Open data and e-government good practices for fostering environmental information sharing and dissemination

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Table of content

Table of figures

Table of tables

Glossary

Abbreviation	Description
EaP countries	Eastern Partnership countries – Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova, Ukraine.
EEA	European Environment Agency
ICT	Information and Communication Technologies
ODGB	Open Data Governance Board
PBWG	Public Bodies Working Group

European Environment Agency

1   Introduction

This report aims to provide Eastern Partnership Countries with good practices for fostering sharing and dissemination of environmental information. As such, it complements the country maturity report executed in the EEA service contract No. 3437/R0-ENIE/EEA.57335 "Conclusion of a road map to modernise sharing and dissemination of environmental information in the Eastern Partnership countries". This good practice report comes in line with the objectives of the European Union EIS-data[1] initiative, which promotes good practices for national environmental information systems and tools for data harvesting at EU level, and also with the yearly work done in the Open Data Maturity Report in Europe[2].The assessment of EaP countries in terms of environmental information sharing and dissemination revealed that few collaboration between e-government and Open Data takes place. Indeed, where e-government provides solutions such as e-signature, electronic document management, interoperability standards and platforms, environmental institutions tend to be separated and often undertake their own initiatives in silo. The multiplication of systems, standards, tools and procedures – sometimes repeating – adds burden and complexity on already overwhelmed institutions. In addition, Open Data portals are usually not used and/or developed at their full potential regarding environmental information. In particular, environment information platforms – namely "eco-portals" – are usually separated from e-government and Open Data solutions. Sharing of environmental data and ensuring their quality is also often problematic where no common standard interface exists between systems.

Leveraging on Open Data and e-government initiatives offers multiple benefits for environmental institutions. Firstly, and most importantly, the coordination between e-government, Open Data, statistical and environmental institutions provides a higher visibility of environmental initiatives in the country. Secondly, the re-use of solutions, platforms, tools and standards has the potential to reduce the cost of environmental information sharing and dissemination whilst improving its quality. Third, it enables citizens to find and re-use environmental information more easily, whilst increasing trust between stakeholders.

As such, the present report aims to present a collection of few good practices which can be used in EaP countries in order to fulfil their national and international commitments regarding environmental information sharing.

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[1] Link to initiative : http://www.eis-data.eu/

[2] Report for 2018 :
https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n4_2018.pdf#page=55&zoom=100,0,0%22

2 Good practices for fostering environmental information sharing and dissemination

2.1 *E-government*

This section presents the good practices and recommendations of e-government as derived from the country analysis.

2.1.1 Content

Building a digital strategy which includes the environment

In general, EaP countries have developed digital agenda (or strategy) that describes the vision for the country in terms of technology usage (e.g. cloud infrastructure, e-signature, e-services, etc.). The digital strategy should be developed in coordination with high-level government officials and engage all stakeholders (main institutions and key businesses). In particular, the strategy should be drafted in coordination with the public leaders of the environment, health, transport and energy. A strategy should state the following points in around a hundred pages:

1. **As-is**: provide a short summary of the main initiatives undertaken since the last strategy, the elements remaining and main results.

2. **Vision**: the vision should briefly describe the future organisation of work of public institutions and interactions with businesses and citizens (e.g. "organisations will leverage on robotic and artificial intelligence technologies to communicate with citizens on simple requests", "businesses will have the possibility to consult an integrated database with all relevant registers"). The vision in general addresses a period of up to 10 years, and briefly describes the main elements of the strategy.

3. **Strategic priorities**: state the priorities to achieve the vision and describe why these initiatives are important for the country.

4. **Strategy implementation guidelines**: this section should provide insights over the high-level implementation mechanisms. It is also advised to put emphasis on mechanisms to leverage on international and national collaboration as well as private-public partnerships.

5. **Control mechanisms**: state how these objectives will be measured in terms of indicators and organisational processes. Describe the concrete actions that will be undertaken, and who will implement them in order to measure the achievement of the objectives (e.g. central coordination body will analyse the results of the strategy in a report annually).

> **Digital agenda for Lithuania[1]**
> As from 2014, the Information Society Development Programme 2014 – 2020 Digital Agenda for Lithuania defines the priorities, objectives and tasks of information society development in order to maximise the advantages provided by information and communication technologies as a very important instrument for economic, cultural and social activities. This allows to provide or receive progressive e-services, work, and access entertainment, communicate and freely express opinions. Lithuania focuses its strategy on:
> - Enhancement of the Lithuanian residents' ability to use the ICTs;
> - Development of the electronic content and services and promotion of use;
> - Promotion of Lithuanian culture and Lithuanian language by ICT measures;
> - Encourage businesses to use ICT;
> - Development of the ICT infrastructure, ensuring the development of safe, reliable and interactive ICT infrastructure.

6. **Budget and funding available**: state the resources assigned for the realisation of these objectives.

To foster international collaboration, the strategy should be made available online in at least two languages: English and the national language.

Building e-services and public information systems according to national and international standards

E-services allow citizen to access public services through modern devices (e.g. mobile phone). As such, they should be easily and simply accessible in some standard way for a broad diversity of customers (including non-citizens). The potential cost savings of implemented e-services can be large. For example, in Denmark, electronic invoicing saves taxpayers €150 million and businesses €50 million a year[3].

Project X-Road, Estonia

X-Road is a tool that allows the databases to interact and make integrated e-services possible[1]. The data exchange layer X-Road was launched in 2001 and has since become the standard platform for streamlining services between government agencies in Estonia. X-Road is a decentralised system in which unified interfaces and interaction and data exchange protocols are defined. Commercial IT systems can also interact with X-Road and use data platforms. Operating principles of X-Road include:

- *Independence of platform and architecture* - X-road enables the information systems of X-road members on any software platform to communicate with the information systems of data service providers on any software platform.
- *Multilaterism* - X-road members are able to request access to any data services provided through X-road.
- *Availability and standardisation* – for managing and developing X-Road, international standards and protocols are used where possible.
- *Security* – exchanging data through X-tee does not affect the integrity, availability or confidentiality of the data.

The X-Road platform is also being implemented in Ukraine and Azerbaijan.

E-services should be built according to standards defined in an interoperability framework. In particular, building blocks, such as e-signature, should be developed as re-usable components. The European Commission, for example, launched the Connecting Europe Facility (CEF) programme. The CEF funds a set of generic and reusable Digital Service Infrastructures (DSI), also known as building blocks. The CEF building blocks offer basic capabilities that can be reused in any European project to facilitate the delivery of digital public services across borders and sectors. Currently, there are seven building blocks: Context Broker, eArchiving, eDelivery, eID, eInvoicing, eSignature and eTranslation. Lately, three additional building blocks have been released in the end of 2018[4]: Big Data Test Infrastructure, eArchiving and Context Broker.

In addition, some countries, such as Estonia, developed a tool that enables writing to multiple information systems, transmitting large data sets and performing searches across several information systems simultaneously[5].

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[3] https://ec.europa.eu/digital-single-market/en/public-services-egovernment
[4] https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/2018/11/08/Meet+the+new+CEF+Building+Blocks
[5] https://e-estonia.com/solutions/interoperability-services/x-road/

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Publishing e-services on a dedicated e-service portal

E-government portals are created as a single contact point to all of the country's public services that are provided digitally. The development level of the e-government portal varies a lot among all EaP countries. For instance, Azerbaijan e-government portal provides sign-in options using e-signature, mobile ID or by a given password, while the e-government portal of Armenia redirects to the website of the relevant institution to proceed with request. Also, not all countries group their services in categories or based on life events[6].

E-government portal in the UK

The UK government provides a portal for accessing government services and Open Data. GOV.UK is the main portal for the UK government. Access to e-government services is done through individual registration to service, or through the usage of gov.uk Verify. Gov.uk Verify enables citizen to verify their identity in order to use online services, through the usage of companies certified to verify their identity. It is safe because it is decentralized, and fast because everything is online.

Figure 2 - Bristish e-government portal

E-government portal in the Lithuania

Lithuania's e-government Gateway portal (www.epaslaugos.lt) is offering a one-stop-shop to public information and services for citizens and businesses. It includes links to public information and public services by providing services in the portal itself and redirecting citizens and businesses to appropriate websites of public authorities. Standardised service design and building blocks are implemented in www.epaslaugos.lt. Other services are electronic tools for personal identification, centralised access to the public services, online payment for the requested services and online tracking of the service provision process.

User's identification in the portal can be enabled via eBanking systems, the national identity card, eSignature certificates or mobile signatures from certain operators.

The portal can be used in Lithuanian and English.
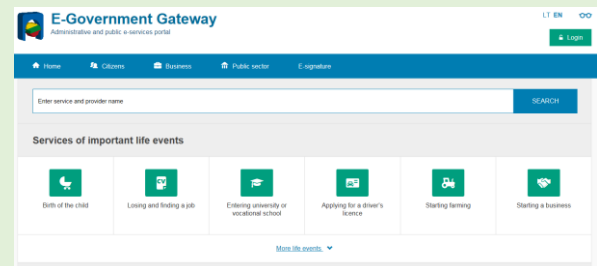
Figure 1 - Lithuanian e-government portal

Ideally, all public services should be described in a standard manner. In this context, the European Union developed the Core Public Service Vocabulary (CPSV), which is a data model for describing public services and the associated life and business events in a structured and machine-readable way by standardising the semantics. The CPSV-AP has been created and is maintained by a Working Group composed of Member State and EU institutions representatives, experts and academia in the field of semantic interoperability and Open Data. The CPSV is used in such countries as Austria, Belgium, Estonia, Finland, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Slovakia, Spain, Sweden, the Netherlands and the UK to describe public services or to create a national data model.

An inventory and horizontal review of central public services in the Republic of Moldova

Currently, the E-government Centre of the Republic of Moldova with the aid of external consultants is making an inventory of all public services provided by the government institutions. Each service will be described according to the European Union Core Public Service Vocabulary (CPSV). Then, services will be categorised based on main type of public services (COFOG taxonomy) and classified to life events to create more convenient access to particular services. Finally, the public services will be prioritised for optimisation, merger or elimination.

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[6] Life events are events which occur during the life of individuals and usually require specific government services. Typically, life events cover events such as « child birth », « marriage », etc.

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2.1.2 Infrastructure

Establishing an interoperability framework

Interoperability is the property that enables the unrestricted sharing of resources between different information systems and organisations. At this moment, each EaP country has room for improvement in this area: the dissemination of resources and information as well as data flows are complicated, not automated and the information is often duplicated and shared with public through different sources (e.g. the same information may be presented by Ministry for Environment and Statistic Bureau). Interoperability ensures data flows among institutions' systems and allows institutions to reach resources in a more effective and efficient manner.

Interoperability of public registers in Lithuania

The population register is a uniform software, which is used at a national level and provides data about the national population. Register has standardised API and web services, which are used by all governmental software to gather citizens' data information.

The e-government gate offers data delivery services for governmental software. Data is gathered from multiple registers (more than 20 national registers) and can be provided in a single package for any registered governmental applications. By using this approach, the Lithuanian government simplified data delivery and integration process among government applications.

Interoperability is achieved at different levels that are:

1) Organisational;

2) Semantic;

3) Technical.

As such, it is necessary to develop interoperability, through the usage of common processes standards, technologies, data exchange standards, etc.

A good way to ensure interoperability between software applications is to implement for example Service Oriented Architectures (i.e. web-services) and to standardise interfaces as much as possible. The usage of standards for common "data" are also useful to reduce the complexity of systems and difficulties in the exchange of information (e.g. description of institutions and people can be done according to a single national or international standard). Likewise, a good way to ensure the interoperability of the infrastructure interoperability and decrease costs is to use Cloud solutions.

