Good practices on Open data and e-government for fostering sharing and dissemination of environmental information

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Legal notice

This report was produced by PricewaterhouseCoopers in cooperation with EEA as a part of the project for developing a roadmap and identifying feasible and practical means for integrating environmental information in national E-governance/Open data processes and platforms. This action was carried out in the context of the ENI SEIS II East project 2016-2020. The report is built on international best practices and country maturity reports and reflects proposed country roadmaps and showcases exemplar practices in the areas of the environmental information and data aggregation, management and dissemination.

This report contains information obtained or derived from a variety of publicly available sources described within the report in more detail. The report does not intend to be a comprehensive analysis of Open data and e-government best practices but a collection of the main elements shaping Open data and e-government domains across the international arena.

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List of abbreviations

Abbreviation	Explanation
API	Application Programming Interface
BPMN	Business Process Modelling and Notation
CC	Creative Commons
CDR	Central Data Repository
CEF	Connecting Europe Facility programme
CPSV	Core Public Service Vocabulary
CPSV-AP	Core Public Service Vocabulary Application Profile
CSV	Comma-Separated Values
DBF	dBase Database File
DCAT	Data Catalogue Vocabulary
DCAT-AP	DCAT Application Profile for Data Portals in Europe
DCMI	Dublin Core Metadata
DCTERMS	Dublin Core Metadata Terms
DSI	Digital Service Infrastructures
EaP countries	Eastern Partnership countries – Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova, Ukraine.
EC	European Commission
EEA	European Environment Agency
EEA 38	European Union Member States, together with Iceland, Liechtenstein, Norway, Switzerland and Turkey (EEA members) and Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia (cooperating countries)
EFTA	European Free Trade Association
eIDAS	Regulation (EU) 910/2014 on electronic identification and trust services for electronic transactions in the internal market
EIF	European Interoperability Framework
Eionet	European Environment Information and Observation Network

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Abbreviation	Explanation
EPA	Environmental Protection Agency
EPA Network	Network of the Heads of Enironmental Protection Agencies
E-PRTR	European Pollutant Release and Transfer Register
ETC/CDS	European Topic Centre on Catalogue of Data Sources
EU	European Union
GEMET	GEneral Multilingual Environmental Thesaurus
GeoDCAT-AP	DCAT-AP extension for describing geospatial datasets, dataset series and services
HBM4EU	Human Biomonitoring for EU project
HTML	Hypertext Markup Language
ICPDR	International Commission for the Protection of the Danube River
ICT	Information and Communication Technologies
INSPIRE	Infrastructure for Spatial Information in the European Union
ISO	International Organisation for Standardisation
JPEG	Joint Photographic Experts Group, file extension for a graphics file
JSON	JavaScript Object Notation
LCP	Large Combustion Plants
LOD	Linked Open Data
MDB	a file-extension used in certain versions of Microsoft Access databases
MEA	Multilateral environmental agreements
MLW	Marine Litter Watch
MoU	Memorandum of Understanding
NAIS	Nationwide Automated Information System
NFP	National Focal Point
NRC	National Reference Centre
ODC	Open Data Charter
ODGB	Open Data Governance Board

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Abbreviation	Explanation
ODS	OpenDocument Spreadsheet
OGC	Open Geospatial Consortium
PBWG	Public Bodies Working Group
PDF	Portable Document Format
PNG	Portable Network Graphics, file extension for a graphics file
PRTR	Pollutant Release and Transfer Register
PSI	Public Sector Information
RDF	Resource Description Framework
Report	Good Practice report, and/or Open data and E-government good practices for fostering environmental information sharing and dissemination
RESTful	Architectural style for an application programme interface (API) that uses HTTP requests to access and use data
SDGs	Sustainable Development Goals
SDI	Spatial Data Catalogue
SDMX	Statistical Data and Metadata eXchange
SEIS	Shared Environmental Information System
SEPA	Scottish Environment Protection Agency
SIRIP	State Information Resources Interoperability Platform
SLA	Service Level Agreement
SPARQL	SPARQL Protocol and RDF Query Language
StatDCAT-AP	DCAT-AP extension, 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.
TSV	Tab-Separated Values
TXT	a file extension for a text file
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme

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Abbreviation	Explanation
UNECE	United Nations Economic Commission for Europe
UNEP	UN Environmental Programme
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
USA	United States of America
VOCAB-DCAT	Data Catalogue Vocabulary
W3C	World Wide Web Consortium
XML	Extensible Markup Language

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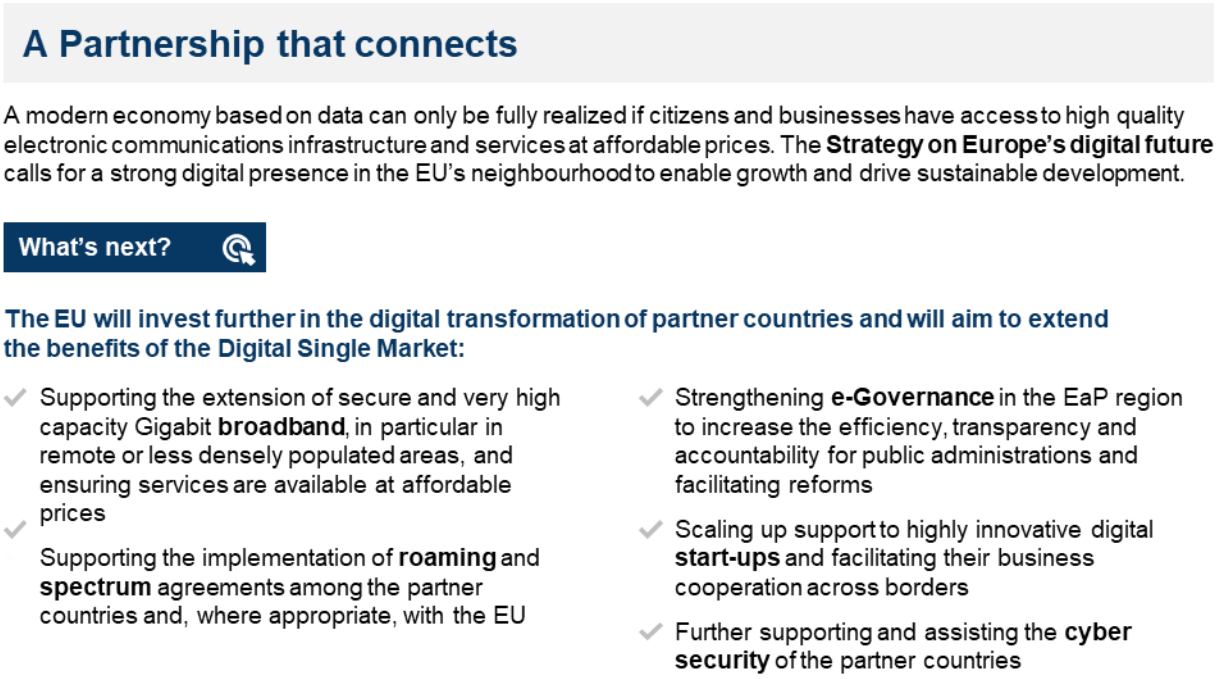
1 | Introduction

This report was compiled by PricewaterhouseCoopers as a part of the European Environment Agency (EEA) service contract No. 3437/R0-ENIE/EEA.57335 for developing a roadmap and identifying feasible and practical means for integrating environmental information into national E-governance/Open data processes and platforms. This action was performed in the context of the EU-funded ENI SEIS II East project 2016-2020, which targets Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova, and Ukraine – the Eastern Partnership countries (EaP).

The ENI SEIS II East project has been strongly embedded in the context of several international commitments and strategic documents1 related to the collection, update, sharing, dissemination and use of the environmental information. The selection of relevant examples includes:

- Eastern Partnership leaders' video conference (18th June 2020)[2];
- Report of the UN Secretary-General: Roadmap for Digital Cooperation (June 2020)[3];
- Eastern Partnership policy beyond 2020, Joint Communication to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions (18th March 2020)[4];

Figure 1 One of the five objectives of Eastern Partnership policy initiative (source: The Eastern Partnership beyond 2020: Reinforcing Resilience – a partnership that delivers for all, 2020)[5]



[1] The ENI SEIS II East project ended on the 31st of July, 2020.

[2] https://video.consilium.europa.eu/event/en/24035?start_time=0

[3] https://www.un.org/en/content/digital-cooperation-roadmap/assets/pdf/Roadmap_for_Digital_Cooperation_EN.pdf

[4] https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/joint_communication_on_the_eap_policy_beyond_2020.pdf

[5] https://www.euneighbours.eu/sites/default/files/publications/2020-03/EaP%20joint%20communication_factsheet4_EN_0.pdf

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- A European Strategy for Data, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (19th February 2020)[6];
- The European Green Deal (11th December 2019)[7];
- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (in particular Art 5) (Aarhus Convention) (25th June 1998)[8] and decision VI/1 of the Meeting of the Parties to the Aarhus Convention on promoting effective access to the information (14th September 2017)[9];
- The Kyiv Protocol on Pollutant Release and Transfer Registers to the Aarhus Convention (Protocol on PRTRs) (21st May 2003)[10];
- The Declaration on Cooperation on Environment and Climate Change in Eastern Partnership (18th October 2016)[11];
- The Batumi Declaration 'Greener, cleaner, smarter!' adopted by Ministers of the environment of the UNECE region calling to have SEIS in place in support to regular assessment in countries of UNECE region by 2021 (June 2016)[12];
- The 2030 Agenda for Sustainable Development (25th September 2015)[13].

SEIS principles also underpins the Good Environmental Governance flagship initiative of the EU. EEA is currently supporting this process in both the East and South European Neighbourhood countries in the context of dedicated projects currently running until the end of 2020.

In all countries of the Eastern Partnership, e-governance and Open data initiatives are recognised as mainstream for making data and information easily accessible to the policymakers, public and other stakeholders. Sharing environmental information through national e-governance and Open data frameworks, based on the Shared Environmental Information System (SEIS) principles[14], has gained an important development in recent years. Nonetheless, it could be further underpinned with a clearly developed vision and comprehensive roadmap for this specific area. The benefits of sharing, disseminating and promoting the use and reuse of information can support the governmental policies and actions in environmental and related areas as well as the transition towards a green and circular economy, innovation compliance with various reporting obligations, the implementation of various Sustainable Development Goals (SDGs). Furthermore, it can streamline efforts and reduce the reporting burden for the national bodies, by working together in a more structured and connected way. The ENI SEIS II East project was aimed to facilitate such exchanges and helped the EaP countries to advance in developing an Open data policy for the environment.

[6] https://ec.europa.eu/info/sites/info/files/communication-european-strategy-data-19feb2020_en.pdf

[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN

[8] https://unece.org/environment-policy/public-participation

[9] https://www.unece.org/fileadmin/DAM/env/pp/mop6/Decison_Excerpts_EN/AarhusConv_MoP6_Decision_VI_1_AI_e.pdf

[10] https://unece.org/environment-policy/public-participation/introduction-kyiv-protocol-pollutant-release-and-transfer

[11] https://ec.europa.eu/environment/international_issues/pdf/declaration_on_cooperation_eastern_partnership.pdf

[12] https://www.unece.org/fileadmin/DAM/env/documents/2016/ece/ece.batumi.conf.2016.2.add.1.e.pdf

[13] https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

[14] https://www.eea.europa.eu/about-us/what/shared-environmental-information-system-1/shared-environmental-information-system

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In the context of the ENI SEIS II project and beyond, the Good practices report (hereinafter – the Report) is an accompanying document to the Country maturity reports[15] and a potential source of inspiration when implementing the Roadmaps[16] proposed. There are many developments taking place in this dynamic area across the world and many of them could be used and reused by others when enrolling in this challenging journey. Furthermore, both the national Roadmaps proposed as well as the present Good practices report are focussing on environment as the centrepiece for attention and actions to be taken to increase accessibility, usability and sharing of existing environmental information, independent of the source and of providers.

The journey into the national systems demonstrated that environmental and related information are to be found in many places, in various forms and formats while their potential, especially in relation with each other, is very little exploited. Therefore, the modern technology of today, the new means of communication and exchange of data and information need to be applied more systematically in the environmental domain. This has to be coupled very closely with the new mind setting of the users and providers of environmental information, highlighting the value and benefits of sharing and exchanging information.

Similar to the structure of the national Roadmaps, the present Report is also structured along the three SEIS pillars: (1) Content, (2) Infrastructure and (3) Network. Reference to the content of the Good practices report is to be found in each national Roadmap and, furthermore, in each proposed action. Some of the chapter names might differ between the documents, therefore we provide an Annex 'How to read this report in relation to the EaP national roadmaps provided in the country maturity reports. In the Annex 1, we have cross mapped all Good practice section references in the country maturity reports with this good practice report. Overall, the message is clear: the journey might be challenging but is not a solitary one and we all can learn from each other!

This report is also a living document, where everyone enrolling in this voyage has something to add and something to share based on his own experience, local circumstances and available resources. Consequently, this report gives you only a glimpse of the many experiences available to be used and invites you to investigate further until finding the most relevant ones suitable to your own situation.

[15] As a part of the ENI SEIS II project, country maturity reports were prepared for 6 EaP countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine)

[16] Roadmap is one of the document sections in the country maturity reports. This section provides recommendations in regard to the key elements for ensuring coherent and effective Open data and environmental information management and for addressing the common challenges presented the country maturity report.

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2 | Good practices for fostering sharing and dissemination of the environmental information

2.1. Examples of policy frameworks facilitating sharing and dissemination of the environmental information

Environmental data, information sharing and dissemination is an integral part of the broader digitisation and digitalisation strategies. Its importance is embedded into the international agenda. Further in this section we present key international and EU level strategic documents, focused on digital agenda and data availability as well as on the environment.

UN Data Strategy (2020)[17]

United Nations (UN) Data Strategy aims to foster data-driven transformation. Three areas for data use were identified: (1) actions to deliver the Sustainable Development Goals by 2030, (2) actions addressing climate change and (3) actions focusing on gender equality. The document presents a framework for building data capabilities in the organisations, upskilling employees, nurturing centres of excellence, fostering data driven cultures, forming cross-functional teams and building partnerships.

UNDP Digital Strategy (2019)[18]

United Nations Development Programme (UNDP) Strategy is based on two key concepts: digitisation and digitalisation. Digitisation is understood as converting physical information into a digital format, such as automating a paper process that already exists. Digitalisation is overhauling the entire business model of an organisation, creating better ways of serving clients and partners.

In order to support the implementation of the strategy, a series of actions are planned to be initiated (UNDP Digital Strategy, 2019):

- investing ‘in new learning opportunities to create a common understanding of digital concepts and capabilities across the organisation’;
- building ‘a global network of Digital Champions, who will help to identify needs and support their colleagues in utilising digital technologies’;
- designing and implementing ‘rapid digital demonstration projects in all areas of UNDP work to demonstrate the potential of these technologies to both staff and UNDP partners’.

This strategy aims to build the cornerstone for digitisation of environmental data and information and to include the environmental domain into countries’ digital transformation.

[17] Data Strategy of the Secretary-General for Action by Everyone, Everywhere with Insight, Impact and Integrity <https://www.un.org/en/content/datastrategy/images/pdf/UN_SG_Data-Strategy.pdf>, 2020-2022

[18] UNDP Digital Strategy, <https://digitalstrategy.undp.org/>

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Report of the UN Secretary General: Roadmap for Digital Cooperation (2020)[19]

In June 2020, the Secretary-General of the UN published a report outlining a roadmap for digital cooperation. The report stresses the critical need 'for technology governance, made more urgent by the ongoing pandemic' (UN Secretary General, Roadmap for Digital Cooperation, 2020). The following five sets of recommendations on how the international community could work together to optimise the use of digital technologies and mitigate the risks, listed in the report, cover (1) building an inclusive digital economy and society, (2) developing human and institutional capacity, (3) protecting human rights and human agency, (4) promoting digital trust, security and stability and (5) fostering global digital cooperation. Report provides specific recommendations in terms of increasing global connectivity, digitalising public goods, fostering digital inclusion and global digital cooperation, building digital capacity and digital trust.

Proposal for a Regulation on European Data Governance (Data Governance Act) (2020)[20]

On 25 November 2020, the European Commission (EC) proposed a Regulation to better exploit the merits of ever-growing data in the European Union. Currently the amount of data generated by the public authorities, business and citizens is expected to multiply by five times until 2025. Therefore, the EC proposed a new Regulation for facilitating data sharing across the EU and between sectors. The Regulation also aims to offer an alternative European model to data handling practice of major tech platforms. Delivering on the announcement in the data strategy, the Regulation will create the basis for a new European way of data governance that is in line with EU values and principles, such as personal data protection, consumer protection and competition rules[21] (EC, Commission proposes measures to boost data sharing and support European data spaces, 25 November 2020).

The proposal is one of the developments related to The European Green Deal implementation (see below for more information).

The proposal for the Regulation includes:

- A number of measures to increase trust in data sharing, as the lack of trust is currently a major obstacle and results in high costs;
- Creation of the new EU rules on neutrality to allow novel data intermediaries to function as trustworthy organisers of data sharing;
- Measures to facilitate the reuse of certain data held by the public sector. For example, the reuse of health data could advance research to find cures for rare or chronic diseases;
- Means to give Europeans control on the use of the data they generate, by making it easier and safer for companies and individuals to voluntarily make their data available for the wider common good under clear conditions (EC, Commission proposes measures to boost data sharing and support European data spaces, 25 November 2020).

