪ How to be part of an EU catalogue

Source: author's own elaboration (January 2022)

The detailed list of questions is presented in annexe I. The detailed data collected during the interviews is a separate deliverable, not included in this report which focuses on presenting the analysis and outcomes of the study.

The analysis of the data collected is described in the next section.

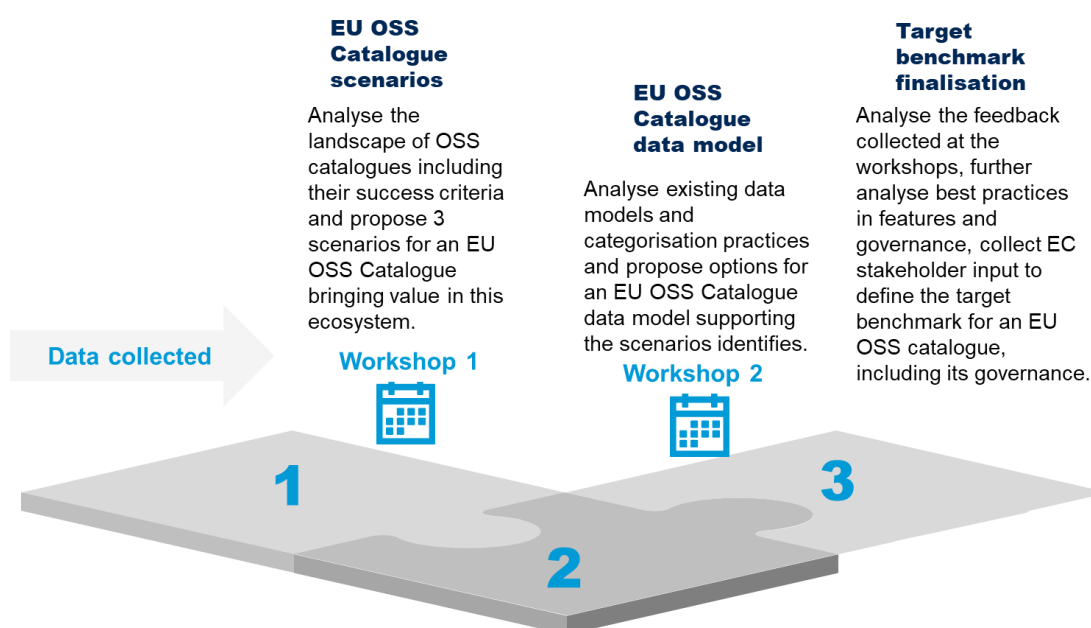
2.2.3 Data analysis

The data analysis leading to the definition of the target benchmark follows a phased approach, with interactions with the stakeholders. This approach consists in:

- An analysis of the landscape and ecosystem of OSS catalogues in Europe and beyond,
- the design and proposals for scenarios for an EU OSS catalogue that provide value in this ecosystem,
- the design, proposals and recommendations of options for a data model that support the selected scenarios,
- a discussion of the scenarios and options in two workshops²⁴,
- a further analysis of best practices in existing catalogues leading to the target benchmark
 - a proposal for the governance of the Catalogue, including feedback from EC stakeholders,
 - further development of the scenarios regarding the vision, target audience and user stories
 - best practices on to usability, discoverability, completeness of information and community support
 - proposal for a data flow structure supporting the scenarios and the data model options
- Recommendations for steps to set up the catalogue.

Figure 4 illustrates this process.

Figure 4. Data analysis approach



Source: author's own elaboration (January 2022)

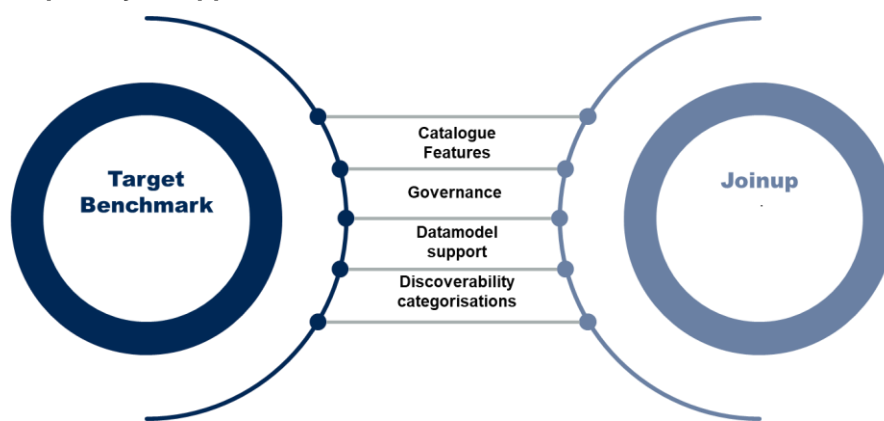
²⁴ The participants to the workshops included the catalogue “owners” that took part in the interviews, invitees from the network of Member State representatives in contact with DIGIT D who wished to participate, and EC stakeholders of the study.

The content of the complete target benchmark is described in section 3.0.

2.2.4 Gap analysis and recommendations

The Joinup collaborative platform has the potential to host a bespoke catalogue. Among several services that Joinup offers to help eGovernment professionals share their experience with each other, there is a catalogue of ICT interoperability solutions, providing a central place for interoperability solutions which could be (re)used in the public sector across Europe. The target benchmark developed in this study is used to assess the usage of Joinup for an EU OSS catalogue. It presents in section 4.0 the gap analysis which details the comparison between Joinup and the target benchmark for the governance, the main features including discoverability, and the way Joinup would support the recommended data model. The section also provides recommendations for the next steps. Figure 5 illustrates the gap analysis approach.

Figure 5. Gap analysis approach



Source: author's own elaboration (January 2022)

EU OSS Catalogue Target Benchmark

.0

3.0 EU OSS Catalogue Target Benchmark

This section provides a description of the target benchmark for an EU Open Source Solutions Catalogue. It provides four sections:

- recommendations for scenarios for an EU OSS catalogue,
- recommendations for options for a data model that support the selected scenarios,
- governance of the EU OSS catalogue, detailed by scenarios,
- business and functional requirements of the EU OSS catalogue.

3.1 Scenarios for an EU OSS catalogue

The analysis of the landscape and ecosystem of OSS catalogues leads to the design of scenarios for an EU OSS catalogue that provide value in ecosystem of the OSS catalogues in Europe.

3.1.1 Analysis of the landscape of OSS catalogues

The study first analyses the landscape of the OSS catalogues, and identifies how to bring value to this OSS catalogue ecosystem. The main findings from the interviews show that an EU OSS Catalogue (EU OSSC) should build on the richness and variety of the ecosystem, further build on the success criteria of the catalogues – sharing or reuse – and find where it can multiply the expected effects to create an impact. From these key findings also emerged where the EU OSSC can support the communities of OSS catalogue owners.

These findings are summarised in Figure 6, and further detailed in each subsequent section.

Figure 6. Key findings for designing an EU OSS Catalogue in the ecosystem of EU Catalogues



Source: author's own elaboration (January 2022)

3.1.1.1 Build on a varied landscape

Gartner developed a landscaping exercise in order to map the different catalogues in their ecosystem.

The main dimensions for describing the OSS catalogue ecosystem stem from the insight collected on the various users of these catalogues:

- target audiences,
- end user features, community aspects,

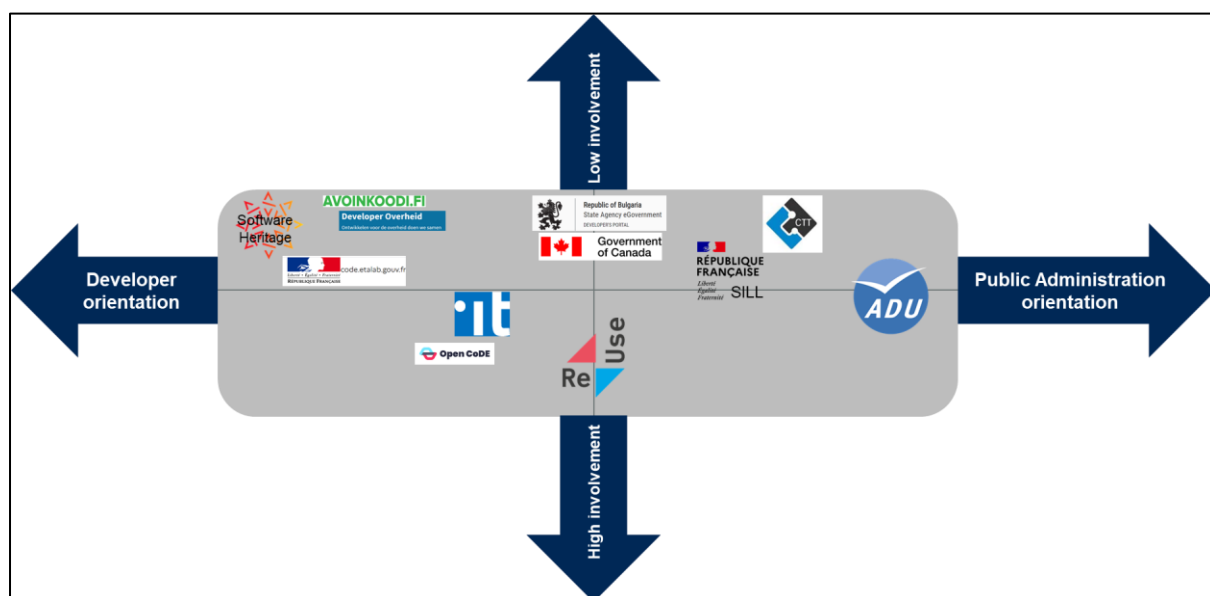
- features for those running the catalogues including ways for managing/automating contribution of solutions and other governance efforts.

A first dimension relates to the main target audience. Profiles targeted by these catalogues are either developers, or “business” profiles from public administrations, including architects with knowledge of the specific aspects of digital government. Some catalogues target both.

A second dimension relates to the level of involvement. Those running and maintaining the catalogues can get involved at various levels, from community animation to solution curation and user support in reuse. This involvement demands a certain level of effort. Some automation of features can lower this effort, potentially also allowing a “federation” of these at an EU level.

Mapping the different catalogues along these two dimensions provides a user centric based landscape of OSS catalogues in the EU, presented in Figure 7.

Figure 7. An OSS catalogue landscape



Source: author’s own elaboration (January 2022)

The landscape shows a trend in the variety of catalogues in terms of target audience. In addition, it highlights a number of catalogues catering for both audiences – due to the selection approach of these catalogues. The landscape shows a trend of most catalogues showing low to medium involvement, catalogues showing high involvement being the minority.

Findings from the interviews on the aim of each catalogue - summarised in the catalogue description tables in section 2.2.2.1 – confirm the varied landscape in terms of background, reasons for foundation, and communities of stakeholders.

3.1.1.2 Sharing or reuse as a goal

The catalogues measure success along several criteria: sharing (e.g. number of solutions), uptake (e.g. number of users), or reuse (e.g. number of solutions reused, return on investment (ROI) of a solution through reuse). These are depicted in Figure 8.

The main finding is that success criteria are not always sharing and reuse, as in sharing *for* reuse, but rather sharing as a goal in itself, and reuse as a goal in itself.

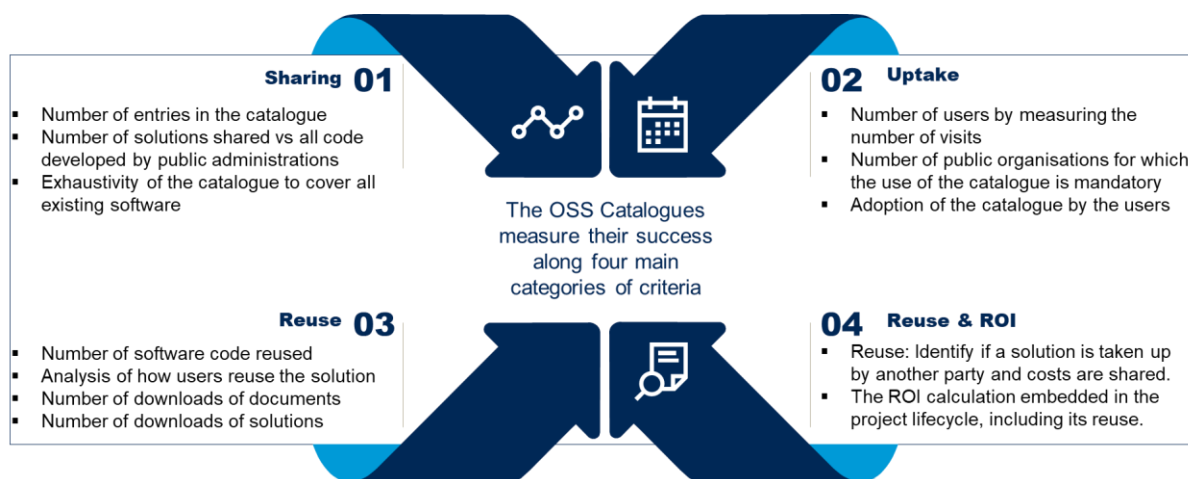
Sharing – as a goal for the catalogue – is usually measured by the number of solutions available in the catalogue. It can track the potential for sharing such as the total number of

public administrations having to share their solutions according to a certain legislation. There are benefits to sharing: sharing open source solutions from public administrations provides transparency on the source code/ algorithms, allowing scrutiny and strengthening democracy. Having access to the source code can provide insight in how an eVoting system works for example, or how are taxes really calculated. Another benefit relates to the notion of commons, with the concept of “public money = public code”. Catalogues sharing solutions also provide visibility on a network of open source developers in the public sector.

Reuse – as a goal for the catalogue – can be traced through the users declaring they are reusing the code, or by tracking the number of downloads of the solution and/ or of its documentation, although this is not a direct measure of reuse of code. In some cases, success criteria also focuses on measuring the return on investment stemmed from the reuse. Reuse has its challenges; the experience from several catalogues shows the shared services model is perceived as much more useful by re-users than the shared software model. In cases where software is available as a service, it is also shared as open source, but for the benefits of sharing.

In addition to sharing and reuse, the **uptake** of the usage of the catalogue is measured by some catalogues, such as the number of visits on the website or the number of potential users. This element of uptake can be used as a proxy for estimating the size of a community of open source in the public sector generated by the catalogue.

Figure 8. OSS catalogues – success criteria



Source: author’s own elaboration (January 2022)

3.1.1.3 Find the impact

An EU OSS Catalogue leverages the success criteria of the catalogues – sharing, reuse and community creation – in order to find where and how it can multiply the benefits, thus creating the most impact. The analysis identifies several areas of high added value, depicted in Figure 9.

A first approach is to **scale sharing** by bridging the existing catalogues. Users can search through more solutions, and such a bridge provides high added value as it scales the benefits of sharing. Scaling sharing with the aim to provide users with a wider pool to find solutions to potentially reuse them does not provide high added value, as solutions are often linked to public administration and country specificities.

A second approach is to **scale uptake**. Expanding the user base and scaling existing communities around business solutions will have low added value as they are often linked to topics that are country-specific, and the language barrier needs to be overcome. Scaling existing communities around technical topics has a wider impact, but the language barrier could still be an issue. The most added value would come from the creation of a community

around an EU OSS Catalogue solution that could be reused, such a community would scale its uptake.

A third approach is to **scale reuse**. Scaling the reuse of code across all catalogues has low added value, due to the challenges of reuse. However, for solutions that are designed for reuse across Europe, solutions reused across borders, and solutions developed by the European Commission for reuse should leverage the EU OSS Catalogue to scale their reuse. Examples of such solutions include the X-roads solution²⁶, CEF Building Blocks²⁷, the Online Collection software (OCS) of the European Citizens’ Initiatives (ECI)²⁸ or the LEOS solution²⁹.

The fourth approach is to **scale reuse and return on investment**. Co-creation is rare, initiating a project on a catalogue in order to attract other developers from other countries is of low added value because of its low likeliness. However, in line with the third approach, the creation of a reusable solution for an OSS catalogue that can be reused by public administrations who wish to have their own catalogue has high added value; the solution would foster interoperability and a community of re-users would be involved early in the process to ensure uptake and buy-in.

Figure 9. EU OSS Catalogue – scaling success criteria for high added value



Source: author’s own elaboration (January 2022)

3.1.1.4 The missing catalogue community

During the interview phase of this study, the Gartner team shared practices and approaches that were collected from other interviews, creating a strong interest in how the other catalogues were designed, how they overcame the challenges, which data models were used etc. There is an opportunity to strengthen the cohesion in the ecosystem of OSS catalogues across the EU and enhance the level of conversation happening between the owners. The OSS catalogue owners would benefit from a community, sharing experience and good practices.

²⁶ https://ec.europa.eu/regional_policy/en/projects/europe/x-road-cross-border-co-development-of-national-data-exchange-platform

²⁷ <https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/CEF+Digital+Home>

²⁸ <https://Joinup.ec.europa.eu/collection/eparticipation-and-evoting/solution/eci-online-collection-software-ocs>

²⁹ <https://Joinup.ec.europa.eu/collection/justice-law-and-security/solution/leos-open-source-software-editing-legislation>

3.1.1.5 Bridge the gap

Public Administrations without an OSSC and wishing to build their own OSS catalogue would benefit from the above community as well as a reusable tool or service. The European Commission could provide a reusable OSS catalogue tool (as code and/ or as a service). Those reusing the solution would benefit from a common tool, a related community and could share code, maintenance, and even costs.

Based on the five key findings developed in this section, Gartner identifies three scenarios for an EU OSS catalogue, detailed in the next section.

3.1.2 Design and selection of scenarios for an EU OSS Catalogue

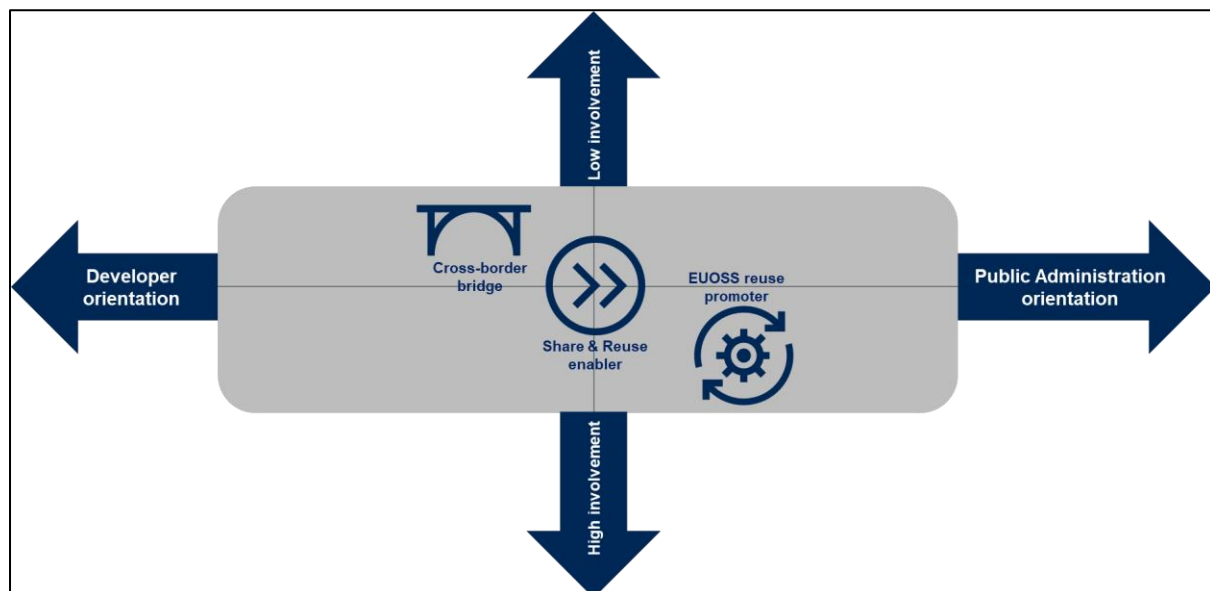
3.1.2.1 Defining the scenarios

Based on the key findings, Gartner identifies three scenarios that are complementary and span the catalogue landscape to impact the ecosystem.

- Scenario 1: the Cross-border Bridge
- Scenario 2: the Share and Reuse Enabler
- Scenario 3: the EU Open Source (EUOSS) Reuse Promoter

Figure 10 below illustrates how the scenarios are mapped onto the landscape. Each scenario is described in detail below.

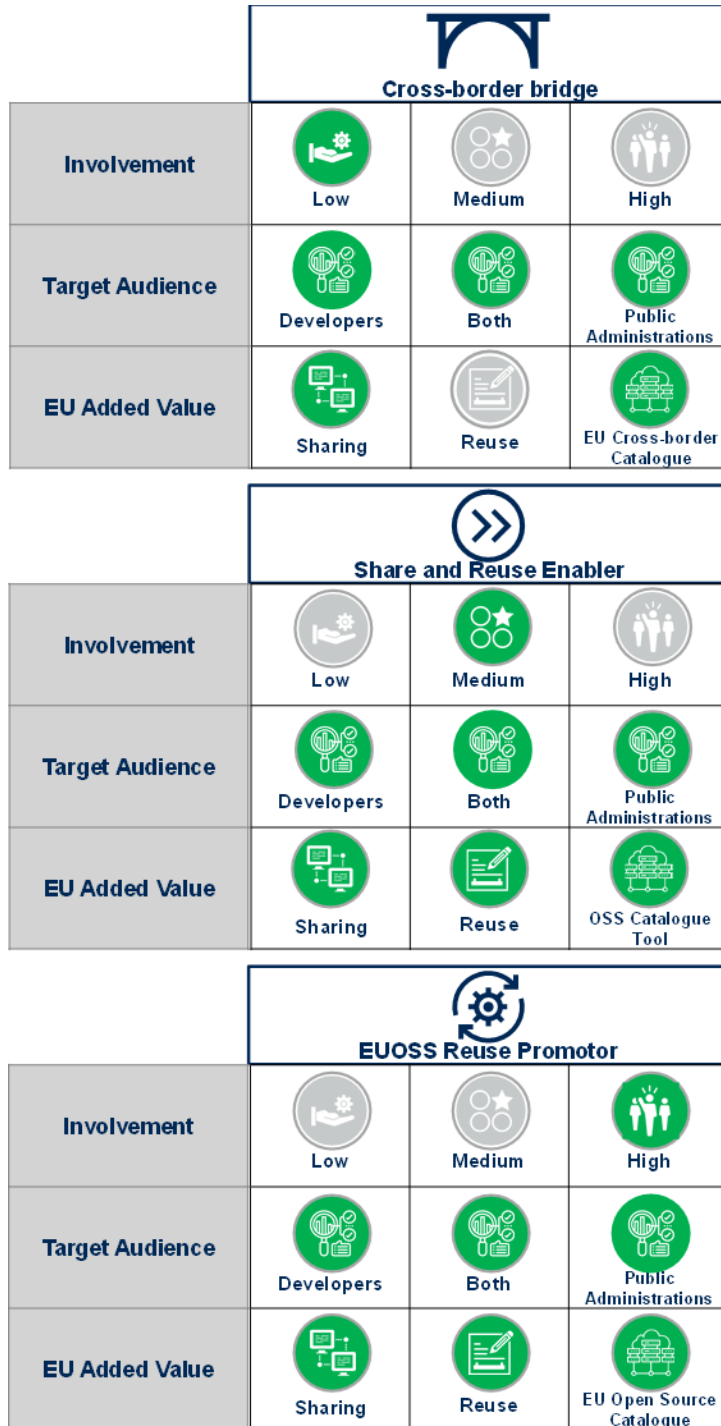
Figure 10. Landscape of EU OSS Catalogue scenarios



Source: author's own elaboration (January 2022)

Each scenario proposes a vision for an EU OSS Catalogue, describing the target audience, the level of involvement and EU added value, as summarised in Figure 11.