Interoperability can also be designed at multiple levels: international, national and sectorial. It is up to each country to choose the right approach, taking into consideration multiple factors, such as geopolitical, workforce and skills available, budget, etc. An example of approach could be:

- International: a country can choose to integrate an international standard, such as CPSV, to describe their public services;
- National: a country can define a national security standard for building interfaces between national systems;
- Sectorial: a country can develop a national standard for the exchange of specific environmental data between institutions, and another one for the exchange of health data.

In the European Union, the European Commission provides guidelines for interoperability, which all member States are free to implement[7]. The new European Interoperability Framework (EIF)[8] was adopted on the 23rd of March, 2017. The framework provides guidance on how to set up interoperable digital public services by offering recommendations on how to improve governance of interoperability activities, establish cross-organisational relationships, streamline processes supporting end-to-end digital services, and ensure that both existing and new legislation do not compromise interoperability efforts. The EIF Conceptual Model is provided in Figure below.

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[7] http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf
[8] https://ec.europa.eu/isa2/sites/isa/files/eif_brochure_final.pdf

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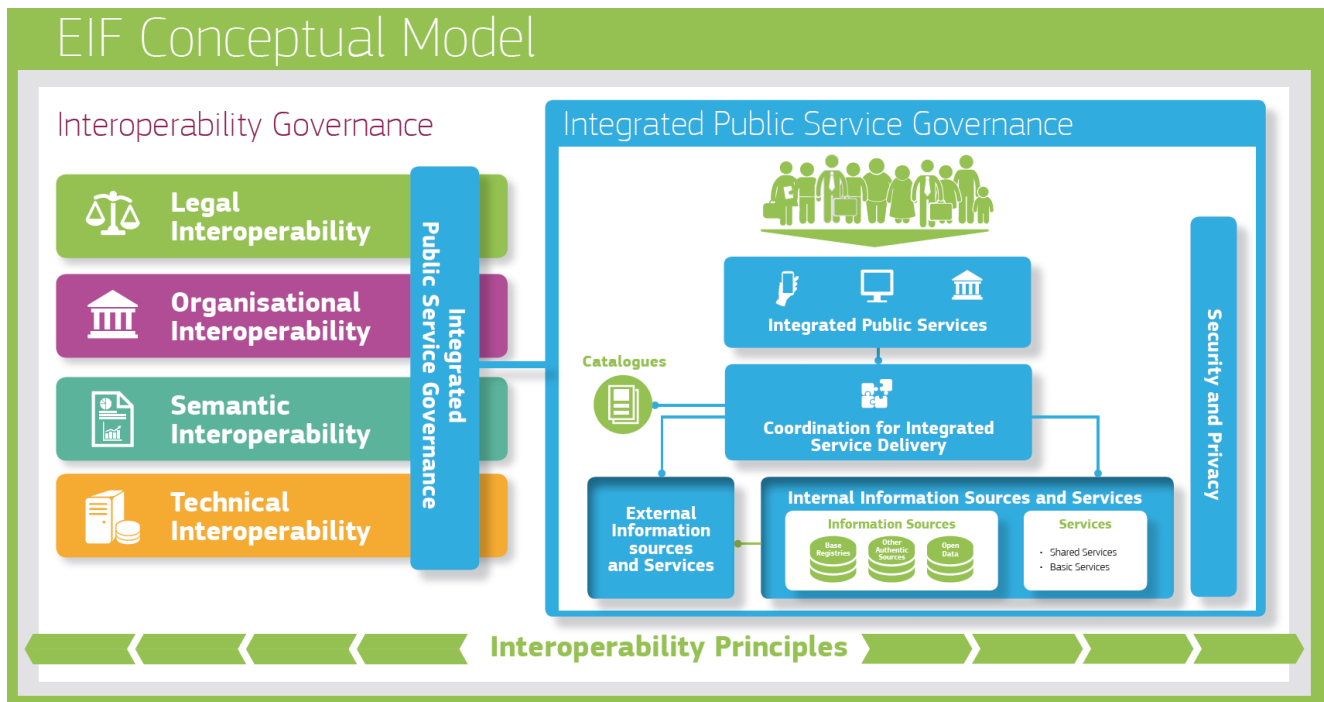
Figure 3 - European Interoperability Framework Conceptual Model [9]

EIF depicts layers of interoperability that are 1) legal, 2) organisational, 3) semantic, and 4) technical:

1. **Legal interoperability** refers that in organisations operating under different legal frameworks, policies and strategies are able to work together. To address it, at first it is necessary to screen existing legislation to identify interoperability barriers, such as restrictions on data publication and dissemination, data protection requirements, etc. It is important to ensure the consistency of Laws.

2. **Organisational interoperability** is concerned with how public administrations cooperate to achieve their agreed goals. In practice, organisational interoperability implies integrating business processes and related data exchange. Organisational interoperability also aims to meet the requirements of the users by making services available, easily identifiable, accessible and user-focused.

   - *Business processes*: align existing business processes or define and establish new business processes. Aligning business processes implies documenting them in an agreed way, so that all public administrations contributing to the delivery public services can understand the overall business process and their role in it. Usually business processes are documented in a central repository that is accessible by all. In practice, business processes should be documented using BPMN, and updated frequently. They should be stored in a repository, ideally as a part of the Enterprise Architecture tool.

   - *Organisational relationships*: the relationship between service providers and service consumers must be clearly structured and documented. Examples of such instruments for this purpose are Memoranda of Understanding (MoUs) on joint actions and cooperation and/or Service Level Agreements (SLAs) signed between participating public administrations.

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[9] https://ec.europa.eu/isa2/sites/isa/files/eif_brochure_final.pdf

- *Change management*: to ensure the involvement of all participants and to manage stakeholders adequately. Change management is the process adopting all of the changes, whether they are technical or process oriented, across the organisations in question.

1. **Semantic interoperability** enables organisations to process information from external sources in a meaningful manner. It ensures that the precise meaning of exchanged information is understood and preserved throughout exchanges between parties. It is recommended to ensure semantic interoperability by using standard vocabulary to exchange information, and ensure syntactic interoperability using common format for exchanging information. In this regard, it is recommended to use where applicable international standards such as RDF, and common vocabularies as described on the European Commission ISA Programme webpage[10].

3. **Technical interoperability** covers the technical aspects of linking information systems. It includes aspects, such as interface specifications, interconnection services, data integration services, data presentation and exchange, etc. Note that standards should be enforced in public organisations and with respect to the suppliers. For this purpose, the UK publishes, for example, a charter for interoperability[11]. All suppliers are required to comply with certain criteria if they want to work for the government, hence, ensuring compatibility of software, processes and data.

> **State Information Resources Interoperability platform (SIRIP) in Lithuania**
> State Information Resources Interoperability Platform (SIRIP)[1] is the main public interoperability platform, created and managed by the Information Society Development Committee of Lithuania. SIRIP consists of two main parts:
>
> - Data exchange platform;
> - Central electronic services portal eGovernment gateway
>
> The communication between SIRIP components is implemented using open standard technologies, such as XML for data structures, WS-S for data security, XML Signature for data integrity. Web-services are used whenever possible, instead of other means of interoperability. This allows each of the SIRIP logical components to be used and scaled independently.

Note that standards should be enforced in public organisations and suppliers should also be taken into consideration. For this aim, the UK publishes, for example, a charter for interoperability[12]. All suppliers are required to comply with certain criteria if they want to work for the government, hence, ensuring compatibility of software, processes and data.

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[10] http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action_en.htm
[11] https://www.techuk.org/insights/news/item/5276-techuk-s-interoperability-charter
[12] https://www.techuk.org/insights/news/item/5276-techuk-s-interoperability-charter

Building a "central" environmental monitoring system

7 November 2018 | The Ukrainian government adopts a concept of the nationwide automated system "Open Environment" developed by the Ministry of Ecology and Natural Resources of Ukraine

Ukrainian Government has adopted the Concept of the nationwide automated system "Open Environment" developed by the Ministry of Ecology and Natural Resources of Ukraine. The system will integrate environmental data of central executive bodies and local governments into one electronic database. The national system "Open environment" will allow Ukraine to open environmental information to the public and integrate with international registers, information resources etc., particularly, in the environment monitoring area, the Pollutant Release and Transfer Registers and the Shared Environmental Information System of the European Environment Agency for research and assessment of environmental indicators.

In general, most EaP countries count numerous systems for monitoring, analysing, storing, sharing and disseminating environmental information. It is clear that each country is different and that a common architecture would not fit all of them at the same time. Nonetheless, it can be noticed that the presence of a central monitoring system, such as in Ukraine and Belarus, increases the efficiency of collecting, sharing and disseminating environmental information.

It is important to note that a central environment monitoring information system can also be built around multiple systems, which are interoperable and based on a national interoperability framework. This is the case, for instance, of Ukraine. In that case, systems have to follow certain rules to be compatible. Each public institution can have its own system, dedicated for its specific areas of competences. The information system can be build and maintained in house or bought. In any case, it is important to note that all systems should follow the same design rules and ensure smooth exchange of data.

Besides, the presence of a central environmental information system simplifies the integration of environmental data on a geoportal, as well as sharing environmental data with the office responsible for statistics.

Provide space and time analysis functionalities for environmental indicators on the statistical portal

Most EaP countries have a statistics portal, which enables consulting the latest statistics and environmental indicators. Nonetheless, in most cases, these portals do not offer advanced data visualisation and comparison features across time and space.

As such, a good practice is to provide citizens with a portal, where they can select the statistics they want to consult, and to generate a graphical representation of it depending on a selection of (filter). In Armenia, the Statistical Committee of the Republic of Armenia, developed a statistical portal (http://www.armstatbank.am/) which has such functionality. The portal is also available in English.

Figure 4 - Armstatbank.am

Each environmental indicator can be selected and refined according to specific criteria (for example, pollutants in the picture above), and the time period. The portal enables visualising the data in a graph or in a table as well as exporting the data in multiple formats (human-readable or machine-readable formats).

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2.1.3 Network

Increasing awareness and motivation among public institutions over e-government and digital solutions

The digitalisation of public institutions is fast and sometimes hard to cope for public servants. As such, any e-government projects should undertake change management activities – which are often underestimated. In order to embed people in the organisation for e-government, it is possible to:

- Official training plan (Mandatory) for people responsible for data publication and recognised certifications for these people to increase the motivation and to be formally recognised as professional development training within the public bodies.

- Organise continuous trainings over new tools and technologies. Give time to public servants to adapt and implement changes gradually.

- Whenever providing a new solution, make sure that the IT equipment and infrastructure is sufficient to provide concrete "work improvement" (too often, technology upgrades do not meet expectations).

- Nominate dedicated "e-government champions" for each project, who are from the business and take in charge awareness campaigns inside institutions.

- Embed public servants in the design of "digital solutions" from the beginning. This can be done through the participation of "e-government project champions" in dedicated "user group" or "working group".

- When choosing between e-government initiatives, focus first on initiatives which target low value and demotivating tasks/processes.

- Integrate new generation employees in older teams: sometimes teams mostly consist of senior people. Adding younger employees to the team can help challenge the way of working and find innovative solutions, which includes everyone.

- Etc.

Besides, the Electronic Government for Development Countries report from the International Telecommunication Union[13] recommends to create a learning organisation. The employees actively create new knowledge derived from their experiences and share it with other employees. To be effective, government leaders should look for ways to give employees the motivation, opportunity and structure to share knowledge and build the requisite ICT capabilities. Managers should also consider developing ICT-tools to build a knowledge management system to serve as a repository to support its e-Government efforts.

In addition, according to the study[14] prepared by Capgemini Consulting and Eurochambres, providing support to users is important. In order to provide effective support services, the helpdesk personnel should be trained to be able to provide user-friendly support, which excludes overly bureaucratic texts, legal jargon, extensive deliberation on the legislation applied, etc. and instead focuses on providing answers to inquiries as practically as possible. The use of social networks, online forum and other internet tools for assisting users can improve the effectiveness of the service as well.