[19] Roadmap for Digital Cooperation, <https://www.un.org/en/content/digital-cooperation-roadmap/assets/pdf/Roadmap_for_Digital_Cooperation_EN.pdf>

[20] Proposal for a regulation of the European Parliament and of the Council on European data governance (Data Governance Act) <https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=71222>

[21] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2102

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The proposal for the 8th Environment Action Programme (2020)[22]

In October 2020, the EC published a proposal for the 8th Environment Action Programme (EAP) as a response to unprecedented environmental, climate and sustainability challenges that Europe is currently facing. The 8th EAP proposal forms the EU's basis for achieving the 2030 Agenda for Sustainable Development and its Sustainable Development Goals and calls for active engagement of all stakeholders at all levels of governance, to ensure that EU climate and environment laws are effectively implemented. The 8th EAP proposal of the European Commission (2020)[23] aims to:

- Achieve the 2030 greenhouse gas emission reduction target and climate neutrality by 2050;
- Enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change;
- Advance towards a regenerative growth model, decouple economic growth from resource use and environmental degradation and accelerate the transition to a circular economy;
- Pursue a zero-pollution ambition, including air, water and soil and protect the health and well-being of Europeans;
- Protect, preserve and restore biodiversity and enhance natural capital (notably air, water, soil, and forest, freshwater, wetland and marine ecosystems);
- Reduce environmental and climate pressures related to production and consumption (particularly in the areas of energy, industrial development, buildings and infrastructure, mobility and the food system).

In order to measure and communicate the achievement of the set objectives, the 8th EAP proposal also suggests 'setting up a new monitoring framework'.

European Digital Strategy (2020)[24]

EU has adopted European Digital Strategy in a response to the needs of the EU countries to modernise information systems, bring the information faster in the hands of the public and also to start using and blending various sources of information with the help of the modern technology. European Digital Strategy is based on four main pillars:

- Technology that works for people. Development, deployment and uptake of technology that makes a real difference to people's daily lives. A strong and competitive economy that masters and shapes technology in a way that respects European values.
- A fair and competitive digital economy. A frictionless single market, where companies of all sizes and in any sector can compete on equal terms, and can develop, market and use digital technologies, products and services at a scale that boosts their productivity and global competitiveness, and consumers can be confident that their rights are respected.
- An open, democratic and sustainable digital society. A trustworthy environment in which citizens are empowered in how they act and interact, and of the data they provide both online and offline. A European way to digital transformation, which enhances our democratic values, respects our fundamental rights and contributes to a sustainable, climate-neutral and resource-efficient economy.
- Europe as a global digital player. The EU is committed to setting global standards for emerging technologies and will remain the most open region for trade and investment in the world, provided that anyone who comes to do business here accepts and respects our rules (EC, Shaping Europe's digital future, 25 November 2020).

[22] The proposal for 8th Environment Action Programme <https://ec.europa.eu/environment/pdf/8EAP/2020/10/8EAP-draft.pdf>

[23] The proposal for 8th Environment Action Programme <https://ec.europa.eu/environment/pdf/8EAP/2020/10/8EAP-draft.pdf>

[24] The European Digital Strategy <https://ec.europa.eu/digital-single-market/en/content/european-digital-strategy>

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The European Data Strategy (2020)[25]

'The Data Strategy and the White Paper on Artificial Intelligence are the first pillars of the new digital strategy of the European Commission. They all focus on the need to put people first in developing technology, as well as on the need to defend and promote European values and rights in how' technology is designed, made and deployed in the real economy (EC, 2020)[26]. According to the recently released European Data Strategy (2020)[27], the European Commission aims to:

- Adopt legislative measures on data governance, access and reuse, for example for government-to-business data sharing based on the public interest;
- Make data more widely available by opening up high value publicly held datasets across the EU and allowing their reuse for free;
- Develop data processing infrastructures, data sharing tools, architectures and governance mechanisms for thriving data sharing, and to federate energy-efficient and trustworthy cloud infrastructures and related services by investing in a European High Impact Project;
- Enable access to secure, fair and competitive cloud services by facilitating the set-up of a procurement marketplace for data processing services and creating clarity about the applicable regulatory framework;
- Empower users to stay in control of their data and investing in capacity building for small and medium-sized enterprises and digital skills;
- Foster the roll out of common European data spaces in crucial sectors, such as industrial manufacturing, green deal, mobility or health.

The European Green Deal (2019)[28]

In November 2019, European Commission released a Communication on the European Green Deal. The European Green Deal is EU's plan to make the economy sustainable by addressing such challenges as climate change and environmental degradation. The key goal is to create resource-efficient and competitive economy, where (1) there are no net emissions of greenhouse gases by 2050, (2) economic growth is decoupled from resource use, and (3) no person and no place is left behind.[29]

The European Green Deal (2020)[30] provides an action plan to (1) 'boost the efficient use of resources by moving to a clean, circular economy', (2) 'restore biodiversity' and (3) 'cut pollution'. The plan outlines investments needed and financing tools available. It explains how to ensure a just and inclusive transition.

It is stated in the European Green Deal (2020)[31] that reaching the target of becoming climate neutral by 2050 will require actions including:

- investing in environmentally friendly technologies;
- supporting industry to innovate;
- rolling out cleaner, cheaper and healthier forms of private and public transport;
- decarbonising the energy sector;
- ensuring buildings are more energy efficient;
- working with international partners to improve global environmental standards.

[25] The European Data Strategy <https://ec.europa.eu/digital-single-market/en/european-strategy-data>

[26] https://ec.europa.eu/digital-single-market/en/european-strategy-data

[27] https://ec.europa.eu/digital-single-market/en/european-strategy-data

[28] The European Green Deal <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN>

[29] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[30] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[31] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

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The EU also envisaged financial support and technical assistance (called the Just Transition Mechanism) to help those most affected by the move towards the green economy.

2.2. Learning from others' experiences on e-government

E-government concept covers multiple country policy domains, including the environment. It also serves as the cornerstone for further development of specific policy areas. This section presents good practices in setting-up the policy framework for e-government development.

2.2.1. Sharing experience in terms of Content

This section describes steps for establishing a clear, transparent and consistent policy framework that can integrate environmental data and information monitoring and dissemination initiatives into e-government.

Building a digital strategy, which considers the environment

Digital strategy is understood as a concept that touches upon and is relevant to all country policy domains, including environmental policy. Each EaP country has developed a digital agenda (or strategy) that unfolds the vision for the country in terms of the use of technology (e.g. cloud infrastructure, e-signature, e-services, etc.). However, they could benefit even more from specific digital strategies focused on the key priorities and connected with an action plan for its implementation. Digital strategy and its governance mechanism should be developed in coordination with high-level government officials and engaging all stakeholders involved in the environmental, health, land administration, social security, emergency preparedness, transport, energy and other sectors. Following best international examples (e.g. the EU digital strategy), digital strategies usually comply with the structure presented below:

1. **The Status Quo**: provide a short summary of the main initiatives undertaken since the last strategy, the elements remaining to be implemented and main results.
2. **Vision**: the vision should briefly describe the future organisation of work of the public authorities and their interactions with businesses and the public (e.g. statements could be formulated in the following way: 'organisations will leverage on robotic and artificial intelligence technologies to communicate with the public on simple requests'; 'everyone will have the possibility to access an integrated database with all relevant registers'). The vision, in general, addresses a period of up to ten years, and briefly describes the main elements of the strategy.
3. **Strategic priorities and objectives**: define the priorities and objectives that need to be achieved in order to translate the vision into practice and describe why these priorities and objectives are important for the country. It also should consider the concept of high-value domains.
4. **Guidance on strategy implementation**: this section should provide insights over the high-level implementation mechanisms. It is also advised to emphasise mechanisms to leverage on international and national collaboration as well as private-public partnerships.
5. **Control measures**: define how the performance of the strategy implementation will be assessed by identifying (1) specific indicators, (2) their values to be achieved within a certain time frame and (3) public authorities responsible for specific indicators. Separately from the strategy document, a technical specification should be prepared, describing in detail monitoring structure and procedures.
6. **Budget and funding available**: state the resources assigned for the realisation of these objectives.

To leverage on international collaboration, the strategy should be made available online and preferably accessible in both national and English language. Many EU countries have developed comprehensive digital strategies; an example of the Lithuanian digital strategy is provided in the case study below.

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Digital Agenda for Lithuania

Content

The Information Society Development Programme for 2014–2020 'Digital Agenda for the Republic of 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 deliver innovative e-services, provide access to information, 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 their use;
- Promotion of Lithuanian culture and Lithuanian language by ICT measures;
- Encouragement of businesses to use ICT;
- Development of the ICT infrastructure, ensuring the development of safe, reliable and interactive ICT infrastructure.

Environmental aspect

The Digital Agenda implementation plan touches upon environmental aspects specifically through the implementation of e-services and ICT products for spatial data management. The effort is co-lead by the Ministry of Environment together with the Ministry of Agriculture and the Ministry of Transport and Communications.

One of the projects being implemented is specifically related to the spatial data management – 'Development of the Lithuanian spatial information infrastructure by implementing the provisions of the INSPIRE Directive regarding the interoperability of spatial data sets and services. The project is being implemented at the time of the preparation of this report.

Sources: https://eimin.lrv.lt/uploads/eimin/documents/files/30310_LRV%20nutarimas(en).pdf
https://esinvesticijos.lt/

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

E-services allow the public to access public services through modern devices, e.g. they allow to engage the public in environmental monitoring and protection. Hence, they should be easily and simply accessible in a standard way for a broad range of customers (regardless their citizenship or domicile). The potential cost savings of implemented e-services usually are significant. For example, in Denmark, electronic invoicing saves taxpayers €150m and businesses €50m a year[32].

E-services should be built according to the standards defined in an interoperability framework. Building blocks, such as e-signature, should be developed as reusable components. The European Commission, for example, launched the Connecting Europe Facility (CEF) programme. The CEF funds are 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 national project to facilitate the delivery of digital public services across borders and sectors. Currently, there are seven building blocks: Context Broker, e-Archiving, e-Delivery, e-ID, e-Invoicing, e-Signature and e-Translation. Lately, three additional building blocks have been released at the end of 2018[33]: Big Data Test Infrastructure, e-Archiving and Context Broker.

In addition, some countries, such as Estonia, developed tools that standardise integration and data exchange amongst multiple information systems, transmitting large data sets and performing searches across several information systems simultaneously[34]. A case study for Estonia's X-Road project is presented below.

[32] https://ec.europa.eu/digital-single-market/en/policies/egovernment

[33] https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/2018/11/08/Meet+the+new+CEF+Building+Blocks

[34] https://e-estonia.com/solutions/interoperability-services/x-road/

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Project X-Road, Estonia

Content

Estonia has developed X-Road tool that allows government information systems to interact and exchange data when delivering integrated e-services.

X-Road is a decentralised system in which unified interfaces and protocols for information system interaction and data exchange are defined. Commercial IT systems can also interact with X-Road and use standard interfaces and protocols after authentication.

The data exchange layer in X-Road was launched in 2001 and has since, become the standard platform for streamlining services between government agencies in Estonia.

Environmental aspect

The X-Road was directly used for the environmental domain, as environmental data exchange (e.g. in the geospatial area) is one of key pillars of country e-services development.

The tool ties eight building blocks of e-Estonia. Environmental e-services are mainly included under the building block 'Business and Finance'. Here businesses can enter declarations, apply for environmental permits and pay environmental fees in one digital environment.

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

Source: https://e-estonia.com/solutions/interoperability-services/x-road/

Presenting e-services on a dedicated portal

E-services or e-government portals are developed as a single-entry point to all country's public services that are provided digitally. The level of development of the e-government portal varies a lot among the EaP countries. For instance, Azerbaijan e-government portal provides sign-in options using e-signature, mobile ID or a given password. The e-government portal of Armenia redirects the user to the websites of the relevant institution to proceed with the service request.

It is considered a good practice to group the services by categories or major life and business events[35].The examples below (the UK and Lithuania e-government portals) showcase the e-service structured by event or category.

E-Government portal in the UK

Content

The UK government provides a portal (gov.uk) for accessing government services and Open Data. GOV.UK is the main portal of the UK government. Access to e-government services is provided through the individual registration to service, or through the usage of gov.uk Verify.

E-Government portal in Lithuania

Content

Lithuania's E-Government Gateway portal (www.epaslaugos.lt) is offering a one-stop-shop to public information and services for the public and businesses. The services in the portal are organised around life events (e.g. birth of a child, finding and/or losing a job) and business events (e.g. registration of the company). The categorisation of the services for thematic areas is provided as well (e.g. environment and agriculture, logistics and transportation, travel).

The portal can be accessed in Lithuanian and English.

[35] Life events are events which occur during the life of individuals and usually require specific government services. Typically, life events cover events such as 'birth', 'marriage', etc. Business events occur during the typical life cycle of the business, e.g. registering a company, paying taxes, issuing permits and licences.

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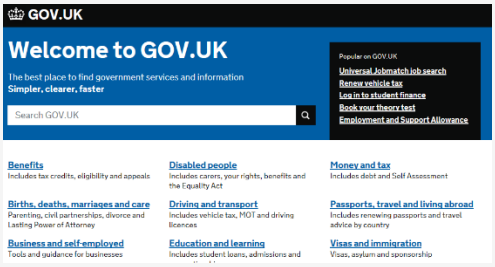
Environmental aspect

The environmental domain is reflected in a separate section 'Environment and Countryside'. An extensive list of environment- related e-services and additional information and advice is provided to the users, for example:

- guidance on coastal erosion;
- boat registration;
- fishing permits;
- reporting dead/stranded or wounded animals;
- land contamination;
- protected areas land management and other.



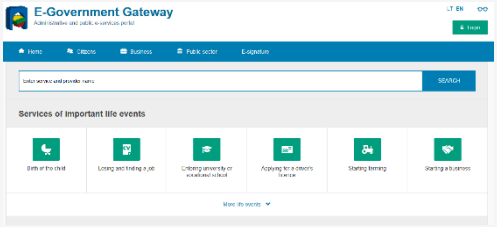
Source: www.gov.uk

Environmental aspect

E-Government Portal holds a section devoted to environment- related e-services, 'Environment and Agriculture'. The section lists 76 services.

62 % of the listed services are free of charge, e.g. providing environmental reports directly through the website, receiving direct link to Lithuanian spatial information portal, direct link to the State Geological Information System and application for a permit / issue of a duplicate permit for import / export / shipment of radioactive waste.

Payed services include, e.g. multiple environmental permits, license acquisition and corporate entity registration.



Source: www.epaslaugos.lt

A dedicated national environment information system can also be built around multiple systems, which are interoperable, based on a national interoperability framework. In this case, systems must follow certain rules to be compatible. Each public authority can have its own system adapted to specific processes. The information system can be built and maintained in house or outsourced. In any case, all systems should follow the same design rules and ensure an efficient and unified exchange of data.

The development and/or modernisation of a national environmental information system should consider interoperability with statistical, health, geospatial and other information systems. The example of Ukraine is presented in the case study below.

Ukrainian Government adopts the concept of a nationwide automated system 'Open Environment'

Content

The system will integrate environmental data of the central public authorities and local governments into one electronic database.

Open environment provides public access to Environmental public authorities' data base, transfer of chemical and radioactive substances and additional environmental country legislation.

Environmental aspect

Environmental e-services provided to citizens and business are fully functioning.

Citizens can request public environmental information, request public consultations or public examination if deemed necessary.

Businesses can apply for environmental licences, submit waste declarations or apply for an Environmental impact assessment.

Source: Ministry of Ecology and Natural Resources webpage: <https://mepr.gov.ua/>

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Ideally, all public services should be described in a standard manner. In this context, the EU 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[36].

The Core Public Service Vocabulary Application Profile (CPSV-AP[37]) has been developed and is maintained by a Working Group composed of the Member States and the EU institutions' representatives, experts and academia in the field of semantic interoperability and Open data. The CPSV-AP is used to ensure compatibility, integration and description of public services based on a standardised data model in countries such as Austria, Belgium, Estonia, Finland, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Slovakia, Spain, Sweden and the UK.

The experience of the Republic of Moldova in categorising and describing the central public services is presented in the case study below.

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

Content

The E-Government Centre of the Republic of Moldova prepared an inventory of all services provided by the public authorities. Each service was described according to the European Union Core Public Service Vocabulary (CPSV). As a next step, the services were categorised based on main types of public services (COFOG taxonomy) and classified according to life events to create more convenient access to services.

E-services are categorised into 5 main areas: modernisation, citizens, business, government and international section.

Environmental aspect

- Environmental e-services can be found in 'Business' and 'Citizens' sections.
- 'Business' section redirects to e-Licensing service page or special water use authorisation.
- 'Citizens' section redirects to special water use authorisation form or to the Open Data Portal.
- Categorisation of central public services allows for easier public service availability. The focus is on the public authority and/or agency providing the services rather than on a specific area for which the service was provided.

Source: https://egov.md/en

2.2.2. Sharing experience in terms of Infrastructure

This section describes steps for developing a functioning technical foundation, enabling the integration of environmental data and information monitoring and dissemination initiatives into e-government concept.

Developing an interoperability framework

Interoperability is the attribute that enables the unrestricted sharing of resources between different information systems and organisations. Currently, each EaP country has a room for improvement in this area: the dissemination of data and information as well as data flows are complex, usually not automated, and the information is often duplicated and shared with the public through different channels. Interoperability facilitates data flows/exchange among institutions and information systems and allows to reach resources more effectively and efficiently.

[36] https://ec.europa.eu/isa2/solutions/core-public-service-vocabulary-application-profile-cpsv-ap_en

[37] https://ec.europa.eu/isa2/sites/isa/files/isa2_-_leaflet_cpsv-ap.pdf

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Interoperability is to be achieved at different levels, namely:

- Legal;
- Organisational;
- Semantic;
- Technical.

In order to develop interoperability, it is necessary to use common processes, well defined and accepted standards, technologies, data exchange standards, etc.

A good way to ensure interoperability between information systems is implementing, for example, standardised web-services (i.e., Service Oriented Architectures) and interfaces where possible. The use of standards for common data structure is useful in reducing the complexity of systems and difficulties in the exchange of information (e.g. the description of specific elements, such as institution, person, can be done according to a single national or international standard). Another possibility to ensure the interoperability of the infrastructure and decrease the costs is to use Cloud solutions that include standard webservices and interfaces for data exchange. Cloud solutions usually apply well defined and accepted international standards to ensure compatibility of data and provide services across countries.