Figure 11. EU OSS Catalogue scenarios



Source: Gartner – author’s own elaboration (January 2022)

– Scenario 1

The cross-border bridge scenario aims to scale sharing across the existing OSS catalogues by federating them and maximising automation of involvement, in a cross-border catalogue. Users can search through the federated metadata and view solutions in existing catalogues. Its target users are both public administrations and developers, with probably some more interest from OS developers who are used to navigate in these catalogues. Involvement is low, the focus is on sharing. Reuse is possible, but there are little efforts to stimulate reuse, besides ensuring the availability of the license and selected descriptions of the solutions. The added value at the EU level is to scale sharing, and provide a cross-border catalogue.

– Scenario 2

The share and reuse enabler scenario provides a reusable tool/ solution for an OSS catalogue, which can be delivered as a service and/or as an OS solution. It provides public administrations without a catalogue a solution to implement theirs. Its target users are both public administrations and developers. This scenario implies medium involvement, as effort is needed to stimulate and facilitate reuse, by creating a community of catalogue re-users who provide input on the roadmap, ensuring buy-in. Pooling of efforts for maintenance and code development can be considered. Consequently, the added value at EU level is to enable reuse, but also sharing as these catalogues are easy to federate due to their high interoperability.

– Scenario 3

The EU OS solution reuse promoter scenario provides an EU OSS Catalogue which hosts EU and cross-border solutions. Examples include solutions from Connecting Europe Facilities, ISA² and Interoperable Europe, digital government building blocks such as X Roads. In a later stage, it can include APIs and potentially services. Its target users are both public administrations and developers, with a slightly stronger focus on public administration user profiles who are searching for reusable solutions. It ensures reuse by curating the solutions through architectural approaches and experts, with strong involvement in community and quality efforts. The added value at EU level is therefore to promote reuse. It will also promote sharing of these solutions because it will be federated in the cross-border bridge scenario.

3.1.2.2 Analysing the scenarios

For each scenario, the European Commission has a clear offering and role in the ecosystem. Each scenario can leverage opportunities, is exposed to some risks, necessitates levels of involvement and have some specificities in terms of sustainability. The involvement of the European Commission and in some cases catalogue owners – referred to in this context as Member States (MS) – is different for each scenario. These points are detailed in Table 18.

Table 18. EU OSS Catalogue scenario analysis

	Cross-border Bridge	Share and Reuse Enabler	EUOSS Reuse Promoter
What the EC offers	The EC provides the bridge, expanding existing catalogues across borders.	The EC shares a reusable solution (an OSS Catalogue) – that fosters sharing and reuse.	The EC is instrumental in architecting and implementing the digital transformation of European public administrations.

	Cross-border Bridge	Share and Reuse Enabler	EUOSS Reuse Promoter
Opportunities	<p>There is a wide ecosystem of existing catalogues, some of which are using similar tools, which makes them easy to federate.</p> <p>With the examples of Software Heritage or the French federation of repositories, such a catalogue is proven feasible.</p>	<p>There are some existing catalogue solutions that can be reused and the emerging ecosystem of gitlab/ github based catalogue solutions provides an opportunity for the OSSC tool to leverage this technology trend.</p>	<p>There is a strong political drive from the EC Open Source Strategy, the Commission decision on OSS distribution and the proposal for Interoperable Europe Act³⁴.</p> <p>There are several public administration solution domains such as digital government (ISA²/ CEF solutions), statistics, spatial data infrastructure (INSPIRE), legal text editing (LEOS) that share reusable tools.</p>
Risks	<p>There is full dependency on existing catalogues.</p> <p>Common metadata models are needed (and agreement among the stakeholders).</p>	<p>There is no demand for this tool, MS without a catalogue do not need one or prefer implementing a different solution.</p> <p>The community should be expanded beyond those reusing the shared tool to include all the OSS Catalogue owners and build on their experience, which can lower the focus on reusing the tool.</p>	<p>Stimulation of reuse will require high pro-active efforts from the EC.</p> <p>The demand for reuse is unpredictable.</p> <p>The needed skills and expertise are very varied and specific (architecture, communication, software development, business knowledge, standards), which could be difficult to acquire.</p>
Involvement	<p>The involvement from the EC and MS is low, except for initially setting up the federations and aligning metadata models.</p>	<p>The involvement from the users and the EC is medium and shared, as in an open source community.</p>	<p>The involvement from the EC is high as it provides support and active expertise to ensure reuse of the EC building blocks and tools in the various eGovernment and EU regulation related systems.</p>

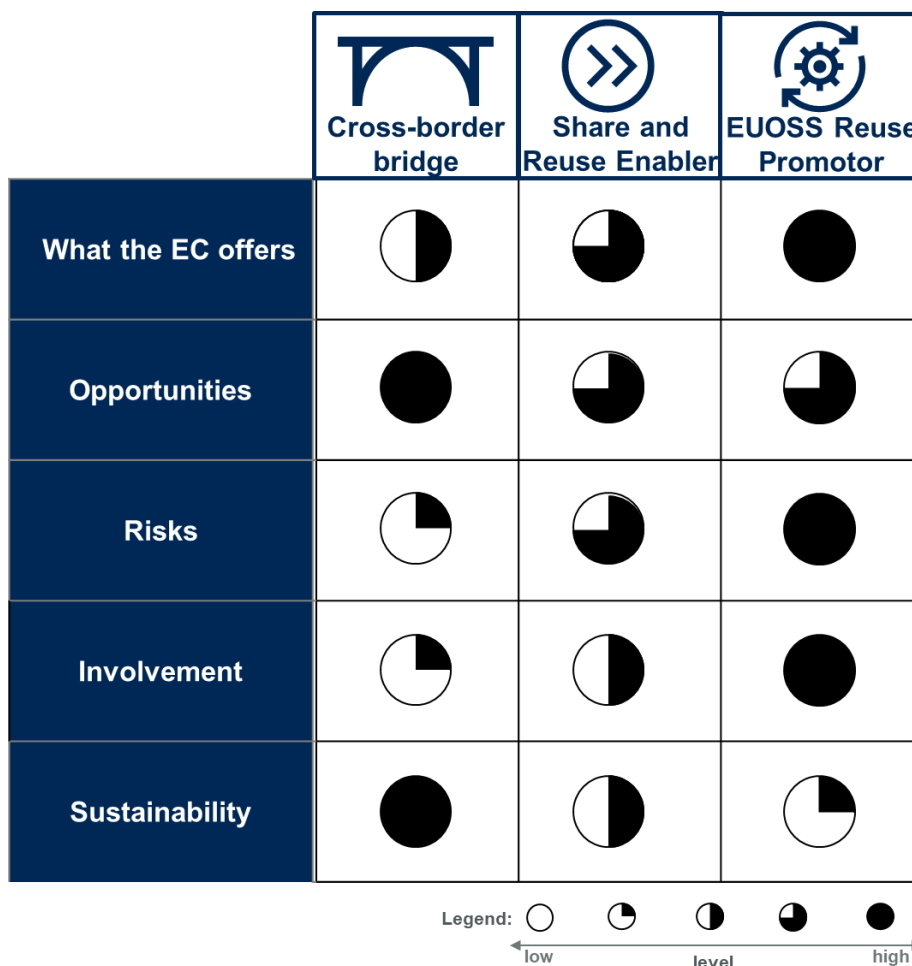
³⁴ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

	Cross-border Bridge	Share and Reuse Enabler	EUOSS Reuse Promoter
Sustainability	Most of the existing catalogues, on which this scenario is based, have legal foundations or are managed by municipality associations, which ensures sustainability.	The pooling of costs of maintenance and development of the source code can be organised among reusers. The EC can consider providing the catalogue as a service, potentially for a fee.	The costs and effort for such involvement is very high and impact and ROI will need to be measured across the complete chain of reuse, taking into account the benefits of interoperability.

Source: author’s own elaboration (January 2022)

The scenarios are compared to each other for each of these points with a scale from low to high, depicted in Figure 12.

Figure 12. EU OSS Catalogue scenario assessment



Source: author’s own elaboration (January 2022)

As shown above, the Cross-border bridge scenario benefits from high opportunities, low risk, low involvement and high sustainability compared to the other scenarios. The role of the EC focuses on cross border sharing.

The Share and Reuse Enabler scenario benefits from opportunities and allows the EC to play a strong role in the ecosystem with a medium level of involvement compared to the other scenarios, but the risks remain high and sustainability is at medium level.

The EU OSS Reuse promoter gives the EC a strong role impacting the actual reuse of solutions, which requires strong involvement and comes with a high level of risk. The sustainability generated will need to measure the benefits of reuse and the impact of the reused solutions in the overall interoperability landscape.

Gartner’s analysis and recommendation to pursue the three scenarios was discussed in a workshop with stakeholders from the existing OSS catalogues, detailed in the next section.

3.1.2.3 Selecting the scenarios

The participants commented on the landscape analysis and on the key findings leading to the scenario definition mainly by confirming the challenges of reuse and explaining how they lower the barriers to reusability. These comments are summarized in Table 19.

Table 19. Reusability challenges

Reusability challenges
The choice of the technical stack is a big barrier to reuse. To counter this, in the Dutch catalogue, they are offering container images of software – a container image is a static file with executable code that can create a container on a computing system. A container image is immutable, meaning it cannot be changed, and can be deployed consistently in any environment.
Another type of barrier is the lack of modularity: big monolithic stacks are very hard to be reused. In Italy, the most modular software packages are those being reused.
There were sporadic examples of reuse between member states (Italy and Greece), although the language barrier is important. User specificity is similar barrier to reuse. For example, software programmed by some municipalities have limited reuse potential in other member states because the solutions are linked to the local legislation.
According to one participant, reuse coaching for solutions and architecture building blocks seemed like a very ambitious bar to set for the catalogue, referring to the work done for the 10 CEF building blocks.
Gartner concluded that you need to design/ architect for reuse and to code for reuse following best practices including documentation and internationalisation options).

Source: Comments from Workshop #1

Workshop participants also commented directly on the three scenarios, providing feedback on their relevance and some recommendations, listed in Table 20.

Table 20. Comments on the proposed scenarios

	Cross-border Bridge	Share and Reuse Enabler	EUOSS Reuse Promoter
Relevance	This scenario was mentioned the most as relevant	The idea of a community was welcome, but the workshop attendees who did not ‘have’ a catalogue did not find that a reusable OS Catalogue solution was a priority.	This scenario was identified as relevant.
Comments	This scenario is a “good starting point” for an EU Catalogue, for which a metadata standard is	Having access to best practices and a community discussion would give them the	Such a catalogue could host shared interoperability resources (code / APIs / services /

	Cross-border Bridge	Share and Reuse Enabler	EUOSS Reuse Promoter
	<p>needed to make the bridge possible.</p> <p>The culture of reuse will most likely grow bottom up, and will benefit from an existing way to have a good and easily maintained overview of all sharing efforts as the bridge aims for.</p> <p>There should be a way to reference existing OS projects in the EU OSSC even if they are not part of a (National, Regional...) catalogue.</p>	<p>information needed to then design the type of OSS catalogue fitting their needs³⁵. Regarding the lack of the lack of discussions with other EU countries about these catalogues, a participant highlighted that this is mainly due to lack of resources and time, not interest.</p>	<p>standards), supporting cross-border public tasks, as well as host EC solutions used across Europe (CEF building blocks, ISA² solutions, ECI, an Open-Source catalogue solution).</p>

Source: Comments from Workshop #1

The outcome of the workshop was constructive, Gartner decided to pursue the target benchmark with all scenarios except for scenario #2, which was risky if there was a low appetite for reuse, confirmed in the workshop. The Community that would have been created in scenario #2 was however relevant and will be included in scenario #1 – stimulating knowledge exchange among catalogue owners.

A second workshop focusing on the need for a common data model - and what it would look like - was set up with the same stakeholders. The approach for defining this model and the outcomes of the workshop are described in the next section.

3.2 Data model options and categorisation needs

A further analysis of the data model landscape in these catalogues lead to the design of options for a common data model which are developed in this section. This section:

- presents a landscape of typologies in existing catalogues (a mapping of data models and categories available), specifying the scope of the EU OSS catalogue,
- analyses the different options for a data model, introducing the concept of a Minimal Interoperability Data Model (MIDM) and providing recommendations,
- analyses categorisations needs and existing practices provides recommendations,
- analyses the need for a unique identifier in the EU OSS catalogue.

3.2.1 Analysis of the data model landscape

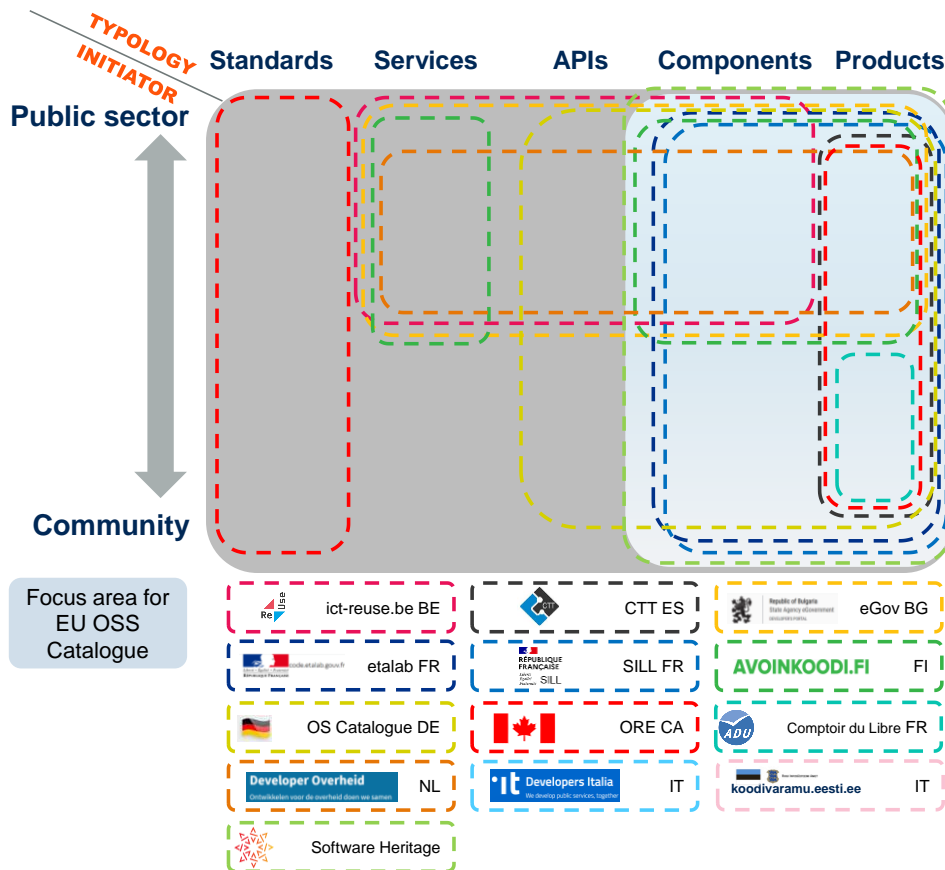
The analysis of data models, including their categories and values in existing catalogues, based on information collected during the interviews and desk research on the catalogues - led to following findings:

³⁵ Note: a later discussion about a common data model highlighted that the availability of a reference implementation could be helpful in rolling out the standard, but this assumes that there are many new MS intending to implement an OSS catalogue, which would need to be confirmed.

- The landscape of typologies used to describe solutions in existing catalogues is varied.

We want to leverage existing typologies as much as possible when creating an EU OS catalogue. The OSS catalogues reviewed in this study present various ways of describing software solutions; they categorise them using different typologies. These typologies are presented in Figure 13, which shows that many catalogues provide software solutions (here referenced as products and components³⁶), but also APIs, services and standards. The vertical axis in the figure differentiates if the solutions are developed by the public sector or developed by the open source community and reused by the public sector.

Figure 13. Landscape of typologies used in OS Catalogues



Source: author's own elaboration (January 2022)

Further analysis of categorisations in this report will focus on open source solution products and components, developed by the OS community and reused by the public sector, in alignment with the scope of the EU OS Solution catalogue.

- The categorisations used do not converge across catalogues

The definition and selection of categories for filtering and subdividing open source solution differs significantly between catalogues. Catalogue owners would benefit from guidance, from sharing best practices, and mostly from recommendations to adopt an existing standard.

³⁶ Software solutions can be either a product (a complete solution such as Jitsi) or a component of a solution (such as Apache Spark). Further analysis of typologies in existing catalogues are available in

Annexe 3 Analysis of typologies in existing catalogues.

Catalogue owners struggle with the value lists they want to propagate and choosing between a fixed category list and a more free-form tagging system. This is especially cumbersome for Software Type / Categories and “Public Administrations”. Section 3.2.3 delves deeper into these domains and proposes some classifications.

- Most of the catalogues do not use an Open Source Solution Unique Identifier (OSSUID)

A unique identifier is an immutable number or code that is guaranteed to identify a specific open source solution, independently from which software catalogue it is in. None of the catalogues have focused on defining or finding an OSSUID, with the exception of Software Heritage. The OSSUID is not present in any of the standards but will be needed in order to pursue an integrated view on usage of an OSS. This topic is further analysed in section 3.2.4.

- There are two valuable standards used in some catalogues and these can be made compatible.

When there are standards used, they are either ADMS or publiccode.yml. Despite notable differences, both ADMS and publiccode largely fulfill the needs. publiccode has the edge, as it is built for the specific purpose of public code reuse, and is easier to understand and integrate as ADMS is more generic, fully multilingual and has fewer mandatory fields.

The publiccode.yml file can be integrated into ADMS. Therefore, both can co-exist in the ecosystem although it is advisable to promulgate one standard for simplicity.

Based on these findings, Gartner proposes a set of options for a common data model for the EUOSS Catalogue, developed in the next section.

3.2.2 Design and selection of options for a data model

This section proposes various options for a data model which specifies the metadata attributes necessary for discoverability, supporting the scenarios in the previous section.

3.2.2.1 Approach and design principles

The design of the options for a data model is based on a set of data modelling principles that reflect best practices in the field, presented in Table 21.

Table 21. Design principles for a data model

Data Model Design Principles
Balance key requisites: a complete enough metadata to enhance catalogue solution discoverability vs a low threshold/ effort for existing catalogues to be federated
Analysis based on existing standards and practices in catalogues (don't reinvent the wheel), and on Gartner research expertise
One single standard data model is pursued
The adequacy of existing models is taken into account
Adopt existing standards where possible, after analysing their adequacy to needs
Find and leverage existing taxonomies or ontologies for categorisation
All relevant information that existing catalogues would like to share should be made available in the EU OSS Catalogue in some way, at least by giving the option to make some information available as free text, discoverable through text search

Data Model Design Principles

Federation is one-directional: information flows from the existing catalogues to the EU OSS Catalogue.

Note: this is a key data integration principle. There may be a feedback loop, in which the Federated catalogue reports back non-compliant entries provided by the MS catalogue.

Source: author's own elaboration (January 2022)

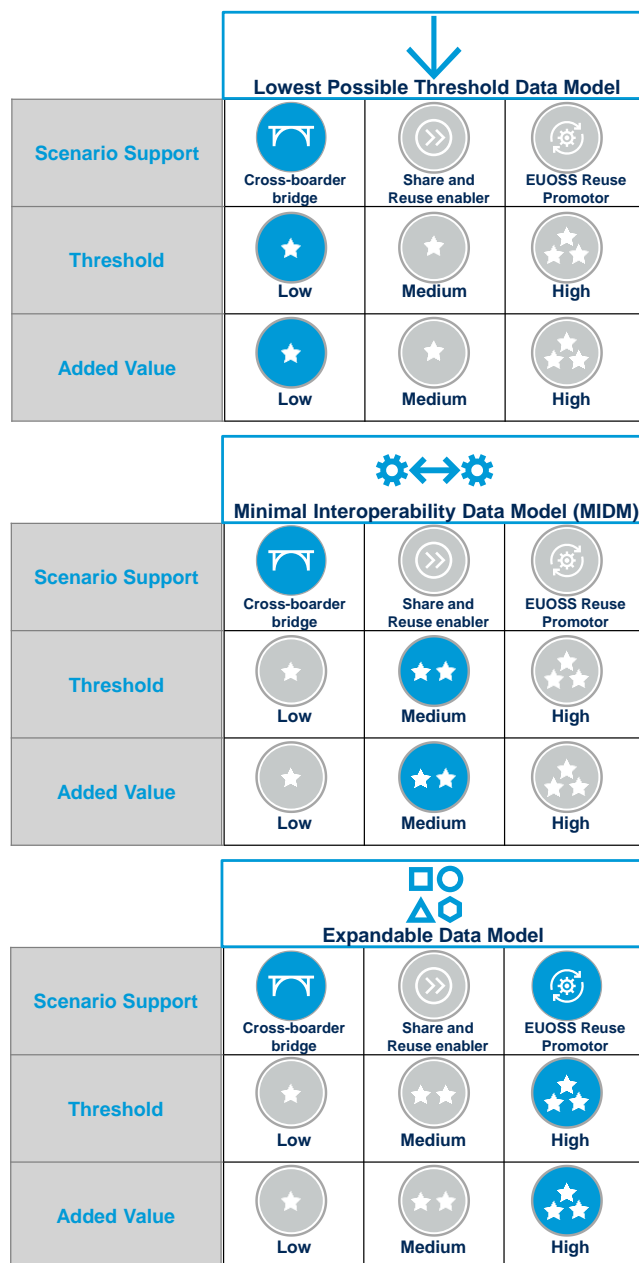
3.2.2.2 Defining the options

Gartner identifies three options for metadata models for an EU OSS Catalogue to support the preferred scenarios: the Cross-border bridge and the EU OSS Reuse promoter. These options are:

- Lowest Possible Threshold Data Model
- Minimum Interoperability Data Model (MIDM)
- MIDM + Expandable Data Model

Each option is detailed below - and presented in Figure 14 - in terms of its added value, the threshold needed to overcome if it is adopted, and the scenario it supports.