The specific needs of foreign users with regards to assistance services should receive more attention. The first step would be assistance in languages other than the national language.

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[13] https://www.itu.int/ITU-D/cyb/app/docs/e-gov_for_dev_countries-report.pdf

[14] http://www.europarl.europa.eu/meetdocs/2014_2019/documents/imco/dv/psc_study_final_report_/psc_study_final_report_en.pdf

The information should be presented in harmonised, organised and constantly updated in a way to ensure that user receives the best information available.

Increasing awareness about e-government among citizens and businesses

Governments should pro-actively act to increase awareness, promote and popularise e-government services, and the usage of solutions (e.g. e-service portal, e-signature). Activities that can be undertaken:

- Advertising the use of e-services (both online and offline);

- Promotion of the use of e-government technologies (e.g. e-signature), through events, seminars, training, and dissemination of guidelines/documentation;

- Start/improve public-private partnerships for the development of e-government solutions (e.g. collaboration between banks and the government for the development of e-services and e-signature)

- Communicating about the benefits of using online service, i.e., if it is cheaper or quicker to use.

> **ISA² Programme: Interoperability solutions for public administrations, businesses and citizens**
> The ISA² programme provides a set of tools for communicating with citizens. For instance:
> - Share and reuse awards
> - Solutions implemented per country to foster e-government and interoperability
> - Events
> - News and blogs

2.2 *Open data*

This section presents the good practices and recommendations of Open Data as derived from the country analysis.

2.2.1 Content

Develop a national strategy for Open Data and action plan to implement it for specific types of information

National strategy

For Open Data, building a strategy and its related policies is as important as for e-government. The policy and strategy should clearly establish the right of access and reuse of information, as well as the obligation to use open licenses[15]. The strategy should be drafted in collaboration with (international) Open Data experts and high-level public servants in order to ensure stakeholders' engagement. In particular, engaging public institutions is crucial for a successful Open Data strategy.

The strategy should include sections, such as:

- Mission, Vision, Objective, Principles (mention FAIR principles) and Values

- *Guiding principles*, describing the main principles for Open Data management (e.g. open by default) and *Open Data Governance*. In particular, the strategy should provide an organigram or refer to a document published on national portal, in which national responsibilities regarding Open Data are described (e.g. which institution lead, which institutions contribute to the Open Data policy and implementation plan, etc.). Sound definition of responsibilities and the presence of enforcement mechanisms are key to ensure stakeholders' engagement.

> **Ireland's Open data strategy 2017-2022**[1]
>
> In July 2017, Government Reform Unit of the Department of Public Expenditure and Reform released an Open Data Strategy 2017-2022. It states the vision as follows "The vision is for Ireland to be a leader in the use of Open Data and to create an environment where the economic, social and democratic benefits of Open Data are recognised and realised". The Strategy sets out seven strategic themes for the Open Data initiative:
>
> - Broaden the range of public bodies actively engaged in the Open Data Initiative – the 'Open Data Providers';
> - Broaden the scope and improve the quality, quantity and range of Open Data and associated metadata. Improve the quality and range of services provided through the national Open Data portal;
> - Continue to engage with all Stakeholders and encourage use of Open Data;
> - Support and encourage various groups of Open Data Users;
> - Provision of a framework to support and train all Data Providers and building capacity in the management and use of Open Data;
> - Evaluate the impact, benefits and risks of the Open Data Initiative and benchmark against other jurisdictions;
> - Ensure that effective governance structures are in place to implement the Strategy.

- *High Priority or high-value domains* (e.g. Transportation, Economical grow, Environment, Health) for the sustainable development of the country. Each domain should come with a list (or a reference to) of corresponding high-value data sets identified and prioritised for publication.

- *Benefits and use of Open data*, providing the economic benefits of the use of Open Data as well as a list of examples of how Open Data is used and re-used.

- *Overarching objectives* that set the direction on Open data.

- *Intended benefits*, which describe the potential social, economic and political results.

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[15] https://datos.gob.es/sites/default/files/doc/file/international_open_data_best_practices.pdf

- *Implementation plan*, where the actions necessary for each strategic theme, timeframe for their delivery and the units responsible for their implementation are listed.

The strategy should also be accompanied with a technical action plan. Such a plan constitutes the foundation on which Open Data will be built in the country as well as its crucial importance. In particular, the plan should address the following elements:

- Open data license: ensure that licensing terms are both available (legally and technically on portals) and used;

- Standards (e.g. metadata, web services): ensure standardisation has a high priority on the agenda in order to avoid the creation of complex solutions lacking interoperability and, hence, increasing long term costs;

- Formats for data: define clear formats for publishing public sector and environmental information, and provide mechanisms for monitoring;

- Metadata for data: provide mechanisms for defining, maintaining and monitoring metadata of datasets published16;

- Metadata for indicators, including environment indicators: provide mechanisms for defining, maintaining and monitoring metadata of KPIs published. Metadata should also include a possibility to add a brief analysis of environmental indicators.

Besides, as a country becomes more advanced in terms of Open Data publication and management, the technical implementation plan should evolve with it. In particular, the objective should be the publication of all public sector and environmental information as linked Open Data, hence using persistent and scalable URI patterns (on the basis of international experience and good practice in the field).

Adopt an Action Plan / Implementation Plan based on the Open Data strategy and the Digital Strategy

The Open Data strategy establishes the main objectives for Open Data to achieve. The Digital Strategy highlights the main objectives for the development of e-government in the country, including the ICT infrastructure and country-wide technology use. These objectives have to be implemented taking the realities of the country into consideration, in particular the organisational structure (attribution of responsibilities), the budget and resources, and priorities. Typically, the Action Plan contains a series of actions, which are attributed to specific institutions / work groups. They are translated into programmes or projects. Besides, international commitment to achieve the national Action Plan can also be a way to drive the Action Plan at a national level and engage stakeholders. Such commitment can be translated, for example, in the participation into initiatives, such as the "Open Government Partnership"[17].

Open Government Partnership

The Open Government Partnership provides support (e.g. webinars) for drafting a national Action Plan.

Actions plans are published as a series of "Commitments", and are monitored. A periodic review is made on the Action Plan, with at least 2 reports: a mid-term and end review.

Link:
https://www.opengovpartnership.org/about/news-and-events/developing-stronger-ogp-action-plans

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[16] The implementation of DCAT-AP according to European standards enable integration with the European Open Data Portal, which already has all the functionalities for monitoring metadata.

[17] https://www.opengovpartnership.org/

The execution of the Action Plan should also be frequently monitored. To this extent, a national working group and/or institution can take up the role of monitoring the execution of different actions against their objectives and budget. It is recommended to monitor the execution of projects on a monthly basis and to evaluate programmes bi-annually. The Action Plan itself can be evaluated annually by consolidating the monthly and bi-annual results.

Adopt an Open Data policy, and extend it to environmental data

Open Data

To facilitate the development of Open Data in the country, it is recommended to establish an Open Data policy. In practice, it is possible to build an Open Data policy on the basis of the European Open Data Portal recommendations[18], or to adopt the Open Data Charter[19].

The Open data charter is a set of principles and good practices on how to publish governmental Open Data. It was founded in 2015 and its main goal is to "embed a culture and practice of openness in governments in ways that are resilient to change through opening up data". The charter focuses on six main principles for how Open Data should be published:

> **EU Open Data policy**
>
> According to the European Open Data Portal recommendations, an Open Data policy should include these aspects:
> - Definition and benefits – should clearly define what Open Data is. For example, the definition could include that data should be free to use and free of charge. The benefits should encourage organisations to Open Data.
> - Scope and goals – the scope should define what kind of data should be opened first and what goals should be reached.
> - Legal aspects – the implementation of Open Data has to be in line with current legislation. The legal aspects should address licensing, the Law of information (the one existing in the country), intellectual property, privacy and liability.
> - Data types and quality – it is important to define the formats, quality and metadata standards that should be used when opening data in order to ensure that data is easy to find and reuse.

1. **Open by default** – all governmental data should be Open Data, if it is not restricted by Law for security or data protection reasons.

2. **Timely and comprehensive** – for data to be relevant and useful, it should be published fast and in an unmodified form.

3. **Accessible and usable** – data should be provided in the machine readable formats, easy to find, described using metadata, and under an open licence.

4. **Comparable and interoperable** – using commonly-agreed data standards can ensure interoperability and thus an increase of the potential value from using a variety of the datasets.

5. **For improved governance and citizen engagement** – Open Data can serve as a tool for improving the transparency in the government.

6. **For inclusive development and innovation** – Open Data can be used for encouraging innovation and economic development.

The Open Data Charter is adopted by Ukraine and its cities Drohobych, Lviv, Chernivtsi, Vinnytsia, Dnipro. It is important to note that Open Data policy principles should be made available to all public institutions, and communication campaigns should be undertaken in order to raise awareness.

Environmental data

In regard ~~with~~ to environmental data, building a data policy is an effective way to increase the quality, timeliness, discovery and availability of environmental data.

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[18] Recommendations from the European Union :
https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf
[19] https://opendatacharter.net

European Environment Agency

The European Environment Agency (EEA) developed a data policy[20], which provides guidelines about how the European Environment Agency (EEA) is handling environmental data collected, acquired, processed and disseminated by the EEA, including the data flows within Eionet. The principles of the data policy include:

- Data provided has clear use or re-use conditions (art. 3);
- Data is provided through services are compliant with established standards from ISO, OGC, INSPIRE and other relevant standardisation bodies. EEA distributes datasets under open standard license ODC-by license or similar (art. 4);
- Data sources are cited and, when possible, opportunities for branding are offered (art. 5);
- Data providers remain responsible for the quality of the data they produce and distribute (art. 7).

Designing an "Open Data" legal framework and provision of enforcement mechanisms

EaP countries have in their Constitution or in their legal framework the concept of "public information". Public information has generally to be disclosed to citizens by the institutions upon request and proactively within their areas of activities. Nonetheless, EaP countries usually do not have mechanisms to monitor and enforce the publication of public information as Open Data. In addition, not all EaP countries have an Open Data portal (i.e. Armenia and Belarus are currently implementing their Open Data portal).

Open Data require a sound legislative framework, licencing, common standards and a strong governance structure. In EaP countries, these elements are not always strongly implemented, which results in low interoperability and low activity in publishing public data.

According to the Aporta Initiative promoted by Ministry of Economics and Business in Spain[21], these are the best examples of legislative aspects for privacy, freedom of information and the right to access data:

> **The Public Sector Information from the European Union**
> The Directive on the re-use of public sector information, also known as the 'PSI Directive' (Directive 2003/98/EC) entered into force on 31 December 2003. It was revised by the Directive 2013/37/EU, which entered into force on 17 July 2013. In 2017, the European Commission launched a public online consultation on the review of Directive 2013/37/EU, fulfilling the periodic review obligation prescribed by the Directive. Building on the results of the consultation, together with an extensive evaluation of the Directive and an impact assessment, a proposal for a revision of the Directive was adopted by the European Commission on 25 April 2018. On 22 January 2019, negotiators from the European Parliament, the Council of the EU and the Commission reached an agreement on the revision proposed by the Commission. Once adopted, the Directive would be renamed as the Open Data and Public Sector Information Directive and will make public sector and publicly funded data re-usable.

1) To have solid and established rights of access to information regulated under their own legal framework and for these rights to be put into practice effectively. Examples of reference in this regard are countries, such as Finland, United Kingdom, New Zealand, Chile, Estonia, Iceland, Republic of Korea or Sweden.

2) To have a consistent data protection framework that is broad in its scope of application and includes the right to choose and the decision-making capacity of individuals, which allows access to personal data and rectification thereof and imposes clear responsibilities in the treatment of the data. Examples of reference in this regard are countries, such as Finland, Estonia, Belgium, Sweden, Spain, Uruguay, France, Norway, Germany, Iceland or Ireland.