Interoperability can also be designed at multiple levels: (1) international, (2) national and (3) sectoral. It is up to each country to choose the right approach, taking into consideration multiple factors, such as user needs, international cooperation, skills available in the local market and budget. Examples of each approach could be the following:

- International: a country may choose to integrate an international standard, such as CPSV, to describe available public services.
- National: a country may define a national security standard for building interfaces between national information systems.
- Sectoral: a country may develop a national standard for the exchange of specific environmental data and another one for the exchange of health data between various public authorities at national and/or regional level.

In the EU, the EC provides guidelines for interoperability that the Member States are free to implement[38]. The new European Interoperability Framework (EIF)[39] was adopted on 23 March 2017. The framework provides guidance on how to set up interoperable digital public services. It gives recommendations on how to improve governance of interoperability activities, establish cross-organisational relationships, streamline end-to-end digital services and ensure that both existing and new legislation do not jeopardise the interoperability efforts. The EIF Conceptual Model is provided in the figure below.

[38] http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf

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

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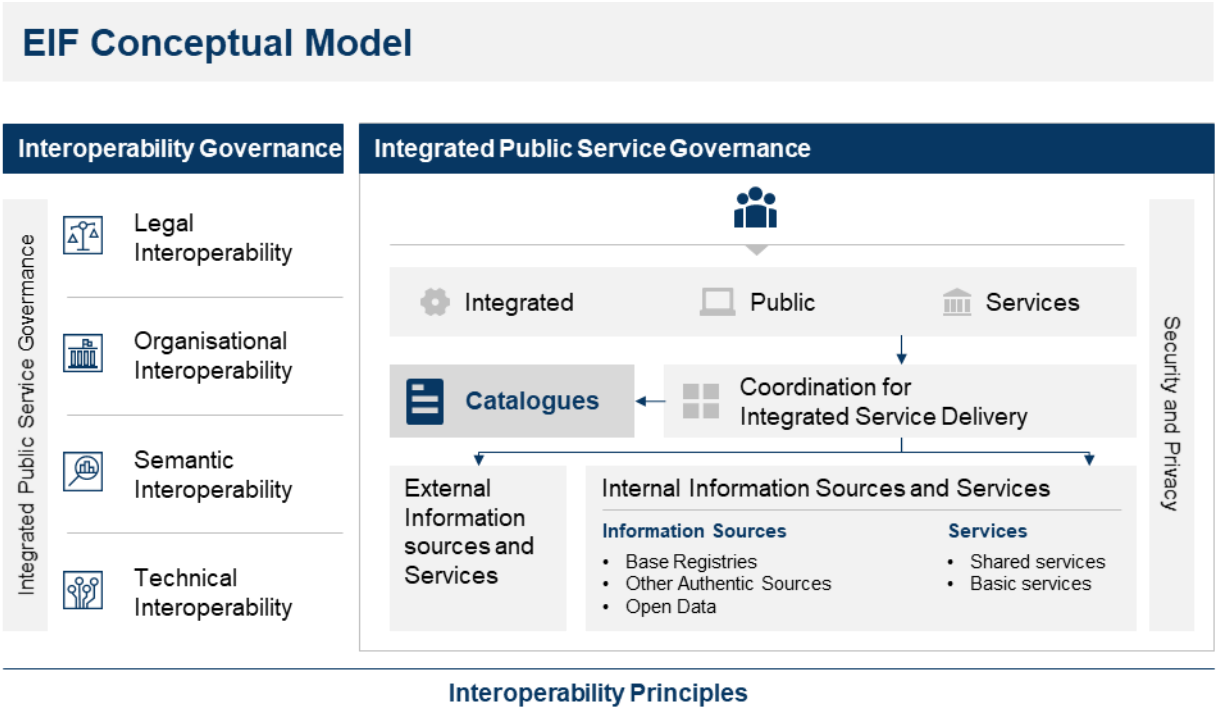
Figure 2 European Interoperability Framework Conceptual Model (source: European Union, 2017)[40]



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

1. **Legal interoperability** refers that organisations operating under different legal frameworks, policies and strategies can work together. To address this, it is necessary to ensure consistency of legislation by reviewing existing legislation to identify interoperability barriers, such as restrictions on data exchange and dissemination, data protection requirements. All legislation should be in line with the Directive on open data and the reuse of public sector information, also known as the 'Open Data Directive' (Directive (EU) 2019/1024). Open Data Directive entered into force on 16 July 2019 and provides a common legal framework for a European market for government-held data (public sector information). It is built around two key pillars of the internal market: transparency and fair competition.[41]
2. **Organisational interoperability** is concerned with how public authorities 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 public service users by making services available, easily identifiable, accessible and user focused.
    - **Business processes:** aligning business processes implies documenting them in an agreed way in which all public authorities that are contributing to the delivery of 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 public authorities. In practice, business processes should be documented using Business Process Modelling and Notation (BPMN) and updated frequently. They should be stored in a repository, ideally as a part of the Enterprise Architecture tool.

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

[41] Directive (EU) 2019/1024 of the European Parliament and the Council of 20 June 2019 on Open data and the reuse of public sector information <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019L1024&from=EN>

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- **Organisational relationships:** the relationship between public authorities must be clearly structured and documented. Examples of such instruments are Memoranda of Understanding (MoUs) on joint activities and cooperation and/or Service Level Agreements (SLAs) signed between public authorities.
- **Change management:** ensure the involvement of all participants and manage stakeholders adequately. Change management is the process of adopting all the changes, whether they are technical or process-oriented, across the organisation in question.

3. **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 different public authorities. It is recommended to use a standard vocabulary and a common format for collection and exchange of data and information. It is recommended to use international standards, such as RDF, and common vocabularies as described on the European Commission ISA Programme webpage[42].

Interoperability of public registers in Lithuania

Content

State Information Resources Interoperability Platform (SIRIP) 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 E-Government Gateway.

Data exchange platform offers data exchange services for governmental software.

Data is collected from multiple registers and can be provided in a single package for any registered governmental information system.

By using this approach, the Lithuanian government simplified data exchange and integration process among government information systems.

Environmental aspect

The information in Real Property Register, Address Register (which provides addresses also in a graphical format in connection with the maps) is provided by State Enterprise Centre of Registers. Some of the data in the national registers is provided through SIRIP as well.

Source: www.epaslaugos.lt, https://www.registrucentras.lt/en/

4. **Technical interoperability** covers the technical aspects of integrating information systems. It includes aspects, such as application programming interface (APIs) specifications, interconnecting services, data integration, data exchange. Interoperability standards should be enforced for the data providers in public organisations as well. For example, for this purpose, the UK publishes a charter for interoperability[43]. All data and information providers are required to comply with certain criteria for ensuring compatibility of data and software processes.

A good example of an interoperability platform (the case of Lithuania) is presented in the case study above.

The interoperability-related examples of EaP countries – Belarus and Ukraine – are provided in the case studies below. The developed solutions would benefit from being expanded to the environmental domain.

[42] http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action_en.htm

[43] https://www.wired-gov.net/wg/news.nsf/articles/techUK+launches+Interoperability+Charter+for+Health++Social+Care+16072015092500?open

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Development of the Nationwide Automated Information System (NAIS) in Belarus

Content

The NAIS is designed to integrate national information resources and automate the activities of public authorities in providing data exchange services to other public authorities, organisations and citizens.

The establishment of interdepartmental cooperation mechanisms allows public authorities to carry out their functions faster and more efficiently.

Environmental aspect

NAIS encompasses 28 national information sources, including the United State Register of Rights to Immovable Property and Transactions and Products purchased for state needs.

Currently, the system does not encompass Environmental data.

Source: https://portal.gov.by/

'Trembita' system in Ukraine

Content

An interoperability system of the state electronic information resources 'Trembita' was implemented by the Ministry of Digital Transformation of Ukraine.

'Trembita' platform connects multiple accredited centres for certification and enables secure data transfer between governmental agencies.

The Ukrainian system is developed following the Estonian X-Road system example and has similar capabilities.

Main function is to secure data transfer between governmental and business or private entities – therefore there is no direct link with any of governmental areas.

'Trembita' acts as an enabler of the e-service to be presented in one webpage for the end user.

Environmental aspect

E The services provided by the Ministry of Ecology and Natural Resources, or related to the environmental domain are currently not available as e-services.

Source: https://trembita.gov.ua/ua

Developing integrated environmental monitoring at the national level

In general, most EaP countries have monitoring systems dedicated to the various environmental domains (air, water, etc.) resulting in numerous and sometimes parallel channels for collecting the environmental data and information. The gradual development of the environment monitoring systems reflected the national priorities and the level of knowledge and understanding of each particular domain. Each institution, especially at the national level, was developing its own information and exchange mechanism and was using technologies and software rather in isolation. In most cases, as currently the case of EaP countries, this development was mostly project driven. This diversity led to incompatibility among systems and consequently the impossibility for data aggregation, exchange and reuse.

The maturity reports of the six EAP countries highlighted the efforts made towards improving the national environmental monitoring systems by gradually connecting the existing information modules, streamlining the information flows from local to national and reducing the time span between collection and publishing of data and information. These efforts require designing an integrated monitoring system concept at the national level, where existing information modules and the new one to be developed are seen as parts of one integrated system, where all modules are connected and interoperable, and act as providers and users of information at the same time.

An example of the efforts undertaken in this respect is provided by Belarus and summarised in the case study below.

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National Environmental Monitoring System (NEMS) of Belarus

In Belarus the most comprehensive framework for managing environmental information is the National Environmental Monitoring System coordinated by the Main Information and Analytical Centre of the National Environmental Monitoring System (NEMS). NEMS was established in 1993 and aims to ensure the availability of environmental information at all levels of government as well as to support the implementation of international agreements.

NEMS covers 12 thematic environmental monitoring areas: land monitoring; surface water monitoring; groundwater monitoring; air monitoring; ozone layer monitoring; flora monitoring; forest monitoring; wildlife monitoring; radiation monitoring; geophysical monitoring; local environmental monitoring; complex ecosystem monitoring in specially protected natural territories.

The organisation of monitoring activities is carried out by:

- the Ministry of Natural Resources and Environmental Protection and its entities in terms of atmospheric air, surface water, groundwater, radiation and local environmental monitoring;
- the Ministry of Education (specifically Belarusian State University, National Scientific Research Centre for Monitoring the Ozonosphere) regarding ozone layer monitoring;
- the National Academy of Sciences regarding monitoring of flora and fauna, geophysical monitoring and integrated monitoring of natural ecological systems, including protected natural areas;
- the Ministry of Forestry regarding forest monitoring;
- the State Committee on Property regarding the monitoring of land.

The Main Information and Analytical Centre under auspices of Republican Centre for Hydrometeorology, Control of Radioactive Contamination and Environmental Monitoring 'Belhydromet' is responsible for managing the information exchange and maintenance of NEMS website.

NEMS website provides public access to the public to reports on various environmental topics. Annual reports on land, surface and underground water, air, ozone layer, flora, fauna, radiation and the state of ecosystems, as well as quarterly reports on air, water and soils, are published on the website. However, no underpinning data can be machine-readable or downloaded; data is only available in the form of reports and in PDF format; no data visualisation tools are used. The portal, as well as the reports, are available in Russian language only.

Source: http://www.nsmos.by

Another example of monitoring system, which has evolved, expanded and modernised in recent years is the case of Bulgaria presented below.

National System for Environmental Monitoring in Bulgaria

'The National System for Environmental Monitoring was developed to provide timely and reliable information and data on the environment and the factors affecting it. The aim is to maintain information, which is used to base analyses, assessments and forecasts to support the activities of preserving and protecting the environment from harmful effects.

The system is managed by the Ministry of Environment and Water through the Executive Environment Agency. The latter also administers the National System for Environmental Monitoring, providing material, technical, methodological and software-related resources necessary for its operation and continued development.

The National System for Environmental Monitoring covers the national monitoring networks for ambient air, precipitation, surface water, groundwater, seawater, geological environment, soil, forests, protected areas, biological diversity, radiological and non-ionising radiation and environmental noise pollution.

All environmental monitoring activities are carried out by the structures of the Agency in accordance with unified methods for sampling and analysis and standard procedures to ensure the quality of the environmental information and data'.

Source: EPR Bulgaria 2017, p 87 at: https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE.CEP.181.pdf

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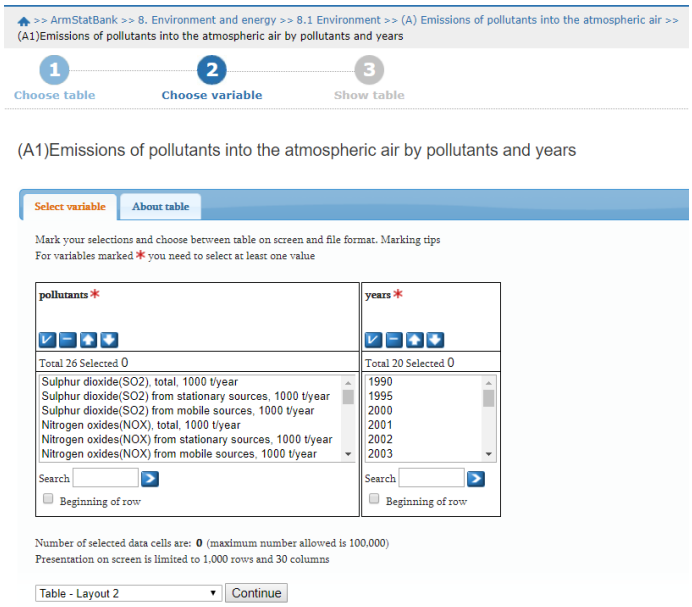
It is further recommended to develop an integrated environmental information system based on SEIS principles to support the environmental monitoring, facilitate the integration of its components and improve the access and sharing of available information. The development of the system needs to be based on the use of open application programming interface, RSS feeds and other interoperability tools in accordance with open data framework. As a result of this development, important progress will be achieved in terms of the environmental monitoring data and information discoverability and accessibility within the nationwide environmental information system.

Developing user-friendly functionalities for accessing data and statistics

All EaP countries have Statistical Committees with clear tasks in providing statistical information, including related to the environment, and are using dedicated statistics portals, which provide access to the latest environmental statistics. In most cases, these portals would benefit of advanced data visualisation and comparison features across time and geographic scope.

In this case, Armenia is a good practice example. The Statistical Committee developed a portal (http://www.armstatbank.am/), where the public can easily select the statistics they want to consult and generate a graphical representation of it depending on a selection of data filters. The portal is also available in English.

Figure 3 Internet portal of the Statistical Committee of the Republic of Armenia (source: Armstatbank.am, May 2020)[44]



Environmental statistics can be selected and refined according to specific criteria (e.g. pollutants in the picture above) and for different time intervals. The portal enables visualising the data in a graph or a table format as well as exporting the data in multiple (human-readable or machine-readable) formats.

[44] https://armstatbank.am/pxweb/en/

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2.2.3. Sharing experience in terms of Cooperation (Network)

This section describes the steps to be taken for the development of the third ENI SEIS pillar – cooperation (network). Creating a platform for internal (within public authorities, i.e. employee support) and external (the public and business in general) support will contribute to the effective implementation of e-government initiatives related to environmental data and information monitoring and dissemination.

Increasing awareness and motivation among public authorities on the benefits of using e-government and digital solutions

The digitisation of public authorities is fast and sometimes hard to cope with for civil servants. As such, any e-government projects should undertake change management activities, such as:

- Develop and organise regular training modules dedicated to build awareness about the new tools and technologies and to develop required skills to use them.
- Gradually introduce digital solutions to allow staff to get familiar and embrace the change.
- Whenever providing a new solution, ensure that IT equipment and infrastructure are relevant to support expected improvements (existing technology may be insufficient to upgraded solutions).
- Designate dedicated 'e-government champions' for each e-government project. Dedicated 'champions' should have the necessary expertise in a specific e-government field and leadership skills to guide colleagues – public servants – through the change.
- Involve civil servants (e. g. 'e-government project champions') in the development of digital solutions from the beginning. This can be done through the participation in the dedicated working sessions.
- When choosing between e-government initiatives, focus first on initiatives which target 'low hanging fruits' – quick wins motivating civil servants to continue active participation in the upcoming change.

The 'Electronic Government for Developing Countries report' from the International Telecommunication Union[45] recommends creating 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 encourage employees' motivation, and to provide required opportunity and structure to share knowledge and build the requisite information and communication technology (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.

According to an EU study[46] prepared by Capgemini Consulting and Euro chambers entitled 'The performance of the points of Single Contact', the user support is important to create effective e-government solutions. 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 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 regard to user support should receive more attention. The first step in this respect would be to provide assistance in other languages than the national language.

All in all, information about public services should be presented online in a harmonised, organised way, and constantly updated to ensure that users receive the best information available.

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

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

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Raising awareness on the benefits of using e-government solutions by the public and business community

Governments should pro-actively strive to increase awareness, promote and popularise e-government services and the usage of solutions (e.g. e-service portal, e-signature) for environmental domain. One of such good practice examples is ISA² Programme, which is presented in the case study below.

Activities that can be undertaken include:

- Advertising the use of e-services for various environment-related needs (e.g. eco-permit renewal, etc.) by communicating the benefits of online services, such as opportunity to save time and/or money, convenience, etc.;
- Promoting the use of e-government technologies (e.g. e-signature) (1) during engaging events, seminars or trainings dedicated to the topic, and (2) by distributing guidelines explaining the use of chosen technologies briefly and in an attractive way;
- Establishing/improving public-private partnerships for the development of e-government solutions (e.g. collaboration between businesses and the government for the development of automated data exchange, cloud services and e-signature).

EU ISA² Programme – Interoperability solutions for public administrations, businesses and citizens

Content

The ISA² programme stands for Interoperability solutions for public administrations, businesses and citizens. The programme provides a set of tools for communicating with citizens, for instance:

- Sharing and reuse awards;
- Solutions implemented per country to foster e-Government and interoperability;
- Events;
- News and blogs.