Figure 14. Data model options³⁷



Source: author's own elaboration (January 2022)

- Option 1: Lowest Possible Threshold Data Model

In this option, the threshold for federating solutions into an EU OSS Catalogue is kept as low as possible in order to maximise sharing. This option supports the Cross-border bridge. It keeps the number of mandatory attributes at a strict minimum, only requiring a Catalogue-dependent Identifier, Name, License Type and Code Repository link to be provided in an agreed template. All other information is welcome but optional and will be discoverable in the EU catalogue through free text search. It enables sharing of catalogue information from a wide variety of sources but is much less suitable for fostering reuse as it will have duplicate entries and limited categorisation, which makes its added value lower than the other options.

³⁷ The scenario "Share and Reuse Enabler" is greyed out as it is not selected as part of the target benchmark.

It allows most of the MS catalogues to be federated with minimal effort on MS level. It indirectly enables some limited reuse by unlocking the information.

- Option 2: Minimum Interoperability Data Model (MIDM)

In this option, a minimal set of attributes enables interoperability with EU OSS Catalogue, ensuring sharing and reuse. This option supports the Cross-border bridge and to some extent, the EU OSS reuse promoter, although Option 3 is better suited. It provides an integrated view on solutions found in multiple catalogues and categories to search and filter. It requires the use of a metadata standard; the MIDM relates closely to the 14 and 10 mandatory attributes in publiccode.yml and ADMS respectively. In the current situation, it allows the catalogues using either of these standards to be federated without significant additional developments, and adaptation of the other catalogues. It also requires alignment on EU level on an open source solution unique identifier – OSSUID, and on the different values/ tags within the categories. This option has a higher threshold than option 1.

- Option 3: MIDM + Expandable Data Model

In this option, the MIDM is made expandable so that custom attributes which are important for / specific to another catalogue can also be integrated. This option builds on the MIDM, and allows the structured provisioning and federation of custom attributes. The custom categories are discoverable through both text search and custom filters. It provides high added value, allowing EU solutions to provide a maximum of information to the federated catalogue, it caters for the EU OSS Reuse Promoter scenario. It allows existing catalogues to also provide more information than agreed in the MIDM and have it structurally available in the EU OSS Catalogue. It requires alignment and flexibility from the agreed standard(s) to be extensible. This option has a high threshold for adoption.

3.2.2.3 Illustrating how the options work

- Option 1: Lowest Possible Threshold Data Model

In this option the threshold for federating solutions into an EU-level OSS catalogue is kept at a strict minimum in order to maximise sharing. Figure 15 illustrates how this option would work in practice, using an example Solution available in the Bulgarian EGOV catalogue³⁸ named (in English) *EU integration layer - ESB*.

The top of the figure shows the ESB solution as it was available in the EGOV catalogue during the analysis in January 2022. Clearly, the 4 characteristics of the lowest possible threshold are available, as marked in yellow. They are:

- the catalogue-specific identifier,
- the catalogue name,
- the license type,
- the link to the code repository.

This implies that the EGOV catalogue is ready to be federated using this option approach. Other characteristics such as the Assignor or the Annotation can be transferred as well (through free text) if the EGOV catalogue owners would like to.

In order to federate this solution and others from the EGOV catalogue into the EU OSS Catalogue, an approach needs to be devised using an agreed template, file format and transfer mechanism. As this option aims to keep the threshold as low as possible, the EU OSS Catalogue team does not impose a template but discusses what would work best for the EGOV catalogue. For example, it can be agreed that the 4 characteristics for each

³⁸ The Bulgarian EGOV catalogue can be accessed through <https://dev.egov.bg/PDev/index.jsf>.

solution will be provided through a csv file that the EGOV catalogue provides on a weekly basis for example through a secure file transfer. In addition, the EGOV catalogue will provide 2 additional characteristics (Type and Assignor), as shown in the Agreed Mapping on the picture. These additional characteristics and their potential values are not controlled in any way by the EU Catalogue.

At the end of the flow, an illustration is provided of what the ESB solution would look like in the EU OSS Catalogue (Cross-border Bridge), which would allow filtering by license type, since this is a mandatory characteristic, and provide text search. Here, the user was searching for ESB and the result from the Bulgarian EGOV catalogue came up because the string “ESB” is included in the Solution’s Name field³⁹. The EU Catalogue then shows all available characteristics in the search results. The additional ones are just made available as free text under the “Additional Info” field.

³⁹ It also got marked in blue to highlight the relevance of the result to the search query

Figure 15. Option 1: Lowest Possible Threshold Data Model

Software development ID: 97

Name
 Надграждане на Интегрираната информационна система и Интернет портала на Народното събрание

Assignor
 Администрация на Народното събрание

Performers
 Index Bulgaria

Annotation
 Разработване, внедряване и гаранционна поддръжка на софтуер за надграждане на съществуващия модул „Въпроси на ЕС“ на Интегрираната информационна система (ИИС) и на софтуер за надграждане на Интернет портала на Народното събрание, както и функционално разширение с публично достъпна информация за директивите и мерките по прилагането на актовете на ЕС в българските закони.

Type of development
 AIS [Link to the system](#)

Budget **Project** [link to the project profile](#)

Starting date 15.09.2020 **End date** 27.04.2021 **Certified by DAEU** No

License LGPL (Lesser General Public License) **Project name in GitLab** IIS-modul-Questions-EU-Portal [Reg. on a project in GitLab](#)



Agreed Mapping template

Egov.bg	EU Cat
ИД	Catalogue-specific ID
Наименование	Name
Лиценз	License
Име на проект в GitLab	Code Repository
Статус	Other 1
Дата на статуса	Other 2
...	...



European OSS Catalogue (bridge)

License: Text search **ESB**

MS Cat	Name	License	Code Rep	Additional Info
BG Egov	EU integration layer - ESB	EUPL	Link	<ul style="list-style-type: none"> Type: Interface Assignor: Agency for Electronic Government ...

Source: Gartner - author's own elaboration (January 2022)

- Option 2: Minimum Interoperability Data Model (MIDM).

In this option a minimal set of attributes enables interoperability with the EU OSS Catalogue, ensuring sharing and reuse. Figure 16 illustrates how this option would work in practice, using an example Solution available in the Developers Italia catalogue⁴⁰ named Globaleaks.

The top of the figure shows the Globaleaks solution as it was available in the Developers Italia catalogue during the analysis in January 2022. The Developers Italia catalogue acquires and updates the characteristics of its solutions through publicCode.yml, an open standard for describing Software Solutions which requires at least 17 characteristics of a solution to be described, many of which are visible in the screenshot.

In this option, Globaleaks and other solutions from the Developers Italia Catalogue can be federated into the EU OSS Catalogue if they provide all the characteristics specified by the MIDM. The MIDM or Minimal Interoperability Data Model, which is shown in the middle of Figure 16, consists of 14 attributes that must be provided by the Developers Italia Catalogue in order to be federated. In addition, the EU OSS Catalogue imposes standard templates, vocabularies to describe specific categories, file formats and transfer mechanisms⁴¹.

As Developers Italia is using the publiccode.yml standard, most of the attributes described in the MIDM are already present. The table in the middle of Figure 16 shows a significant level of alignment between the MIDM set of attributes and the attributes found in publiccode.yml, although some adaptations to the standard are still necessary in order to be compliant. The table also shows that both ADMS and publiccode.yml can be adapted to allow federation of OS Solutions into the EU OSS Catalogue. When done, the characteristics of the Globaleaks solution are available for federation.

At the end of the flow, an illustration is provided of the Globaleaks solution showing up in the search results of the EU OSS Catalogue (cross-border bridge) when filtered on the Product typology. While not all solution characteristics are shown, some of the ones that are described by the MIDM can be seen, such as Development Status and Typology.

⁴⁰ Developers Italia can be access through <https://developers.italia.it/>.

⁴¹ Templates, formats and mechanisms are plural because there can potentially be two similar approaches be developed: one based on the publiccode.yml and another based on ADMS.

Figure 16. Option 2: MIDM

Whistleblowing Software

Last release: 2022-01-05 (4.7.6) Type of maintenance: community

Technical contact:
 Giovanni Pellerano
 +390287186005

License AGPL-3.0	Platforms web windows mac linux ios android	Enabling platforms None	Compliance GDPR Design Guidelines Security Guidelines Interoperability Model
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MIDM Attributes

MIDM Attribute	ADMS	Publiccode
Version of the MIDM Standard	Not identified	Mandatory attribute
Contributor Name	Mandatory attribute	Mandatory attribute
Contributor Email	Mandatory attribute	Optional attribute
OSSUID Unique Identifier General Name	Not identified	Not identified
Description	Mandatory attribute	Mandatory attribute
Typology	Not identified	Not identified
Development Status	Not identified	Mandatory attribute
Release date of most recent version	Not identified	Mandatory attribute
Distribution License	Mandatory attribute	Mandatory attribute
ContactPoint Name	Mandatory attribute	Optional attribute
ContactPoint Email	Mandatory attribute	Mandatory attribute
Code Repository	Mandatory attribute	Mandatory attribute
Public Administration Name using the OSS	Not identified	Not identified



European OSS Catalogue (bridge) 🇪🇺

License: Typology: **Product** Text search

OSSUID	Name	License	Code Rep	Typology	Dev Status	...
Q979204	Globeleaks	AGPL3.0	Link	Product	Stable	

Source: Gartner - author's own elaboration (January 2022)

Note: the MIDM gives a strictly minimal set, however, it can be decided to have other attributes in the proposed baseline. Many of these attributes are already available in ADMS and/or publiccode.yml and specified either as optional or mandatory.

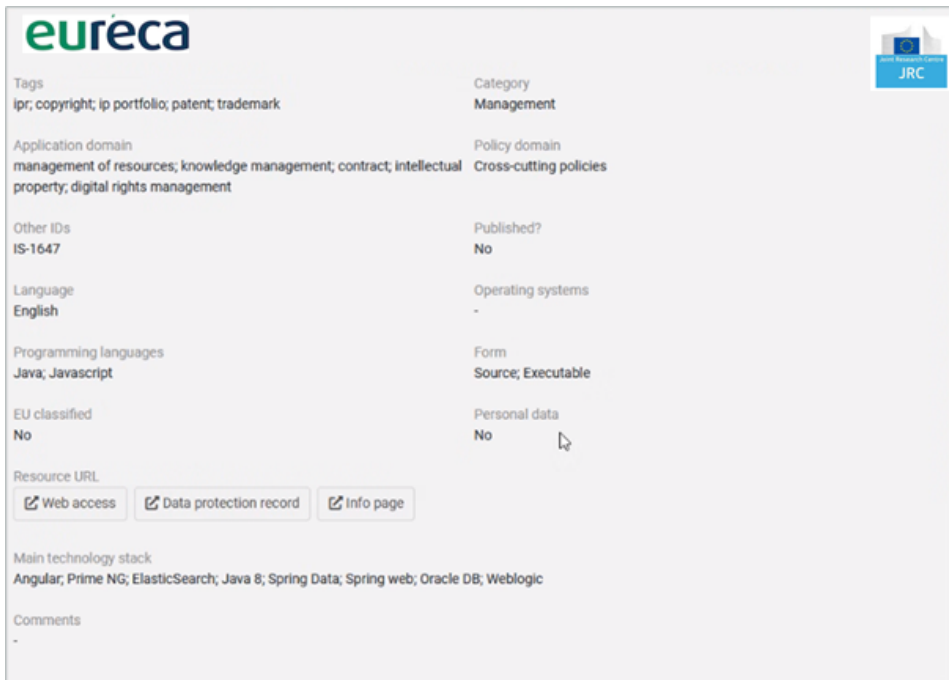
– Option 3: *Expandable Data Model*

This option builds on Option 2 MIDM and adds the possibility to provide custom attributes which are important for / specific to another catalogue can also be integrated. Figure 17 illustrates how this option would work in practice, using an example solution (unnamed) available in Eureka, assuming it is also Globaleaks for the sake of this illustration. Eureka is a catalogue of the European Commission for managing Intellectual Property of software. In our illustration narrative, this catalogue provides enriched information on OS solutions, specifically a flag indicating that a compatibility issue with the open source license is currently under investigation. This information is not part of the MIDM but could be added as a custom attribute and federated into the EU OSS Catalogue, expanding on the MIDM.

The top of the figure shows a solution as it was available in the Eureka catalogue during the analysis in January 2022. When federated into the EU OSS Catalogue, supplemental custom attributes can be defined and agreed upon. In this example, these are “software version” and the “legal issue with licence” flag. These custom attributes then appear in the EU OSS Catalogue as extended attributes alongside the ones described by the MIDM.

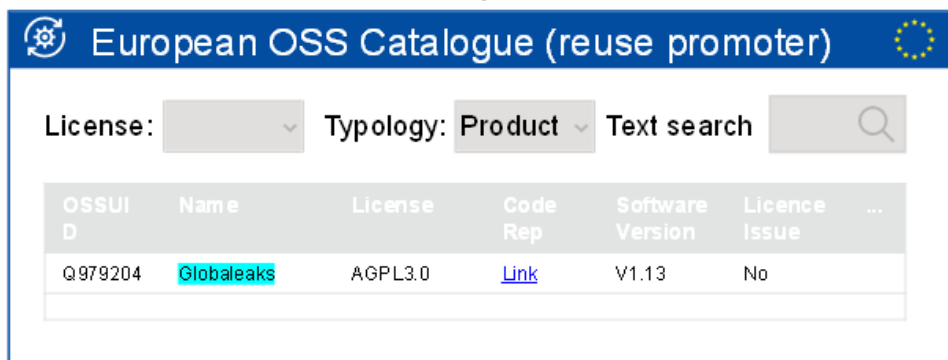
Note: it is good practice to describe the custom attributes with the same diligence as the standard attributes.

Figure 17. Option 3: MIDM + Expandable Data Model



MIDM Attributes

MIDM Attribute	ADMS	Publiccode
Version of the MIDM Standard	Not identified	Mandatory attribute
Contributor Name	Mandatory attribute	Mandatory attribute
Contributor Email	Mandatory attribute	Optional attribute
OSSUID Unique Identifier General	Not identified	Not identified
Name	Mandatory attribute	Mandatory attribute
Description	Mandatory attribute	Mandatory attribute
Typology	Not identified	Not identified
Development Status	Not identified	Mandatory attribute
Release date of most recent version	Not identified	Mandatory attribute
Distribution License	Mandatory attribute	Mandatory attribute
ContactPoint Name	Mandatory attribute	Optional attribute
ContactPoint Email	Mandatory attribute	Mandatory attribute
Code Repository	Mandatory attribute	Mandatory attribute
Public Administration Name using the OSS	Not identified	Not identified
Software Version	Optional attribute	Optional attribute
Legal Issue with License flag	Not identified	Not identified



Source: Gartner - author's own elaboration (January 2022)

With the options defined and illustrated, we then provide a detailed analysis of these options in the next section.

3.2.2.4 Analysing the options

For each option of the data model, its usage in an EU OSS Catalogue provides a clear value proposition. Each option can leverage opportunities, is exposed to some risks, and will have some specificities in terms of evolution. The involvement of the European Commission and in some cases catalogue owners - referred to in this context as Member States (MS) – is different for each scenario. These points are analysed in Table 22.

Table 22. Data model options analysis

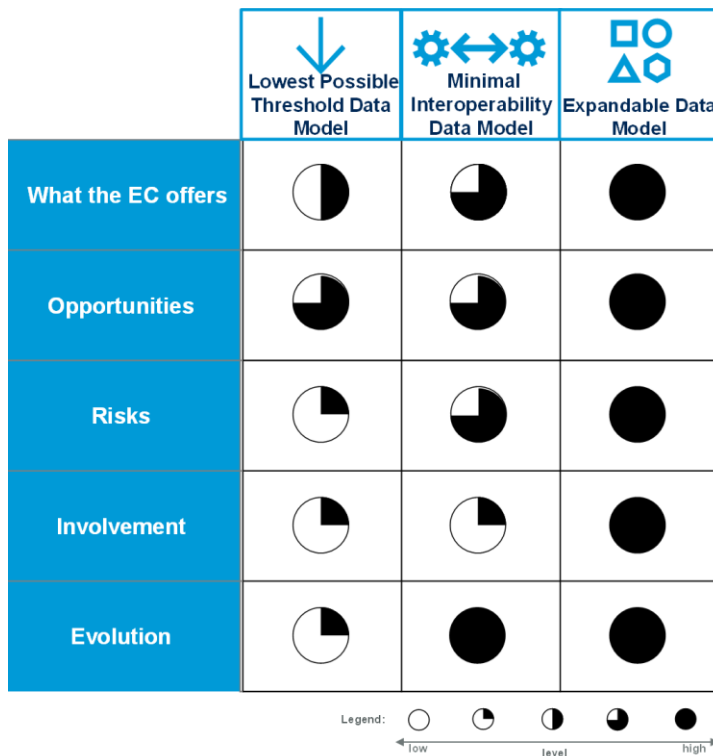
	Lowest Possible Threshold Data Model	Minimal Interoperability Data Model	Expandable Data Model
What the EC offers with a catalogue using the data model	OSS of a large number of existing catalogues is shared with some basic solution description.	A solid, integrated view of OSS from a number of existing catalogues which fosters sharing and reuse of OSS across member states.	An integrated platform showcasing OS Solutions with classifications catered to the EC's and MS's needs.
Opportunities	A fast-growing OSS catalogue with many MS on board creates a strong dynamic and a fast means for producing a first "minimal viable product".	The (future) Interoperability policies support the need to implement the MIDM. MIDM aligns closely with existing open standards for software description (ADMS, publiccode.yml). This ensures smooth federation for MS catalogues that already use these, and provides a clear adoption path for the others, based on best practices.	The (future) Interoperability policies supports the need to implement the MIDM and can promote the development of a specific version of it (e.g.: for digital government solutions).
Risks	Its use provides limited discoverability due to absence of categories, cluttered search results, duplicates and no clear view on who uses a solution. This could lead to catalogue users losing interest due to poor user experience.	Only a handful of existing catalogues are able to onboard at first, which impacts the breadth of the federation at first. Data quality issues might still create some limited duplicates, which requires monitoring and some alignment. The implementation of the OSSUID on EU level could take some time.	Limited potential of leveraging custom categories for discoverability since they are solely related to a single catalogue or a small subset of catalogues.

	Lowest Possible Threshold Data Model	Minimal Interoperability Data Model	Expandable Data Model
Involvement	The involvement from the EC and MS is low, except for initially setting up the federations.	The involvement from the EC is low once MS catalogues adhere to the MIDM. Involvement from existing catalogue owners is also low but adapting to the standard may require significant investment.	The involvement from the EC is high as it contributes to the custom categories and potentially to the usage of the extended model by other catalogues.
Evolution	Evolving to option 2 (MIDM) is technically possible but challenging and potentially costly because it requires changing unique identifier and migrating from a free form data model to a completely different data model that is imposed.	The MIDM can easily be broadened to a larger scope, e.g. to include all categories required by publiccode.yml and/or ADMS. Evolving to option 3 is natural, bringing in more flexibility while leveraging the same standards.	Evolving will become a constant renewal process, in which new custom metadata is added on the request of catalogue. These additions need to be centrally governed in order to sustain overall conformity.

Source: Gartner – author’s own elaboration (January 2022)

The options are compared to each other for each of these points with a scale from low to high, depicted in Figure 18 and explained in the section below.

Figure 18. Data model option assessment



Source: Gartner - author’s own elaboration (January 2022)

As shown above, the option of the Lowest Possible Threshold Data Model benefits from strong opportunities, low risk, low involvement but also low evolution potential compared to

the other scenarios. By promoting this option, the EC also promotes the idea of sharing OSS in a catalogue with limited discoverability leading to poor user experience impacting uptake.

The Minimal Interoperability Data Model benefits from strong opportunities, low involvement, and by promoting this option, the EC also promotes a solid, integrated view of OSS from a number of existing catalogues. The risks are high but the opportunities for evolving the data model are also high.

The Expandable Data Model benefits from strong opportunities and evolution possibilities. Although the risks are high, this option gives the EC a means to promote an integrated platform showcasing OS Solutions with classifications catered to the EC’s and MS’s needs. This option provides the most benefits (evolution, opportunities, EC offering) compared to the drawbacks (risks and involvements).

The analysis of these options is used to select the most suitable approach, this selection process is described in the next section.

3.2.2.5 Selecting the option

The options were discussed in the dedicated second workshop, with a strong and broad consensus on using the option of the Minimal Interoperability Data Model (MIDM), which is the recommendation from Gartner. The comments are summarised in Table 23.

Table 23. Comments on the proposed options

	Option 1: Lowest Possible Threshold Data Model	Option 2: Minimal Interoperability Data Model	Option 3: Expandable Data Model
Comments	While the very low threshold is more inclusive and fosters sharing, workshop participants feared it would lead to suboptimal and disjointed results in the federated catalogue, and was perceived as low value. Also the low reuse potential and intensive re-engineering required to potentially “upgrade” to Option 2 at a later point in time added to the low appeal for this option. Participants agreed it is better to raise the bar and support member states instead.	There is a high reuse potential of existing standards, especially publiccode.yml. there is similar thinking in existing catalogues. The greatest challenge is the unique identifier. The minimum list proposed by the MIDM is “frugal” (on purpose). The MIDM should be complemented with supplementary characteristics (for example functions of government ⁴²). This option is seen by many as a great first step, to be succeeded by extending it into option 3.	It is a good option as a natural evolution of MIDM, but not to be implemented immediately.