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[20] https://www.eea.europa.eu/legal/eea-data-policy/data-policy#toc-2

[21] https://datos.gob.es/sites/default/files/doc/file/international_open_data_best_practices.pdf

European Environment Agency

In addition, in order to be effective, the Laws have to ensure:

3) Clear definitions and limitations of access to public sector information, geographic and environmental data. As a basis, all public information should be disclosed if they are not restricted by rules defined in the Law (e.g. State secret, personal data, etc.).

4) Attribution of clear responsibilities for each institution involved in the collection, sharing and dissemination of environmental data and information. To ensure the consistency of the legal framework, it is possible to make an overarching Law to define the institutional framework for the environment.

5) The presence of monitoring and/or enforcement mechanisms for measuring the publication of Open Data. These mechanisms can be for instance implemented as regular public reporting (e.g. number of datasets published per institutions), etc.

6) The presence of licences: to ensure re-usability of Open Data, it is necessary to define and attribute a licence for datasets. The Law can define the responsibilities for the provision of licensing mechanisms to an institution.

7) To leave the door open for intellectual property: it is possible to limit the re-use of Open Data by setting some legal boundaries to protect the data provider(s). A possibility is to add restrictions of re-use of Open Data in the licence.

Overall, it is important to ensure that the Laws provide sufficient mechanisms to implement the Aarhus Convention from a practical perspective, and that clear results are achieved. Where the Protocol on PRTR has been signed, the Law should also provide mechanisms to ensure its implementation.

Definition of metadata description standard for all environmental information

According to the ''Data on the Web Best practice'' document [22], providing metadata is a fundamental requirement when publishing data on the Web because data publishers and data consumers may be unknown to each other. Then, it is essential to provide information that helps human users and computer applications to understand the data as well as other important aspects that describes a dataset or a distribution of a dataset.

The usage of metadata is widely accepted for Open Data. Metadata should be provided for both human users and computer applications. Different approaches are used to provide data for human users and machines.

Possible approaches to providing human-readable metadata:

- To provide metadata as part of an HTML Web page;

- To provide metadata as a separate text file.

Possible approaches to providing machine-readable metadata:

- Machine-readable metadata may be provided in a serialisation format, such as Turtle and JSON, or can be embedded in an HTML page using [HTML-RDFA] or [JSON-LD]. If multiple formats are published separately, they should be served from the same URL and made available under separate URIs, distinguished by filename extension. Maintenance of multiple formats is best achieved by generating each available format ad hoc based on a single source of the metadata.

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[22] https://www.w3.org/TR/dwbp/#metadata

- When defining machine-readable metadata, reusing existing standard terms and popular vocabularies are strongly recommended. For example, the Dublin Core Metadata (DCMI) terms [DCTERMS] and the Data Catalog Vocabulary [VOCAB-DCAT] can be used for providing descriptive metadata. Such vocabularies are designed to be very flexible, so it is often helpful to use a specific profile of a vocabulary, such as the European Commission's DCAT-AP.

The machine-readable version of the descriptive metadata can be provided using, for example, the Data Catalog Vocabulary [VOCAB-DCAT]. This provides a framework in which datasets can be described as abstract entities.

In this regard, the European Union implements the DCAT[23] standard, which provides a set of classes to describe Open Data. The DCAT Application Profile for Data Portals in Europe (DCAT-AP) is a specification based on the Data Catalogue Vocabulary (DCAT) developed by W3C. DCAT-AP allows:

- Data catalogues to describe their dataset collections using a standardised description, while keeping their own system for documenting and storing them.

- Content aggregators, such as the European Data Portal, to aggregate such descriptions into a single point of access.

- Data consumers to more easily find datasets from a single point of access.

DCAT-AP also has an extension GeoDCAT-AP for describing geospatial datasets, dataset series and services. In that regard, other metadata standards are available for the description of spatial data: ISO 19115-1:2014 Geographic information – Metadata, ISO 19119:2016 Geographic information – Services, ISO/TS 19139-1:2019 Geographic information -- XML schema implementation.

Another extension of DCAT-AP is StatDCAT-AP, which aims to deliver specifications and tools that enhance interoperability between descriptions of statistical data sets within the statistical domain and between statistical data and Open Data portals.

The UK e-Government Metadata Standard Framework

The UK e-Government Metadata Standard Framework (eGMF) was published in May, 2001. It defines how the UK public sector bodies should label content such as web pages and documents to make such information more easily managed, found and shared. eGMF was based on Dublin Core standard. Currently, the standard defines twenty-five elements that has a statement of purpose, notes, clarification, refinements, examples of use, HTML syntax, encoding schemes and mappings to other metadata standards where applicable.

Even if EaP countries usually describe the data published on their Open Data portal, it should be noted that these metadata are often poor and/or not based on a published standard. More importantly, the environmental data and information published usually do not have metadata, which hampers finding and re-use of these data.

As such, the development and/or the adoption of a metadata standard for the publication of public sector information, and Open Data would increase their transparency. Typical metadata include: title, information provider, time and space coverage, author, licence, distributions (i.e. links to datasets, often in different formats).

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23 https://ec.europa.eu/isa2/solutions/dcat-application-profile-data-portals-europe_en

European Environment Agency

A good example of environmental information described with metadata would be:

Table 1 - Example of metadata for describing environment dataset

Title	Air quality monitoring report – Tbilisi
Description	This report provides monthly the last month's results of the air quality monitoring in Tbilisi.
Time coverage	February 2019
Space coverage	Tbilisi, Georgia
Distribution	Report in pdf: http://reportinpdf.pdf Report in Word format: http://reportinword.docx Data in Excel: http://excelrawdata.xlsx Alternative link: http://eiec.gov.ge/airqualitytbilisimarch2019.pdf
Publisher	Environmental Information and Education Centre
Contact person	Mr. XYZ
Contact email	xyz@eiec.ge
Contact person phone number	+99532xxxxxxx
Theme	Air
Data dataset released	03.03.2019
Language	Georgian, English
Keyword	Air quality, air monitoring, February 2019

Increase the findability of environmental data and information

It is important to ensure findability (discoverability) of environmental data and information. To do so, multiple measures can be undertaken. For example:

- Define a content-driven structure for the menu: the closer the navigation will be to the data, the easier it will be to find information.

- Provide advanced search functionality that allows the user to use multiple field search and filter options (e.g. file format) in order to refine a search. In addition, it is also possible to provide mechanisms for complex filtering, including, for example, the combination of keywords with Boolean operators.

- Link datasets published to other portals, or publish metadata in a regional and/or international format so that datasets can be harvested by other websites.

- Provide specific "Request data" button for users to be able to request data. The country should also setup a process for managing Open Data requests.

European Environment Agency

Categorising Open Data

Data should be created, stored, and distributed covering a large variety of topics and categories. However, not all types of data are of equal relevance. The following are the main categories of Open Data identified by the European Commission:

- Agriculture, fisheries, forestry, foods;
- Education, culture and sport;
- Environment;
- Energy;
- Transport;
- Science and technology;
- Economy and finance;
- Population and social conditions;
- Health;
- Government, public sector;
- Regions and cities;
- Justice, legal system, public safety;
- International issues.

Figure 5 - Open Data categories on European Open Data portal

Transformation of data published to machine-readable format

The W3C Foundation provides a basic model for Open Data with regard to maturity: the 5-Star Open Data model[24].

Table 2 – Open Data maturity level

Level	Description	Used standards
★	Data is available on the web (whatever format) under an open licence	PDF
★★	Data is available as structured data (e.g. Excel instead of image scan of a table)	Excel
★★★	Data is provide in non-proprietary formats (e.g. CSV instead of Excel)	CSV
★★★★	URIs are used to denote things, so that people can point at your data	RDF, JSON
★★★★★	Data is linked to other data to provide context	Linked Open Data (LOD)

At the beginning of the Open Data initiatives, countries should aim at opening data at the third level and then improve the quality of the data.

It is important to ensure that the data are available in machine-readable format so that they could be easily re-used. Most popular formats are as follows: xls (x), csv or tsv, xml, json and dbf or mdb database dumps. While all formats are easily reusable, xls spreadsheets - the most used - is a proprietary format that could again limit its use. It is to be noted that electronic formats, such as pdf, html, ods, txt, jpeg or png, are not considered as machine-readable – even though some techniques can be used to extract information, their absence of standard structure classifies them as non-machine-readable. It is also worth noting that data publication through programming interfaces (APIs) could greatly facilitate the access and use of data[25].

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[24] https://5stardata.info/en/

[25] https://datos.gob.es/sites/default/files/doc/file/international_open_data_best_practices.pdf

Develop and publish quality control mechanisms for environmental data

The quality of Open Data is a continuous process, managed at national and institutional levels. There are six core data quality dimensions for assessing the quality of data[26]:

1. **Completeness** - The proportion of stored data against the potential of "100% complete";
2. **Uniqueness** - Nothing will be recorded more than once based upon how that thing is identified;
3. **Timeliness** - The degree to which data represents reality from the required point in time;
4. **Validity** - Data valid if it conforms to the syntax (format, type, range) of its definition;
5. **Accuracy** - The degree to which data correctly describes the "real world" object or event being described;
6. **Consistency** - The absence of differences, when comparing two or more representations of a phenomena against its definition.

To evaluate the quality of data, it is possible to establish quality guidelines and/or procedures at a national level, to which all institutions have to comply with. Inside each institution the process of publishing (dissemination) environmental data and information should be supported by a public servant responsible for ensuring the quality of data and metadata. As such, the definition of quality control mechanisms for environmental data is crucial for ensuring that the data provided is of high-quality and can be trusted by the data consumers.

Besides, the quality of spatial environmental data can be managed according to different standards. For example:

- ISO/DIS 19157 Geographic information – Data quality;

- The INSPIRE Data Specifications, which contain a specific section regarding data quality (e.g. Protected Sites theme –Technical Guidelines, Chapter 7 - Data Quality, https://inspire.ec.europa.eu/id/document/tg/ps).

European Data Portal Metadata quality dashboard
The quality analysis is based on 3 criteria: the accessibility of distribution, their machine readability and their compliance to the DCAT-AP specification. For each catalogue all datasets and their corresponding distributions are checked. This dashboard provides a general overview of all catalogues, and it is possible to check the quality of metadata for each Open Data portal.
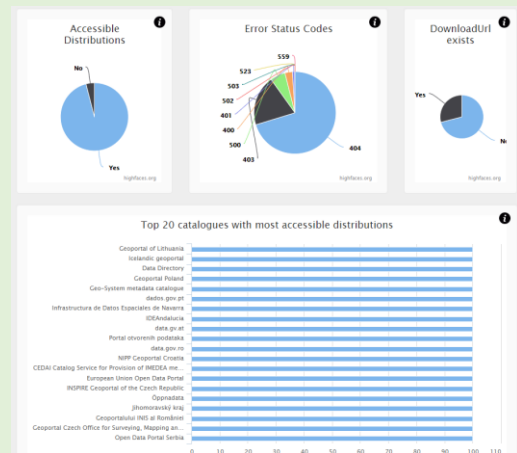

Figure 6 - EU Data portal metadata quality dashboard
https://www.europeandataportal.eu/mqa-service/en

Harmonise licensing terms and conditions of environmental data to promote its public use and re-use

There are many licences available that can be used when publishing data. At first, licences are not absolutely necessary in the country. But as the amount of data and portals grow, the licence becomes an absolute necessity to ensure proper re-use of data. Hence, all datasets published should be accompanied by a licence. In some cases, such as for the Scottish Environment Protection Agency[27], licences are attached to data catalogues (i.e. in practice websites).

In this context, in the European Union, the European Open data portal recommends to use the Creative Commons 4.0 licence for Open Data licensing in public institutions. Three main categories of Creative Commons are provided in the table below.