Environmental aspect

One of the notable improvements provided by the interoperability is the increased quality of environmental data provided by the EU Member States via data exchange.

Source: ISA² Dashboard: <https://ec.europa.eu/isa2/dashboard/>

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2.3. Learning from others' experiences on Open data

This section presents good practices and recommendations of open data initiatives harvested from the EU and EaP countries.

2.3.1. Sharing experience in terms of Content

The Content section covers key steps for the journey of opening data while making sure that environmental data are not left behind.

Considering the environment while developing a national strategy for Open data

For open data, building a strategy is as important as for e-government. Open Data Strategy should provide a sound framework leading to the long-term outcomes required.

The strategy should clearly establish the right to access and reuse the information as well as the obligation to use open licenses[47]. The strategy should be preferably drafted in partnership with (international) open data experts, leading officials of public authorities and open data users. Engaging key stakeholders across the sectors is crucial for the development of a successful open data strategy. One of the good practice examples for open data strategy is presented in the case study of Ireland below in the section.

Building on such good practice examples and Ireland's Open Data Strategy[48], European Data strategy[49] and other, the structure of the strategy could include sections such as:

- **Mission, Vision, Objective, Principles and Values;**
- **Principles,** describing the main guidelines for open data management (e.g. open by default) and open data governance. It should provide a clear split of key responsibilities by identifying the leading institution and other contributing parties. Sound definition of responsibilities and the presence of an enforcement mechanism contribute to ensuring smooth management of the strategy implementation. It is recommended to present the structure of the national open data management and related governance, including the responsibilities attached.
- **High Priority or high-value domains** (e.g. Transportation, Economic growth, 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. Priority datasets should mostly focus to support the demand of Open data users.
- **Benefits and use of open data,** presenting the economic and societal benefits of the use of open data as well as a list of best practices on how open data is used and reused by public authorities, businesses and the public.

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

[48] data.gov.ie

[49] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en

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Open Data Strategy of Ireland 2017–2022

Content

Government Reform Unit of the Department of Public Expenditure and Reform in Ireland released an Open Data Strategy 2017–2022. 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 the 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.

Environmental aspect

The strategy focusses on such initiatives as **real-time monitoring of air quality**, which are enabling smart city strategies to tackle environmental challenges. The strategy also supports specific programmes implemented by Environmental Protection Agency (EPA), e.g. development of a **national bathing water information website**, allowing the public to make informed decisions about the location and timing of their holidays.

Source: data.gov.ie

Implementing the Open data strategy through action plans

The Open data strategy sets up the main objectives to achieve in the field. An Action Plan helps implementing the strategy by providing a clearly defined and structured list of actions, an estimate of the necessary resources to be allocated as well as a clearly defined timeframe for achieving the objectives. Actions can be further translated into programmes or projects. International commitments related the objectives set in the Open data strategy can raise motivation to drive the Action Plan at a national level and encourage stronger stakeholder engagement. Such international commitment can be translated in the initiatives, such as the 'Open Government Partnership' presented in the case study below[50].

Open Government Partnership

Content

The Open Government Partnership (OGP) is an organisation of reformers inside and outside of government, working to transform how government serves its citizens. OGP was established in 2011, currently, seventy-eight countries and a growing number of local governments along with thousands of civil society organisations are members of the OGP.

OGP members endorse the Open Government Declaration, create action plans in consultation with civil society, and commit to the independent and public evaluation of their progress. OGP provides support for the countries drafting their national Action plans for the implementation of Open data strategies, among others.

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

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Environmental Aspect

Members of OGP have made multiple commitments (in the form of Action plans) related to transparency and community participation in environmental matters. Many of these commitments focus on publishing georeferenced data related to protected areas. Several Action Plans focus on public involvement in climate resiliency programmes and conservation efforts.

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

The implementation of the Action Plan should be frequently monitored. To this extent, a national working group and/or institution can be assigned to monitoring the implementation of different actions against their objectives and the proposed budget. The annual review of the progress could lead to the amendment of the Action Plan, could influence the priority setting or the initial budget estimates.

Adopting an Open data policy, which considers the environment as a key component

Open data

To facilitate the development of Open data at the national level, it is recommended to establish an Open data policy. In comparison to Open data strategy, the Open data policy should constitute a set of rules and guidelines to help the implementation and the translation into practice of the strategic objectives defined in the strategy.

On the EU level, the new Directive (EU) 2019/1024[51] on open data and the reuse of public sector information was adopted and published on 20 June 2019, and to be implemented by Member States by 16 July 2021. More details are provided in the case study below.

EU Directive on open data and the reuse of public sector information

Content

The Directive introduces the concept of high-value datasets, defined as documents the reuse of which is associated with important benefits for the society and economy. They are subject to a separate set of rules ensuring their availability free of charge, in machine-readable formats, provided via Application Programming Interfaces (APIs).

Environmental aspect

The Directive regards environmental datasets to be of high value, associated with important benefits for the society and economy. The thematic categories indicated by the European Commission as having the important socio-economic benefits include such examples as national and local maps (geospatial), satellite images (earth observation and environment), data from instruments and weather forecasts (meteorological).

Source: https://ec.europa.eu/digital-single-market/en/open-data

On a practical note, it is possible to build a national Open data policy based on the European Open Data Portal recommendations[52]or the Open Data Charter[53]. According to the European Open Data Portal recommendations (2018)[54], an Open data policy should include the following aspects:

- ‘Definition and benefits’ – clearly define what Open data is;
- ‘Scope and goals’ – define what kind of data should be opened first and what goals should be reached;

[51] https://ec.europa.eu/digital-single-market/en/open-data

[52] https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf

[53] https://opendatacharter.net

[54] https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf

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- 'Legal aspects' – the implementation of Open data has to be in line with current legislation. The legal aspects should cover licensing, 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 publishing data in order to ensure that data is easy to find and reuse.

Another important source of guidance is the Open Data Charter containing a set of principles and good practices on how to publish governmental Open data. It was published 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'[55]. The charter focuses on six main principles on how Open data should be published, namely:

- 'Open by default' – all governmental data should be Open data if it is not restricted by law for security or data protection reasons;
- 'Timely and comprehensive' – for data to be relevant and useful, it should be published as close as possible with its availability and unique design;
- 'Accessible and usable' – data should be provided in the machine-readable open formats (such as CSV, JSON, XML, RDF), easy to find, described using metadata, and under an open licence;
- 'Comparable and interoperable' – using commonly-agreed data standards can ensure interoperability and increase the potential value by allowing the use of a variety of the datasets;
- 'For improved governance and citizen engagement' – Open data can serve as a tool for improving the transparency of the activities and decisions of the public authorities;
- 'For inclusive development and innovation' – Open data can be used for encouraging innovation and economic development. New products or services can be created using available open data.

The Open Data Charter (ODC) principles are adopted by Ukraine and some cities such as Drohobych, Lviv, Chernivtsi, Vinnytsia, Dnipro. According to the Charter, adopting the ODC principles brings the following benefits to the national and local governments: (1) a common framework for the Open Data, (2) support in the implementation of Open Data projects, (3) possibility to better connect various sectors on common issues (e.g. experts in anti-corruption, climate change) for practical use and higher impact of the Open Data, and other[56].

It is important to note that Open data policy principles should be made available to all public authorities, and communication campaigns should be undertaken in order to raise awareness between the public, businesses and public authorities.

Environmental data

In 2013 the European Environment Agency (EEA) has developed and adopted its data policy. This was further updated in 2018 [57]. The document defines the framework and basic principles according to which the environmental data reported to the Agency is handled, processed and disseminated by the EEA, in particular, the regular data flows between the European Environment Information and Observation Network (Eionet) and EEA. The principles of the EEA data policy (November 2020) are referring to:

- Data provided has clear use or reuse conditions (art. 3);
- Data provided through services is compliant with established standards from ISO, OGC and other relevant standardisation bodies. EEA distributes datasets under open standard license (art. 4);
- Data sources are cited and, when possible, opportunities for branding are offered (art. 5);

[55] https://open-data-charter.gitbook.io/open-up-guide-using-open-data-to-combat-corruption/background-charter-open-up-guides

[56] https://opendatacharter.net/adopt-the-charter/

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

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- Data providers remain responsible for the quality of the data they produce and distribute (art. 7).

Building a legal framework for Open data which includes an enforcement mechanism

Harnessing the benefits of Open data requires, among others, a sound legislative framework, licencing mechanisms, common standards and a strong governance structure to ensure implementation. In EaP countries, these elements are not always fully available and even when existing are not systematically implemented, resulting in low interoperability and low activity in publishing, use and reuse of data.

According to the *Aporta Initiative*, promoted by the Ministry of Economy and Competitiveness in Spain[58], the best examples of legislative aspects for privacy, freedom of information and the right to access data are as follows:

1. The right to access the information is regulated by law (dedicated legislation recognising the access to information) and mechanisms to allow the effective exercise of these rights are available. Examples of reference in this regard are to be found in countries, such as Estonia, Iceland, Sweden, and the United Kingdom.
2. The framework of access to data should allow access to personal data and correction of it as well as impose clear responsibilities in the management of the data. Examples of reference in this regard are countries, such as Belgium, Estonia, Finland, France, Germany, Iceland, Ireland, Norway, Spain, and Sweden. Countries listed as good examples have adopted specific legal acts for data access and data protection, i.e. Finland has established an Office of Data Protection Ombudsman, Sweden adopted legislative acts for data accessibility and protection, and the United Kingdom adopted 'Freedom of Information Act 2000'[59].
3. Clear definitions and limitations of access to public sector information, geographic and environmental data. As a rule, 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 public authority involved in the monitoring and dissemination of environmental data and information. To ensure the consistency of the legal framework, it is possible to develop an 'umbrella' Environmental Law to define and regulate the institutional framework for the environment.
5. The presence of monitoring and/or enforcement mechanisms for evaluating the scale of publishing Open data. These mechanisms could be implemented as regular public reporting (e.g. several datasets published per institutions).
6. The presence of licences: to ensure re-usability of Open data, it is necessary to define and attribute a licence per datasets. The responsibilities for the provision of licenses can be assigned by law to a certain public authority that possesses and updates information.
7. Protection of the intellectual property: it is possible to limit the reuse of Open data by setting some legal boundaries to protect the data provider(s). A possibility is to include in the licence some restrictions on the reuse of Open data.

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

[59] Report on international best practices of Open data, January 2017

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'The Aporta Initiative' in Spain

Content

'The Aporta Initiative' was launched in 2009 to promote the opening of public information and the development of advanced services based on data. It is backed by the Ministry of Economy and Business, the Ministry of Territorial Policy and Civil Service and the Public Corporate Entity Red.es. Developed under the current legislative framework, it includes seven lines of action which are reflected on datos.gob.es, the platform used as a meeting point for administrations, businesses and citizens who are part of the Open data ecosystem in Spain.

The main goal of the 'Aporta initiative', a key element in the Spanish government's Open data policy, is to harmonise and efficiently take advantage of the synergies between ongoing Open data projects. It seeks to always drive and coordinate actions carried out by different levels of the administration, the private sector and the academic field, according to an integrative governance model. It does all of this in order to promote new products and services from the private sector and civil society to benefit society.'

Environmental aspect

'Aporta Initiative' covers three sectors: environment, culture & leisure, and education. Data and the innovation associated with it in the environmental sector is fundamental in the fight against climate change, deforestation and environmental degradation - existential threats faced by Europe and the rest of the world.

Source: datos.gob.es

Overall, it is important to ensure that there is a dedicated piece of legislation on Open data, providing a clear, transparent and consistent framework to implement the provisions of the Aarhus Convention[60] and other relevant international commitments, and consequently clear results can be achieved. For the countries which ratified the Protocol on PRTRs, the national Open data legislation should also include provisions on the necessary mechanism to ensure its implementation.

Applying a standard referring to the metadata structure for all environmental information

According to the World Wide Web Consortium (W3C) report 'Data on the Web Best practice'[61], providing metadata is a fundamental requirement when disseminating data on the Web, because data publishers and data users may be unknown to each other. Therefore, it is essential to provide information that helps both users and computer applications to understand the data as well as other important aspects that describe a dataset or a distribution of a dataset. Metadata should be provided for both human users and computer applications. Different approaches are used to provide data for human-readable[62] and machine-readable metadata.

Possible approaches to providing human-readable metadata include:

- To provide metadata as a part of an HTML Web page. A good example of metadata availability is the EEA SDI – geospatial data catalogue[63]. The metadata available through the EEA SDI –geospatial data catalogue is compliant with the EEA metadata profile v2.164 . As a result, the metadata is compliant also with ISO 19115:2003 and ISO/TS 19139:2007 standards. It further complies with the

[60] 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

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

[62] A human-readable medium or human-readable format is any encoding of data or information that can be naturally read by humans.

[63] https://taskman.eionet.europa.eu/projects/public-docs/wiki/EEA_SDI

[64] https://taskman.eionet.europa.eu/projects/public-docs/wiki/Cataloguemetadata_guidelines

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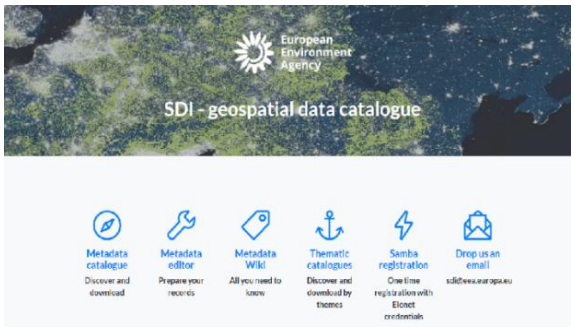
INSPIRE Implementing Rules and Technical Guidelines. 'EEA SDI is a metadata catalogue service that facilitates the discovery of the data sets produced, acquired and, when possible, published by the EEA'[65]. With the help of metadata, the users can easily access information on the content and the quality of the data sets, and ultimately are able to download the data sets[66].

Figure 4 Snapshot of the EEA's SDI – Geospatial data catalogue webpage (source: https://sdi.eea.europa.eu/, status September, 2020)



- To provide metadata as a separate file in open format e. g. CSV, XML, RDF.

  Possible approaches to providing machine-readable metadata as per W3C recommendations:

  - Machine-readable metadata may be provided in a format, such as JSON, or embedded in an HTML page using [HTML-RDFA][67] or [JSON-LD][68]. As per W3C recommendation, if multiple formats are published separately, they should be served from the same Uniform Resource Locator (URL) and made available under separate Uniform Resource Identifiers (URIs), distinguished by filename extension. Maintenance of multiple formats is best achieved by generating each available format based on a single metadata source.[69]
  - 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 Catalogue 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 vocabulary, such as the European Commission's DCAT-AP.

The EaP countries usually describe the data published on their Open Data Portal. The compliance with the published metadata standard could be however further improved. It is strongly recommended that the environmental data is supported by metadata, which would substantially assist finding and re-using the available data.

European Union has implemented the DCAT 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[70]:

[65] https://taskman.eionet.europa.eu/projects/public-docs/wiki/EEA_SDI

[66] EEA public documentation on SDI Catalogue https://taskman.eionet.europa.eu/projects/public-docs/wiki/EEA_SDI#3Registration-of-data-sets-in-the-EEA-SDI

[67] RDFA is a W3C Recommendation that adds a set of attribute-level extensions to HTML, XHTML and various XML-based document types for embedding rich metadata within Web documents. The RDF data-model mapping enables its use for embedding RDF subject-predicate-object expressions within XHTML documents

[68] JSON-LD is a method of encoding linked data using JSON. One goal for JSON-LD was to require as little effort as possible from developers to transform their existing JSON to JSON-LD. JSON-LD allows data to be serialised in a way that is similar to traditional JSON.

[69] https://www.w3.org/2013/dwbp/wiki/Comments_to_be_considered_before_publishing_the_last_working_draft

[70] https://www.w3.org/TR/dwbp/

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- 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[71].

DCAT-AP also has an extension, GeoDCAT-AP, for describing geospatial datasets, dataset series and services. There are also other metadata standards 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[72].

As such, the development and/or the adoption of a metadata standard for the publication of public sector information and Open data would increase transparency and facilitate accessibility and use. Typical metadata include the title, the information provider, time and space coverage, author, licence, distributions (i.e. links to datasets, often in different formats), references to the national legislation and the international commitments requiring collecting and report the respective dataset.

Increasing the discoverability of environmental data and information

It is important to ensure discoverability of environmental data and information. To do so, multiple measures can be undertaken, such as:

- 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;
- Set up a process for managing Open data requests and provide specific functionality to request data in the Open Data Portal;
- Provide advanced search functionality that allows the user to use multiple field search and filter options (e.g. file format) to refine a search. Also, it is possible to provide mechanisms for complex filtering, including, for example, the combination of keywords with Boolean operators. An example of an Open Data Portal of the Republic of Moldova is provided in a case study below;
- 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.

[71] https://www.w3.org/TR/vocab-dcat-2/

[72] https://www.w3.org/TR/vocab-dcat-2/

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Republic of Moldova – Open Data Portal

Content

- The portal has in total 1338 datasets available,
- User can find a well-built dataset search option. Datasets can be searched by organisations, groups, tags, formats or using keywords.
- Available formats are clearly defined near each dataset (data can be extracted from the website in multiple data formats (XLS, xlsx, CSV, PDF, docx, doc, ZIP, TXT).

The portal has well-developed data discoverability features. It is to be noted that last updates took place 4 and more years ago. Ensuring a regular update of the data provided is an area for improvement of this solution going forward.

Environmental data

- From 17 search groups, five are related to the environmental domain – 'Environment', 'Geospatial', 'Agriculture', 'Transport" and 'Energy'. They hold 120 datasets in total. However, the portal has some limitations, e.g. no systematic update of data is ensured, datasets cannot be accessed by clicking on environmental institutions.
- Available reports with downloadable data on environmental topics can be accessed on the portal, e.g. lists of surface water bodies, emissions of greenhouse gases, air quality in urban areas, the land cadaster of the Republic of Moldova, water losses and other.