Source: Comments from Workshop #2

The next section analyses the categorisations needs and existing standards in order to understand how the MIDM fits in this landscape, where existing categorisation typologies are efficient, and where Gartner can provide suggestions for improvement.

⁴² see categorisations analysis in the next section

3.2.3 Analysis and recommendations of categorisations

In addition to the proposed entries in the MIDM data model, there is a need for a common approach to categorisation of “software types” and “public administration”. This section – which dives into technical details - analyses these needs and provides recommendations, leveraging best practices identified in Table 16 from the data collection section.

3.2.3.1 Software types

Discoverability for an OSS Catalogue relies primarily on a well-structured description of the solution itself. A clear redesignation of the type of software fosters discoverability of OSS in the EU OSS Catalogue.

- Recommended practice

Important traits for a category are its usefulness, stability, intelligibility. For OSS contributors, they should be easy to distinguish, and applicable to the majority of OSS. Gartner considers following categories as valuable for an OSS Catalogue if the values are well-chosen

- Typology, which can be Products (e.g. Jitsi) or Components (e.g. Apache Spark)
- Operating System under which the solution can run
- Software group, which can be either functional oriented (e.g. eLearning) or technical oriented (e.g. Database Management software) (see Figure 1 Figure 19 and next paragraph)
- Programming Language

- Analysis of existing software group categorisations

Each catalogue seeks to find a way of classifying an OSS in a different way. Several dimensions make this notoriously hard to accomplish:

- Granularity: categories defined too broadly don't add much information to the OSS; categories defined too much in detail see contributors struggle to find the right category and sometimes miss the mark. A taxonomy should not exceed 15-20 different values.
- Standards: no agreed and uniform categorisation available, as depicted in the figure below.

Figure 19. Analysis of software groups in existing catalogues

Category		more functionally oriented		
Catalogue		solutions.dial.community (Digital Impact Alliance)	Digital Impact Alliance / Govstack	Canada ORE
Catalogue Category Name		Workflows	Building Blocks	Software Category
Values		Client Case Management Client Communication Client Education Content Management Data Analysis and Business Intelligence Data Collection and Reporting Decision Support Financial Services Identification and Registration Knowledge Management Marketplace Problem Diagnosis Procurement Remote Working Supply Chain Management Work Planning and Coordination	Analytics and business intelligence Artificial Intelligence Client case management Collaboration management Consent management Content management Data collection Digital registries eLearning eMarketplace Geographic information services (GIS) Identification and authentication	Data management and query software Industry specific software Business function specific software Content management software Content authoring and editing software Information exchange software Development software Educational or reference software Security and protection software

Category		more technically oriented		
Catalogue		CTT	OSSPAL (3 levels)	Gartner
Catalogue Category Name		Technical Area	Project Categories	Software Markets
Values		Electronic processing Management of services and systems Communications and messaging infrastructure Security infrastructure and identity management Horizontal services for AA.PP Standardization and regulation Semantic assets Economic and financial management Websites, electronic offices and citizen service Support for electronic processing Human resources management	Application Development & Deployment Cloud Services Application Development Software Application Platforms Data Access, Analysis and Delivery Software Integration and Orchestration Middleware Network Management Software ...	Analytic platforms Application development Application infrastructure and middleware Customer relationship management (CRM) Data management software (excluding DBMS) Database management systems Email and authoring Enterprise resource planning IT operations Operating systems Project and portfolio management Security Storage management Supply chain management Virtualization infrastructure software

Source: Gartner - author's own elaboration (January 2022)

Other software group categorisation approaches - publiccode.yml and the one used by the Next Generation Internet innovation catalogue - preferred to use a more free-form tagging system. In publiccode.yml the tags are controlled within the standard to avoid duplicates or dirty tags. This avoids having for example a value "api_management" and another value "API Management".

- Gartner recommendations
 - Have a typology that distinguishes between Products and Components⁴³.

⁴³ In time, additional typologies could be useful for the catalogue such as APIs, services or standards.

- Use a strong categorisation for “software groups” which allows filtering and drilling down. While several existing vocabularies would work, Govstack and Gartner’s own classification stand out. Govstack has the advantage that it clearly focusses on software for public institutions. Gartner’s taxonomy has the advantage of reflecting a sound knowledge of the market of software solutions, and its values are more accurately defined.
- The Operating System and Programming Language categories are both useful and stable and should also be included.
- Use a controlled tagging system that describes the solution in a free-form fashion. PublicCode.yml provides a head start for accomplishing this and should be used as a starting point.

Note: A strong categorisation on top of a tagging system might seem overkill, but is still recommended. Not only does it foster discoverability, it also allows the values to be clearly and formally defined, which helps contributors in deciding what category applies for their specific OSS, which benefits the metadata quality.

3.2.3.2 Public Administrations

OSS Catalogue users looking to reuse existing OS Solutions, are interested in which other public administrations are using a specific solution. Clear designation of these public administrations provides insight on the actual usage of the solution.

- Identified categories

Since a complete taxonomy of all public institutions in all levels of government within the EU is neither feasible nor very useful, it is better to just have a text field with the name of the public administration and focus on following categories:

- Level of Government – European, National, Regional, Local, Other (as found in the CTT catalogue)
- Function of Government – Defence, Environment, Sports etc.
- Country to which the Public Administration belongs

- Analysis of Public Administration taxonomies

Most catalogues mentioning a public administration stick to a text field in which the name of the public administration is provided.

Only the CTT has included both a Level of Government and Function of Government-like field. It even goes beyond and defined a full stack of public administrations in Spain.

In publiccode, there is an “Intended Audience” field which does provide a list of Functions of Government. Gartner recommends however that a standard is used whenever it exists, and the COFOG standard is highly appropriate. The COFOG standard for functions of government⁴⁵, visible in the figure below.

⁴⁵ the Classification of the functions of government, abbreviated as COFOG, was developed in its current version in 1999 by the Organisation for Economic Co-operation and Development and published by the United Nations Statistical Division as a standard classifying the purposes of government activities

Figure 20. COFOG Government function classification

COFOG Level 1	COFOG Level 2	COFOG Level 1	COFOG Level 2	
01 - General public services	01.1 - Executive and legislative organs	06 - Housing and community amenities	06.1 - Housing development	
	01.1 - Financial and fiscal affairs		06.2 - Community development	
	01.1 - External affairs		06.3 - Water supply	
	01.2 - Foreign economic aid		06.4 - Street lighting	
	01.3 - General services		06.5 - R&D Housing and community amenities	
	01.4 - Basic research		06.6 - Housing and community amenities n.e.c.	
	01.5 - R&D General public services		07 - Health	07.1 - Medical products, appliances and equipment
	01.6 - General public services n.e.c.			07.2 - Outpatient services
	01.7 - Public debt transactions			07.3 - Hospital services
	01.8 - Transfers of a general character between different levels of government			07.4 - Public health services
	02 - Defence			02.1 - Military defence
02.2 - Civil defence		07.6 - Health n.e.c.		
02.3 - Foreign military aid		08 - Recreation, culture and religion	08.1 - Recreational and sporting services	
02.4 - R&D Defence			08.2 - Cultural services	
02.5 - Defence n.e.c.			08.3 - Broadcasting and publishing services	
03 - Public order and safety	03.1 - Police services		08.4 - Religious and other community services	
	03.2 - Fire-protection services		08.5 - R&D Recreation, culture and religion	
	03.3 - Law courts	08.6 - Recreation, culture and religion n.e.c.		
	03.4 - Prisons	09 - Education	09.1 - Pre-primary and primary education	
	03.5 - R&D Public order and safety		09.2 - Secondary education	
	03.6 - Public order and safety n.e.c.		09.3 - Post-secondary non-tertiary education	
04 - Economic affairs	04.1 - General economic, commercial and labour affairs		09.4 - Tertiary education	
	04.2 - Agriculture, forestry, fishing and hunting		09.5 - Education not definable by level	
	04.3 - Fuel and energy		09.6 - Subsidiary services to education	
	04.4 - Mining, manufacturing and construction	09.7 - R&D Education		
	04.5 - Transport	09.8 - Education n.e.c.		
	04.6 - Communication	10 - Social protection	10.1 - Sickness and disability	
	04.7 - Other industries		10.2 - Old age	
	04.8 - R&D Economic affairs		10.3 - Survivors	
	04.9 - Economic affairs n.e.c.		10.4 - Family and children	
05 - Environmental protection	05.1 - Waste management		10.5 - Unemployment	
	05.2 - Waste water management		10.6 - Housing	
	05.3 - Pollution abatement		10.7 - Social exclusion n.e.c.	
	05.4 - Protection of biodiversity and landscape		10.8 - R&D Social protection	
	05.5 - R&D Environmental protection		10.9 - Social protection n.e.c.	
	05.6 - Environmental protection n.e.c.			

Source: COFOG Standard – (c) OECD

- Gartner recommendations

The EU OSS Catalogue should have a good and centralised view of public administrations that used a particular OS Solution. Gartner recommends a name (e.g. “Federal Public Services Finances”, Level of Government (e.g. “National”), Function of Government (e.g. “01.1 - Financial and fiscal affairs”) and Country (e.g. “Belgium” or BE) to be included when a Public Administration uses the Solution.

Since the COFOG standard for Functions of Government exists and is widely adopted, Gartner strongly recommends using it here. Recommendation is to use both Level 1 and Level 2.

Note: Although not recommended to pursue, a taxonomy of public administrations (or a bottom-up built list using a controlled tagging approach) would still make sense. This is because it would avoid the hassles of an identical public administration being named slightly differently by different open source solution contributors, which would result in duplicates.

In addition to these recommendations on aligning on the two categorisations – “software type” and “public administration”, Gartner recommends to create a unique identifier – developed in the next section, which addresses a technical audience as well.

3.2.4 Recommendation for an Open Source Solution Unique Identifier

An OSSUID uniquely defines an existing open source solution, it is not tied to a specific catalogue.

It is required for realising the proposed data model options 2 and 3, which promote reuse of solutions through the EU catalogue: it allows the creation of a single, integrated view on any OSS that is federated from multiple MS catalogues. For example, if two Member States' catalogues list the "Jitsi" solution, the federated view only shows one aggregated view, also showing all the public administrations using it. Such integrated view is especially useful for mapping the use of OSS across member states. It allows e.g. a French public servant to consider an OSS based on it being used already by Italian and Slovenian public institutions.

Gartner's analysis showed that no common approach for an OSSUID currently exists. Each investigated catalogue defines an internal proprietary ID.

Some proxy candidate IDs have been identified:

- The Solution Name is generally considered a strongly distinctive characteristic but relying on it is tricky. Software produced by Public Administration for example might have their name translated into another language if it is reused by another member state in which a different language is spoken. It is also prone to typos, diversity in potential abbreviations etc.
- Code Repository ID / link generally is a strongly identifiable characteristic. However, there may be a risk of repositories migrating to another location (e.g. GitHub to GitLab)⁴⁶.

The following options were not considered.:

- Setting up a central Master Data Management system within the OSS Catalogue. Such capability ensures uniqueness across catalogues through a series of functionalities such as linking similar solutions together using fuzzy logic, providing deduplication procedures, facsimiles etc. It was not considered because the associated investment and maintenance costs would be excessive.
- The generation of an OSSUID within the EU OSS Catalogue. Gartner considered this option as unfeasible because it would require sending the OSSUID back to Local Catalogues. Setting up such a bi-directional interface is complex and violates one of the Data Model Design Principles presented in 3.2.2.1.

Gartner recommends to set up a OSSUID . For creating an OSSUID, an independent, stable, open, central authority is needed where such unique ID can be registered and kept safe. For this, Gartner recommends to leverage the WikiData ID⁴⁷, as is the most suitable candidate found in the analysis. Generating a WikiData "QID" for each open source solution will work.

However, mandating a QID from an individual contributor in a Catalogue requires some discipline from contributors and ultimately elevates the threshold for people to contribute a new open source solution and coordination effort is needed.

One alternative, although a bit risky, is to use the Code Repository URL as a proxy. When implemented well, it should work, but will lead to temporary doubles in case the Code Repository from a tool found in multiple catalogues changes and isn't updated at the same

⁴⁶ There can also be issues expected for services, specific APIs and certainly for non-open source solutions, which by definition do not share their code.

⁴⁷ <https://www.wikidata.org/wiki/Wikidata:Identifiers>

time in each catalogue. This risk is reduced if all catalogues would rely on publiccode.yml and federation would be done by directly ingesting the publiccode.yml file from the original Code Repository instead of providing it from a local catalogue.

This was the last of the four sections on the data model and categorisation analysis which provides a clear set of recommendations on the use of a Minimum Interoperability Data Model, the alignment on a set of categorisations for software and public administration categorisations, and on the need for a unique identifier. The next section develops the aspects relating to the governance of the EU OSS Catalogue.

3.3 Governance of the EU OSS Catalogue

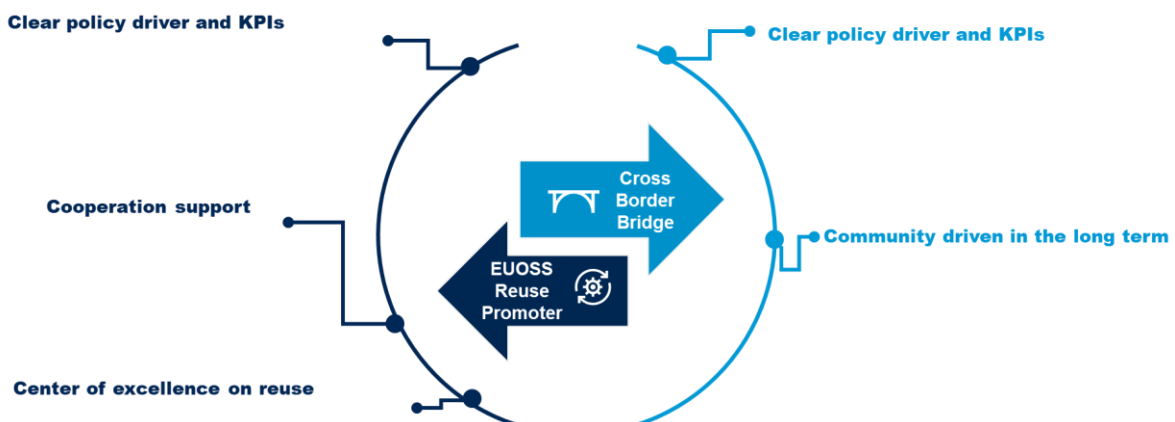
This section builds on the successful practices identified in the existing catalogues, and proposes a governance approach for the EU OSS Catalogue and its different scenarios: the Cross-border Bridge and the EU OSS Reuse Promoter.

The governance is described in 6 sections: the sponsorship, the overall governance approach, the management of solution contribution, user engagement and security and trust, and finally, the various organisations and their roles. Each section provides an overview, a figure with the main points for both scenarios, and details each point.

3.3.1 Sponsorship and sustainability

Both scenarios will benefit from clear policy drivers and the definition of key performance indicators (KPIs) reflecting their impact. Sustainability of solutions can be fuelled by cost sharing opportunities in the EUOSS Reuse Promoter scenario. It will develop expertise on further benefits of reuse with the creation of a Center of Excellence on reuse. This Center of Excellence is a competency center providing expertise and gathering insight on reusability and good practices. The sustainability of the catalogue solution created for the cross-border bridge can be pursued by developing it “in the open”, generating an open source community that will be able to contribute and potentially take up its maintenance in the future. The catalogue owners will be part of this community, as the solution will be federating their catalogues.

Figure 21. Sponsorship and sustainability



Source: Gartner - author’s own elaboration (January 2022)

- EU OSS Reuse promoter
 - Clear policy drivers and KPIs: the policy driver behind the EUOSSC should be clearly promoted; stronger policy in the future will ensure more sustainability and

drive for uptake - such as the proposal for Interoperable Europe Act⁴⁹. Clear KPIs on reuse of solutions as well as the impact on ROI should be made visible, and included in some indicators for tracking the impact of the regulation.

- Cooperation support: the EUOSSC will provide support for creating solution communities, identifying opportunities for cost sharing on the solutions.
- Center of excellence on reuse: experience from the catalogue solutions will provide expertise on reuse. The European Commission develops a center of excellence developing this expertise, which can include total cost of ownership models, architecture design principles for reuse, coding for reuse etc.
- Cross-border bridge
 - Clear policy drivers and KPIs: the policy driver behind the EUOSSC should be clearly promoted; stronger policy in the future will ensure more sustainability and drive for uptake - such as the proposal for Interoperable Europe Act⁵⁰. Clear KPIs on uptake and number of solutions should be visible and included in several relevant dashboards (e.g.: NIFO).
 - Community driven in the long term: the initial investment for setting up the EUOSSC is done by the EC, with development done in an open manner to encourage a community driven maintenance and evolution of the solution, allowing for a federated sponsorship and cost sharing in the future. The sustainability of the catalogue solution created for the cross-border bridge can be pursued by developing it “in the open”, generating an open source community that will be able to contribute and potentially take up its maintenance in the future. The catalogue owners will be part of this community, as the solution will be federating their catalogues.

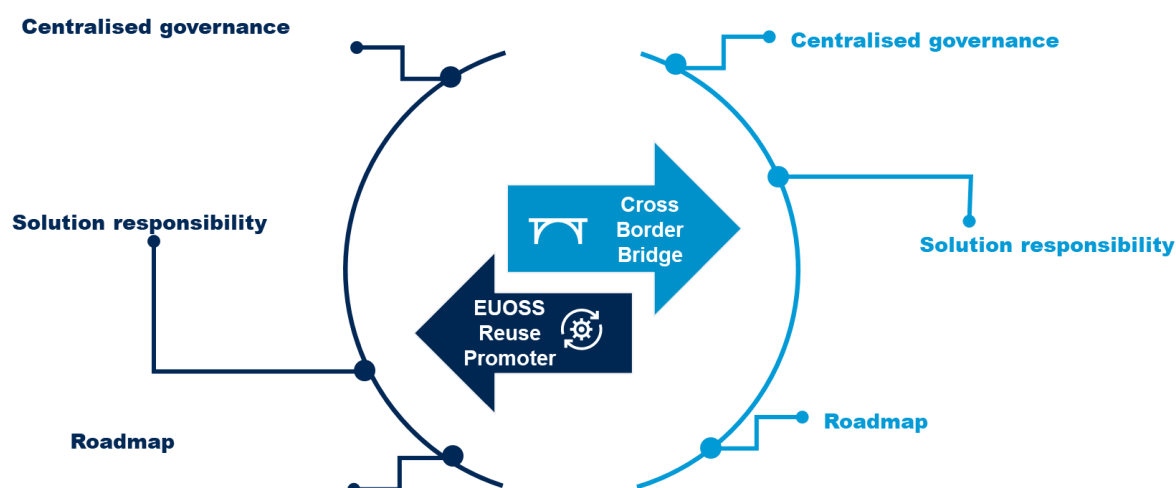
3.3.2 Governance approach

The main trend observed in the governance of the catalogues is centralisation. This approach ensures speed and cohesion in decision making. A further detailing of this approach in section 3.3.6 describes the various bodies and their roles. The responsibility of the solutions - in terms of their availability, data quality and latest versions - is in the hands of those who share the solutions – this federated approach preserves flexibility and ownership. Stakeholder involvement in the roadmap setting is done in the context of agile development.

⁴⁹ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

⁵⁰ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

Figure 22. Governance approach



Source: Gartner - author's own elaboration (January 2022)

- EU OSS Reuse promoter
 - Centralised governance:⁵¹ for initiatives and decision making, centralised governance is the main approach in all the catalogues, this allows speed and cohesion and is recommended for the governance of the EU OSSC.
 - Solution responsibility: a federated responsibility of up-to-dateness, availability and completeness of information is recommended; however, a coordination on shared maintenance can be done.
 - Roadmap: stakeholder feedback is used to gather ideas for setting the roadmap⁵².
- Cross-border bridge
 - Centralised governance; for initiatives and decision making, centralised governance is the main approach in all the catalogues, this allows speed and cohesion and is recommended for the governance of the EU OSSC.
 - Solution responsibility: the responsibility of the solutions - in terms of their availability, data quality and latest versions - is in the hands of those who share the solutions – this federated approach preserves flexibility and ownership of each catalogue.
 - Roadmap: stakeholder engagement in roadmap setting ensures buy-in.

This section highlighted the need for having a strong drive through a centralised governance of the platform, which will be managed by the European Commission. Details of the interaction with Member States, catalogue owners, solution owners and the organisation bodies in the Commission are available in section 3.3.6.

3.3.3 Management of solution contribution

The Cross-border bridge federates existing catalogues, with the solution contribution managed at that level. With this scenario aiming at providing visibility on the widest set of

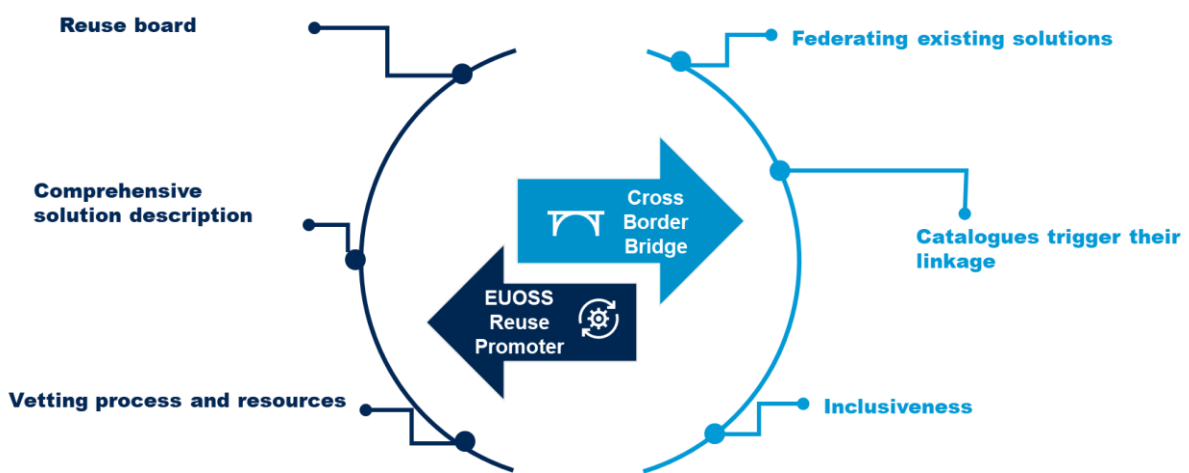
⁵¹ See section 3.3.6 for the various bodies and their roles.