Table 3 – Creative Common 4.0 licence details

Scope	Name	Licence allows to	Licence obliges to
Public domain	**CC0 1.0**	• Grant or extend a licence to the software • Redistribute the data • Make copies of the work by any means • Create derivative works of the data	
Attribution	**CC-BY 4.0**	• Redistribute the data • Make copies of the work by any means • Create derivative works of the data	• Keep copyright and licence notices intact • Keep copyright and licence notices intact • Give proper credit to the copyright holder and/or author
Share alike	**CC-BY-SA 4.0**	• Redistribute the data • Make copies of the work by any means • Create derivative works of the data	• Keep copyright and licence notices intact • Keep copyright and licence notices intact • Indicate which changes have been made to the original licenced work in a manner that permits attribution. • Give proper credit to the copyright holder and/or author

It should also be noted that a few countries have developed their own licence, where standard CC licences do not meet their expectations. Few examples are:

- Czech Republic at http://portal.chmi.cz/files/portal/docs/uoco/isko/tab_roc/tab_roc_EN.html, documented at https://creativecommons.org/licenses/by-nc-nd/3.0/cz/

- UK at http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

- FR at https://www.etalab.gouv.fr/licence-ouverte-open-licence

The Eionet Central Data Repository provides a legal notice at https://cdr.eionet.europa.eu/legalnotice:

„As a general principle, datasets on CDR are publicly available unless they have explicitly been access-restricted due for instance to protection of privacy, public security, commercial interests or otherwise have sensitive content.

With regards to the right to access CDR datasets, the EEA thus follows the policy related to documents owned or held by the European Parliament, Council and Commission as regulated through [Regulation (EC) No 1049/2001](#) of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents.

Additionally, in environmentally related matters, access to datasets owned by a country is governed by the United Nations Economic Commission for Europe (UNECE) [Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters](#) adopted on 25 June 1998 in the Danish city of Aarhus (Ãarhus).

Re-use (including redistribution): Creative Commons Attribution Licence CC BY 2.5: Unless otherwise indicated, re-use of content on the CDR website for commercial or non-commercial purposes is permitted free of charge, provided that the source is acknowledged."

Timely and regular collection, update and publishing environmental data

It is important to monitor the number of datasets, their usage, quality as well as their publication format. Keeping track of the number of datasets published and re-used, especially per institution, enables knowing which data are the most in demand.

In the UK, in order to ensure that information is constantly updated and the new datasets are published, several functionalities are added to the Open Data portal to facilitate the continuous feedback from users, and make request for new data[28]. It should be noted that most EaP countries offer such mechanisms, but in practice, this needs to be pushed further and enhanced.

Besides, data and reports are mostly valuable when up-to-date. Hence, it is crucial to set up a legal framework, processes, tools, and systems, which enable the maintenance of data published. In particular, it is possible to define in the Law minimum frequencies for reporting and publishing environmental data on the Open Data portal. For example:

Table 4 - Example of frequencies for updating datasets

	Minimal frequency for publishing data on the eco-portal and/or Open Data portal	Minimal frequency for publishing reports on the eco-portal
Air	Weekly	Daily, depending on report
Water	Weekly	Daily, depending on report
Biodiversity	Bi-annual	Bi-annual, depending on report
Waste	Monthly	Monthly, depending on report
Energy	Monthly	Monthly, depending on report
Transport	Monthly	Monthly, depending on report
Soil	Monthly	Monthly, depending on report
Climate	Monthly	Monthly, depending on report

It is important to note that the frequency of publication will have an impact on environmental organisations. As such, setting the frequency should be done with great care regarding the capacity in terms of people,

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[28] https://datos.gob.es/sites/default/files/doc/file/international_open_data_best_practices.pdf

processes and systems. At first, it is possible to start with a few datasets (e.g. air and water quality) and to establish a process, which will maintain and publish the datasets on a monthly basis. In the second phase, after a few months, it is possible to increase the frequency to twice a month, and then once a week.

Evaluate the impact of Open Data

While measuring the impact of Open Data, it is essential to understand effectiveness of an Open Data policy, programme or initiative. In fact, most countries have difficulties in communicating the benefits of Open Data, even though clear studies have been made, and hundreds of stories are available. Hence, it is important for EaP countries to set-up an "impact assessment framework", to evaluate the return on investment (ROI) by way of impact.

There are a number of techniques that can be used to achieve impact.

- Identify shared goals;

- Seek out and foster stories;

- Reflect, iterate, reiterate.

Usually, the impact is measured in terms of political, economic, social and environmental impact.

> **European Data Portal Impact maturity**
>
> The European Open Data portal monitors the maturity of a series of elements regarding Open Data.
> - Political Impact
> - Social Impact
> - Environmental Impact
> - Economic Impact
>
> These elements are summarised on a dashboard publicly available:
>
>
>
> *Figure 7 - EU Open Data impact dashboard*
> https://www.europeandataportal.eu/en/dashboard#2018

- Political impact: impact on government efficiency and effectiveness, and impact on transparency and accountability. According to the European Open Data portal, in 2018, the highest scoring countries for political impact were Ireland, Spain, Italy, Luxembourg, Cyprus.

- Economic impact: based upon the implementation of multiple macro-economic studies assessing the market value of Open Data and studies regarding better service delivery or looking at related subjects. According to the European Open Data portal, in 2018, the highest scoring countries for economic impact were Ireland, Spain, Italy, France and Cyprus.

- Social impact on environmental sustainability and the inclusion of citizens in policymaking and in accessing government services. According to the European Open Data portal, in 2018, the highest scoring countries for social impact were Ireland, Spain, Italy, France, Cyprus and Slovenia.

> **Ukraine has analysed the economic impact of Open Data in the country**
>
> The research is prepared by Kyiv School of Economics jointly with Open Data Institute within USAID/ UK aid Transparency and Accountability in Public Administration and Services program /TAPAS and with the support of the State Agency for eGovernance of Ukraine.
>
> Result: Open Data could contribute up to USD 1.4 billion to the Ukrainian economy by 2025, representing 0.92% of Ukrainian GDP, through a combination of direct and indirect benefits.

- Environmental impact: based on the development and implementation tools and decisions, which enable preserving the environment. According to the European Open Data portal, in 2018, the highest scoring countries for social impact were France, Ireland, Italy, Spain, Cyprus and Poland.

European Environment Agency

Improve accessibility and use of available environmental data and information by improving the multi-lingual aspect of portals

The translation of Open Data portal(s) and public institutions websites to international and regional languages (e.g. English and Russian) is a good practice to foster collaboration. For translating websites, it is possible to use translation plugins such as Google translate (with disclaimer regarding the translation) and/or to provide the websites/portals in multiple languages. In that regard, the website from the EEA and governmental institutions websites in Belarus are good examples.

2.2.2 Infrastructure

Build an Open Data portal, and foster publication of public sector information (PSI)

Creating a centralised data portal managed by a single institution is important for Open Data management. While EaP countries usually have one (or more) Open Data portal, it is often not as developed as it could be. The following section overviews the main functionalities of the Open Data portal provided by Ireland, Spain and the Netherlands, which are considered having mature Open Data portals. EaP countries could draw inspiration from these portals to further develop their own portal.

Ireland - Open data portal[29]

Data.gov.ie is intended to provide easy access to datasets that are free to use, reuse, and redistribute. The portal is operated by the Government Reform Unit of the Department of Public Expenditure and Reform. The portal provides a good functionality to "suggest" data to be opened. The figure below presents the homepage of the Portal.

Figure 8 - Irish Open Data portal

Main sections of the portal include:

- **Datasets** – the portal has almost 9,000 published datasets from 100 institutions. Datasets can be searched based on criteria of the words of interest, publisher, licence, themes, format, release date and update date.

- **Publishers** – the list of 103 publishers is provided. A publisher is any Irish Public Sector Body, who publishes Open Data on this portal. Each institution has its profile, which presents the number of

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[29] https://data.gov.ie/

datasets, the number of total views, main tags used, the list of published datasets, their formats and licences, and other information about the institution.

- **Suggest data** - this functionality allows users to suggest a dataset that should be published. To suggest a dataset, users have to fill a form and provide relevant information about the requested dataset. The list of suggested datasets is provided.

- **Showcases** - Showcases collect the best examples of datasets in use, to provide further insight, ideas, and inspiration.

- **Other -** the latest news, guide for publishers and developers and other publications are provided on the portal.

Spain - Open data portal[30]

Datos.gob.es provides the National Open Data Catalogue, which is the only point of access to the data sets offered by the public authorities for re-use Spain. A strong feature of the Spanish Open Data Portal is the presentation of the impact analysis of Open Data on its portal.

The figure below presents the homepage of the Portal.

Figure 9 - Spanish Open Data portal

Main sections of the portal include:

- **Data catalogue** – the database contains over 21,500 datasets categorized by data format, publisher, administration level, update frequency, tag. The category "Environment" has the most datasets – 4236.

- **API** – the API is a mechanism for querying in a datos.gob.es semantic database.

- **SPARQL Endpoint** – with the aid of this service it is possible to configure queries using the SPARQL query language for datas.gob.es RDF charts.

- **Impact** – this section consists of: a dashboard to overview an activity on datos.gob.es, such as general statistics and data catalogue statistics, all the provided graphics are interactive and can be adjusted; an initiative map that provides the main Open Data initiatives all around Spain based on administration level and other criteria; applications that present the best examples of datasets in use; and reuse companies that provide some examples of companies and entities that have created novel products using Open Data.

- **Interact** – in this section, useful documentation, FAQs, data availability studies are provided.

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[30] http://datos.gob.es/en

The Netherlands - Open data portal[31]

This portal provides an overview of all available datasets provided by government organisations in the Netherlands. More than 150 governmental organisations publish data on the portal. The portal provides a good example of amount of data published. The figure below presents the homepage of the Portal.