Source: https://dataset.gov.md/

Collection of environmental data and information from complementary sources

An example of innovative and complementary environmental data collection aiming primarily to filling gaps or giving real-time information on certain issues (such as bathing water quality for example) is citizen science. European Commission in its staff working document 'Best Practices in Citizen Science for Environmental Monitoring (2020), presents citizen science as the non-professional involvement of volunteers in the scientific process, commonly in data collection, but also in other phases, such as quality assurance, data analysis and interpretation, problem definition and the dissemination of results. Other definitions exist and are under debate in the scientific community[73].

There are many environmental citizen science initiatives. The majority are 'contributory', i.e. designed by academics/research organisations but entailing the collection of monitoring data by volunteers. However, initiatives with greater public involvement in the scientific process have recently been on the rise, i.e. 'collaborative' projects (designed by researchers, with volunteers contributing data, refining project design, analysing data and/or disseminating findings) and 'co-created' initiatives (volunteers and researchers work together throughout). A collection of citizen science initiatives is briefly introduced in the case studies below.

The first examples presented below are from the above-mentioned EC report.

[73] Best Practices in Citizen Science for Environmental Monitoring, 2020. <https://data.consilium.europa.eu/doc/document/ST-9973-2020-INIT/en/pdf>

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Swedish example of citizen science – Swedish Species Observation System ('Artportalen')

The citizen science initiative in Sweden in the area of biodiversity has started in 2000 and is successfully running since. 'Artportalen' data are the primary biodiversity data used to support planning and management decisions in Sweden, e.g. for nature reserves. The data are used routinely by all government authorities, agencies and many environmental consultancies (which have developed their own interfaces to enable rapid searching of the 'Artportalen' data). The data are used to monitor biodiversity, invasive species and changes in species distribution, and form the key tool in the creation of the Swedish 'red list'.

Source: European Commission Staff Working Document, Report on Best Practices in Citizen Science for Environmental Monitoring, 2020

EEA examples of citizen science and citizen engagement

Marine Litter Watch

Another example is the pan-European citizen science initiative Marine Litter Watch (MLW), coordinated by EEA since 2014. MLW is focused on fighting litter pollution in European waters through clean-ups and monitoring operations using common protocols and a mobile app maintained by EEA. The initiative has helped improve evidence base for monitoring progress on the Marine Strategy Framework Directive´s main objective of 'good environmental status' of Europe's seas by 2020, in particular for 'descriptor 10' (marine litter). By determining single-use plastics abundance and trends on European beaches, it is also contributing to the evidence base for the EU strategy on plastics and, the Single-Use Plastics Directive.

Source: https://marinelitterwatch.discomap.eea.europa.eu/, status November 2020

Clean Air at School

In 2018 the EPA Network launched an initiative CleanAir@School, coordinated by the EEA, during which eight EPAs across Europe engaged pupils, teachers and parents over 2019 and 2020 to measure nitrogen dioxide levels around their schools with the use of simple low-cost devices. Together with the interesting results from the indicative measurements at the different locations, the initiative has demonstrated the potential for these approaches to increase the awareness of air pollution and impact on commuting behaviours to and from schools.

Source: https://experience.arcgis.com/experience/1b517a82583e451fb3e6ee622d8ec34a/, status November 2020

Another relevant European initiative – Human Biomonitoring for European Union project – is presented below.

HBM4EU (Human Biomonitoring for European Union project) example of citizen science – Citizen Survey

An example of citizen engagement is provided in the context of from the HBM4EU project, a joint effort of 30 countries, the European Environment Agency and the European Commission, co-funded under Horizon 2020. In the framework of the project , a citizen survey is being conducted in order to understand the citizen's perspectives on chemical safety and human biomonitoring. The information collected is anonymous.

Source: https://www.hbm4eu.eu/citizen-survey/, status November 2020

The last example of citizen science initiatives is a national initiative of Romania, encouraging the public to contribute to the conservation of old Romania's trees by sharing information on their location, status (including relevant pictures) on a dedicated webpage.

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Romanian example of citizen science – Remarkable Trees of Romania

The project 'Remarkable trees of Romania' is dedicated to the conservation and sustainability of the old trees of Romania. As knowledge is the essential first step to protect Romania's remarkable trees and their environments, the project initiators encourage the public to contribute to the collective knowledge by sharing their pictures of Romania's remarkable trees and other information (e.g. location of the tree) on a dedicated website. Project initiators are dedicated to stimulating and inspire local communities to use these trees for strengthening community cohesion and local identity while protecting crucial wildlife habitats.

Source: https://arboriremarcabili.ro/en/about-project/, status, November 2020

There is a substantial policy, scientific and societal value in citizen science, as it enriches the policymaking process with evidence and scientific data, while at the same time empowering citizens to participate in the decision-making process. However, there are still challenges related to the quality of data, available time series provided as a basis for integration with other datasets and other.

Categorising Open data

Open data should include in its structure a dedicated environment category. To improve the discoverability, datasets should be published in a structured way by organising them into specific categories. This kind of distribution allows Open data users to easily find datasets even if the users do not specifically know what kind of open data is available. As good practice and for consistency reasons, the countries can use the categories of Open data identified by the EU, as follows:

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

Transforming available data into a machine-readable format

Open data maturity could be viewed in a scheme, suggested by Tim Berners-Lee[74]. The 5-Star Deployment Scheme for Open Data is cumulative – meaning that each additional star presumes the data meets the criteria of the previous step(s)[75]. The scheme is presented in the table below.

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

[75] https://dvcs.w3.org/hg/gld/raw-file/default/glossary/index.html#x5-star-linked-open-data

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Table 1 The 5-star deployment scheme for open data

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 provided 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)

Source: Tim Berners-Lee (Author), 5-star Open Data, status November, 2020

When deciding to implement an Open Data initiative, each country should aim at opening at least at the third-star rating (as described above) the data available. In time, and gradually, the country will aim towards improving the quality of the data and Open data in additional formats.

It is important to ensure that the data are available in a machine-readable open format so that it could be easily reused. Most popular formats are as follows: XLS, CSV or TSV, XML, JSON and DBF or MDB database dumps. While all formats are easily reusable, XLS is a proprietary type of format and could limit its use. 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. Data publication through application programming interfaces (APIs) could greatly facilitate the access and use of data[76]. Azerbaijan's Open Data Portal is presented as a good practice example of data publication.

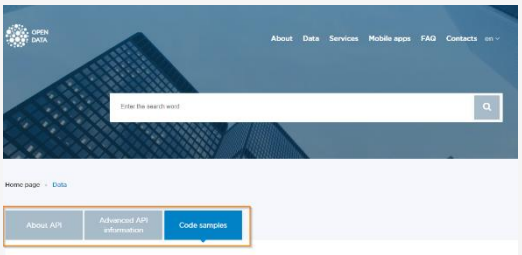
Azerbaijan – Open Data Portal

Content

- Data portal has 19 categories for representing fields – one is specifically assigned to Ecology.
- Open data is presented in XML and JSON formats consequently the datasets are machine-readable and re-usable.
- The portal also provides an API functionality which allows users to access data by sending a direct link to the system. Data exchange between the Open Data Portal and the user is carried out over the HTTPS protocol. Parameters transmitted to the services during each application are mainly implemented using the Get method (one of the most common HTTP methods).
- The portal clearly defines how information between portal and user is exchanged: code examples are provided to ease the access and the use of the open data in the portal.

Environmental aspect

- Azerbaijan Open Data Portal provides data on the topics such as 'natural resources', 'ecological quality of life', 'ecological and resource efficiency of the economy' and other. Data regarding environment topic can be accessed under the category 'Statistics'.
- The category 'Ecology' is prepared for data population but is currently not activated.



Source: https://www.opendata.az/en, status November, 2020

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

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Developing and providing mechanisms for the quality control of environmental data

The quality of Open data is a continuous process, managed at national and institutional levels. To evaluate the quality of data, the country should establish quality guidelines and/or procedures at a national level, which all public authorities must follow. Inside each institution the process of publishing (dissemination) environmental data and information should be supported by a dedicated civil servant responsible for ensuring the quality of data and metadata. 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 various users.

Specific quality guidelines should be provided for both the metadata of datasets and the data. The quality of metadata mainly addresses how datasets are described focusing on the completeness of standard metadata description. The quality of data focuses on the data itself and requirements such as unified structure for all distribution cases, a minimal number of mistakes in data, information on the completeness, links to data vocabularies, where available. As an example of data portal quality evaluation, we present the European Data Portal Metadata quality dashboard in the box below.

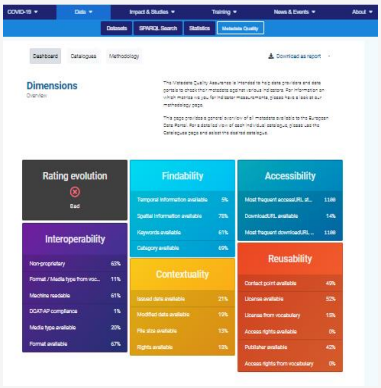
The Metadata Quality Assessment dashboard provides a general overview of all metadata available in the European Data Portal

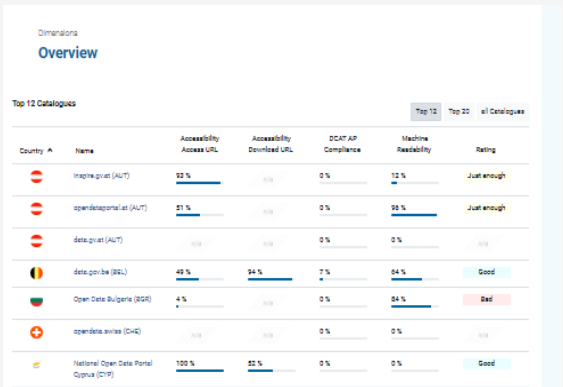
Content

- The quality analysis public sector data in the pan-European region is based on five criteria: (1) findability, (2) accessibility, (3) interoperability, (4) contextuality and (5) reusability. For each catalogue, all datasets and their corresponding distributions are checked.
- This dashboard provides a general overview of all catalogues harvested by the European Open Data Portal, and it is possible to check the quality of metadata for each Open Data Portal.

Environmental aspect

- An evaluation of 28 geoportals and other environment-related data portals from 24 countries from the pan-European region is accessible through dashboards presented on the website.
- Under the category ‘Data’, subcategory ‘Statistics’ is indicated an increase by 51,98% of accessible environmental data between January and November 2020 (97806 datasets, which are present now compared to 64355 datasets accessible on 1 January 2020).
- Subcategory ‘EU and International data’ holds 2377 environmental datasets – readily available for review or download in 22 different data formats (including XLS, PDF, ZIP, XML and other).
- More than 60% of accessible data comes directly from the European Union Open Data Portal.





Source: https://www.europeandataportal.eu/mqa?locale=en, status November, 2020

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The quality of spatial environmental data can be managed according to different standards, as for example:

- ISO 19157:2013 Geographic information – Data quality[77];
- The INSPIRE Data Specifications, which contain a dedicated section on data quality (e.g. Protected Sites theme –Technical Guidelines, Chapter 7 – Data Quality[78].

An example of the quality control procedure of the data received by the EEA is presented below.

Quality control of the dataflows received by the EEA for WISE SoE reporting obligation under the Water Framework Directive

The quality checking of the data received by EEA from the Eionet member countries and cooperating countries, as regular reporting data flows, is a well-established and documented process. The European Topic Centres assisting the EEA in its work for dedicated thematic areas have an important role in this process. The quality checking implies several steps. First, there is an automatic quality checking of the data received, covering format, variables to be reported and thresholds. A standard pre-defined template is provided by EEA allowing the automatic checks of the quality delivered. The second step is a more content-based one and is managed by dedicated data stewards in EEA. They interact with country reporters along the whole process to ensure the reporting process is correctly understood, novelties introduced and errors explained. Helpdesk service is also in place to assist reporters in addressing any difficulty or technical challenges when reporting. Once the data stewards give their acceptance on the data reported, the data can be aggregated with other datasets reported in order to build the European related dataset.

Source: WISE –Water Information System for Europe (https://water.europa.eu/)

The EEA Reportnet system and its continuous development are presented in the case study below.

Evolution of Reportnet – EEA/Eionet infrastructure to supporting and improving data and information flows

Reportnet is the EEA/Eionet infrastructure to supporting and improving data and information flows between the Agency and its members and cooperating countries. Reportnet is based on a set of inter-related tools and processes which all build on the active use of the World Wide Web. The purpose of Reportnet is to make it easy for European countries to deliver and store the obligatory environmental reporting. The system integrates different web services and allows for distributed responsibilities. Reportnet was initially used for reporting environmental data to EEA, but now is also hosting some of EC reporting obligations related to environment or related areas. The open system provides access to other national and international organisations in a very transparent way.

The reporting platform operated by EEA and Eionet - Reportnet is now moving to a new version 3.0 where cloud technology will allow increase data storage, easy and simplified reporting procedures and increase interaction with the data by the end-user. Reportnet 3.0 will act as a central hub through which all e-Reporting activities handled by the EEA with Eionet and other partners will be performed. The system stepwise replaces the current Reportnet system and is foreseen as a one-stop-shop for all involved stakeholders. It will effectively address the issues faced by the reporters so far and employ modern approaches in software development (i.e. with regards to security, scalability, architecture, interoperability, etc.). Reportnet 3.0 will be designed to work seamlessly across organisations and supports existing legal obligations (e.g. INSPIRE Directive) and standards to assure the reuse and interoperability of data. The Reportnet 3.0 project was initiated in 2018 and the operational Reportnet 3.0 platform was launched in July 2020. The production of future thematic and integrated assessments by EEA will be strongly relying on the data and information stored and available through the new revamped Reportnet 3.0 system.

Sources: https://www.eionet.europa.eu/reportnet; https://www.eionet.europa.eu/reportnet/reportnet-3.0

[77] https://www.iso.org/standard/32575.html

[78] https://inspire.ec.europa.eu/id/document/tg/ps

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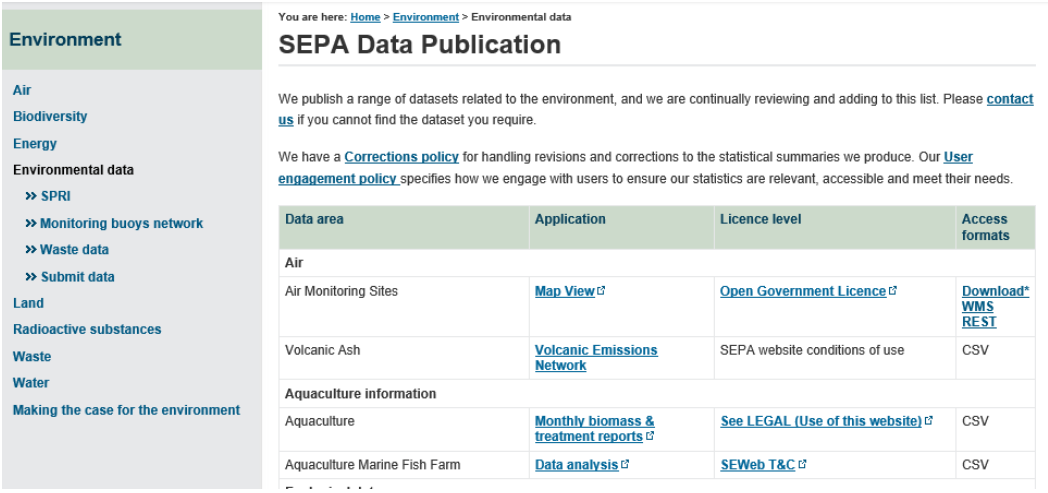
> Other examples are the EEA's data management framework, the E-PRTR, LCP Integrated Data Reporting manual, and the Quality Assurance Logic Manual – all available on the Eionet platform: http://cdr.eionet.europa.eu/help/eprtr_lcp.

Harmonising licensing terms and conditions for accessing environmental data

There are many licences available that can be used when publishing data. As the number of datasets in the Open Data Portal is growing, licences become fundamentally important to ensure access, use and reuse of data. According to common practice, all datasets published should be accompanied by a licence. In some cases, such as for example in the Scottish Environment Protection Agency[79], licences are attached to the data catalogues and applied for all datasets in the catalogue.

Figure 5 Example of Scottish Environment Protection Agency (Source: Scottish Environment Protection Agency website sepa.org.uk, status September, 2020)



The European Union Open Data Portal recommends using the Creative Commons 4.0 licence for Open Data licensing by all public authorities. Three main categories (public domain, attribution, share alike) of Creative Commons licences provided in the table below, are advised to be used by the European Union Open Data Portal[80].

Table 2 Creative Common 4.0 licence details[81]

Category/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 from the data	• 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

[79] https://www.sepa.org.uk/environment/environmental-data/

[80] https://creativecommons.org/licenses/by/4.0/

[81] https://creativecommons.org/licenses/by/4.0/

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Category/scope	Name	Licence allows to	Licence obliges to
Attribution	CC-BY 4.0	• Redistribute the data • Make copies of the work by any means • Create derivative works from the data	• Keep copyright and licence conditions 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 from the data	• 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

Source: Creative Commons (CC) website, status September 2020

A few EU countries also developed their own licences. A couple of examples of share-alike licences are, as follows:

- France: https://www.etalab.gouv.fr/licence-ouverte-open-licence.
- The UK: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/.

Additional explanations on the terms and conditions for use and reuse of Open Data can be provided in Open data catalogues or for a specific dataset. Eionet Central Data Repository (CDR) managed by EEA provides a legal notice for accessing and re-using the content available on the CDR website 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 the 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 environmental matters, access to datasets owned by a country is also provided in accordance with the Aarhus Convention.