⁵² Stakeholder involvement in the roadmap setting is done in the context of agile development

solutions possible, the process for linking / requesting to link a catalogue should be straightforward.

The EU OSS Reuse promoter identifies solutions that have a strong potential for reuse. Setting up a reuse board ensures an organised vetting structure and process. The process will include aspects on security and quality further developed below. In theory, this scenario does not limit the solutions to open source software. In practice, the catalogue set up in this scenario will start with open source software and further grow to share APIs and services when these are identified and have policy support. The information to be provided on each solution was analysed in the section 3.2 on data model options.

Figure 23. Management of solution contribution



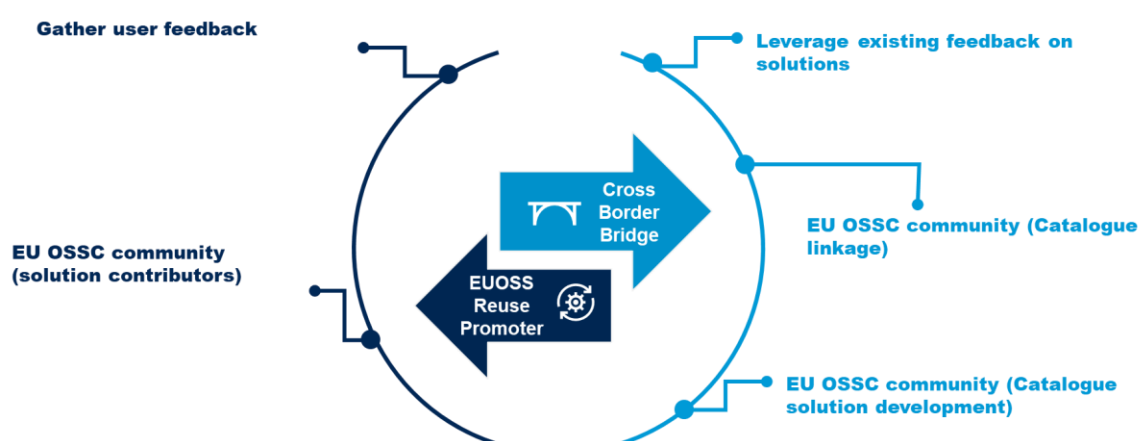
Source: Gartner - author's own elaboration (January 2022)

- EU OSS Reuse promoter
 - Reuse board: the EU OSS Reuse promoter identifies solutions that have a strong potential for reuse. A reuse board is a good practice, it ensures an organised vetting structure and process.
 - Comprehensive solution description: the description of the solutions is comprehensive, to ensure that enough information is provided to the potential reuser..
 - Vetting process and resources: the reuse board and the assessment of the comprehensiveness of information implies a strong vetting process is in place with resources that can act on these aspects.
- Cross-border bridge
 - Federating existing solutions: the cross-border bridge federates existing catalogues, with the solution contribution managed at that level. The EU Catalogue depends on the contribution processes and information provided by each federated catalogue. Each catalogue can decide what information is shared; a minimum is needed to ensure discoverability.
 - Catalogues trigger their linkage: with this scenario aiming at providing visibility on the widest set of solutions possible, the process for linking / requesting to link a catalogue should be straightforward.
 - Inclusiveness: as the aim of the cross-border bridge is to share as much as possible, the selection process of the linked catalogues is not too restrictive.

3.3.4 User satisfaction and engagement of communities of users and contributors

Several catalogues track which public administration has used a solution, and this good practice should be expanded to the EU OSS Catalogue when possible, for both scenarios. Other means of gathering user feedback are not often exploited in the catalogues, besides a rating system that is gathered from the repository of the code, and a common forum or slack channel. Animation of communities and moderation of their discussions is not a trend in the existing catalogues, not only due to a lack of resources; they prefer online events for creating community belonging and supporting community discussions. Communities will have a role to play in both scenarios, and their involvement will be based on these good practices. The promotion of new solutions available in the OSS Reuse promoter can be done using social media and specialised IT magazines, targeting the specific audience.

Figure 24. User engagement and communities



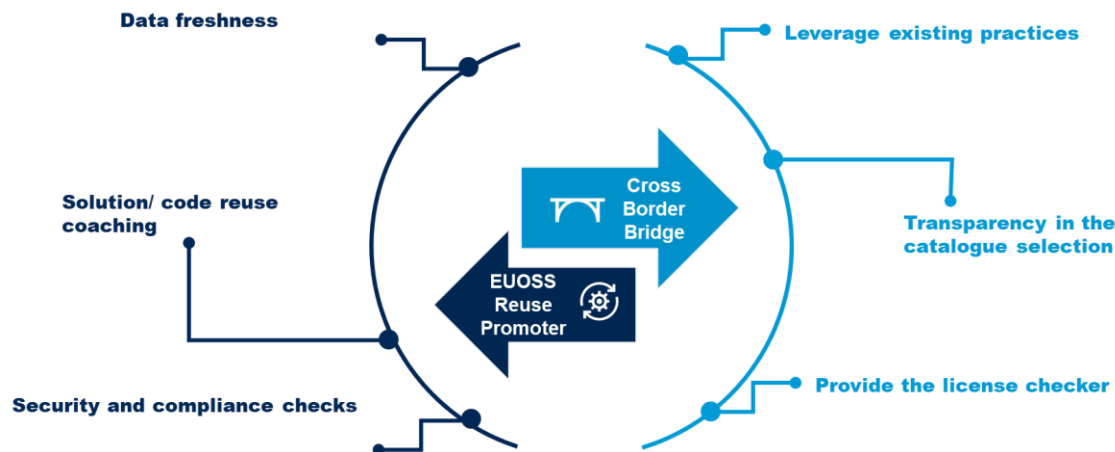
Source: Gartner - author's own elaboration (January 2022)

- EU OSS Reuse promoter
 - Gather user feedback: the EUOSSC will provide lightweight options to gather feedback on solutions e.g.: through a channel/ forum, or a rating system. Tracking reuse should be done, either in an automated way or, when not possible, through self-declaration.
 - EU OSS Community of solution contributors: there should be a community of contributors of solutions set up in the EUOSSC, with quarterly meetings to discuss on the feature roadmap and on user satisfaction – as a contributor.
- Cross-border bridge
 - Leverage existing feedback on solutions: the EUOSSC will provide visibility on the user feedback available in the catalogues that are federated – technical considerations will guide on whether they can be made visible at the EU OSS catalogue level.
 - EU OSS Community (catalogue linkage): there should be a “catalogue contributor community” set up in the EUOSSC with quarterly meetings or targeted online events, e.g.: to align on the feature roadmap, to give user feedback.
 - EU OSS Community (catalogue solution development): the EC OSSC is developed in an open source repository and is visible through the EUOSSC – thus attracting a community of developers to contribute and potentially maintain it.

3.3.5 Security and trust governance

Providing trust in the solutions is a strong element of governance of the EU OSS Catalogue. The risks associated with open source are detailed in this section and the EU OSS Catalogue will provide mechanisms to mitigate them and to create trust.

Figure 25. Security and trust governance



Source: Gartner - author's own elaboration (January 2022)

- EU OSS Reuse promoter
 - Data freshness: do bi-annual checks with owners of catalogue items to make sure data is kept up to date.
 - Solution/ code reuse coaching: the EUOSSC provides reuse coaching on solutions and architecture building block, as well as reuse coaching on source code.
 - Security and compliance checks: the solutions shared should have done license compliance checks and other software composition analysis checks.
- Cross-border bridge
 - Leverage existing practices: the EUOSC will leverage the existing chains of trust in the catalogues that it federates. These are relatively low in general. Information about the federated governance will be available to the end user.
 - Transparency in the catalogue selection: the process of approving a catalogue to be referenced in the EUOSSC should be transparent to the end user.
 - Provide the license checker: the EUSSC should provide its license compliance checker in a visible manner and explain its benefits to the users who can run it on solutions from the federated catalogues.

With the recent events, the topic of security in open source has gained strong interest. Gartner elaborates how this impacts the scenarios.

According to Gartner research, the core risks related to open source have been and continue to be the same as any other software asset.

- Technical risks include general quality of service defects and security vulnerabilities.

- Legal risks include factors related to OSS license compliance, as well as potential intellectual property infringements. Ultimately, whether built, bought or borrowed, software development efforts require rigorous standards and best practices for security, quality and risk management.
- Security risk begins with the nature of OSS acquisition costs. For one thing, the total cost of acquisition (TCA) for open source is virtually always zero. Open source adopters are never compelled to pay for the privilege of using it. Unfortunately, one critical side effect resulting from such a low burden of acquisition is that many open-source assets are either undermanaged or altogether unmanaged once established in an IT portfolio. This undermanagement can easily expose both quality and security risks because these assets are not patched and updated as frequently (if at all) as they should be.

Open source is neither immune to these risks, nor is it more exposed than alternative models. For example, despite conventional wisdom, open source solutions are, by their nature, neither more nor less secure than proprietary solutions. Instead, a combination of factors, such as license selection, developer best practices and project management rigor, establish a unique risk profile for each OSS solution.

Providing trust in the solutions is a strong element of governance of the EU OSS Catalogue. It will aim to address these three points: creating a chain of trust focusing on quality and security, and development best practice impacting reusability of solutions, including license compatibility.

The cross-border bridge will leverage the existing chains of trust in the catalogues that are federated. Typically, these chains of trust require low governance; they are built on the assumption that as solutions are submitted by public administrations, they are developed using the security and trust governance of the public administration which sets a standard that is valid. The cross-border bridge will have to provide transparency on these chains of trust by explaining the processes for federating catalogues and including solutions.

The EU OSS Reuse Promoter will provide more in-depth security and trust governance. A first need is to ensure the quality of the description of the solution (e.g.: latest information on the status, latest version of the solution) by organising regular checks with the solution owners.

A second need is to provide support promoting best practices on reusability. The study shows that catalogue owners promote the reuse of solutions and code with “coaching” support. They either provide guidance on needed testing or on architectural aspects.

In addition to these guidance practices, Gartner recommends the usage of software composition analysis. Software composition analysis (SCA) products are specialised application security testing tools that detect open source software and third-party components known to have security and/or functionality vulnerabilities, and to identify potentially adverse open source licensing terms. SCA’s ability to help ensure the software supply chain is current, free of known vulnerabilities, and properly licensed supports the use of open source in application development. It is an essential element of application security testing, given the ubiquity of open source in applications and the potential for significant risk.

Analysing SCA warnings on licensing issues to address the legal issues stemming from components’ IP ownership or license terms should be done by legal experts within a formal IP strategy that has established clear responsibility across the organisation. For the software developed by the European commission, there is a dedicated approach managed by the Joint Research Center IP Unit that has developed the EURECA tool and related processes which support a team of legal experts managing the licence compatibility issues and other IP issues. They are part of the process for publishing open source software at the European Commission and will have a strong role to play in the EU OSS Reuse promoter scenario. When there is an infringement, the software is flagged and marked as non-reusable until the

issue is solved. However, working on avoiding IP and licencing issues upstream of the development process is a best practice part of coding and designing for reuse. The catalogues in both scenarios should provide a tutoring area with clear instructions on which components should be excluded and the reasons why. The license checker currently available on Joinup is a tutoring wizard that provides a means for contributors to check if the license that they have selected is compatible with any component that they have reused.

SCA tools should be used to inspect the components application developers plan to use to detect open-source software and third-party components known to have security and/or functionality vulnerabilities. SCA tools fit well within DevSecOps workflows, where scanning can be automated as part of the rapid development processes. One of the best practices in modern application development is to use an artifact repository management system such as JFrog Artifactory and Nexus Repository manager. With such a system in place, SCA scanning can be automated to scan and remediate the artifacts in the repository once — and only once — to produce “known good components” that the EU OSS Reuse Promoter catalogue can publish for reuse.

To complement these security aspects, Gartner recommends to further analyse reusability of the software which is typically done through Source Code Analysis which reveals the black box of source code, and provides objective metrics on the overall architectural quality. This evidence-based analysis from static artefacts (source code, databases, embedded structures) or logs (web server/application exception logs, defect logs, test logs) provides insights in maintainability, robustness, extensibility and scalability. Typical indicators on code design issues are analysed and provide information on complexity/readability of the code, classes with(out) logging of exceptions, relations between classes, completeness of comments and API documentation, and conformity with best practices. Source Code Analysis is applied when seeking answers to the following questions:

- Does my source code allow (new) developers to maintain it fast and at a low cost?
- Is the source code flexible?
- Will problems with the application be visible (logs) or hidden?
- Does the solution comply to market conform quality?

The EU OSS Reuse promoter will build on existing security and compliance processes (EURECA) and strategies (European commission Testing Strategy) of the European Commission, and develop reusability analysis expertise in the Center of Excellence of Reuse.

3.3.6 Governance organisations and roles

This section presents the organisational set up of the target benchmark for each scenario within the strategic and operational governance.

Setting up the right governance should enable the EU OSSC with the decision framework required to ensure strategic alignment and operational efficiency within the ecosystem of European OSS catalogues. The approach for governance of the EU OSS Catalogue is based on centralisation, as identified as best practice in section 3.3.23.3.2. The importance of a centralised governance was explained by the different catalogue owners to ensure fast decision making and drive. This centralised approach can be translated at operational level with a core team at the European Commission taking the lead on the initiatives for both scenarios. At the strategic level, the governance will include the wide set of stakeholders.

- Strategic governance

Strategic governance aims to ensure legal and political support, strategic alignment with stakeholder expectations and definition of the main key performance indicators (KPIs).

The steering committee will oversee the strategic governance, and will include representatives of the catalogue owners, Member State representation for ensuring CIO sponsorship, and directors of the different units involved at the EC.

- Operational governance

Operational governance aims to ensure operations and management of governance activities (processes for bridging a new catalogue, for adding a new project, etc.), defining core team activities, means for stakeholder involvement and monitoring of KPIs.

The role of the EC Open Source Programme Office (OSPO) is key in the governance of such a catalogue. An OSPO is a central focus point for an organisation's work with open source. The OSPO creates and evolves an open source strategy with input from various leaders that clearly and succinctly identifies the benefits, risks and policies governing it. According to Gartner research, the role of OSPO governance is to review and approve OS solutions, provide advice on license compliance, define processes for reuse of OS software, define stakeholder responsibilities and automate policy enforcement. The EC OSPO liaises with the catalogue owners, and its expertise also builds on a network of OSPOs across Europe and the rest of the world. With the OSPO leading the operational governance, this ensures the needed continuity of knowledge and expertise on open source and related good practices for this project.

In the mid-term, the EC OSPO will expand part of its activities into the Reuse Center of Excellence, expanding on the OSPO's role of reviewing and approving open source solutions, building expertise on reuse. Interoperable Europe will sponsor this expansion.

The proposal for Interoperable Europe Act⁵³ be a driver for the EU OSS Catalogue, but it is not clear yet which unit(s) will be in charge of implementing it. The table below refers to the Unit in charge of Interoperable Europe as part of the core team for operational governance together with the OSPO, bridging the operational aspects relating to interoperability, creating synergies between projects, taking part in the reuse board etc.

For each scenario, the target benchmark activities can be mapped to the responsible for the strategic or operational governance body, as well as the catalogue owner and the solution owner - detailed in Table 24 for the Cross-border Bridge, and in Table 25 for the EU OSS Reuse Promoter.

Table 24. Governance organisation – Cross-border Bridge

Cross-border Bridge	Steering committee	EC CoreTeam	Catalogue owner	Solution owner
Organisations	Catalogue Owners, CIOs for sponsorship or equivalent (MS representation), and Director/ HoU DIGIT D2, B3	EC OSPO Unit in charge of Interoperable Europe	Depends on each catalogue	Depends on each catalogue

⁵³ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

Cross-border Bridge	Steering committee	EC CoreTeam	Catalogue owner	Solution owner
Sponsorship (including drive), KPIs and sustainability	Implementation and usage of MIDM Identification of relevant policies Inclusion of KPIs in key EU dashboards	Communication on achievements EU catalogue KPI tracking (ex: number of solutions shared and of catalogues federated)	Communicate regularly on any KPIs that their catalogue is tracking	Solution owners should be aware of the legislation in their country and the benefits of publishing their solution using the MIDM description.
Management of solution contribution	Intervention when escalation needed on catalogue inclusion issues	Decision on inclusion of a catalogue, based on the principle of inclusiveness Communication on the need to comply with the MIDM	The catalogue owners communicate the main criteria for selecting the solutions, and manage the way solutions are contributed. The catalogue owners should promote the benefits of using their catalogue, including the usage of the MIDM	The solution owner (or the catalogue owner depending on the policy of each catalogue) fills in the description of his/her solution according to the MIDM
Security, chain of trust and data quality	Align on common practices for the quality of the federated catalogues	The process of approving a catalogue to be referenced in the EUOSSC should be explained to the end user Provide support on the use of the license checker	Common data quality practices agreed on in the steering committee should be disseminated to the solution owners	Data quality and maintenance of the solution are the responsibility of solution owners who should implement the practices
Engagement of the user and contributor community and user satisfaction	Feature roadmap approval, based on an agile approach prioritising user value Disseminate success stories (implementation of MIDM, federation of catalogues, etc.)	First line user support, liaise with federated catalogue EU Catalogue linkage community - animation EU Catalogue solution development community – animation User engagement	EU Catalogue linkage community - participation EU Catalogue solution development community – contribution User engagement (according to MS catalogue's governance)	Provide feedback on the visibility of their solution in the EU and other catalogue. Provide feedback on the impact of being listed in these catalogues.

Source: Gartner - author's own elaboration (January 2022)

Table 25. Governance organisation – EU OSS Reuse Promoter

EU OSS Reuse Promoter	Steering committee	EC CoreTeam	Catalogue owner	Solution owner
Organisations	Director/ HoU DIGIT B3, B4, D2, S, CNECT E2	EC OSPO Unit in charge of Interoperable Europe	N/A This scenario does not federate catalogues. The catalogue owner is the core team	Needs to be identified and can be contacted
Sponsorship (including drive), KPIs and sustainability	Identification of relevant policies Inclusion of KPIs in key EU dashboards	Communication on achievements Tracking: number of solutions shared that are reused, numbers of reuse for a solution, ROI calculation of a solution		Provide insight on reuse, contribute to enhancing documentation
Management of solution contribution	Regular review of results of the reuse board EC solutions	Reuse board in charge of solution vetting process		Once the solution is accepted in the catalogue, the solution owner fills in the description of his/her solution according to the MIDM
Security, chain of trust and data quality	Ensure resources for the growing Center of Excellence for reuse Align with practices for the quality of the federated catalogues – this catalogue will be federated - and define the specific quality practices for this catalogue	Vetting process includes SCA / IP check of EURECA, code reviews Code reuse coaching Solution reuse coaching (architecture) Common data quality practices agreed on in the steering committee should be disseminated to the solution owners		Contribute to reuse coaching, brief the reuse board members on reusability and usage Data quality is the responsibility of solution owners who should implement the practices Maintenance is the solution owner's responsibility, but pooling of efforts can be stimulated

EU OSS Reuse Promoter	Steering committee	EC CoreTeam	Catalogue owner	Solution owner
Engagement of the user and contributor community and user satisfaction	Feature roadmap approval Disseminate success stories on pooling of efforts and successful reuse	Manage feedback on solutions, including security aspects and bug bounties Community of contributors of solutions – animation User engagement All user support		Provide feedback on reuse – new code contributions, shared maintenance, pooling of efforts, or even unsuccessful reuse

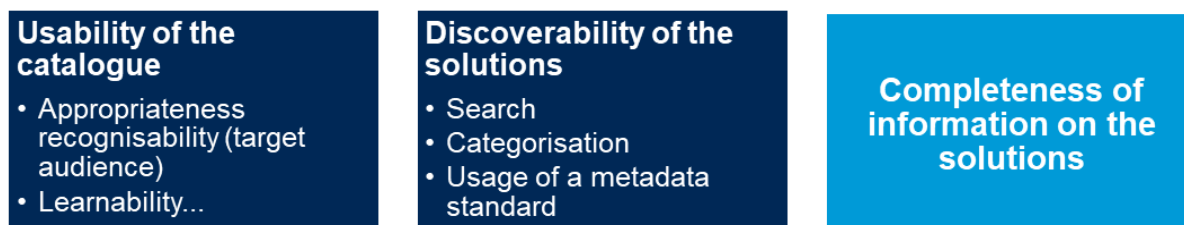
Source: Gartner - author's own elaboration (January 2022)

As described in this section, the EU OSS Catalogue has a complex governance due to the different organisations involved and due to the different scenarios. However, with this ecosystem of catalogues already in place, and with the proposed approach described in this section, most of the organisations exist, and for those that need to be set up, they build on existing structures and initiatives, which will however require additional resources. The next section provides the business and functional requirements of the catalogue.

3.4 Business and functional requirements

The business and functional requirements for an EU OSS Catalogue leverage the best practice framework derived from the software quality standard, presented in 2.2.1, with the main elements reminded in Figure 26.

Figure 26. Best practice criteria framework based on the ISO Software Quality Standard



Source: Gartner - author’s elaboration on the ISO Software Quality Standard (January 2022)

The study develops the target benchmark requirements in terms of:

- Usability of the catalogue,
- Discoverability, and
- Completeness of information on the solutions.



3.4.1 Usability of the catalogue

The target audience needs to recognise the appropriateness of the catalogue. This section elaborates on the vision and target audience, and adds user stories to illustrate the use of the catalogue. Lastly, a best practice showcases the usability requirements.

3.4.1.1 Vision and target audience

The business vision and target audiences for each scenario are described in Table 26.

Table 26. Business vision and target audience

	Cross-Border Bridge	EUOSS Reuse Promoter
Business principles	Scaling sharing, inclusiveness of solutions	Foster reuse, selection of solutions
Catalogue name	 Open Source Exchange	 Solution Hub
Vision	The cross-border bridge catalogue optimises visibility of a maximum number of OS solutions.	The EU OSS reuse promoter optimises reuse of curated EC and cross-border OS solutions.