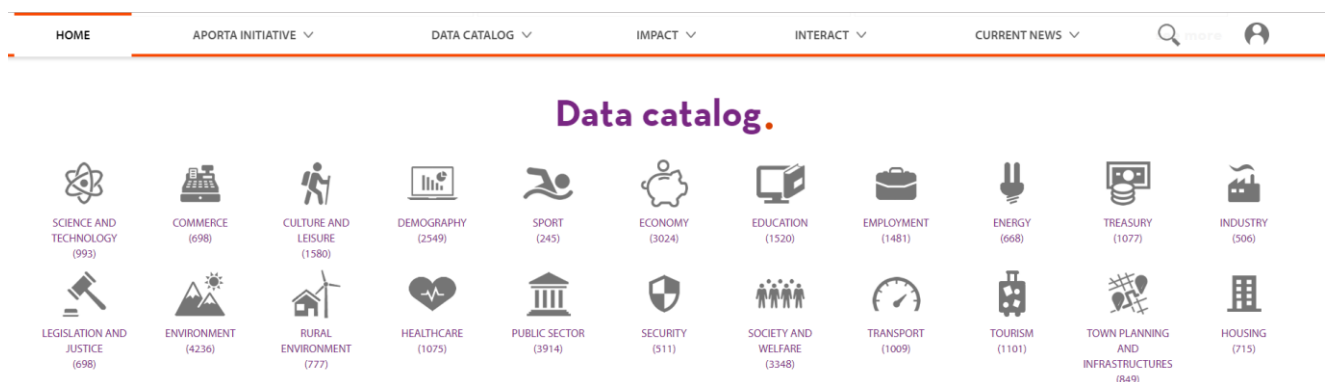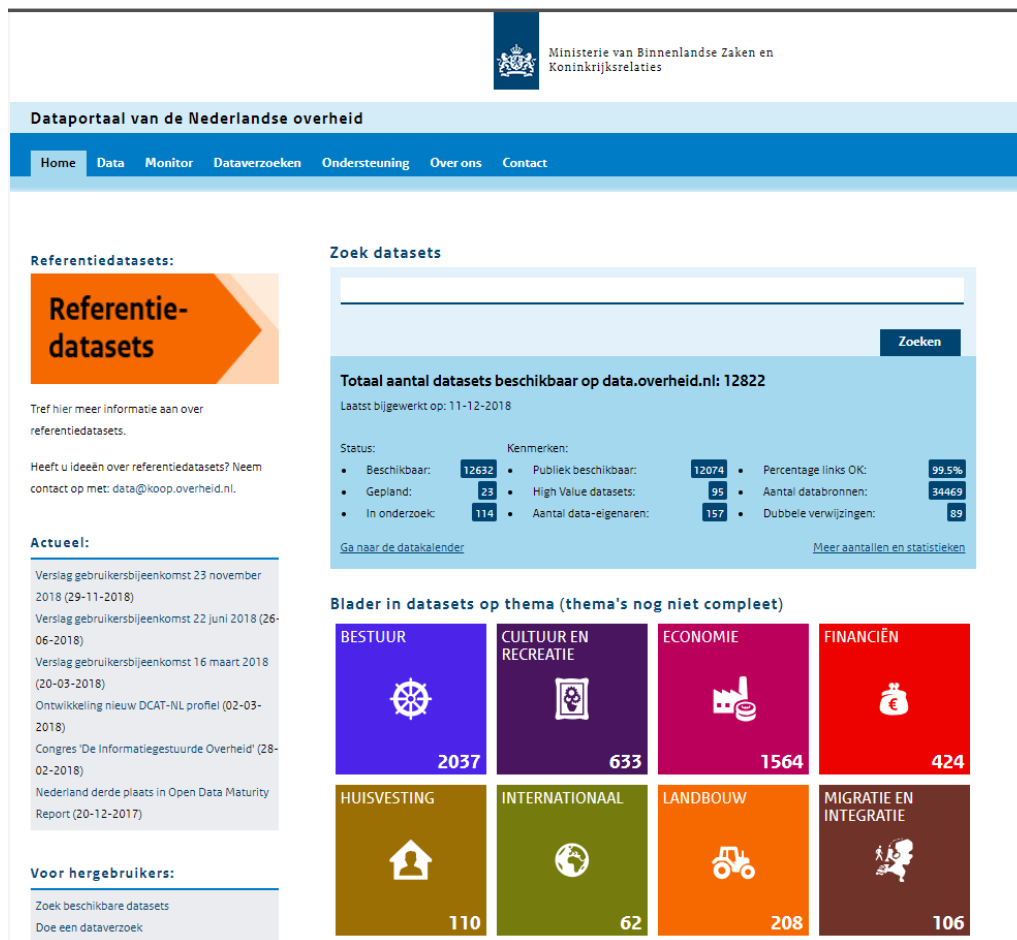*Figure 10 - Dutch Open Data portal*

Main sections of the portal include:

- **Data** – the database contains over 12,000 datasets categorised by status, accessibility, topic, keywords, publisher, and other criteria.

- **Monitor** – this section provides main statistics of the use of the Open data portal. Moreover, there is a calendar that provides information about the planned publication datasets. Data can be filtered by date, topic or publisher.

- **Data requests** - This page provides an overview of the data requests that have been made on data.overheid.nl. Data requests with specific status, theme or action holder can be searched. The users can also submit a data request by filling a request form.

- **Support** – this section provides additional information for data publishers and developers.

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[31] https://data.overheid.nl/

Establish a single and user-friendly web-access point for environmental information

A single point of environmental information access is also commonly referred to the term "eco-portal". In a nutshell, it is a data portal dedicated only for environmental data and information. Data are either hosted on the portal, or can be accessible through links to other portals (e.g. air quality data monitoring published on a dedicated air quality portal[32]). When the "eco-portal" links to other thematic portals, it is said that the portal is based an "interlinked system". The website Eis-data.eu[33] defines such system as "Mutually link environmental portals, thematic portals, and (spatial) data portals".

As such, the eco-portal doesn't replace the Open Data portal, but rather complements it. At this stage, most EaP countries have not yet developed a national eco-portal, nonetheless most have embryos of "eco-portals":

- Georgia: "Eco-portal" from the Environmental Information and Education Centre

- Armenia: Shared environmental information system for Lake Sevan

- Belarus: the Main Information Analytical Centre website

- Ukraine: eco-portal under the development of the "Open Environment" concept

In order to have a fully functioning eco-portal, it is important to ensure interoperability, the use of commonly accepted standards, the exchange of metadata and the cooperation among the institutions. The following sections present the examples of eco-portals.

Single web-access to environmental information in Ireland - http://www.epa.ie/irelandsenvironment/[34]

The environment portal in Ireland provides access to all environmental information, licensing and permitting, enforcement regulation, monitoring and environmental assessment, research and education as well as key publications. The portal also provides access to videos, news and events and has a section for contacting the portal administrators.

Also, the portal provides a user-friendly web-interface and a functionality for searching information. Though the discoverability of environmental information could be improved (e.g. usage of complex search and/or advanced filtering), the portal is a good example of single web-access point for environmental information.

Figure 11 - Environmental single web-access point in Ireland

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[32] Note: the Air Quality Portal in Georgia is one of the good practice in providing Near Real-time data for information to the public : http://air.gov.ge/en/

[33] http://www.eis-data.eu/the-project/

[34] More information about the portal can be found in a study made by the UNECE: http://www.unece.org/fileadmin/DAM/env/pp/a_to_i/TFAI_Case_studies/IRELAND_case_study.pdf The study summarises the main objectives laid down by Ireland for the portal, and also highlights the legal framework built for it.

"Eco-portal" from the Environmental Information and Education Centre - http://eiec.gov.ge/

The website is administered by the Environmental Information and Education Centre. It is the central environmental information portal, as defined by the Law.

The website provides information on environmental themes, projects, legislation, strategic documents, guidelines and so on. It also contains the texts of multilateral environmental agreements (MEAs) and national reports on the implementation of the provisions of MEAs, national reports on the state of the environment, a registry of environmental organisations as well as infographics. The site also includes information pertaining to issued permits and other related information.

Shared environmental information system for Lake Sevan, Armenia[35] – http://seis-sevan.am/?p=about-us
As a pilot project for building national Shared environmental information system (SEIS), the smaller scale SEIS for Lake Sevan basin in Armenia was implemented in 2014.

The National Statistic Service is responsible for collecting data from the environmental information holders, managing it and publishing it in a complete and timely manner. For this, National Statistic Service closely cooperates with the Ministry of Nature Protection and other environmental information holders.
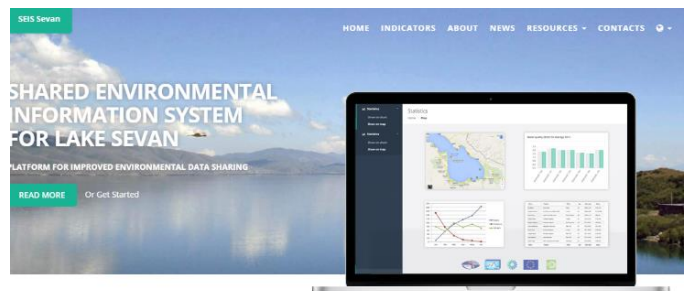
Figure 12 - Lake Sevan website

The portal provides data of climate change and water resources indicators and visualises it in a form of a table, and when possible, in a form of a chart or a map. The portal is open for public use. The content and the structure will be later used as the basis for nation-wide environmental SEIS.

The National Environmental Monitoring System in Belarus – http://www.nsmos.by/

The National Environmental Monitoring System aims to ensure the availability of environmental information at all levels of government as well as in support of implementation of international agreements. The operation of the National Environmental Monitoring System is regulated by the 2003 Resolution of the Council of Ministers No. 949 "On the National Environmental Monitoring System in the Republic of Belarus" and many other resolutions referring to the specific types of monitoring.

Figure 13 - NEMS website

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[35] http://seis-sevan.am/?p=about-us

European Environment Agency

The European Environmental Agency website[36]

In its website, the EEA provides a variety of environmental data from the European Union presented in a form of graphs, maps or other forms. The website is available in 29 languages and provides access to environmental data, reports and indicators.

Data is regularly updated and the website also provides a semantic data service via APIs.

Figure 14 - EEA website

Build an infrastructure to embed environmental data in geographic data

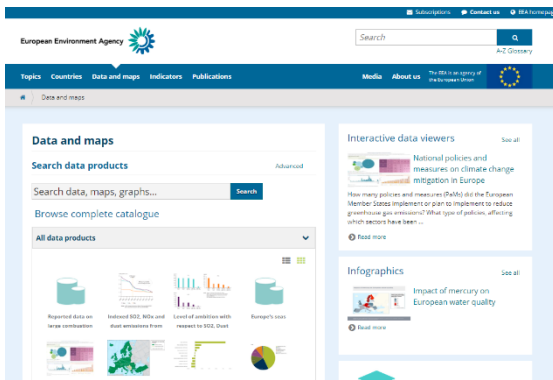Spatial information data relating to local, regional or global scales are the basis of geography. Due to recent developments in space technology, the emphasis has shifted to data made available for everybody. These elements have generated a need for a unified and standardised Spatial Data Structure (SDI)[37].

In EaP countries, few geoportals are available. In particular, they are usually sparse and not interoperable. They have very few environmental datasets, and are usually dedicated to specific environment component (e.g. air, water). In addition, EaP countries produce environment indicators at different maturity levels. The visualisation mechanisms are various and do not provide time and space functionality.

The creation of a national Spatial Data Infrastructure in EaP countries would enable the dissemination of environmental information through a national geoportal.

The European Union: building a spatial data infrastructure, the INSPIRE directive[38]

INSPIRE stands for Infrastructure for Spatial Information in the European Community. This directive aims to "establish an infrastructure for spatial information in Europe that is geared to help to make spatial or geographical information more accessible and interoperable for a wide range of purposes supporting sustainable development". The directive was passed in 2007 and will be fully implemented by 2021.

The directive provides implementation rules, metadata rules, data specifications on the implementation of interoperability of special datasets and services, network services and monitoring, reporting.

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[36] https://www.eea.europa.eu/data-and-maps
[37] Standardisation of geographic data: the European INSPIRE directive, European Journal of Geography 2 2: 79-89, 2011.
[38] https://inspire.ec.europa.eu/

European Environment Agency

The INSPIRE Geoportal was developed under the INSPIRE Directive. It provides a centralised access to the EU spatial datasets and allows monitoring the availability of the datasets, discovering them based on their metadata and viewing or downloading the selected datasets. The geoportal hosts the "INSPIRE Thematic Viewer", which provides access to the INSPIRE data sets provided by EU Member States and EFTA countries. Data can be browsed by country and by "Data Themes". Themes are defined separately and standardised for all

Figure 15 - INSPIRE, dataset map

data providers[39]. In particular, the data themes comprise of cadastral parcels, hydrography, protected sites, transport, geology, land cover, atmospheric conditions, agricultural and aquaculture facilities, bio-geographical regions, environmental monitoring facilities, energy resources, land use, meteorology, mineral resources, etc. In addition, INSPIRE defines a series of priority datasets to be published on the geoportal[40].

INSPIRE also provides documentation for implementing spatial metadata and service metadata:

- INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119

- Technical Guidance for the implementation of INSPIRE dataset and service metadata based on ISO/TS 19139:2007

It is also recommended to use a standardised approach for publishing spatial environmental data, for instance using OGC services, RESTful web services, or semantic web/SPARQL Endpoints (linked data).

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[39] http://inspire.ec.europa.eu/theme
[40] http://inspire.ec.europa.eu/metadata-codelist/PriorityDataset

Lithuania: using spatial metadata to register

In Lithuania, the portal "Regia.lt [41] is the regional geo-informational environment service. It is a tool developed for citizens, local authorities and local businesses. It aims to create favourable conditions for making geographically-based decisions and to facilitate the exchange of information. Data providers who sign an agreement with REGIA can create and manage their own data layers in REGIA. As such, data providers can collect and manage data, information and documents in their own data layer and develop as well as provide services based on georeferenced data. The users can decide to make their data layer public or not and who will have access to it.