Producing and disseminating environment assessments and reports by using modern technology

In accordance with the article 5 (4) of the Aarhus Convention, Parties should regularly publish and disseminate a national report on the state of the environment, including information on the quality of the environment and information on the pressures on the environment. Also, other multilateral environmental agreements and other international processes established reporting mechanisms to track progress in their implementation.

At the international level, UNEP and European Environmental Agency (EEA) are mandated through their funding regulations to produce regular and comprehensive state and outlook reports on the environment every five years. In terms of geographical coverage, the UNEP Global Outlook report covers, as the name confirms the entire world, while The EEA State and Outlook report is dedicated to

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EEA members and cooperating countries (EEA 38[82]). The latest reports produced in the series are the UNEPs Global Environment Outlook 6 report[83] (GEO-6) and the EEA's 'The European environment — state and outlook 2020' report - SOER2020[84]) provide good examples of such assessments.

The UNEP GEO6 report is also available for access and further use free of charge and with acknowledgement of the source. It can be downloaded or access as an e-book. The report findings also fee derived reports in view of broadening the audience by addressing various target groups and different levels. In this respect alongside the main report, a summary for policymakers is also available. The interested public can access a GEO-6 for business, a GEO-6 for youth or a GEO-6 for Cities report as well. Also, part of the GEO family and to support and detail its findings for each world region, the reader can access the Regional reports (pan-European region, African region, Asia and Pacific a.s.o.). Links to all previous GEO reports is also provided in order to revisit findings, compare status or monitor progress. Most of the data and information behind the GEO6 report are steaming from the UNEP World Environment Situation Room, an open and accessible hub of environmental information fed by national and international sources, which is currently under development and gradual expansion (https://uneplive.unep.org/), is presented in the case study below.

All data and information available in EEA through Reportnet are linked to UNEP system and available freely for further use, aggregation and analysis at various levels (with the proper acknowledgment of the source).

The World Environment Situation Room implements the Big Data Initiative

The project is global with overarching environmental policy relevance and impact. It includes geo-referenced, remote-sensing and Earth observation information integrated with statistics and data on the environmental dimension of sustainable development. The themes of this Global platform cover complementary dimensions for Global Green Solutions for the Environment. It targets country's policymakers, top environmental policymakers, the environmental scientific community, business and interested citizens. The platform is essential as a knowledge instrument to support progress on delivering the environmental dimension of Agenda 2030 for Sustainable Development.

The World Environment Situation Room will be implemented in different cities, countries and regions. This platform will facilitate in transforming data into information products and services which can be used by non-data experts. The online platform will provide access to near-real-time information, allowing any willing stakeholder to explore data, visualise trends and use these data-based products to support action toward sustainable development. The platform automatically processes data to transform them into products such as images, maps, graphs (with trends), a table in a format which is easy to use by mainstream software.

Source: https://uneplive.unep.org/home/aboutus, status November, 2020

The EEA SOER2020 is a good example of a modern European report focusing particularly on assessment and evidence-based for future policymaking. It is also developed as a suite of products including executive summaries in all EU languages, a quick five-minutes reading of an online summary, visual and infographics and presentation videos. Furthermore, for interested readers, each chapter of the report is complemented by its specific visuals, indicators, infographics and related publications. All products are freely accessible and downloadable for future use with the obligation of acknowledging the source. An online feedback survey tool is attached to the page to gather input, views, opinions and possible future actions inspired by the findings of the report.

[82] EU Member States, EFTA countries and Turkey as EEA members and Albania, Bosnia-Herzegovina, Kosovo*, Montenegro, North Macedonia, and Serbia

[83] https://www.unenvironment.org/resources/global-environment-outlook-6

[84] https://www.eea.europa.eu/soer/2020

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The package is complemented by thematic and specialised reports highlighting and detailing various environmental topics addressed in the key report. These documents are addressing specialised audiences interested in a specific topic or involved in educational activities. Finally, the dedicated GEO6 page includes a toolkit for integrated assessment with the aim to assist countries, regions, in developing their own assessment or improving the existing ones.

Both reports take advantage of modern technologies. This ensures easy access and navigation, increased usability of environmental information presented as reports, indicators and assessments (thematic or integrated assessments).

At a national level, some good examples in the field of environmental reporting are provided below:

- The Ministry of Natural Resources and Environmental Protection of Belarus sets a good example with its main webpage[85]. Here the environment reports, the monitored environmental indicators and other assessments are available and regularly updated. The website provides links to all subordinated institutions, operating in various activities related to the environmental domain.
- France presents a good example in the field of state of environment reporting. The 2019 edition of the state of environment report shows a turning point – the traditional format of the report is transitioned to the website[86] which provides both – structural analyses over the long periods as well as information which is updated continuously[87].
- Another relevant example is the 'Enviroportal' of Slovakia[88], hosting regular reports on the state of the environment and environmental indicators:
  - Reports on the state of the environment published on the portal in the relevant calendar year are identical electronic versions of the official reports on the state of the environment, issued by the Ministry of Environment of the Slovak Republic in cooperation with the Slovak Environmental Agency;
  - Environmental indicators, or the indicators related to the environment, processed and regularly updated by the Slovak Environment Agency, are provided in the portal in the following structure: key indicators, sectoral indicators, sustainable development indicators, green growth indicators, resource efficiency indicators.

Ensuring timely and regular collection, update and dissemination of environmental data and information

Monitoring the number of datasets published and reused, especially per public authority, enables the identification of data that are the most in-demand. In the UK, for example, in order to ensure that information is constantly updated, and the new datasets are published, several functionalities are added to the Open Data Portal. They include, among others, functionalities to facilitate the continuous feedback from users and the possibility to make a request for new data[89]. Most EaP countries offer similar functionalities, but in practice, they need to be further developed and enhanced. It will be advisable in this respect to introduce a standard process and clear responsibilities for public authorities to ensure demand-driven data opening process. Data and reports are most valuable when kept up to date. Hence, it is crucial to set up a legal framework, mechanisms and processes, assisted by necessary tools and systems, to enable the maintenance and regular update of data and information published.

It is important to note that the frequency of publication will have an impact on the human and financial resources of the responsible public authorities. Art. 5 of the Open Data Directive defines the obligation

[85] http://minpriroda.gov.by/en/nac_dokl-en/

[86] https://ree.developpement-durable.gouv.fr/

[87] https://www.eea.europa.eu/themes/sustainability-transitions/state-of-the-environment-reporting/france-state-of-the-environment-reporting/view

[88] https://www.enviroportal.sk/en/about-enviroportal

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

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of public sector organisations and public authorities to make available dynamic data (including environmental, traffic, satellite, meteorological and sensor-generated data) for reuse immediately after collection. When committing to a frequency, making upfront a clear assessment of the impact on resources, both human and financial, as well as on processes and systems, are needed. Specifics of each environmental domain have to be considered when setting up policy priorities and reporting obligations (e.g. frequency for publishing soil monitoring data is different than the frequency of publishing air or water monitoring data). At first, it is possible to start with a few datasets and establish a regular process of maintaining and publishing the datasets on a monthly basis. In the second phase, the frequency should be increased to, for instance, twice a month, and later once a week.

Running an Open data impact evaluation

While measuring the impact of Open Data, it is essential to regularly assess the effectiveness of an Open Data policy, programme or initiative. Countries have difficulties in communicating and promoting the real benefits of Open Data, as it impacts simultaneously economic, social and environmental activities hence cannot be evaluated from a narrow perspective. To raise awareness on the positive effects of open data, countries can use for inspiration international and national studies, experiences and good practices widely available. In this context, it is important also for all EaP countries to conduct an impact assessment and to evaluate the benefits received while engaging in this process or when assessing progress against some given objectives.

According to the Open Data Maturity report 2019 of the European Commission, the impact is measured in terms of strategic awareness, political, economic, social and environmental impact[90]:

- **Strategic awareness** emphasizes the importance of a structured approach to monitoring and measuring open data reuse and impact. This allows to identify trends, bottlenecks and new opportunities and enables decisionmakers to steer initiatives and boost open data and its reuse and impact.
- **Political impact:** evaluates government efficiency and effectiveness, and impact on transparency and accountability. There are several tools for the evaluation of political impact (e.g. Open data barometer). According to the European Open Data Portal, in 2019, the highest-scoring countries for political impact assessment were France, Denmark, Ireland, Poland and Spain.
- **Economic impact:** based on the implementation of multiple macroeconomic studies assessing the market value of Open Data. According to the European Open Data Portal, in 2019, the highest-scoring countries for economic impact assessment were Spain, the UK, France, Denmark and Ireland.
- **Social impact** on environmental sustainability and the inclusion of the public in policymaking and in accessing government services. According to the European Open Data Portal, in 2019, the highest-scoring countries for social impact assessment were Spain, France, Italy, Ireland and Slovenia.
- **Environmental impact:** based on the development and implementation tools and decisions, which enable preserving the environment. According to the European Open Data Portal, in 2019, the highest-scoring countries for social impact assessment were Spain, Ireland, France, Italy and Denmark (EC, Open Data Maturity Report 2019, p. 37).

Several examples of impact evaluation are presented in the case studies below.

[90] https://www.europeandataportal.eu/sites/default/files/open_data_maturity_report_2019.pdf

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Study on the economic potential of Open Data for Ukraine

Content of the study

The study was prepared by Kyiv School of Economics jointly with Open Data Institute within USAID/UK aid Transparency and Accountability in Public Administration and Services programme/TAPAS and with the support of the State Agency for eGovernance of Ukraine.

The research showed that Open data could contribute up to USD 1.4bn to the Ukrainian economy by 2025, representing 0.92% of Ukrainian Gross domestic product (GDP), through a combination of direct and indirect benefits.

Environmental aspect

The additional benefits of Open Data to the environmental domain have not been evaluated in this study.

Source: The Economic Impact of Open Data, <https://www.europeandataportal.eu/sites/default/files/the-economic-impact-of-open-data.pdf>

European Data Portal Impact maturity

Content

The European Open Data Portal monitors the Open data impact level on each of the five dimensions:

- Strategic awareness
- Political Impact
- Social Impact
- Environmental Impact
- Economic Impact

Data for maturity impact monitoring is collected based on (1) specific country Open Data Portal data availability measurement and (2) surveys sent out to national Open data representatives working with the European Commission and the Public Sector Expert Group.

Environmental aspect

The environmental impact is analysed under Open data impact category with five main criteria that are evaluated:

- Monitoring activities have been launched to assess the environmental impact of the Open data.
- Various data reuse examples exist showcasing the Open data impact on public awareness for air and water quality.
- Various data reuse examples exist showcasing the Open data impact on increasing public awareness on the noise levels in cities
- Various data reuse examples exist showcasing the Open data impact on enabling better waste management and waste reduction practices
- Governmental support for the society-driven Open data initiatives is evident.

Source: https://www.europeandataportal.eu/en/dashboard#2019

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

The translation of Open Data Portal(s) and websites of public authorities into other languages of wider circulation (e.g. English and Russian) is a good practice, broadening the access, encouraging the multiple-use and reuse of information available and in the end, fostering international exchange and cooperation. For translating purposes, it is possible to use translation plugins such as Google translate (with a disclaimer regarding the quality of the translation) and/or to provide the websites/portals in multiple languages. In that regard, the websites of the UN system, EU, including the European Environment Agency or of public authorities such as in Armenia are good examples to follow.

The translation of the key environmental information systems should also include a quality assurance aspect. To provide qualified translation and relevant terminology, a machine-driven translation process (using standard thesaurus provided by an international organisation or EU) could be implemented. In addition, quality assurance procedures have to be applied. The high quality of the translation must be ensured by performing a review of the translated information by qualified professionals. As a first step to improve the multilingual aspect, some key sections of the Open Data Portals could be translated as well as priority metadata fields for published datasets such as name and description.

GEMET, the GEneral Multilingual Environmental Thesaurus, has been developed as an indexing, retrieval and control tool for the European Environment Agency (EEA) and Eionet. The basic idea for the development of GEMET was to use the best of the presently available excellent multilingual thesauri, in order to save time, energy and funds. GEMET was conceived as a 'general' thesaurus, aimed to define a common general language, a core general terminology for the environment. EEA/Eionet develop, update and maintain GEMET over the past 25 years. The number of languages included increased continuously and now, amongst other languages, GEMET embraces EaP countries as well[91].

2.3.2. Sharing experience in terms of Infrastructure

Building an Open Data Portal and fostering access to environmental data and information

The following section gives an overview of the main functionalities of Open Data Portals in the EU. Examples are provided from Ireland, the Netherlands and Spain, which are considered as rather mature portals. The EaP countries could draw some inspiration from these portals to further improve and develop their own portals.

Ireland – Open Data Portal[92]

Data.gov.ie is intended to provide easy access to datasets that are free to use from several policy domains. The portal is operated by the Department of Public Expenditure and Reform. The portal provides good functionality and user experience. The figure below presents the homepage of the Portal.

[91] GEMET website, https://www.eionet.europa.eu/gemet/en/themes/, status November 2020

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

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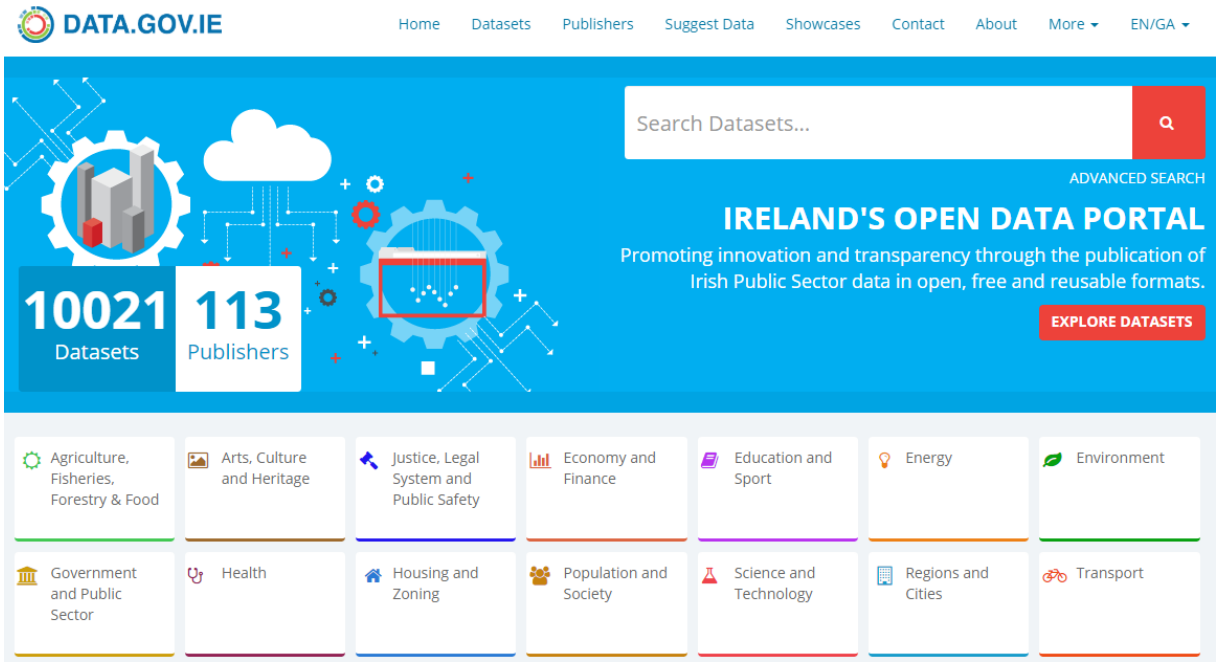
Figure 6 Irish Open Data Portal, data.gov.ie (status May 2020)



The portal presents 14 categories of datasets at the landing page with the category 'Environment' containing more than 3900 datasets.

The main parts of the portal include:

- **Datasets** – the portal contains more than 10000 published datasets. Datasets can be searched based on various criteria such as words of interest, publisher, licence, themes, format, date of release or update.
- **Publishers** – a list of 117 publishers is provided[93]. 'A publisher' is any Irish public authority, which publishes Open Data on the portal. Each institution has its own profile, presenting the number of datasets, the number of total views, the main tags used, the list of published datasets, their formats and licences, and other information related to the institution.
- **Suggest data –** this functionality allows users to suggest a dataset that should be published. To suggest a dataset, the users must fill in a form and provide relevant information about the requested dataset. The list of suggested datasets is provided in the portal.
- **Showcases –** showcases collect the best examples of datasets in use, to provide further insight, ideas, and inspiration for data analysis.
- **Other –** the latest news, the guide for publishers and developers and other publications are provided on the portal.

Spain – Open Data Portal[94]

The Spanish Open Data Portal *Datos.gob.es* provides the National Open Data Catalogue, which is a single access point to the data and information provided by the public authorities for use and reuse in the country. A strong feature of the Spanish Open Data Portal is the availability of the impact analysis of Open Data on the portal.

[93] As accessed in November 2020

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

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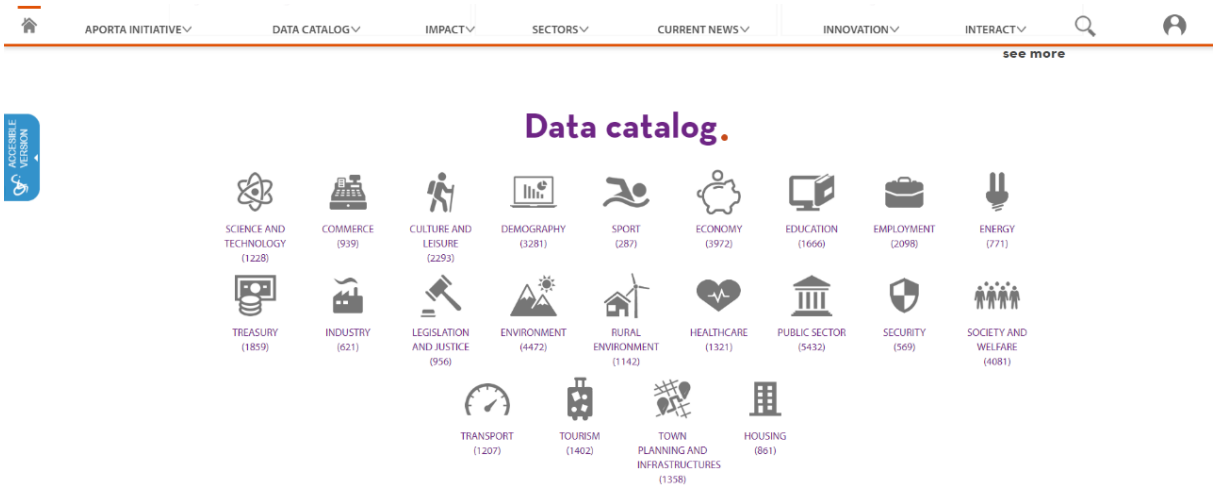
The figure below presents the homepage of the Spanish Open Data Portal.