	Cross-Border Bridge	EUOSS Reuse Promoter
	<p>The cross-border bridge scenario aims to scale sharing across the existing OSS catalogues by federating them and maximising automation of involvement, in a cross-border catalogue. Users can search through the federated metadata and could view solutions in existing catalogues.</p> <p>Involvement is low, the focus is on sharing. Reuse is possible, but there are little efforts to stimulate reuse, besides availability of the license and selected descriptions of the solutions.</p>	<p>The EU OS solution reuse promoter scenario provides an EUOSSC which hosts EU and cross-border solutions (solutions from Connecting Europe Facilities, ISA² and Interoperable Europe, digital government building blocks such as X Roads).</p> <p>It ensures reuse by curating the solutions through architectural approaches and experts, with strong involvement in community and quality efforts.</p>
Target audiences	<p>Developers working in/ for public administrations</p> <p>Public administrations</p> <p>Policy makers</p> <p>Businesses developing solutions for public administrations</p> <p>Citizens</p>	<p>Developers working in/ for public administrations</p> <p>Public administrations</p> <p>Solution architects</p> <p>Businesses developing solutions for public administrations</p> <p>Policy makers</p>

Source: Gartner - author's own elaboration (January 2022)

3.4.1.2 User stories

User stories are developed for each scenario. Table 27 provides those for the Cross-border Bridge scenario which implements a catalogue named the Open Source Exchange.

Table 27. User stories – Cross-border bridge scenario

User	Open Source Exchange
Developer	<p>The exchange is an easy-to-use way to find reusable open source components sorted by domains relevant to me: (eg statistics, geoinformation, AI).</p> <p><i>As a developer, I want to identify if there are any open source components in a specific domain (e.g.: statistics) that I could reuse for developing my solution. I enter a search term in one of the federated catalogues. I select that I want to search in catalogues across Europe. I am directed to the Open Source Exchange site, where I can see my search term – which has been translated – return results, and I can drill down in the categories (name of catalogue, license, etc...).</i></p>
	<p>The exchange lets me find my peers. The exchange helps build a community around tools and components.</p> <p><i>As an open source developer working in/for a specific public administration, I want to identify if there are other open source developers in my organisation, in order to grow my network and build a community.</i></p>
Public administrations	<p>The exchange shows which open source tools are used by others in my domain.</p> <p><i>As a public administration I want to see what open source tools are used by other public administrations in the domain I am working in.</i></p>

User	Open Source Exchange
Policy maker	<p>I work on IT policies, and the exchange shows the practical and strategic value of open source.</p> <p><i>As a policy maker (in the areas of IT policies such as interoperability or open source), I want get a view on the importance of open source in public administrations.</i></p>
Citizen	<p>I am involved in open source and the exchange helps me find specific solutions (eg eVoting) so I can analyse the code, check how it works, find and fix bugs.</p> <p><i>As a citizen with IT knowledge, I want to find the solution used in my country for eVoting, in order to check how it works and potentially identify bugs or vulnerabilities.</i></p>

Table 28 provides user stories for the EUOSS Reuse Promoter scenario which implements a catalogue named the Solution Hub.

Table 28. User stories – EUOSS Reuse Promoter scenario

User Stories	Solution Hub
Developer	<p>As an open source developer working in/for a specific public administration, I would like to reuse a tool from another country that I identified in the cross-border bridge, but I have no knowledge of its reusability, and I would need some coaching and to share experience with some who have used it. I can check if it is available in the Reuse Promoter part of the EU OSSC or submit it to the reuse board if it is not.</p> <p><i>In the Exchange I have identified a tool that we could be re-using. The Hub lets me check if the tool is available and I can submit it to the reuse board if it is not.</i></p> <p><i>The Hub makes it easy to get in touch with the developers, to better understand how to implement it, get some assistance, and share experience with others in a similar position.</i></p>
Public administration	<p>As a public administration I want to see what open source tools are shared by other public administrations in the domain I am working in, with the aim to be reused, and eventually share maintenance and development cost.</p> <p><i>The Hub shows me which open source solutions are shared by my peers in my domain. The Hub helps me join this group, and gets me started on sharing development and maintenance efforts.</i></p>
Solution architect	<p>As a solution architect working in a business providing solutions for public administrations, I want to find reusable solutions to implement a public service, which supports a set of open standards that are commonly used or recommended for interoperability of these services.</p> <p><i>The Hub shows me reusable solutions that help implement a public service. The Hub also indicates which tools use open standards and are recommended for interoperability.</i></p>
Businesses	<p>As a business developer working in a business providing services for solutions for public administrations, I want to find reusable solutions that would benefit from our services (maintenance, support).</p> <p><i>The Hub helps develop my business, by showing the demand for expertise (development, maintenance) in open source in government-business domain as well as by technology areas.</i></p>

User Stories	Solution Hub
<p>Policy maker</p>	<p>As a policy maker, I am interested in developing a solution to be reused by the stakeholders of my policy that would support the reporting requirements in a specific format, and I want to liaise with a center of excellence in reuse to ensure success.</p> <p><i>The Hub lets me liaise with those involved in my IT policies. I can use to Hub to share tools that help others to report on policies.</i></p>
	<p>As a policy maker (in the areas of IT policies such as interoperability or open source), I can get an impression of the level of reuse of solutions.</p> <p><i>The Hub lets me focus on interoperability, the intensity of reuse, and the demand for and importance of open source.</i></p>

Source: Gartner - author's own elaboration (January 2022)

3.4.1.3 Best practice example

To illustrate the notion of usability, this section presents a best practice example, with clear information about **appropriateness** and **recognisability** of the page for various target audiences, easing learnability. The page provides information on the software solution to a wide audience, and each audience can quickly identify where to retrieve additional information that it is interested in. Table 29 described how this is done, providing comments to a screenshot.

Table 29. Best practice – description of a solution and target audience

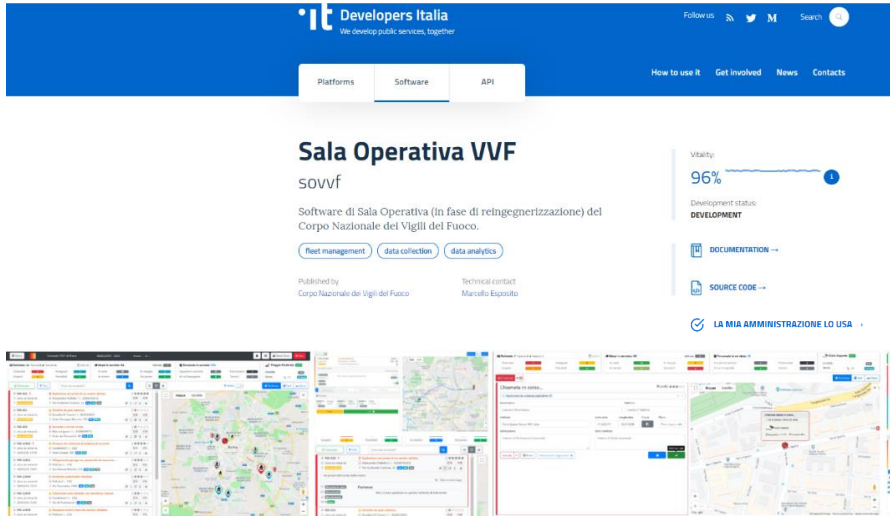


Image of web page	Description
 <p>The screenshot shows a web page for 'Sala Operativa VVF' on the Developers Italia platform. The page includes a header with the site logo and navigation links. The main content area features the title 'Sala Operativa VVF', a subtitle 'sovvf', and a description: 'Software di Sala Operativa (in fase di reingegnerizzazione) del Corpo Nazionale dei Vigili del Fuoco.' Below this, there are tags for 'fleet management', 'data collection', and 'data analytics'. The page also displays the publisher 'Corpo Nazionale dei Vigili del Fuoco' and technical contact 'Marcello Esposito'. On the right side, there is a 'Vitality' score of 96% and a 'Development status' of 'DEVELOPMENT'. At the bottom, there are links for 'DOCUMENTATION' and 'SOURCE CODE', and a note 'LA MIA AMMINISTRAZIONE LO USA'.</p>	<p>Software short description with tags providing information on the “business” areas addressed, relevant for understanding what the solution does (including the visual rendering of the software).</p> <p>Summary of information relevant for developers and IT decision makers (Vitality, development status). Quick access to source code and documentation.</p> <p>Straightforward way to declare that “my public administration uses it”.</p>

Image of web page	Description
 <p>The screenshot shows a software page with a blue header. The main content area is titled 'Software functionality' and lists several features: 'Web based frontend for operators.', 'RESTful backend.', 'Call management.', 'Emergency Teams dispatch.', and 'GIS based emergency management.'. Below this, it states 'USED BY 1 ADMINISTRATIONS'. At the bottom, there are four buttons labeled 'emergency-services', 'defence', 'security', and 'transportation'.</p>	<p>Overview of software functionality.</p> <p>Number of public administrations using it.</p> <p>Clear information on intended audience.</p>
 <p>The screenshot shows a software page with a blue header. The main content area is titled 'Sala Operativa VVF' and 'SOVVF'. Below this, there is a section for 'DETAILED INFORMATION' which includes: 'Last release: 2018-05-17', 'Type of maintenance: internal', 'Technical contact: Marcello Esposito', 'License: AGPL-3.0-or-later', 'Platforms: web', 'Enabling platforms: None', 'Compliance: GDPR, Security Guidelines', and 'List of dependencies: None'. At the bottom, there is a section for 'EXTENDED DESCRIPTION' which states: 'SOVVF è il progetto di reingegnerizzazione del software applicativo per le sale operative del Corpo Nazionale dei Vigili del Fuoco. Il software consente l'acquisizione delle chiamate di soccorso, la gestione delle code, il dispiegamento delle risorse per il contesto all'emergenza, la classificazione automatica del tipo di evento, il...'</p>	<p>Detailed information on the software for technical audiences: including latest release data, type of maintenance and technical contact.</p>

Source: Developers Italia website⁵⁴ and author's own elaboration (2022)

3.4.2 Discoverability of the solutions in the catalogue

This section lists the best practices in:

- search,
- categorisation and
- metadata usage

that are key in supporting the different scenarios of the EU OSS Catalogue. For each best practice, there is an explanation about its value in helping users discover solutions.

⁵⁴ https://developers.italia.it/en/software/m_it-vvfosprojects-sovvf.html

3.4.2.1 Search

Table 30. Best practice – discoverability through search

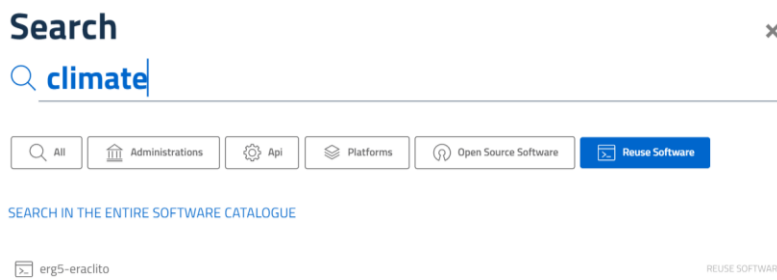
Best practice	Value
Auto-complete: while typing in a search query, the search box will start suggesting relevant keywords based on the metadata available	Rapid and active guidance towards relevant search results.
Auto-results: while typing in a search query, the results already start being filtered.	Rapid and active guidance towards existing results.
Search on category values: while typing, the auto-complete doesn't only show relevant keywords but also potential category values and tags. When clicking on such a tag or value, the results are filtered based on the detected category / tag.	Unified experience through tight integration between categories and text search.
Search within filtered results (and vice versa): allow combining search and categorisation to narrow down solutions	Unified experience through tight integration between categories and text search.
One specific category is the name of the catalogue: while not be part of the MIDM, it is necessary to filter based on the catalogue which contains a specific solution. Please note that solutions can appear in different catalogues.	Enhanced discoverability
Valuable search results: search results show more than just the name of the solution. A 3-line (beginning of a) description, and some key categories, such as solution type are recommended.	Fosters analysis of search results, leading to a better and more efficient discoverability.
Avoid duplicates: make sure one solution appears only once in the list, even though it can be found in multiple local catalogues.	A clear, non-cluttered view enhances the user experience and indirectly discoverability.
Multilanguage search: leverage machine translation to translate existing texts in multiple languages, which allows multi-language search to take place. Note: to maximize the experience, it is recommended that also categories and category values (and their descriptions) are translated. This would be done best manually (as part of the standard) to mitigate the poor contextualisation provided by machine learning based translation.	Enhanced and more inclusive discoverability when applied by the EU Catalogue, but also to the link embedded in local catalogues.

Source: author's own elaboration (2022)

Figure 27 provides an illustrative example of an applied best practice: the search page of *Developers Italia*⁵⁶ providing **auto-results**.

⁵⁶ <https://developers.italia.it/en/software>

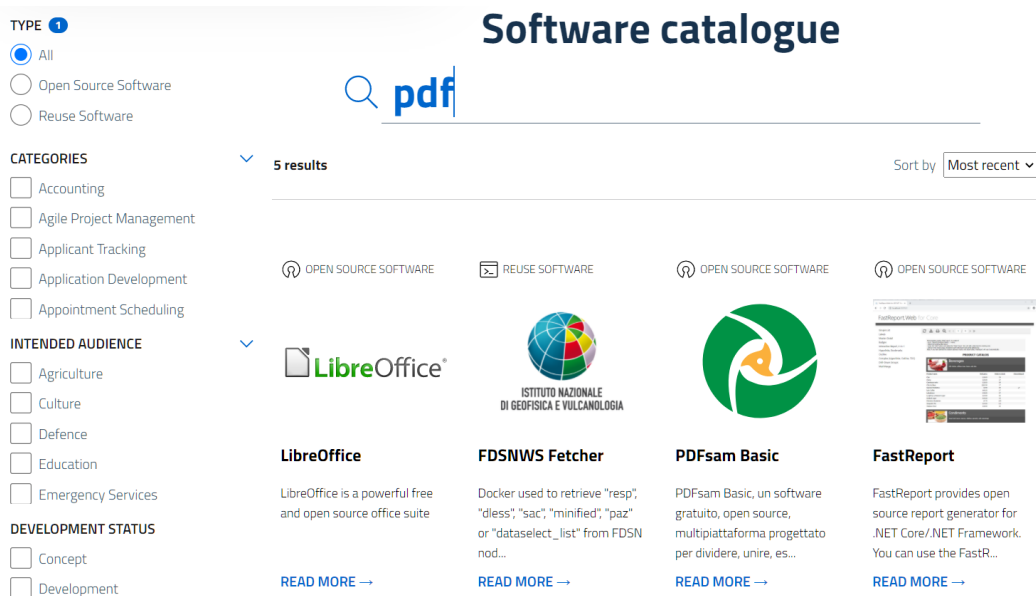
Figure 27. Illustrative example of auto-results



Source: Developers Italia website (2022)

Another illustrative example of an applied best practices from *Developers Italia* is the search results web page - Figure 28 - of Developers Italia providing a short summary of **valuable search results**.

Figure 28. Illustrative example of the valuable search results



Source: Developers Italia website (2022)

For the other best practices recommended, no specific examples were encountered in the investigated catalogues. However, many examples for the categories can be found on major websites.

3.4.2.2 Categorisation

Table 31. Best practice – discoverability through categorisation

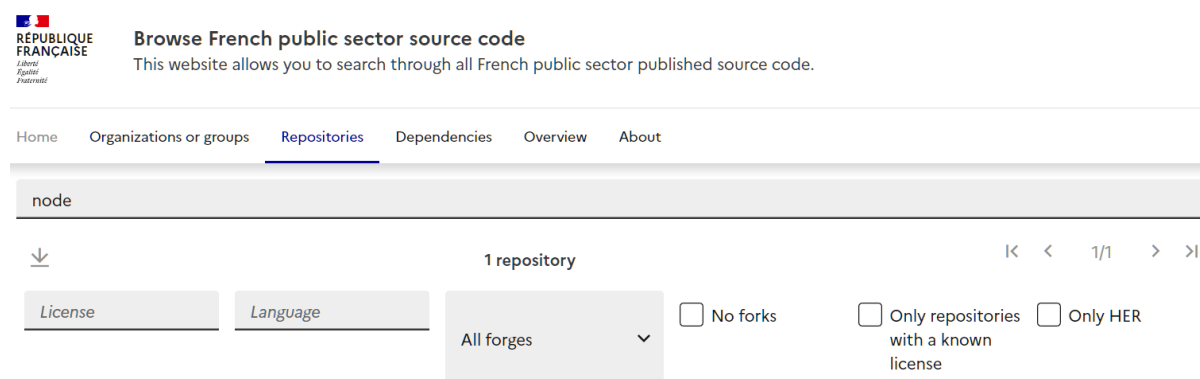
Best practice	Value
<p>Visible categories: while typing in a search query, the search box will start suggesting relevant keywords based on the metadata available</p>	<p>Rapid and active guidance towards relevant search results.</p>

Best practice	Value
<p>Hovering category value / tag descriptions: when hovering over a category value or tag, the description appears on screen. Note: doesn't work on smartphones and tablets.</p>	<p>Better insights into the categorisation as it has been determined. Many different categorisations exist in the world, so knowing what is meant by a specific category value (e.g. Software Category → Customer relationship management) fosters discoverability of the solutions.</p>
<p>Prioritised categories: categories that are used more appear more prominently on the screen Note: could be made dependent on the role of a user that is discovering the OS Solutions</p>	<p>Ease of use, avoid a cluttered view/</p>
<p>Number of solutions per category: show how many relevant results exist for each value within a category (e.g. 27 solutions have the tag "API" associated). When the user performs a search, or filters down using categories, the number of relevant solutions for each value within a category meets the searched and/or filtered results.</p>	<p>Ease of use, focus on more fine-grained discoverability.</p>
<p>Multi-tag selection: allow multiple tags from the same taglist to be selected at the same time. Contrarily to categories, in which a solution can only be linked to one value, a taglist can have multiple tags associated.</p>	<p>Further refinement of search functionalities, enables more accurate discoverability.</p>

Source: author's own elaboration (2022)

Note: best practices that combine categorisation with search are included in 3.4.2.1.

Figure 29. Illustrative example of prioritised categories



Source: French catalogue code.gouv.fr (2022)

3.4.2.3 Usage of a metadata standard

Using a metadata standard is the best way to ensure the MIDM is provisioned by all the OS Solutions provided by the EU OSS Catalogues, ensuring compliance, interoperability and a uniform user experience.

Table 32. Best practice – discoverability through usage of a metadata standard

Best practice	Value
<p>Minimum set of mandatory metadata: the standard specifies the minimum set of information that has to be provided for each solution. This s</p>	<p>As this minimum set is considered a threshold for allowing OS Solutions into the catalogues (both local ones and the EU catalogue), the user can be sure to discover all solutions available in a consistent and equivalent way, which increases the value of the search results.</p>
<p>Availability of a consolidated set of core categories: the metadata standard contains a standard set of categories that can be shown in the EU OSS Catalogue</p>	<ul style="list-style-type: none"> - Information on the consolidated set of categories is available on all of the solutions and leads to a uniform and well-devised discoverability experience. - Recognisability of the search and categorisation best practices offered by the EU OSS Catalogue for users that before only used their local catalogue.
<p>Availability of the same consolidated set of well-considered values for each category: the values specified for each category, as well as the available standard tags are identical across all the solutions federated into the EU OSS Catalogue. These are defined once for all catalogues, can be well-considered and well-documented as part of the metadata standard. They become easily extendable through upgrading the standards.</p>	<ul style="list-style-type: none"> - Information on the standard lists of values, their description and even potential instructions for use/assigning categories and tags is available on all of the solutions through the standard, enhancing the discoverability experience. - On top of that it provides comfort and clarity for solution contributors in describing their OS Solutions in a consistent way.
<p>Common quality checks: a metadata standard can provide quality requirements (structural quality, completeness) which can be converted into a single list of quality checks that works for ingestion of all compliant catalogues into the EU OSS Catalogue.</p>	<p>Better quality of the search results and categorisation through an efficient quality check process that is identical for all catalogues from which the EU OSS Catalogue is ingesting.</p>
<p>Customised characteristics: these characteristics can also be described by the metadata standard (as optional values).</p>	<p>Mitigates the risk of several “almost identical” customised characteristics to be introduced by different catalogues. Integrating these in the metadata standard provides convenience and simplicity for the catalogue’s technical approach, but it also gives visibility on other potentially interesting characteristics, which, in time, could be <i>promoted</i> to a core characteristic.</p>

Source: author’s own elaboration (2022)

Attention points:

- Leveraging two standards will make continued management and operationalisation of these best practices more complex.
- With the exception of the “customised characteristics”, these best practices can be found in / associated with both PublicCode.yml and ADMS.

3.4.3 Completeness of information on the solutions

To ensure completeness of information on the solutions, the table below presents recommended attribute subsets and provides a rational for each.