For citizens, it provides a geographic view of different environmental data, including cadastres. For instance, citizens can see the quality of water, the deepness of groundwater, the presence of gas/electricity network, etc. It is a powerful tool for citizens and businesses. The portal is also available in four languages: Lithuanian, English, Polish and Russian.
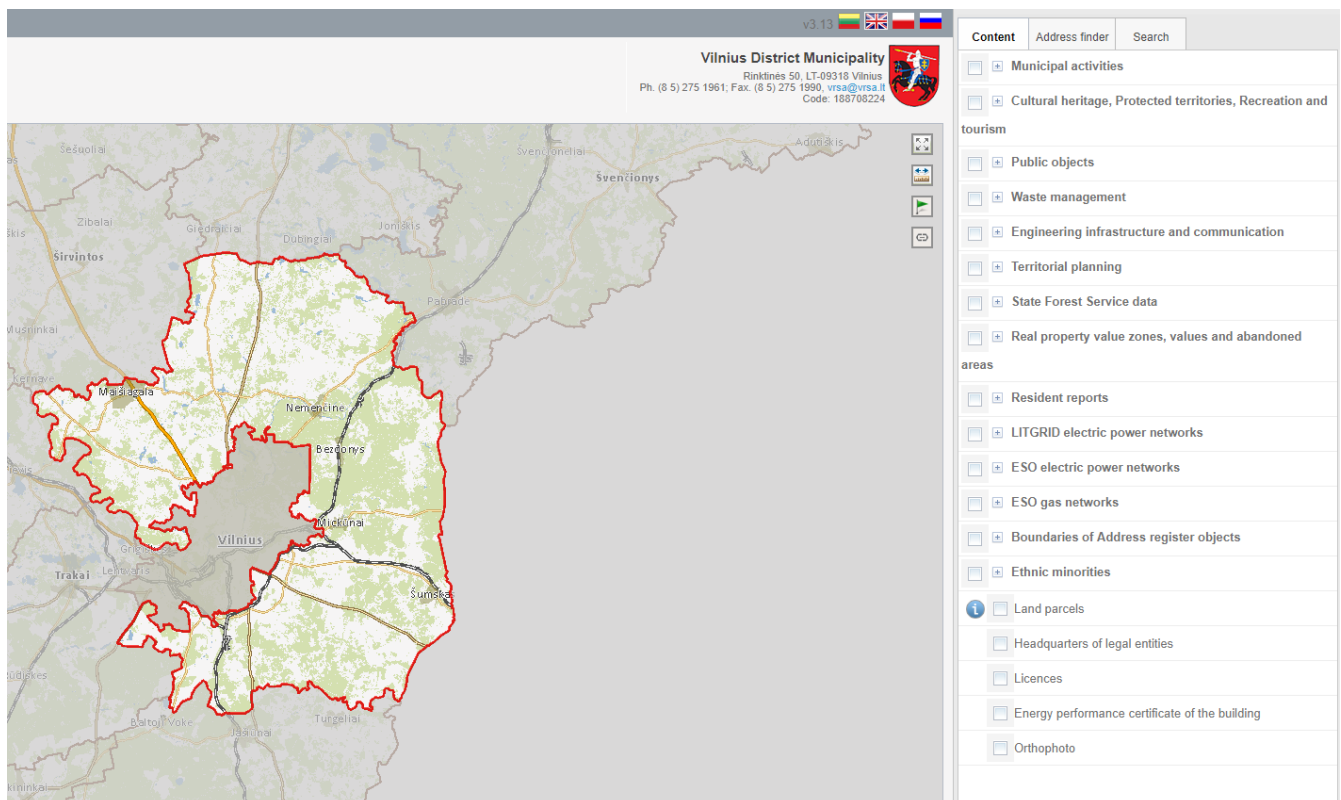

Figure 16 - Regia.lt

Figure 17 - Regia.lt

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[41] https://www.regia.lt

European Environment Agency

Provide technological means for sharing environmental data at a regional level

Sharing environmental data at a regional level is an important enabler of sustainable development. Indeed, cooperation on environmental matters at a regional level because it enables tackling issues at their source. In order to ensure sharing of environmental data, multiple elements are necessary:

Legal framework: countries have to setup regional and/or bilateral agreements among them for sharing environmental data. In order to be effective, it is recommended that such agreements 1) define and list environmental data (or refer to an external document), 2) define technologies and means for sharing information, 3) standards for monitoring (principle of comparability of data – e.g. alignment of measurement units and key indicators), and standards for encoding (delivery format – e.g. XML, or RDF) and describing information (metadata), 4) frequencies and timing of data exchange, and 5) security measures for securing information.

Information systems: a key problematic in the design of information system is the ability to exchange information not only at a national but also at a regional level. For facilitating the exchange of information, it is recommended to either 1) build information systems with standard interfaces to which national systems can connect for exchanging information, 2) build a platform for exchanging information at a regional level. In any case, in order to achieve interoperable technological solutions, a good practice is to establish a regional working group, which is responsible for ensuring regional interoperability.

People, infrastructure and processes: exchange of information at a regional level should be automated as much as possible. Nonetheless, it is crucial for countries to document the processes by which data are collected, processed and shared at regional level. On this basis, sufficient amount of resources (people and material) should be provided to ensure information exchange.

2.2.3 Network

Coordinating Open Data initiative(s)

To ensure the effective coordination of the Open Data initiative, it is essential to establish organisational structure and establish a clear division of responsibilities among the institutions. EaP countries usually do not have a clear organisational governance for Open Data initiatives, and functions are usually shared between several institutions.

In general, a central institution should be responsible for setting procedures and guidelines for Open Data. The same institution or a subordinate should ensure the implementation and maintenance of the Open Data portal. Common Open Data responsibilities for each institution should be defined in the Law, but each institution should have the freedom to publish Open Data according to its specificities – in respect of national rules/guidelines set.

Public institutions should also coordinate among each other on common actions related to Open Data (e.g. establishment of procedures, selection of tools, organisation of events, etc.).

Example of Open Data strategy governance – Ireland [42]
In Ireland, the implementation of the Open Data Strategy is driven by Open Data Governance Board which is supported by the Public Bodies Working Group and the Open Data Unit in the Department of Public Expenditure and Reform. The figure below presents the governance structure of Open Data Strategy in Ireland.

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[42] https://www.per.gov.ie/wp-content/uploads/Draft-Open-Data-Strategy-2017-2022.pdf and
https://data.gov.ie/sites/default/files/files/Final%20Strategy%20online%20version(1).pdf
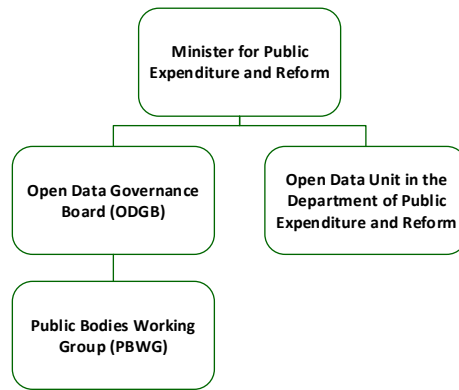
Figure 18 - Governance of the Open Data Strategy – Ireland

Each party has its responsibilities and duties:

- **Open Data Governance Board** (ODGB) - leads and drives the Open Data Initiative and ensures implementation of the Open Data Strategy 2017- 2022.

- **Public Bodies Working Group** (PBWG) - provides technical support to the ODGB and ensures a coherent and consistent approach to the publication of Open Data.

- **Open Data Unit in the Department of Public Expenditure and Reform** - supports the ODGB and the PBWG in implementing the Strategy and oversees the operation of the Open Data portal.

Establishing processes and procedures for managing Open Data

Without official guidelines and procedures to publish and maintain Open Data, it is difficult for institutions to take the pace in publishing public information and conform to legal requirements. As such, establishing clear guidelines for institutions enables them not to "re-invent the wheel" and simply customise a general "organisational framework" to their specificities. Typical elements to be included in the guidelines:

- Generic organisational structure for identifying, collecting, cleaning, preparing, and publishing Open Data (key processes, roles, and responsibilities);

- Identification of datasets for publications: national rules for the selection of high-value datasets;

- Production of Open Datasets and description: metadata standards and tools to use for keeping track of datasets;

- Cleaning, preparing and ensuring quality of datasets: national methods and tools for ensuring the quality of datasets;

- Publishing datasets: tools for publication of datasets (i.e. portal(s), APIs);

- Updating datasets: rules for updating and maintaining datasets;

- Managing requests for new datasets and user feedback;

> **Organisational framework for managing Open Data in Lithuania**
> Lithuania has dedicated a Ministry (IVPK, Informacinės visuomenės plėtros komitetas) for the supervision and setup of standards regarding Open Data. In particular, the country is preparing standard national guidelines for institutions to follow. This will enable institutions to work more efficiently for the publication of Open Data. This initiative also includes data provider training.

- Impact analysis: methods and tools for monitoring the impact of datasets.

Increasing public administration, citizens and business awareness over Open Data and environmental data

The value of Open Data and environmental data lies its usage. If data is not used, then they have no value. In order for citizens, administrations and businesses to use the Open Data and environmental data, it is necessary to raise awareness.

Main means for increasing awareness

Typically, EaP countries could undertake the following measures:

> **Share-PSI in the European Union**
> Share-PSI 2.0 was a Thematic Network, as opposed to a research project, and was designed to bring people together to discuss common problems arising from their existing work, not necessarily to develop new work itself. It is a place where a wide range of people working on similar projects benefitted from each other's experience. In each of the workshops, several of the partners presented case studies – that is, details of projects they were working on or had completed.

- Publish articles and success stories in popular media (including social media).

- Integrate (e.g. building apps) in university programmes: educating younger generations in using Open Data enables the creation of a "culture for Open Data".

> **Example of application developed thanks to Open Data**
>
> - Italian Ministry of Environment, Land and Sea: portal for viewing environmental assessments and authorisations given to companies.
> - Belgium: launch of a biodiversity informatics, which provide tools and events to support publication and reuse of biodiversity data.
> - Luxembourg: information on electric stations for charging vehicles.
> - Cyprus: creation a fertilizer calculator for farmers

- Create Open Data / environmental data communities: the creation of communities enable people to connect to each other.

- Build apps, social media groups in which citizens and business can participate in activities linked to the data disclosed (e.g. app for notifying environmental pollution).

- Organising conferences by uniting policy makers, solution providers, researchers and other stakeholders as well as contributors with a keen interest in the topics relating to the management and exchange of information can be very beneficial. The topics, which are discussed during the conference, help to demonstrate that Open Data usage can bring direct benefits to citizens. Provide Open Data online training: one of the examples could be the website joinup.ec.europa.eu. This website hosts several interoperability tools and methods, and also trainings over Open Data. Such a platform enables public administrations, businesses and citizens to find public documentation in one place.

- Etc.

Other means for increasing awareness
More means for increasing awareness of Open Data are provided in the table below.

Table 5 – other means for increasing awareness

No.	Tool	Description	Example
1.	**Success stories**	Share success stories with the different stakeholders.	Success stories and descriptions are available on portals of open source countries such as Ireland, France, Spain, USA, New Zealand, etc.