Figure 7 Spanish Open Data Portal, datos.gob.es (status May 2020)



Some good practices in the portal include:

- **Clearly structured data catalogue** – includes 22 categories of datasets with more than 5000 datasets made accessible under a designated 'Environment' category.
- **API** – clearly defined API documentation with various examples of different queries, which can be processed in the portal.
- **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. SPARQL endpoint can query metadata of the published datasets as well as the data published in RDF format.
- **Impact** – this section consists of a dashboard for overviewing the initiatives related to open data. A map provides information on the main Open Data initiatives and best practices and use cases around the country at the administrative unit level and/or other criteria.
- **Interact** – in this section, useful documentation is available on the usage of the portal as well as on the possibility to request additional data to be published as new datasets or extension of the existing ones.

A practice for improvement noticed in the case of the Spanish portal – *datos.gob.es* would benefit by enhancing the English part of the portal and providing full translation.

The Netherlands – Open Data Portal[95]

This portal gives an overview of all available datasets provided by the public authorities in the Netherlands. More than 150 governmental organisations publish data on the portal. The portal is a good example in terms of the amount of data published, as it allows the user to deep dive into the main categories and their sub-sections. One of the main categories is 'Nature and Environment' with more than 2500 datasets, which mostly cover the national level. The figure below presents the homepage of the portal.

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

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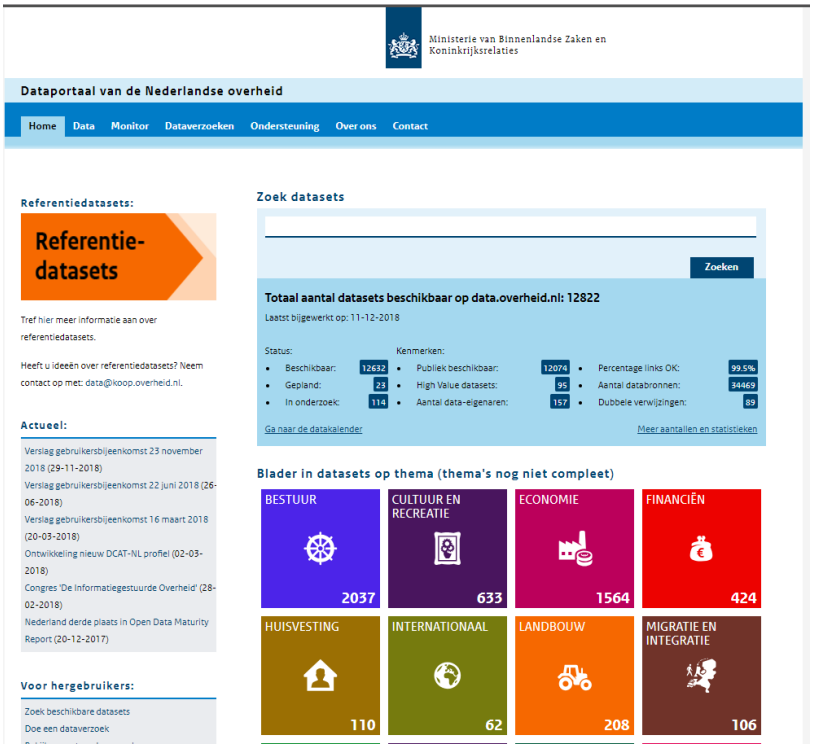
Figure 8 Dutch Open Data Portal (status May 2020)



Good practices on this portal refer to:

- **Monitoring** – this section provides the main statistics on the use of the Open Data Portal. Moreover, there is a calendar that provides information on the planned publication of datasets. Data can be filtered by date, topic or.
- **Support** – this section provides information to data publishers and developers on the technical solutions implemented in the portal.

Establishing a single, user-friendly web-access point for environmental data and information

A single access point for environmental data and information is commonly referred to as an 'Ecoportal'. Data are either hosted on the portal or can be accessed through the portal via links to other portals (e.g. air quality data on a dedicated air quality portal[96]). When the Ecoportal links to other thematic portals, the portal is based on an 'interlinked system'. The website of the EU funded project 'Promotion of good practices for national environmental information systems and tools for data harvesting at EU level' EIS-data.eu[97] defines such a system as 'Linked environmental portals, thematic portals, and (spatial) data portals'.

The Ecoportal does not replace the Open Data Portal but rather complements it and facilitates the exchange of high-value datasets. At this stage, most EaP countries are in the process of developing a national Ecoportal or have a recently developed national Ecoportal or at least some of the key components:

[96] Note: the Air Quality Portal in Georgia is one of the good practice in the region in providing near real-time data to the public: http://air.gov.ge/en/

[97] https://www.villa-arion.com/eis-data.eu/project-consortium/

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- Georgia: 'National Water Information System (WIS Georgia)' managed by the Environmental Information and Education Centre of the Ministry of Environment Protection and Agriculture[98];
- Armenia: 'Water EcoPortal of Armenia' managed by the Environmental Monitoring and Information Centre of the Ministry of Environment[99];
- Azerbaijan: 'Water information system of Azerbaijan' managed by the National Hydrometeorology Department of the Ministry of Ecology and Natural Resources;
- Belarus: 'National environmental monitoring system', managed by the Main Information Analytical Centre of the Republican Centre for Hydrometeorology, Control of Radioactive Contamination and Environmental Monitoring[100];
- Ukraine: 'Open Access Environment' portal developed by Open Society Foundation in partnership with the former Ministry of Energy and Environment Protection of Ukraine;
- Republic of Moldova: 'National PRTR system' of the National Environment Agency[101].

To have a fully functioning Ecoportal, it is important to ensure interoperability, the use of commonly agreed data and metadata standards, and well-established cooperation among the public authorities. The following section presents a selection of examples of ecoportals.

Single web-access to environmental information in Ireland

http://www.epa.ie/irelandsenvironment/

- The environment portal in Ireland provides access to all environmental information, licensing and permitting, enforcement regulations, monitoring and environmental assessment data, 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.
- 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.

'Eco-portal' of the Environmental Information and Education Centre, Georgia

http://eiec.gov.ge/

- It is the central environmental information portal in the country, 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 related obligations, national reports on the state of the environment, a registry of environmental organisations as well as infographics. The site also includes information on the issued permits and other related information.

[98] http://wis.mepa.gov.ge/Home/Welcome

[99] http://ecoportal.mnp.am:92/

[100] https://www.nsmos.by/

[101] http://www.prtr.eco.vox.md/index.php/en/

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The National Environmental Monitoring System of Belarus

http://www.nsmos.by/

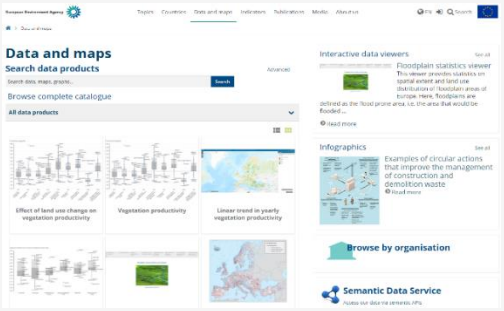
- The National Environmental Monitoring System aims to ensure the availability of environmental information at all levels of decision as well as in support of the implementation of international commitments.
- The portal is divided per monitoring areas: Land (soil), Air, Surface/Groundwater, Forest/Plant/Animals, the Ozone layer, Radiation, Local and other types of Environmental monitoring.
- Each monitoring area page provides basic information and publicly accessible yearly reports of monitoring observations (from 2006 to 2019).

The European Environmental Agency website

https://www.eea.europa.eu/

On its website, the EEA provides a variety of environmental data and information structured thematically and presented through graphs, diagrams, maps or other formats. Other communication materials such as videos, news, calendar of events is also available. The website is available in all EU languages (24 languages) and provides free access to environmental data, reports and indicators.

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



Building an infrastructure for geo-referenced environmental data

Due to recent developments in space technology, the emphasis has shifted towards the availability of geo-referenced environmental data. It has generated a need for a unified and standardised Spatial Data Infrastructure (SDI)[102].

The analysis made during the ENI SEIS II East project in EaP countries revealed that few geoportals are available. They contain very few environmental datasets and are usually dedicated to a specific environmental domain (e.g. air, water). The further development of a National Spatial Data Infrastructure covering the full environmental domain in EaP countries would enable the active dissemination of environmental information through a national geoportal, facilitate collaboration among public sector organisations and increase interest and usage of the portal by the business community and the public.

The European Union: building a spatial data infrastructure, the INSPIRE directive[103]

INSPIRE stands for Infrastructure for Spatial Information in the European Union. Adopted in 2007, the INSPIRE Directive aims to 'create a European Union spatial data infrastructure for the purposes of the EU environmental policies and policies or activities which may have an impact on the environment. This European Spatial Data Infrastructure will enable the sharing of environmental spatial information among public sector organisations, facilitate public access to spatial information across Europe and assist in policymaking across boundaries'[104].

[102] Standardisation of geographic data: the European INSPIRE directive, European Journal of Geography 2 2: 79-89, 2011.

[103] https://inspire.ec.europa.eu/

[104] https://inspire.ec.europa.eu/about-inspire/563

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

The INSPIRE Geoportal was developed under the INSPIRE Directive. It provides 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' and 'Priority Data Sets Viewer'. The 'INSPIRE Thematic Viewer' provides access to the INSPIRE data sets published by the EU Member States and European Free Trade Association (EFTA) countries. Data can be browsed by country and by 'INSPIRE Data Themes', out of which there are 34 spatial data themes under the 3 Annexes. The themes are defined separately and standardised for all data providers[105]. In addition, 'Priority Data Set Viewer' provides access to a series of priority datasets for environmental reporting which are made available by the EU Member States and EFTA countries on the geoportal[106].

Figure 9 INSPIRE geoportal, status November 2020

INSPIRE knowledge base also provides technical guidelines for data specification on spatial data and implementation of metadata and services:

- Technical guidelines for spatial data themes, such as INSPIRE Data Specification on Protected Sites;
- 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;
- Technical Guidance for INSPIRE Spatial Data Services and services allowing spatial data services to be invoked.

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

EaP countries: using a spatial data infrastructure to the environmental domain

The EaP countries have developed geo-referenced portals and web applications with good functionality and usability. A selection of the examples of geo-referenced portals and web-applications their specifics are presented in the case studies below. Even though portals are currently oriented towards a specific environmental theme, the further expansion of spatial data infrastructure to other environmental themes will facilitate the public access to environmental information and streamline the environmental information flows.

[105] https://inspire.ec.europa.eu/data-specifications/2892

[106] http://inspire.ec.europa.eu/metadata-codelist/PriorityDataset

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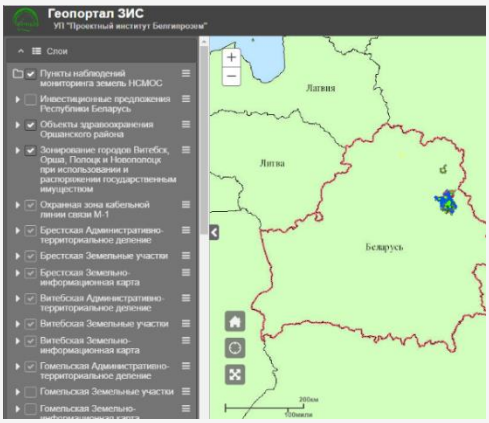
Belarus – Geoportal

http://gismap.by/

The geoportal provides spatial information, supporting the decision-making process regarding the environment and management of natural resources, such as land, forests and water. It also provides information on the administrative and territorial units. The portal is also deemed useful for geodesy, land cadastre, pipeline maintenance and other organisational purposes.

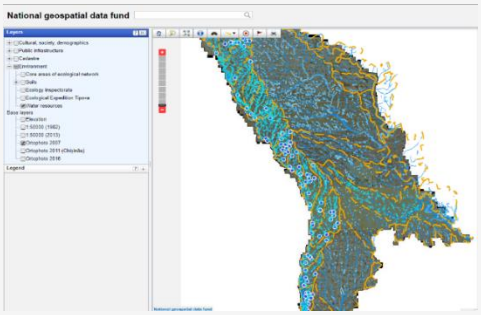


The Republic of Moldova –- National geospatial data fund – State Cartographical and Geodetic Fund

http://geoportal.md

The website hosts topographical, geodetic and mapping materials and data for use by public authorities, and for the private sector on demand, where sign-in is required. Open data in the form of maps is available for the public through a GIS browser.

The map has four layers, including 'Environment', to choose from. The 'Environment' layer consists of sublayers: 'core areas of ecological network', 'soil', 'ecology inspectorate', 'ecological expedition Tipova', and 'water resources'. Based on the chosen layers 'Information' and 'Search' functions are activated, providing additional information on the selected area.



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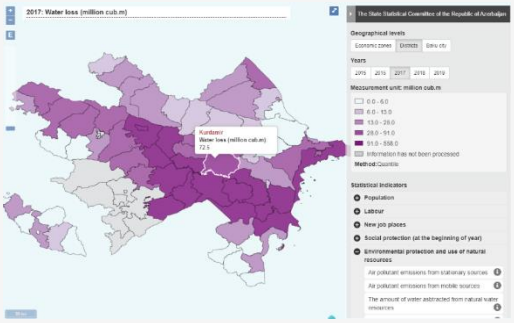
Azerbaijan – Web Map Application for visualisation and dissemination of statistical data

https://www.azstat.org/webmap/

The web mapping application is an interactive tool for visualisation of regional statistical data through thematic maps. The users can choose the geographical layer, the year and a statistical indicator from 22 dimensions. The application provides functionalities for a quick overview of the spatial distribution of a phenomenon and its trends observed by the official statistics.

The map has an environmental dimension that presents air pollutant emissions from stationary and mobile sources, the amount of water abstracted from freshwater resources, water consumption, water losses and the quantity of municipal waste at the region level.



Georgia – Air Quality Portal

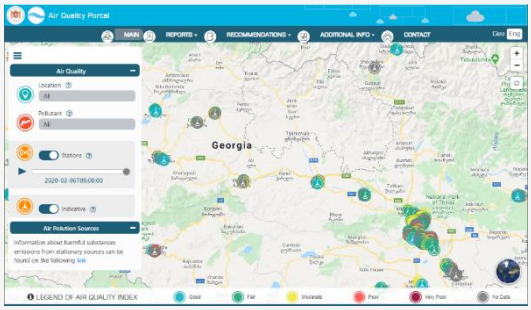
http://air.gov.ge

The portal is maintained by the Environmental Information and Education Centre. It provides access to comprehensive information on the ambient air quality and near-real-time air monitoring data via an interactive map.

The interactive map allows geo-tagging based on the pollutants selected from a given list. Functionality 'Stations' shows the changes of pollution level on an hourly basis (from past 48 h) in the stations where observations on air pollution are conducted on an hourly basis. Additionally, air pollution data can be provided from the stations where air pollution observations are conducted at other intervals ('Indicative').

The legend of the air quality index explains in detail the significance of different levels of pollutants' concentration.

Under the Reports section the user can generate and download Air Quality Reports based on the following selections: i) the temporal coverage of the report (daily, monthly, annually), ii) the stations available in different cities and iii) the day or month to be covered by the Air Quality Report.



This development will also stimulate the cooperation, sharing and multiple use of environmental data and information among various public authorities. And not the least encourage the public to interact with the website and become not just a user but a gradual provider of environmental data and information.

Providing technological support for sharing environmental data and information at the regional level

Sharing environmental data at the regional level enables better monitoring, close cooperation and trust, objective grounds for addressing common challenges and in the end a reliable basis for assessing the countries' performance at both national and regional levels. Cooperation on environmental matters at the regional level is important because it enables tackling common issues at their source and among the parties concerned.

To ensure the sharing of environmental data in this context, multiple elements are to be considered:

- **Legal framework:** countries should conclude regional, bilateral, cross-border or environment-specific (ecosystem-based specific) agreements for sharing environmental data, information and

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knowledge in a structured and regular way. In order to be effective, it is recommended that such agreements 1) define and list the environmental data and information (or refer to an additional document), 2) define technologies and means for sharing information, 3) set up standards for environmental 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) define the frequency and timing of the regular data exchange, and 5) adopt security measures for securing information flows, (6) link them to a clearly set target/objective to be achieved; (7) ensure effective public access to information and participation in international decision-making, by applying the principles of the Aarhus Convention (obligation of the Aarhus Convention, article 3.7)[107].

- **Information systems:** a key problem in the design of an information system is the ability to exchange information not only at national but also at regional and international levels. For facilitating the exchange of information, it is recommended to either 1) build information systems with standard interfaces to which national systems can connect to for exchanging data and information, or 2) build a dedicated platform for exchanging certain data and information at the regional/international level. In any case, to achieve interoperable technological solutions, a good practice is to establish a regional working group responsible for ensuring the regional interoperability. This working group should be represented in many ways (as to ensure geographic representation and knowledge diversity by bringing together IT experts and environmental specialists from all countries involved).
- **Trained experts, infrastructure and processes:** exchange of environmental data and information at the regional level should be automated as much as possible. Countries must document the processes through which data are collected, processed and shared at the regional level. On this basis, resources (both human and financial) need to be foreseen to ensure the regular exchange at the standard of quality and quantity agreed.