Table 33. Complete list of information on the solutions

Attribute subset	Rationale
<p>Minimum Interoperability Data Model (MIDM): the minimal set of attributes which enable interoperability with the EU OSS Catalogue, ensuring sharing and reuse. These are described in §3.2.</p> <p>The MIDM already includes the OSS Unique Identifier (OSSUID) which is essential for integrating solutions in a federated catalogue.</p>	<p>Following the broad consensus of leveraging the MIDM, this subset should be in there.</p>
<p>Recommended software characteristics (also described in 3.2):</p> <ul style="list-style-type: none"> - Typology: Products, Components (potentially to be extended with APIs, OS Algorithms...) - Operating System: such as found in e.g. publiccode.yml - Categorisation: just one categorisation should suffice, such as the one used by Gartner - Programming Language: also found in e.g. publiccode.yml 	<ul style="list-style-type: none"> - Accurate and diligent software descriptions are essential for sharing and reuse.
<p>Solution characteristics expressed as tags. Note: the PublicCode.yml already provides a base list with tags which are a good starting point.</p>	<ul style="list-style-type: none"> - Provides flexibility towards assigning specific characteristics to an OS Solution.
<p>Mandatory properties of PublicCode.yml not included in other subsets: such as Application Language, LandingURL, and distinguishing between short and long descriptions.</p>	<p>Provides compatibility with the standard.</p>
<p>Mandatory properties of ADMS not included in other subsets: such as publisher.</p>	<p>Provides compatibility with the standard.</p>

Source: author's own elaboration (2022)

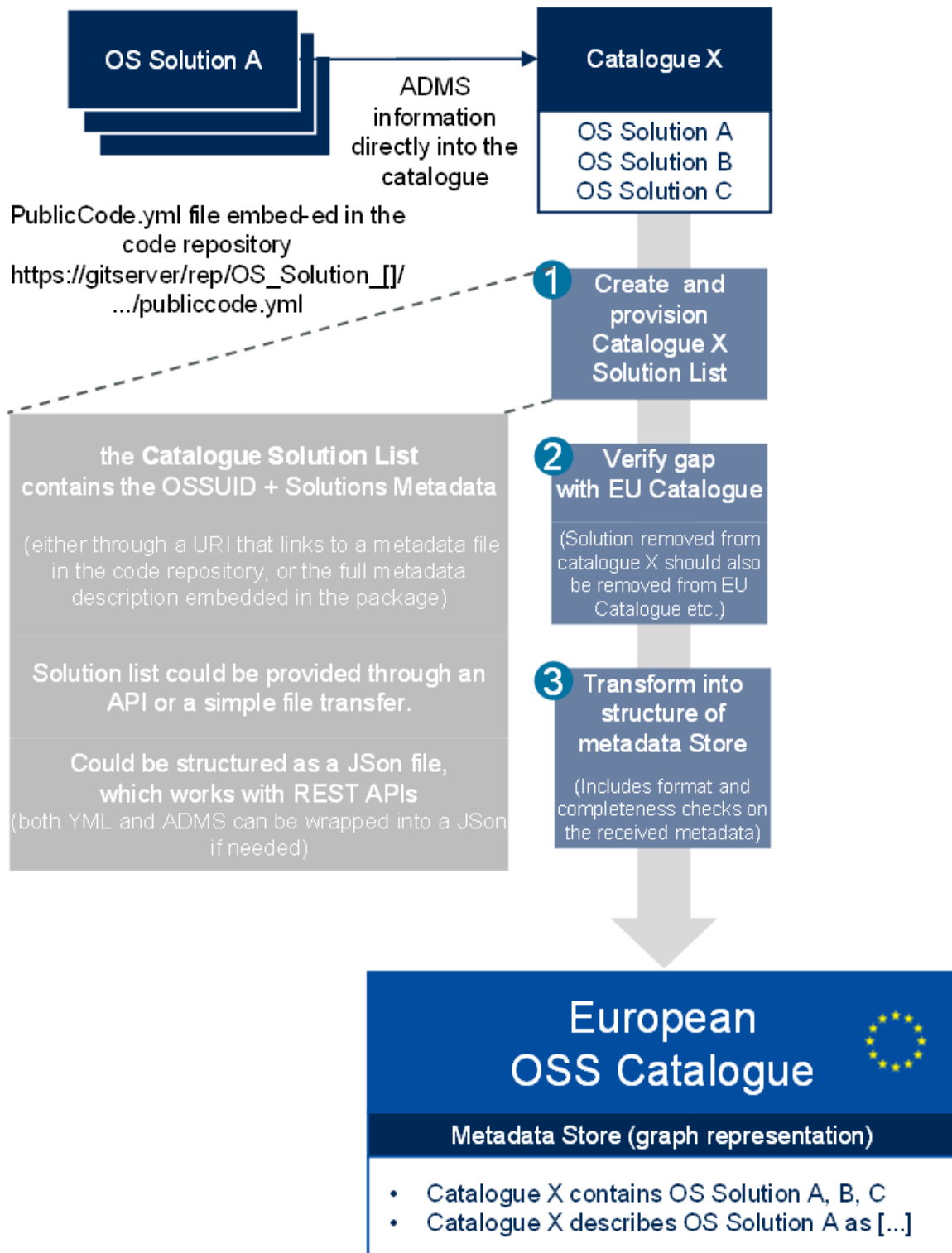
Attention points:

- Leveraging two standards will make continued management and operationalisation of these best practices more complex.
- When establishing and consolidating the complete list, is recommended to further assess whether the remaining mandatory characteristics (in the last two lines of the table) of PublicCode.yml and ADMS are really essential in federating local catalogues. Some of these could potentially be made optional in these standards, as including them could inadvertently create a higher threshold for local catalogues without significantly improving usefulness and discoverability.
- Customised characteristics will become a subset that is recommended to be part of the standard, although it is clear that all these characteristics will need to be labelled as optional. Both ADMS and PublicCode.yml already include a number of optional characteristics that could serve as a baseline when needs arise.

3.4.4 Data flow diagram

Information from catalogues is described through a MIDM compliant standard and ingested into the European OSS Catalogue on regular intervals (daily, weekly) using the following structured 3-step integration process.

Figure 30. Data Flow for populating the EU Catalogue



Source: author's own elaboration (2022)

1. Each Catalogue that can be bridged provides a list of the solutions it wants to provide to the European OSS Catalogue. The list contains the OSSUID and then either a list

of URIs pointing to the OS Solution repository's metadata file (for PublicCode.yml) or the metadata file contents directly (for ADMS data)⁵⁷.

2. The European OSS Catalogue will make sure that the data is updated and catalogue entries are added, as provided by the Solution list. As the solution list in the EU catalogue is to be identical, solutions that have disappeared with relation to a prior solution list also need to be removed from the EU catalogue.
3. Finally, the metadata from each solution in the list is ingested into the EU catalogue's internal store. This requires some data transformations, especially if the metadata is provided through publiccode.yml. To ensure proper ingestion can take place, some quality checks (structural, completeness) are executed on the embedded or linked metadata. If a check fails, the European OSS Catalogue needs to notify the local Catalogue, which would mean that, at least temporarily, a new solution is not added, or an existing one not updated.

After ingestion, the European OSS Catalogue contains an integrated view of all the metadata about the OS Solutions that the local catalogue wanted to share. This is written down in the form of triples.

This technical section on the data flow concludes the set of various requirements, and in the next section we propose as way forward the recommendations for the different steps needed to set up the EU OSS Catalogue, taking into account the target benchmark requirements.

⁵⁷ This data flow model caters to the different integration needs of the two standards, because the Cross-border bridge aims to be as inclusive as possible. An alternate data flow pattern that only has a federated approach (which ingests the metadata as stored in the code repository rather than provisioned by the catalogue through an embedded metadata file) would be possible only if all the catalogues use publiccode.yml.

3.5 Steps for setting up the EU OSS Catalogue

Gartner recommends that setting up the EU OSS Catalogue should include these five stages.

1. Set up the governance of the OS Catalogue

The realisation of the EU OSS Catalogue interface and discoverability requirements must be done using an agile approach, building value incrementally and involving users. This means that **the governance of the OS Catalogue** – see section 3.3 - should be in place as one of the first main milestones. Setting up the governance early on will ensure user buy-in, but also strong sponsorship and trust from the start.

2. Implement the MIDM

- Create compatibility between MIDM, PublicCode.yml and ADMS

All mandatory fields in PublicCode.yml and ADMS must be included in the new model.

Steps:

- Inform the consortiums managing the standards that an update of their standards is necessary in order for them to remain valid carriers. This would make the standards compliant with attributes identified within the MIDM.
- Establish the unique identifier by leveraging existing unique identifiers as set up by Wikidata.⁵⁸
- Preserve MIDM compliancy when PublicCode.yml and ADMS further evolve.

- Upgrade catalogues to become compliant with the MIDM

Steps:

- All catalogues that are already using PublicCode.yml or ADMS:
 - upgrade to the latest version of the standard.
- All other catalogues which have the ambition to become part of the EU OSS Catalogue:
 - prepare for changing their current data model towards an MIDM compliant standard. Secure funding for this transformation through local or EU channels
 - Implement the required changes and launch the new upgraded Catalogue.
- All catalogues:
 - Set up process for OS Solution owners to adapt the metadata of their solutions to the upgraded standards, by upgrading to the MIDM compliant standard.

3. Implement the EC OSS Catalogue

Steps:

- Set up intuitive catalogue according to requirements defined in 3.30.
- Set up federation mechanism for ingesting OSS information from the bridged catalogues using the MIDM compliant standard

⁵⁸ Wikidata is a central storage repository that can be accessed by others, such as the wikis maintained by the Wikimedia Foundation. Content loaded dynamically from Wikidata does not need to be maintained in each individual wiki project. For example, statistics, dates, locations, and other common data can be centralised in Wikidata.

- Establish the cross-border bridge once 3-5 catalogues have completed the steps above. Current assumption is that at least 5 catalogues are able to perform the upgrade in a straightforward way because they are already using either PublicCode.yml or ADMS.

4. **Embed discoverability of the EC OSS Catalogue into existing catalogues**

Steps:

- Provide search features in the existing catalogues to the EC Catalogue.
- Since this is simply established through a link which points to the EC Catalogue, embedding the discoverability is not limited to catalogues that have been bridged.

One important point raised in the workshop is about the drive and uptake of the EU OSS Catalogue. It currently has a mandate related to the interoperability rules of the European Commission. The proposal for Interoperable Europe Act⁵⁹ is in the making and will strengthen this drive. Gartner recommends to time the launch of the EC OSS Catalogue with the Act. This will set a strong case and create momentum in the EU Member States who wish to link up and/ or to create a new catalogue.

The realisation of these steps will take time. Implementing the upgraded standards in the existing catalogues could take 6 to 12 months. Hence the European Commission should time the launch.

⁵⁹ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

Joinup Gap Analysis

4.0 Joinup Gap Analysis and Recommendations

This section provides an assessment of the usage of Joinup. The detailed gap analysis in each section is summarised in a set of tables with a colour coding indicating the level of the gap. This colour coding is explained in the table below.

Table 34. Gap analysis - colour codes for indicating gaps

Colour	Indication
	No gap is observed. Best practice is fully present in Joinup
	A gap is observed which can be easily filled
	A significant gap is observed which requires some implementation / some resources
	A considerable gap is observed; a large or full implementation / a large amount of resources is needed to fill the gap

Source: author's own elaboration (2022)

The analysis covers the different elements of the target benchmark, namely the governance, the requirements - usability, discoverability and completeness of information. It also provides an analysis of how Joinup supports the proposed data model.

The final recommendations take into account some elements of the high-level roadmap of Joinup which were available at this stage.

4.1 Governance

The target benchmark proposes a governance approach for the EU OSS Catalogue and its different scenarios described in section 3.3. In the table below, we summarise the different elements of this target benchmark which include sponsorship, solution contribution, user engagement and communities and security. In the Joinup approach column, we present the main relevant elements that Joinup caters for, and the issues creating the gap to the target. The gap colour coding qualifies the level of the gap. The gap analysis is valid for both scenarios (the Cross-border bridge and the EU OSS Reuse Promoter) unless otherwise mentioned.

Table 35. Gap analysis - governance

Target benchmark topic	Joinup approach	Gap	Recommendations
Sponsorship - including KPI tracking for policy feedback	<p>Strong sponsorship, usage of Joinup potentially proposed in the proposal for Interoperable Europe Act⁶⁰.</p> <p>Political support is important but the actual usage of Joinup hampered by a weak reputation / low usability and discoverability qualities.</p>		Further political support is needed to ensure user-centricity of Joinup (see also recommendations in the usability and discoverability sections 4.2 and 4.3)

⁶⁰ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

Target benchmark topic	Joinup approach	Gap	Recommendations
	<p>Currently, the tracking of KPIs such as “number of reused solutions” is not implemented.</p> <p>Future roadmap: Joinup will have a means to capture “who is using which solution”, by assigning a community animator who will reach out to the members and ask them if they reuse the solutions. This approach is time consuming and does not cater for the cross-border bridge scenario.</p>		<p>Ensure tracking of important KPIs relating to the impact of Interoperability such as reuse and related ROI indicators.</p> <p>Enhance the “used by” process to make it more efficient by allowing users to declare they use the solution – see best practice example in Table 29.</p>
Management of solution contribution	<p>(Cross-border bridge)</p> <p>Joinup currently federates only catalogues which use the ADMS standard. The target benchmark requires inclusiveness as the main rule for federating a new catalogue.</p>		<p>See recommendation section 4.5 on the data model support.</p>
	<p>(EU OSS Reuse promoter)</p> <p>Joinup does not make a selection of the solutions contributed based on their reusability.</p>		<p>Create a reuse board and a pool of reusability experts in various domains (code, architecture, security, IP) by linking with the related EC units and ensuring an efficient process.</p> <p>Select a small set of highly reused solutions in Joinup that can lead by example when the Catalogue is set up.</p>
Security, chain of trust and data quality	<p>(Cross-border bridge)</p> <p>Joinup provides transparency on the processes for federating catalogues. The criteria for adding solutions in these catalogues is not clear on Joinup.</p> <p>Joinup provides a licence compatibility checker that can inform those sharing or reusing solutions if the solution has an appropriate license.</p>		<p>Clarify how the catalogues that are federated include their solutions.</p>

Target benchmark topic	Joinup approach	Gap	Recommendations
	(EU OSS Reuse promoter) No related practices identified in Joinup. Joinup does not provide services supporting reuse ⁶¹ (to our knowledge)		Ensure resources for the foundation of a Centre of Excellence for reuse Put in place reusability vetting processes which include on SCA / IP check with EURECA and code reviews Set up cycles of quality reviews of solutions (up-to-dateness of data) Provide reuse coaching
Engagement of the user and contributor community and user satisfaction	Currently on Joinup, user feedback (mostly bug reporting and complaints) is captured and feeds into the feature roadmap. User input will soon be tracked by a voting system for feature prioritisation. The governance of the roadmap will be owned by the Member States/ User Group in the near future. User features are often de prioritised to focus development efforts on infrastructure priorities or software upgrades.		Create a community on OSS catalogue owners, ensure animation with events and key milestones (e.g. update of catalogues to latest version of the standards). Develop the catalogue using an agile approach and prioritise user value in development efforts. Consider separating user value related resources and work teams from maintenance related resources and work teams.

Source: author's own elaboration (2022)

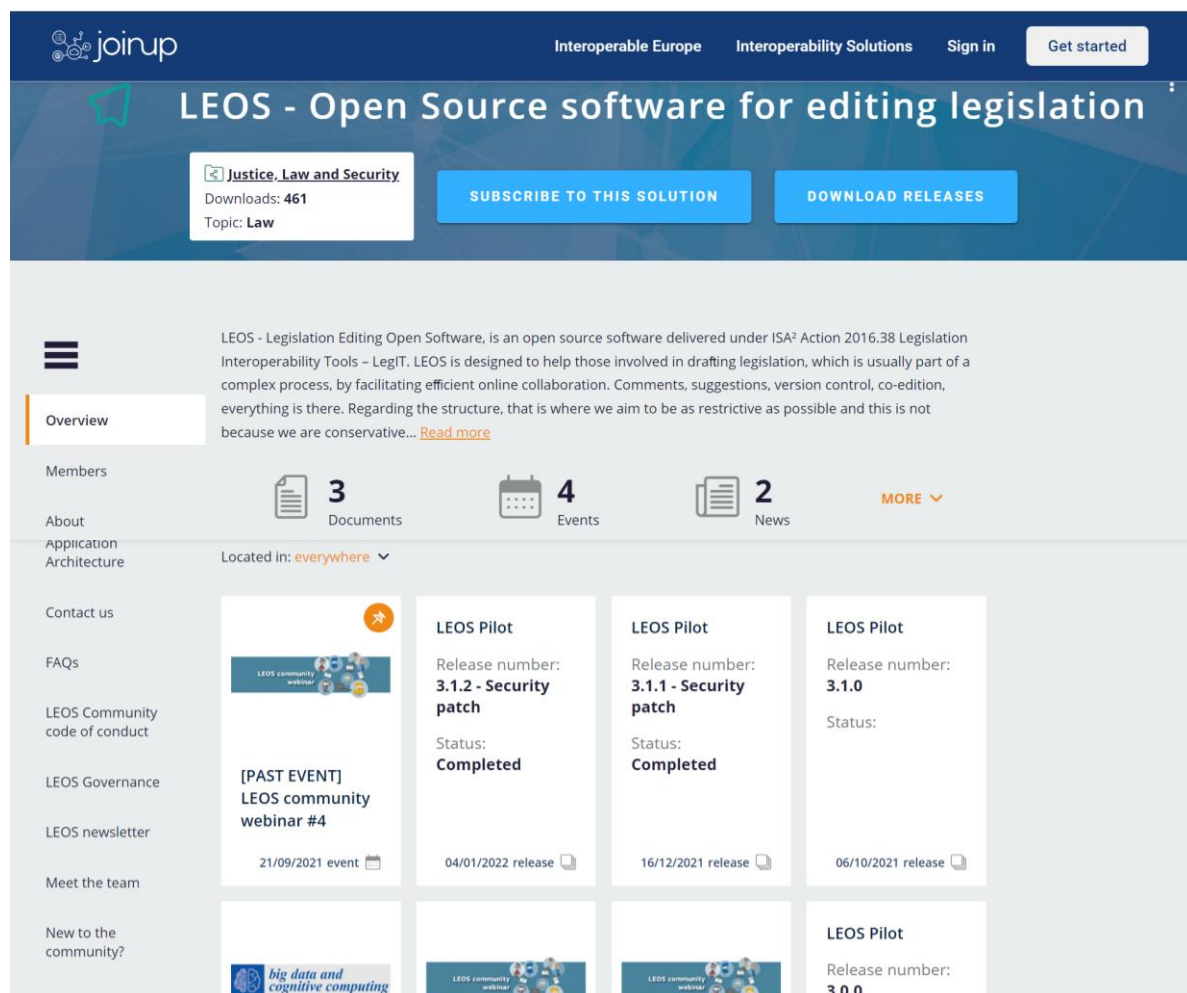
4.2 Usability of the catalogue

The target benchmark emphasizes the importance of usability, clear information about appropriateness and recognisability for various target audiences – see section 3.4. It provides an analysis of a best practice (see Table 29) for a software solution webpage.

In order to compare, Figure 31 provides a view of a software solution webpage on Joinup, and explains if appropriateness and recognisability are met by analysing the information of the page from the point of view of the different target audiences.

⁶¹ At least not in a systematic manner: there may be some activities of community animation for the LEOS project which fosters contributions.

Figure 31. Solution page on Joinup



Source: Joinup (2022)

The following points analyse if and how the various audiences can relate with the solution page in the figure above:

- There are some tags relating to “business areas” (Justice, Law and Security) and a nice description of what the solution does.
- The information for developers and IT decision makers is not easily visible: there is no quick access to source code and documentation, no quick access to information on development status. Instead, here is an overload of information on the different releases, in different areas of the screen. To access the code, the user needs to click on the top right blue button “download releases”, which is not intuitive, as the other release buttons are more visible in the middle of the page.
- There is no straightforward way for a re-user of the solution to declare that “my public administration uses it”. There is no information about the number of public administrations using it.
- There is information on the intended audience, but it has to be deduced from the information in the description text, it does not stand out on the page.
- The solution page provides most of the present solution metadata, but this is only available if the user discovers it behind the “Read more” link, which is neither straightforward nor intuitive.

- There is some information on the software for technical audiences with a partial view of the latest releases.
- The solution page provides a lot of information but does not prioritise which information is most important for each target audience, and does not place it on the page in a way that these different target audiences can recognise it easily.

In addition to recognisability and appropriateness, other elements contribute to usability, such as *ease of use* and *ease of learning*. *Ease of use* covers aspects such as the design of the user interface, the design and intuitiveness of the process flows, and the overall flexibility of the solution to accommodate role-specific nuances. This is not present in Joinup. *Ease of learning* measures the time and effort required to "get up to speed" using the software. Using Joinup requires some familiarity with its underlying data model to use it effectively. For example, the notion of "collection" is confusing.

The risk of using Joinup for an EU OS Catalogue is that Joinup is not intended to be used only as a software catalogue; it caters for a very wide range of solutions and audiences.

The history of Joinup's infrastructure and maintenance upgrades has left a trace in user's experience of changes in interfaces, disappearance of "old" or "archived" content, poor discoverability and a long series of bugs. This point relates more to reputation management, but Gartner recommends – if Joinup is used – to work on a rebranding when launching the EU OS Catalogue. Rather than mentioning Joinup, the European Commission can set up "new" catalogues accessible through a new url "www.SolutionHub.eu" and "www.OpenSourceExchange.eu" which both redirect automatically to "collections" or "solutions" on Joinup with a strong visual branding on "Solution Hub" and "Open Source Exchange".

Table 36 summarises the assessment of usability and provides recommendations.

Table 36. Gap analysis - usability

Best practice	Gap	Recommendations
Usability		Provide content visibly for the different target audiences
Appropriateness		Enhance ease of use and ease of learning
Recognisability		"Rebrand" Joinup: when launching the catalogue, communicate on www.SolutionHub.eu and www.OpenSourceExchange.eu

Source: author's own elaboration (2022)

4.3 Discoverability of the solutions in the catalogue

This section analyses the gap between Joinup and the best practices on discoverability as described in section 3.4.2.

In general, Joinup already makes use of some of the best practices but they are only present in the main view for e.g. *Topics* and *Content Types* (see Figure 32). However they are not present in the catalogue view and not applied to any of the metadata that are relevant for OS Solutions (Figure 33). Since the below gap assessment only applies to the main view, it does not reflect the assessment for the whole of Joinup.

4.3.1 Search

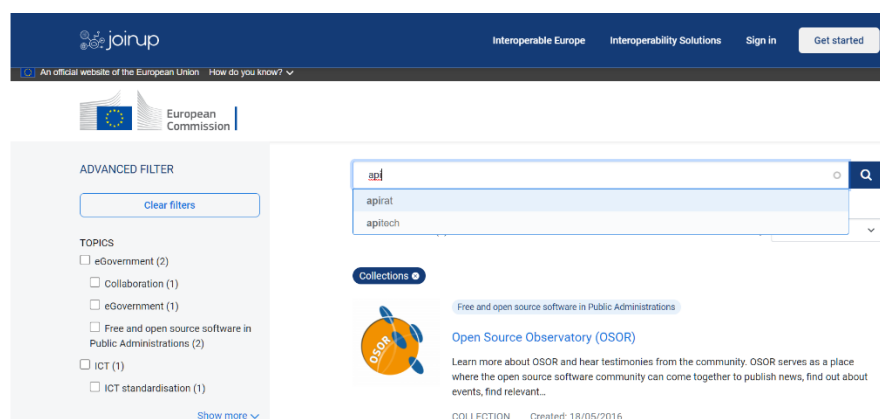
Joinup already adheres to a number of the best practices below when executing a search on its main page. However, once a catalogue federated in Joinup such as CTT has been opened, the search functionality and categories disappear. In the table below, the search best practices are assessed against the functionality that is found in the main screen.