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No.	Tool	Description	Example
2.	**Events**	Organise conferences, forums, presenting the benefits of Open Data, success stories, and opportunities for Open Data use. Hackathons can be organized or supported, in which participants create new programs that use data visualisation and other forms of open source data.	Fishackathon[43] – organised by US Department of State's Office of Global Partnerships to promote creation of digital solutions to address sustainable fisheries challenges.
3.	**Open data usability studies and research**	Conduct and publish research and studies on data usage cases and applications.	*Open Data 500 Australia[44]* is a survey of Australian companies that use Open Data. One of the results is a graphic representation of the data used by different companies.
4.	**Setting public goals and reaching them**	Set a goal and conduct a monitoring of the progress.	Kenya plans to create 1 billion of economic value using Open Data [45] . The value of projects and the savings of public sector funds are assessed.
5.	**Private and public sector partnership**	Together with private-sector companies, create initiatives to promote the creation and growth of new businesses that use Open Data.	The Australian government has set up a *DataStart* [46] incubator to promote data innovation in the country. Its goal is to select business ideas that actively use Australian Open Data and contribute to their development. The partners of this initiative are Google and Optus.
6.	**Awards**	Organise contests and awards for companies, public bodies, research body, educational body, and civil society actively using Open Data.	The Spanish government organizes the Aporta Awards [47] , in which the commission evaluates the participating projects and award them awards.
7.	**Engagement funds**	Provide funding mechanisms for Open Data based projects.	Ireland has set up the "Open Data Engagement Fund". This is a competitive fund designed

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[43] https://fishackathon.co/

[44] http://www.opendata500.com/au/

[45]

https://www.mckinsey.com/~/media/mckinsey/industries/public%20sector/our%20insights/how%20government%20can%20promote%20open%20data/how_govt_can_promote_open_data_and_help_unleash_over_$3_trillion_in_economic_value.ashx

[46] https://www.pmc.gov.au/news-centre/data/datastart

[47] http://datos.gob.es/en/premios-aporta

No.	Tool	Description	Example
			to provide support towards promoting the use of open data on the national Open Data portal data.gov.ie[48].

The promotion of Open Data to organisations

The promotion of Open Data in organisations usually starts with the training of public servants. Indeed, public servants should have the knowledge and skills to prepare, clean, publish and implement Open Data initiatives. Training can include topics, such as 1) basic principles of Open Data, 2) how to use Open Data as a tool for addressing policy challenges, 3) case studies on benefits, 4) data science skills, 5) and practical aspects of discovery, publication, the Law and licensing.

Nonetheless, even with the provision of all tools for publishing Open Data, authorities may not be interested in opening data due to lack of motivation or knowledge about the possible benefits. Therefore, it is important to properly inform, as well as publicise the contributions of each organisation in the Open Data field. The following table describes the tools for promoting Open Data in the institutions.

Table 6 – Tools for promoting Open Data to organisations

No.	Tool	Description	Applied in
1.	**Promotion of organisations (institutions) publishing Open Data**	Indicate how many datasets were published by the organisation, how many times they were used, how many users subscribe to the data of the organisation, the quality of the datasets. Those organisations, which publish the highest number of datasets (or with the highest quality) could be distinguished on the Open data portal as "success stories".	France Spain Ireland
2.	**Map of initiatives**	Create a map of initiatives that shows the regional Open Data initiatives carried out by local, national and regional administrations and universities.	Spain[49]
3.	**Open Data champions**	Establish the network of Open data champions of employees at management level. Their task is to encourage the publishing and use of Open Data within the organisation and the public sector as a whole. One or several employees per institution should receive training about Open Data benefits.	Australia[50]

Collect user feedback and provide new means of communication between Open Data providers and users

The true potential of Open Data can only be unleashed by releasing the right datasets for data consumers. In this context, Open Data portal should provide mechanisms for communicating wishes and feedback from data consumers to data providers. In particular, the Open Data portal should provide:

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[48] https://data.gov.ie/pages/open-data-engagment-fund

[49] http://datos.gob.es/en/iniciativas

[50] https://www.pmc.gov.au/sites/default/files/publications/Implementation%20of%20the%20Public%20Sector%20Data%20Management%20Report.pdf

- Means to directly contact Open Data providers: this can be done through the website or by referring an email address in the metadata of specific datasets. There should also be a facilitation mechanism to connect data consumers and data providers. For example, on the website, clear indication of "data domains / themes" could be available for selection in the request, so that the request can be directed to the right data provider (e.g. environmental data – water quality).

- Group discussion / forum for Open Data consumers.

- Feedback button on the Open Data portal, and on each dataset in order to collect diverse feedback and improve both the data and the platform.

- Communication options (e.g. a "Contact us" or "Feedback" button, or comment/ discussion section) to invite relevant end-users to participate in:

  o open consultation rounds (e.g. https://www.keskkonnaagentuur.ee/et)

  o review new development of the portal, public e-service development

  o submit good ideas

  o get involved ("Submit your data" , "Get involved" – getting involved as volunteers with different projects or by recording observation) .

  o a mechanism for data users to rate data sets; assess the data services

  o a discussion forum for data users, which would facilitate the dialogue and exchange between open data   users (e.g. developers, volunteers, universities, research institutes and centres, NGOs, citizens etc.)

Feedback collection and experience sharing on the Spanish Open Data portal[51]

The Spanish Open Data portal provides functionalities to share one's experience with Open Data, and also to report feedback on the website.
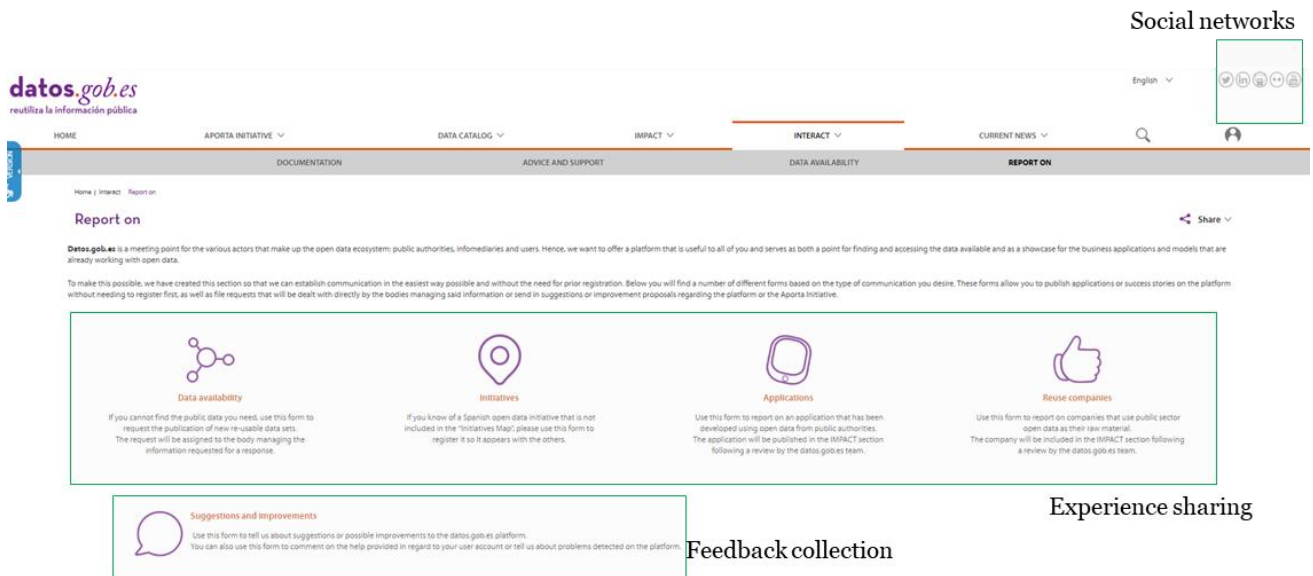

Figure 19 - Open Data portal in Spain, user feedback collection and experience sharing

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3 Conclusion/recommendations

In EaP countries environmental information and data sharing and dissemination are at the moment mostly managed by environmental institutions independently. This results in silos approaches and data is often multiplied across portals. This report highlighted several important good practices for sharing and disseminating environmental information and data. As such, it aimed at starting to bridge the gap between Open Data, e-government and environmental information and data.

In this regard, the most important points from this report are 1) the necessity to establish a single web access-point for environmental information and data, 2) to define a homogenous and interconnected vision for open data, e-government, and thematic data (i.e. environmental data, spatial data, health data, transport data, etc.), 3) to leverage on established Open Data e-government infrastructure, 4) to improve the technological and organisational mechanisms for monitoring and sharing environmental data, and 5) to define and use metadata standards for describing environmental data.

The necessity to establish a single web access-point for environmental information and data

The report showed that there are two options for establishing a single web access-point for environmental information and data, namely "eco-portal". The first is to build a single "Eco-portal", which centralises all information. The second is to adopt an "interlinked" approach, where the portal can be connected to multiple other portals. In this context, it is important to note the initiatives done in the EU, such as INSPIRE or the environmental portal in Ireland. These are good example of how environmental data can be accessed centrally, starting either from a spatial perspective (INSPIRE) or a single web-portal perspective (Ireland). In any case, the "eco-portal" has to be user-friendly, easily accessible and provide an easy way to search for environmental data.

Besides, it was also demonstrated that Open Data portal can be used to publish environmental data. In fact, these portals remain the main tools for sharing a wide range of public sector information, and the integration of these portals with the "eco-portal" would give great benefits.

Defining a homogenous and interconnected vision for open data, e-government, and thematic data

Most countries in the world have a silo approach towards Open Data, e-government and thematic datasets management. Such approach often prevents the leverage of open data and e-government initiatives on sharing and dissemination of environmental information. Sometimes, it also results in the duplication of systems and in a lack of clarity for environmental information from a user perspective.

As such, establishing the vision for e-government and Open Data should be made in consultation with thematic owners, namely, "environmental, health, energy and transport data owners". From this perspective, common initiatives for improving for instance "metadata standards", "interoperability" and "e-services" could be foreseen beforehand.

Leverage on established Open Data e-government infrastructure

The isolation of environmental information systems with other public sector information systems sometimes leads to extra-costs and/or difficulties in data sharing. This is the case, for instance, of exchange of information between the Open Data platforms, environmental information systems and other thematic information systems (e.g. energy, health). As such, this report recommends institutions – especially environmental institutions – to work closely with the e-government responsible, taking into consideration plans for the future and existing interoperability solutions (e.g. data exchange standards, Cloud infrastructure, etc.). Besides, re-using existing solutions and/or basing new solutions on existing standards would reduce the workload from environmental

institution to focus their IT workforce on finding technological solutions for improving environmental data monitoring, sharing and dissemination solutions.

Improving the technological and organisational mechanisms for monitoring and sharing environmental data

At the moment, many environmental institutions in EaP countries could benefit more from a better use of resources and/or material for monitoring, sharing and disseminating environmental information and data. In particular, environmental data is often not connected to spatial, health, transport or energy data. This results in sparse datasets published on a range of portals. Technologies to automatically exchange and connect this information are also often missing. As such, the provision of improved technological, organisational and legal solutions for monitoring, sharing and disseminating environmental information are crucial.

Defining and using metadata standards for describing environmental data

A pre-requisite for finding and sharing data automatically is the presence of metadata. Indeed, without good metadata, it is likely that datasets, reports, etc. won't be easily discoverable, even using an advanced search engine. EaP countries currently do not implement any environmental metadata standard for publishing environmental data, with the exception of data published on the Open Data portal. As such, the definition and usage of a metadata standard for environmental data is crucial. Ideally, the definition of such standard should be done in consultation of neighbouring countries to ensure interoperability. Indeed, such interoperability would enable sharing cross-border data automatically. In this context, the EU has developed the DCAT-AP metadata standard for publishing public sector information. Other variations of such standard are Geo-DCAT and Stat-DCAT, which provide a metadata standard for the description of geographic and statistical data.

In conclusion, multiple initiatives can be undertaken to foster dissemination and sharing of environmental information. Nonetheless, all should be undertaken in close collaboration with national stakeholders from Open Data and e-government initiatives. Where possible, it is recommend to adopt international standards and also to take a regional approach, which will enable cross-border data sharing.