Table 37. Gap analysis – discoverability through search

Best practice	Gap	Recommendations
Auto-complete and auto-results		<ul style="list-style-type: none"> - Maintain the existing search functionalities when showing a specific catalogue or list of solutions, instead of replacing it with a static view which can only be further filtered by content type. - Add search best practices as described in a gradual way.
Search on category values and within filtered results (and vice versa)		
One specific category is the name of the catalogue		
Valuable search results, which show search results that are enriched with a description and some key categories.		
Avoid duplicates in search results		
Multilanguage search ⁶²		

Source: author’s own elaboration (2022)

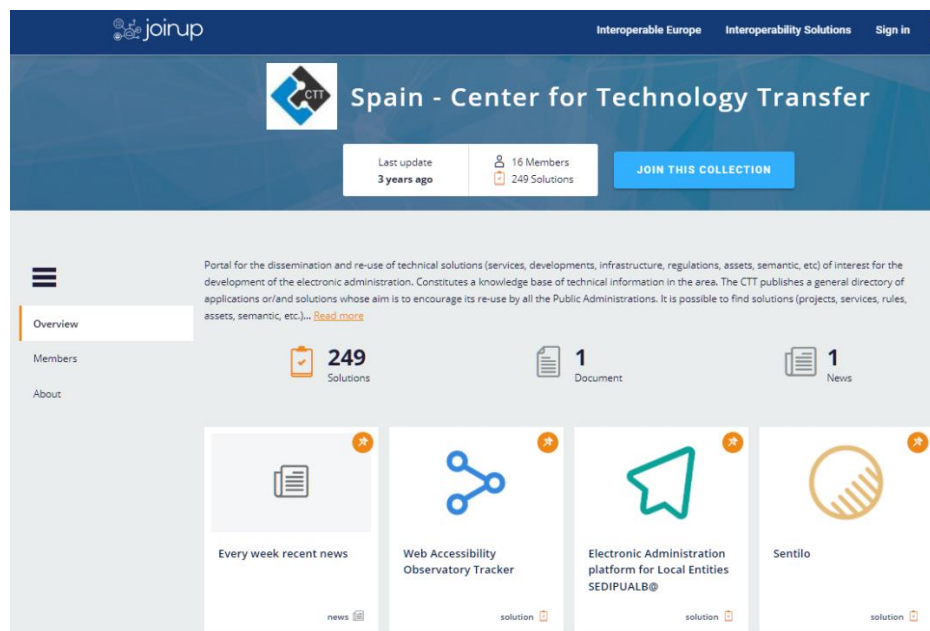
Figure 32. Some search best practices observed in Joinup’s main search screen, such as auto-complete and valuable search results



Source: Joinup (2022)

⁶² No multi-language is currently provided in search, however there is a machine translate option of a solution’s overview page.

Figure 33. Lacking search functionalities when opening a federated catalogue



Source: Joinup (2022)

4.3.2 Categories

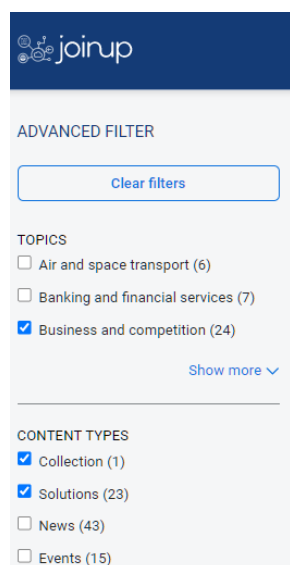
Joinup follows some of the best practices on categories on its main view. Although available, these best practices are neither applied to the catalogue view, nor to solution characteristics. As above, the category best practices are assessed against the functionality that is found in the main screen (see Figure 34).

Table 38. Gap analysis – discoverability through solution-specific categories

Best practice	Gap	Recommendations
Hovering category value / tag descriptions		<ul style="list-style-type: none"> - Provide specific solution-oriented categories which remain visible after a specific catalogue or category is shown. These should be prioritised to make sure the most important categories are the easiest to access. - Add categories best practices as described in a gradual way.
List of prioritised categories		
Number of solutions per category		
Multi-tag selection		

Source: author's own elaboration (2022)

Figure 34. Some category best practices observed in Joinup’s main search screen, such as number of solutions per category / value and multi-tag selection (with the *content types* section)



Source: Joinup (2022)

4.3.3 Usage of a metadata standard

This best practice is followed. Joinup uses ADMS to describe the solutions in the catalogue. This metadata standard can be adapted to the MIDM.

Table 39. Gap analysis – discoverability through usage of the metadata standard

Best practice	Gap	Recommendations
The metadata standard should include the attributes described in the MIDM as well as the other types of information on the OS Solutions as described in section 3.4.3 .		<ul style="list-style-type: none"> - Adapt ADMS to cater for the suggested information as suggested in the best practice. - Consider using publiccode.yml as preferred standard and adapt Joinup's data architecture accordingly.

Source: author’s own elaboration (2022)

4.4 Completeness of information on the solutions

Joinup currently shows most of the metadata it collects on a Solution. To meet the target benchmark of the EU OSS Catalogue, it needs to show the complete list of information on the OS Solutions as described in section 3.4.3.

Table 40. Gap analysis – completeness of information on the solutions

Best practice	Gap	Recommendations
Show the complete list of available information on the OS Solutions		<ul style="list-style-type: none"> - Modify solutions page to include all available information (and deprioritise the focus on releases).

Source: author’s own elaboration (2022)

Figure 35. Solution description page in Joinup showing most of the metadata that's mandatory in ADMS.

About CEF Context Broker Translate

CEF Context Broker is an API that can integrate data from multiple systems, creating a holistic view of information.

By providing the layer that describes each type of data, the Context Broker makes it possible to create an interface that makes it easy for anyone to view and interpret big data. Using the Context Broker, organisations can monitor their metrics in real time through live updates. You can share the context information you choose with third parties, enabling process improvements and innovation across the whole data value chain.

Through the Connecting Europe Facility (CEF), the European Commission offers a range of services to support public and private sector entities that want to implement Context Broker, at no cost;

Owner/Contact Information

Owner

Name
European Commission - DG CONNECT

Type
Supra-national authority

Contact information

Name
Thomas FILLIS

E-mail address
Thomas.FILLIS@ext.ec.europa.eu

Website URL
<https://ec.europa.eu/cefdigital/wiki/x/wXvB>

Categorisation

Solution type
Key Interoperability Enabler

Source: Joinup (2022)

4.5 Data model support

Supporting all components of the metadata model (MIDM + other recommended categories) as described in section 3.4.3 impacts Joinup's data architecture and governance in several ways:

- The solution's current data model (ADMS-AP⁶³) needs to be extended in order to cater for the additional categories. As the data model is based on ADMS, it requires an update of the ADMS standard itself.
- Joinup needs to be able to ingest a OS Software metadata described in PublicCode.yml and store it into its own knowledge graph.

⁶³ More info on <https://Joinup.ec.europa.eu/collection/Joinup/technical-documentation>

- The key challenge is to ensure a balanced control over the value lists: the data model assessment reveals that categories can be either dynamic or stable. Some categories, such as the *Level of Government* are expected to be very stable. The same applies to categories such as *Functions of Government* or *Public Administration Country*, which are linked to well-established international standards. Other categories such as *Programming Language* or *Operating System* however require a vocabulary provides a higher degree of flexibility. Tagging systems, just like the vocabularies, can be controlled. This avoids having for example a value “api_management” and another value “API Management”. This recommended tagging system needs to provide more an even higher degree of flexibility, allowing a new tag to be added on shorter notice. Currently, ADMS has strongly controlled vocabularies which in some cases are useful but also lack the flexibility to be adapted on a relatively short notice when the need arises. The same applies to the proposed tagging system. Consequently, Joinup lacks the required flexibility and agility to fully cater for these more dynamic categories.
This gap is also at the level of the management of these aspects of the data model. For each category the “master” location of the vocabulary needs to be defined (inside Joinup, or in Publiccode). This allows the future EU OSS catalogue to stay up to date on the vocabularies and clarifies ownership regarding management of each vocabulary. A good practice of ensuring coherence for the most dynamic vocabularies is to make them part of the metadata standard. *Programming Language* is part of PublicCode.yml. This allows a fast update process that is controlled.
- The OSS Unique Identifier (OSSUID) should be part of the data model that Joinup uses.

According to the Joinup technical experts, it is technically feasible to adapt Joinup and close the gaps identified above. The technical experts emphasize the need to adhere to the foundational principle of Joinup: maintaining an architecture which is open (open source and open standards), expandable and compliant with EC corporate guidelines and best practices (e.g. the recommended use of linking to CELLAR⁶⁴ for EC controlled reference data). The technical experts highlighted that based on their experience, the complexity of federating catalogues into Joinup has mostly been on the organisational and governance side, relating also to semantic alignment.

Gartner concludes that technically it is feasible to close gaps relating to data model support by Joinup. The work however is not straightforward: it requires extensive adaptations to ADMS-AP and changes the way of managing the sets of values. This respectively requires a significant upgrade of ADMS and more diversity in the way the vocabularies are controlled.

Using Joinup – which follows EC corporate best practices - for an EU OSS Catalogue will ensure that this catalogue is aligned with these corporate best practices. This should not be done at the detriment of the data model’s usability or flexibility or lead to high costs with low value. Therefore it is recommended to balance EC corporate conformity with data model flexibility. When the categories use a stable vocabulary, it can be embedded in CELLAR, making it conform to EC Corporate approaches. When the categories need a more a flexible vocabulary, its management should be done where it makes most sense, for example by Publiccode.yml.

⁶⁴ CELLAR is the semantic repository of the European Commission's Publications Office. More info can be found at <https://op.europa.eu/en/publication-detail/-/publication/50ecce27-857e-11e8-ac6a-01aa75ed71a1/language-en/format-PDF/source-73059305> or <https://Joinup.ec.europa.eu/collection/content-and-knowledge-management/solution/cellar>.

Table 41. Gap analysis – data model support

Best practice	Gap	Recommendations
Technically it is feasible to close gaps relating to data model support by Joinup. The work however is not straightforward.		The work requires extensive adaptations to ADMS-AP and changes the way of managing the sets of values. This respectively requires a significant upgrade of ADMS and more diversity in the way the vocabularies are controlled.

Source: author’s own elaboration (2022)

Gartner recommends the following actions in order to optimise the **data model support**:

- Reassess whether all solution characteristics currently mandatory in ADMS are essential for the intended purpose of cataloguing open source solutions and not lead to federation difficulties or complex semantic alignment. An example of this is the mandatory alignment with the European Interoperability Reference Architecture (EIRA)⁶⁵. This could also help mitigating long and hard federation processes such as the integration of CTT into Joinup.
- Consider evolving towards one metadata standard. Adhering to two standards makes federation and maintenance of the EU OSS Catalogue unnecessarily complex.
- Focus on compliance with publiccode.yml. This standard is much more fit for the intended purpose of describing and federating open source solutions and comes with hands-on and flexible vocabularies.
- Build a standard process or ‘cookbook’ with best practices and a structured roadmap for federating local catalogues into the European OSS Catalogue. This would mitigate long and difficult integration experiences that lead to friction and potentially discourage other local catalogues to initiate the federation process.
- Leverage standardised features that exist within GIT (such as the API) to facilitate the federation process.

4.6 Conclusion on the gap analysis

The analysis shows that there is a significant gap to fill if Joinup were to be used for the EU OSS Catalogue.

The risk of using Joinup for an EU OS Catalogue is that Joinup is not intended to be used only as a software catalogue; it caters for a very wide range of solutions and audiences. However, in the future, the SolutionHub could be hosting other solutions than software, such as APIs and services. It would need to progress on usability to be efficient.

Gartner recommends considering other options than Joinup when building the catalogue solution reusing existing tools. A first one is the Software Heritage. Software Heritage provides an existing catalogue of all solutions, which could be used as the “Open Source Exchange” once the MIDM compliant metadata standard is rolled out. The search tool however would need to be further developed. A second option is to reuse catalogue

⁶⁵ <https://joinup.ec.europa.eu/collection/european-interoperability-reference-architecture-eira/solution/eira>

solutions or some of their main components from Member States (IT, FR or even DE) that are available as open source, once the adaptation to the updated standards is done. This requires a more in-depth analysis of these options and an analysis of their feasibility.

Annexes

Annexe 1: Data collection grid

A Features

Open questions		Answers
A1	For what target audience(s) is the catalogue intended and what was the rationale behind this?	Is it open to everyone or not? Only public sector employees? Business users / developers?
	What types of OS software is hosted on the catalogue and why was this focus area defined?	Is it only for OS tooling? Does it focus on software components (that can be integrated by the users) or end-to-end applications? Only developed by the Public Sector?
A2	On what technological foundation the solution based? What were the deciding factors in making these choices?	Existing open source? Custom-built? Proprietary? What is used for content search (SOLR, ElasticSearch...)? Cataloguing? Also released as open source?
	What open standards are used by the catalogue?	For interoperability/integration with other OS repositories (e.g. Github), exchange of information (e.g. REST APIs) etc.
A3	How does the tool support for end-users?	Search functionalities? Links to other repositories? Text search? Possibilities to ask questions to other end-users / contributors through a form? Similar tools?
	How does the tool support for administrators / contributors?	Submit and update tools? Link data to other catalogues and repositories? Provide visibility into what other public organisations are already using / contributing to?

A Features

Questions on specific features			
	Question	Tick	(Optional) Which ones? What for?
A4	Is the application based on existing (open source) catalogue technology?	Y/N	e.g. Drupal for content management, ElasticSearch for content search...
A5	Are multilingual features supported?	Y/N	Catalogue interface? Search (e.g. Translated categories, tags, ?
A6	Can users directly develop code in the solution repository of the catalogue?	Y/N	
A7	When users download a solution, do they need to authenticate? Ask to join?	Y/N	
A8	Are the number of downloads, visits etc. tracked?	Y/N	
A9	Is the catalogue only pointing to solutions or hosting the solutions themselves?	P/H	
A10	Is the solution looking specifically for open-source solutions?	Y/N	If not, what others? Could be also open standards, or closed source solutions developed by the public sector of which use and development costs can be shared for a common or similar goal.
A11	Is the content of the catalogue made available as open data for federated use?	Y/N	
A12	Is the data catalogue leveraging existing catalogue repositories?	Y/N	These could be code-hosting repositories or other open-source solutions from elsewhere?

A Features

Questions on specific features			
	Question	Tick	(Optional) Which ones? What for?
A13	What type of software is supported and how is the classification done?	Y/N	Difference between open source code (made by public sector) and open source solutions (made by other, used by public sector)
A14	What is the status of the software? Is this available in the catalogue?	Y/N	
A15	To what extent is documentation on OS solutions available through the catalogue?	M/F	Is it mandatory to include documentation before a solution is included/accepted in the catalogue?
A16	Is the licence of the OS solution visible in the catalogue?	Y/N	Is it mandatory to be included? Can the catalogue filter on the licence?
A17	Is interoperability / compatibility of the OS solution visible in the catalogue?	Y/N	Is it mandatory to include the supported standards? Are there any platform dependencies (e.g. only runs on Linux) ? Can the catalogue filter on these characteristics?
A18	Is the maturity of the solution visible in the catalogue?	Y/N	Is there a notion of the market readiness level visible in the catalogue? (e.g. Related to OW2 classification levels - https://www.ow2.org/view/MRL/#)
A19	Is the up-to-date-ness of the information about the solution visible in the catalogue?	Y/N	
A20	Is the source / owner (or both) of the solution visible in the catalogue?	Y/N	
A21	Does the catalogue provide information on the availability of support?	Y/N	e.g. support from service providers, the developer's community...
A22	Is user feedback on a solution available / visible in the catalogue?	Y/N	Could be through a rating system, textual reviews... The information could be either directly provided in the catalogue or ingested from the federated catalogues.

B Governance

Open questions		Answers
B1	What are the political context and main drivers behind the construction of the catalogue?	Is it open to everyone or not? Only public sector employees? Business users / developers?
	How is sponsorship and funding of the catalogue's management and maintenance set up?	What is the cost model for the catalogue? Is it to be self-sustainable? Who is responsible for maintenance?
B2	How active is the community (users and contributors) and what initiatives / actions to you conduct to keep the community engaged?	How do you estimate the size and activeness of the community? Is there uptake? What are some of the best practices in keeping the community engaged?
	How do you maintain chain of trust within the community and in the quality of the OS descriptions?	
B3	How is the success of the catalogue measured?	Number of solutions managed? Number of searched? ...
	What user satisfaction feedback is collected, and what are the outcomes?	At what moment is this done? How much feedback is collected? How useful is it?
B4	What governance model is applied and why?	Centralised? Federated? Why was this model chosen and how efficient is this?
B5	How is the contribution of solutions managed?	What are the responsibilities (e.g. keep data on the solution up to date, acceptance of a solution)? Who maintains the catalogue?

C Categories / Data Model

Open questions		Answers
C1	What are the key categories you are assigning to OS applications? Do you differentiate for different OS types?	e.g. geography, development status, categorisation of applications, used by, used for, similarity to other categories...
	What taxonomies and ontologies are you supporting?	Do you base these on open standards, e.g. ISO? Have they been self-made? In that case, how and how often are you reviewing / updating them? Do you use input from the community?
	What types of tagging systems do you use?	What types of tagging is allowed? Do you work with a fixed list? Can users/contributors make their own tags?
	How does the catalogue inform about interoperability of the solutions?	Does the metadata include the type of standards supported?
C2	How is the quality and validity of the information in the data model maintained?	Do you conduct regular reviews? Are there specific roles assigned? Do you engage the community for this?
	How did data models of the catalogues evolve and why were these changes applied?	What best practices / lessons learned can you share?
C3	What would it take for your catalogue to be part of an EU catalogue?	
C4	Does the catalogue use a standard metadata model?	
	Does the metadata model cater for different audiences?	This means focussing on characteristics that are important to business users as well as technical users

Annexe 2: Mapping of existing standards to the MIDM

The Minimal Interoperability Data Model contains mandatory attributes, to which the existing standards used in catalogues – ADMS and publiccode.yml - can be readied. The table below details the mapping of the three models.

We found that both ADMS and publiccode.yml standards are well-aligned with the MIDM. ADMS already has 8 attributes defined as mandatory, missing only 6. publiccode.yml has 9 attributes defined as mandatory and 2 as optional, missing only 3. For both, a minor redefinition (or mapping) of certain vocabularies is required. Consequently, Gartner considers adapting ADMS and publiccode.yml to be MIDM compliant as feasible. Updating the OS Solutions currently described by publiccode.yml and ADMS should also be straightforward.

Table 42. Mapping of the standards

Category	MIDM Attribute	Description	Mandatory motivation	ADMS	Publiccode
Entry-specific Information	Version of the MIDM Standard	Version of the standard in which this solution description was formulated.	As everything, also the MIDM or used standard can change. This aligns with the version of the standard specified here	Not identified	Mandatory attribute
	Contributor Name	Name of the person responsible for maintaining the MIDM model	In case of errors to the MIDM metadata, there is information on who to contact.	Mandatory attribute	Mandatory attribute
	Contributor Email	Email of the person responsible for maintaining the MIDM model	In case of errors to the MIDM metadata, there is information on who to contact.	Mandatory attribute	Optional attribute
General information	OSSUID Unique Identifier General	Solution should have a unique identifier which is neutral and specifies the OSS independently of any specific catalogue.	For full federation (one tool appear only once, even if available in different MS catalogues) a unique identifier is indispensable.	Not identified	Not identified
	Name	Solution should have an official name.		Mandatory attribute	Mandatory attribute
	Description	General description of what the software is and what it does	As the name itself isn't explanatory, at least a bit of description is necessary.	Mandatory attribute	Mandatory attribute
	Typology	Identifies to which typology the OSS belongs. Within	There must be at least one public administration which	Not identified	Not identified

Category	MIDM Attribute	Description	Mandatory motivation	ADMS	Publiccode
		Open-source it's either a Component or a Product.	uses the OSS. Otherwise, the solution isn't relevant to have in the catalogue.		
	Development Status	Basic identification of where the OSS is in terms of usefulness: Concept, Beta, Stable, Obsolete.	Needed for users to make an initial decision on whether the project is useful for them to look into. If they are ready to co-develop something, a Concept made by someone else can be interesting; if they are just looking for something to leverage directly, a solution needs to be stable. This information should be supplemented by the release date of the most recent version (attribute #25)	Not identified	Mandatory attribute
	Release date of most recent version	Date on which the most recent version was released.	This gives an indication on the up-to-dateness of the solution, which a catalogue user needs to know in order to decide on usefulness.	Not identified	Mandatory attribute
	Distribution License	License for using and distributing the software	Essential to know under what conditions the application can be used and built upon	Mandatory attribute	Mandatory attribute
	ContactPoint Name	Email of a person who can be contacted about the OSS	Some contact point is necessary to get more information about the OSS.	Mandatory attribute	Optional attribute
	ContactPoint Email	Name of a person who can be contacted about the OSS	Some contact point is necessary to get more information about the OSS.	Mandatory attribute	Mandatory attribute
Developer-oriented	Code Repository	URI to the source code repository in which the software is published. (GitX, svn...)	Developers need to be able to investigate the OSS from a technical PoV	Mandatory attribute	Mandatory attribute

Category	MIDM Attribute	Description	Mandatory motivation	ADMS	Publiccode
Public administration oriented	Public Administration Name using the OSS	One or more public administrations using the OSS	There must be at least one public administration which uses the OSS, otherwise, the solution isn't relevant to have in the catalogue.	Not identified	Not identified

Source: Gartner - author's own elaboration (January 2022)

Annexe 3 Analysis of typologies in existing catalogues

Figure 36. Analysis of typologies in existing catalogues

Category		Typology		
Catalogue	Catalogue	publiccode.yml	ict-reuse.be	CTT
	Catalogue Category Name	Software type	Typology	Mode of Use
	Values	Controlled voc: "standalone/mobile", "standalone/iot", "standalone/desktop", "standalone/web", "standalone/backend", "standalone/other", "addon", "library", "configurationFiles"	Framework Library Product Service System	Installable product Infrastructure network service Integrated network service in customer applications End-user network service
Catalogue	Catalogue	Bulgaria EGOV	sil.etalab.gouv.fr	Developer.Italia
	Catalogue Category Name	Type	Type	Type
	Values	Information System Interface Webservice Library	Workplace automation (bureautique) Development Production	Open Source Software Reuse Software (made by public institution)

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