A few examples of regional cooperation are presented in the case studies below.

ICPDR (International Commission for the Protection of the Danube River) initiative

Another example of regional cooperation comes from Danube Basin+ project. Inventories and databases are fundamental requisites to assess the human influence on the environment. The ICPDR has been empowered by the Danube countries to organise data collection and to process the received information to serve the decision-making processes. The Danube River Basin Geographic Information System and the Danube river Water Quality Database help to monitor the state of Danube river waters

Source: https://www.icpdr.org/main/publications/databases

Baltic Data Flows initiative

An example of regional cooperation is the Baltic Data Flows initiative. Baltic Data Flows seeks to enhance the sharing and harmonisation of data on marine environment originating from existing sea monitoring programmes and to move towards service-based data sharing. The project is lead by Baltic Marine Environment Protection Commission (HELCOM) and co-financed by the Connecting Europe Facility of the European Union. It is being implemented from 2020 until 2023.

Sources: http://www.ices.dk/about-ICES/projects/Pages/Baltic_Data_Flows.aspx, https://helcom.fi/about-us/

[107] https://unece.org/environment-policy/public-participation/aarhus-convention/text

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2.3.3. Sharing experience in terms of Cooperation (Network)

Coordinating Open data initiative(s)

To ensure the effective coordination of the Open data initiative, it is essential to define a clear organisational structure and establish clear responsibilities for each public authority involved in the process. A relevant example is the Eionet partnership network working closely with EEA and presented below.

> **Eionet – a partnership network**
>
> Eionet is a partnership network of the EEA and its member and cooperating countries. It consists of the EEA itself, a number of European Topic Centres (ETCs) and a network of around 1 500 experts from 39 countries in up to 400 national bodies dealing with environmental information. These experts are designated as National Focal Points (NFPs) and National Reference Centres (NRCs). Through Eionet, the EEA brings together environmental information from individual countries concentrating on the delivery of timely, nationally validated, high-quality data.
>
> The concept of Eionet encompasses the following defining elements:
>
> - Strong institutional cooperation across several levels (national, regional, European, international) as well as partnerships with civil society, facilitated by a coordinating entity;
> - Agreed common content – data, information, indicators, analysis;
> - Shared infrastructures, standards, tools.
>
> Source: EEA, Eionet connects nr.1/2012, https://www.eea.europa.eu/publications/eionet-connects

At the country level, a public authority with coordinating powers should be responsible for setting procedures and guidelines for Open data. The same institution or a subordinate one should ensure the implementation and maintenance of the Open Data Portal. Common Open data responsibilities for all institutions should be defined by law, while each institution should have the freedom to publish Open data according to its specificities – in respect of national rules/guidelines.

Establishing processes and procedures for managing Open data

The guidelines and procedures on publishing and maintaining Open data, enable public authorities to flexibly organise and fine-tune the managed data sets and information. Based on a couple of examples of the country's practices (e.g. Lithuania[108], Ireland[109]), the following elements are to be included in the respective processes and procedures:

- Organisation of roles and responsibilities within the public authority for identifying, collecting, preparing, and publishing Open data;
- Recommendations for the selection of the dataset to be published – guidelines for the demand identification, prioritisation and selection of high-value datasets (as defined in the previous sections of this report);
- Guidelines related to the process of opening and publishing data:
  - preparation of the datasets and their description – metadata standards, datasets formats and tools to use for keeping track of datasets;
  - ensuring the quality of the datasets – methods and tools;
  - publishing of the datasets – tools and technical guidance for publication of datasets (i.e. portal(s), APIs);

[108] https://data.gov.lt/page/regulation_legal?lang=en

[109] https://data.gov.ie/pages/guideforpublishers

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  - updating the datasets – rules for updating and maintaining datasets;
  - managing the requests for new datasets and user feedback.
- A method for measuring the progress of opening the data;
- A method for impact assessment of opening the data.

Increasing awareness of public administration, business and public at large on Open data

The value of Open data lies in its usage. For public authorities, businesses and the general public to use environmental data through the Open Data Portal, it is necessary to consistently and systematically raise awareness of its use and potential benefits.

The need to increase awareness

Typically, EaP countries could undertake a series of actions to increase public awareness on open data for environmental matters as for example:

- Publish articles, success stories, quizzes, interactive games etc. in popular media (including social media);
- Integrate the aspects of open data in the university curricula (e.g. in a form of developing apps): educate the young generation in using Open data enables the creation of a 'culture for Open data';
- Create Open data/environmental data communities: the creation of dedicated communities enable experts/specialists to connect and share knowledge, information, good practices in the field and promote further the benefits of using open data in the environment;
- Build applications, social media groups in which the general public and businesses can participate in activities linked to the data use cases (e.g. an application for notifying about environmental pollution);
- Organise conferences, round tables by bringing together policymakers, solution providers, researchers and other stakeholders, including interested public to address topics such as management, exchange and sharing of environmental information. The debate could demonstrate the benefits and added value of using Open data for all stakeholders involved, including the public;
- Provide Open data online training. One of the examples of such training is 'JOINUP Share and reuse Interoperability solutions for public administrations, businesses and citizens', available on the EU website joinup.ec.europa.eu. This website hosts several interoperability tools and training modules on Open data. This platform enables public authorities, businesses and the public to find public documentation on this topic in one single place.

An extended but not exhaustive list of modalities and tools for raising awareness on Open Data and its benefits is presented in the table below. These are just examples harvested from a wide array of initiatives taking place around the world. The variety of activities included in the table, is aiming to serve as a source of inspiration for all interested in promoting Open data at the regional, local or thematic level. The list could be complemented by many other relevant initiatives in this area and is a living material under continuous expansion, similar to the report itself.

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Table 3 Additional means for increasing awareness

No.	Tool	Description	Example
1	**Success stories**	Share success stories with different stakeholders	Success stories and Open Data category descriptions are available on Open Data portals such as France, Ireland, New Zealand, Spain, USA, etc.
2	**Events**	Organise conferences, fora, presenting the benefits of Open data, success stories, and opportunities for Open data use. Hackathons can be organised in which participants create new programmes that use data visualisation and other forms of open-source data.	Fishackathon[110] – is organised by the US Department of the State Office of Global Partnerships in order to promote the creation of digital solutions to address the sustainable fishery challenges. EU Datathon[111] is organised by the EU Publications Office, in close collaboration with the European Commission Directorate-General for Regional and Urban Policy to promote open data usage.
3	**Open data usability studies and research**	Conduct and publish research and studies on data usage cases and applications.	*Open Data 500 Australia*[112] was 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	**Private and public sector partnerships**	Through public-private partnerships, public authorities can support initiatives to promote the establishment and growth of new businesses that use Open data.	The Australian government has set up a *DataStart*[113] incubator to promote data innovation in the country. The goal is to select business ideas that actively use Australian Open data and contribute to their development. The partners of this initiative are companies like Google and Optus.
5	**Awards**	Organise contests and set up awards/prizes for companies, public bodies, the research community, schools and academia, and civil society actively using Open data.	The Spanish government organises the Aporta Awards[114].
6	**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 to provide support towards promoting the use of Open data on the national Open Data Portal data.gov.ie[115]. Open Data Day 2020 mini-grant scheme[116] provided small funds/grants to support the organisation of Open data-related events across the world on Saturday 7th March 2020 (Open Data Day)[117].

[110] https://fishackathon.co/

[111] https://op.europa.eu/en/web/eudatathon

[112] https://data.gov.au/data/dataset/open-data-500-australia-responses

[113] https://datastart.com.au/

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

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

[116] https://blog.okfn.org/2020/01/16/announcing-the-launch-of-the-open-data-day-2020-mini-grant-scheme/

[117] https://opendataday.org/#what

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Promoting Open data to public sector organisations

The promotion of Open data in public sector organisations usually starts with the training and awareness-raising of the employees. The training is required to equip them with knowledge on how to prepare, disseminate and implement Open data initiatives. Training can cover 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 of Open data use, (4) data science skills, (5) practical aspects of discovery, publication, applicable laws and licensing.

The lack of understanding of the benefits of sharing and making data available to the public might hinder the motivation to create, maintain, update and finally use an Open Data Portal. By sharing good practices and experiences amongst public authorities, and with the international community, the awareness of civil servants will be increased, and the interest stimulated. In addition, it is important to properly acknowledge as well as to promote the contribution of each organisation in the field of Open data.

Collecting user feedback and facilitating new ways of communication between Open data providers and users

The true potential of Open data can only be witnessed by providing the relevant datasets to Open data users. In this context, the Open Data Portal should contain the necessary mechanisms for communicating requests and receiving feedback from data/information users to data providers. In particular, the Open Data Portal should provide:

- Modalities for the portal users to directly contact Open data providers: this can be done via the website or by attaching an email address in the metadata of specific datasets. A facilitation mechanism could be created to connect data users with data providers. For example, on the website, a clear indication of 'data domains/themes' could be available for selection in the request form, so that the request can be directed to the right data provider (e.g. water, air, biodiversity and further on specific information such water quality, air quality etc.).
- Group discussion/forum for Open data users.
- A feedback button on the portal and, furthermore, on each dataset to collect various types of comments and consequently help 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:
  - open consultations;
  - review a new development of the portal, public e-service development;
  - submit good ideas, suggestions for improvements;
  - a mechanism for users to rate the quality and usefulness of the information/data sets available;
  - a discussion forum for data users, which would facilitate the dialogue and exchange between data/information users (e.g. volunteers, universities, research centres, NGOs, the public, etc.).

Few examples of engaging Open data users are provided in the case studies below.

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Collection of user feedback and facilitation of experience sharing on the Spanish Open Data Portal

Content

The Spanish Open Data Portal provides functionalities for users in terms of:

- providing feedback: giving suggestions for possible improvements;
- requesting new dataset;
- sharing information about Open data initiatives that can be included in the 'initiatives map';
- sharing information on the applications created by using Open data from this portal.

Environmental aspect

- Spanish Open Data Portal presents over twenty-seven thousand datasets in 23 categories – with the Public sector and Environment categories containing the highest volumes of datasets.
- The category Environment contains 5210 datasets, which are updated on a regular basis.
- Topics range from hourly measurements of atmospheric pollutants and ozone in specific regions to maps visualising the level of water erosion in soil.
- With 64 contributing organisations, high data reliability, frequent updates and readily downloadable data sets, the Spanish Open Data Portal represents a good practice example of highly functioning Open Data Portal in Europe.

Source: https://datos.gob.es/en, status November, 2020

Communication with users on the Georgian Open Data Portal

Content

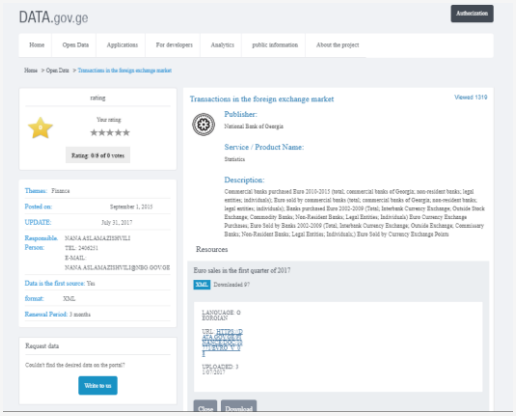
The Data Exchange Agency of Georgia has established the Open Data Portal – data.gov.ge, which is a unified national platform for publishing Open data owned by government institutions. The portal is enabling any interested person, group or entity to further process, use and reuse the data for various purposes. Data are available free of charge and can be reused without limitation but requires acknowledgment of the Open Data Portal as a source.

Open Data Portal has ways of communicating with users such as:

- gather user feedback by rating datasets;
- gather demand for new datasets by using 'request data' option.

Environmental aspect

- The Open Data Portal has the Environmental Protection category containing eight reports and the National Action Plan for the Association Agreement and the Implementation of the association agenda (rather modest and requiring further development and regular update).
- Filtering based on topics of Open data is still to be developed.
- The Report pages provide the possibility to download available reports in original formatting.
- Multilingual functionality is not available.



Source: http://www.opendata.ge/en, status November, 2020

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Our journey through e-government and Open Data path is ending with a feedback topic. The EEA and the authors of this report are looking forward to your feedback as well!

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3 | The way forward

The present document was aiming to provide a snapshot of the many and diverse activities, initiatives and developments taking place around the world in the dynamic area of Open data, e-governance and information technology. But the focus was to look a bit further and identify where the environmental information stands in this technological boom. In fact, the intention was to identify the extent environment benefits of this development and how it can be further enhanced, expanded and promoted to other countries and regions. Finally, this report is also an attempt to respond to the main challenges identified in the national Roadmaps prepared for the six Eastern Partnership Countries. Therefore, the current report is an integral part of a package prepare with and for the countries in the EaP region to help them address and overcome the many tasks ahead.

As technology advances with this incredible speed the applications developed, the initiatives launched, and the experiences gained also increased exponentially. Therefore, this report is just a stopover in this journey, and everyone is invited to join and bring its experience onboard and push further the existing boundaries.

Ambitious objectives are set up around the world in the field of transition towards green and circular economies, combating climate change, or halting the biodiversity loss and sustainable development. With these tasks come new demands for wide participation and engagement, quick access to information and sharing and the need to act fast and targeted. It is in this context and for this purpose that we have to bring the modern technology along, bring the IT and environmental experts together, engage public and motivate businesses to start sharing their information and knowledge from local to national and across borders. And with the sharing start working together, trust more and systematically address the problems ahead. Almost everything is possible today from the technological perspective, the need is for commitment and strong political will.

The coronavirus pandemic showed that today challenges are local and global in nature at the same time, showed us how effective access to information and technology can help and how good practices and initiatives can inspire others. This was a major test for our generation. Many lessons can be learnt on how to use technology in the benefit of all, the importance of sharing fast and reliable information and the need to cooperate in addressing global challenges. For the environment, this is the best example at hand to be followed, and the proof that it is possible should give us confidence and drive to act.

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Annex 1. How to read and use the Good practice report in relation to the Roadmaps provided in the Country maturity reports

Further, we present a structured table which will help the reader to find links between the relevant sections of the Good practice report and references in the Country maturity reports.

Table 4 Cross-referencing between Country maturity reports and the Good practice report

No	Sections in the Good practice report	Section names in the Countries' maturity reports
1	**Introduction**	
2	**Good practices for fostering sharing and dissemination of the environmental information**	
2.1.	Examples of policy frameworks facilitating the sharing and dissemination of the environmental information	
2.2.	Learning from others' experiences on e-government	
2.2.1.	Sharing experience in terms of Content	
	Building a digital strategy which considers the environment	Building a digital strategy which includes the environment
	Building e-services and public information systems according to national and international standards	Building e-services and public information systems according to national and international standards
	Presenting e-services on a dedicated portal	Publishing e-services on a dedicated e-service portal
2.2.2.	Sharing experience in terms of Infrastructure	
	Developing an interoperability framework	Establishing an interoperability framework

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No	Sections in the Good practice report	Section names in the Countries' maturity reports
	Developing an integrated environmental monitoring system at a national level	Building an integrated environmental monitoring system at a national level
	Developing user-friendly functionalities for accessing data and statistics	
2.2.3.	Sharing experience in terms of Cooperation (Network)	
	Increasing awareness and motivation among public authorities on the benefits of using e-government and digital solutions	Increasing awareness and motivation among public institutions over e-government and digital solutions
	Raising awareness on the benefits of using e-government solutions by the public and business community	Increasing awareness of e-government among the public and businesses
2.3.	Learning from others' experiences on Open data	
2.3.1.	Sharing experience in terms of Content	
	Considering the environment while developing a national strategy for Open data	Develop a national strategy for Open data and a measure plan to implement it for specific types of information
	Implementing the Open data strategy through action plans	Adopt an action plan based on the Open data strategy and the digital strategy
	Adopting an Open data policy, which considers the environment as a key component	Adopt an Open data policy, and extend it to environmental data
	Building a legal framework for Open data which includes an enforcement mechanism	Designing an Open data legal framework and provision of enforcement mechanism
	Applying a standard referring to the metadata structure for all environmental information	Definition of metadata description standard for all environmental information
	Increasing the discoverability of environmental data and information	
	Categorising Open data	
	Transforming available data into a machine-readable format	Transformation of data published to machine-readable format
	Developing and providing mechanisms for the quality control of environmental data	Develop and publish quality control mechanisms for environmental data
	Harmonising licensing terms and conditions for accessing environmental data	Adopt/update licencing terms and conditions of environmental data to promote its public use and reuse

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No	Sections in the Good practice report	Section names in the Countries' maturity reports
	Producing and disseminating environment assessments and reports by using modern technology	
	Ensuring timely and regular collection, update and dissemination of environmental data and information	
	Running Open data impact evaluation	Evaluate the impact of Open data
	Improving accessibility and use of available environmental information by improving the multi-lingual aspect of portals	Improve accessibility and use of available environmental data and information by improving the multilingual aspect of portals
2.3.2.	Sharing experience in terms of Infrastructure	
	Building an Open data portal and fostering access to environmental data and information	Building an Open data portal and foster publication of public sector information
	Establishing a single and user-friendly web-access point for environmental information	Establish a single and user-friendly web access point for environmental information
	Building an infrastructure for geo-referenced environmental data	Developing infrastructure on the most advanced platforms based on geospatial data and GIS technologies
	Providing technological support for sharing environmental data and information at the regional level	Providing technological support for sharing environmental data at the regional level
2.3.3.	Sharing experience in terms of Cooperation (Network)	
	Coordinating Open data initiative(s)	Coordinating Open data initiative(s)
	Establishing processes and procedures for managing Open data	Establishing processes and procedures for managing Open data
	Increasing awareness of public administration, business and public at large on Open data	Increasing awareness of public administration, public and business on Open data and environmental data
	Promoting Open data to public sector organisations	Promoting Open data to organisations
	Collecting user feedback and facilitating new ways of communication between Open data providers and users	Collecting user feedback and providing new means of communication between Open data providers and users
3	**The way forward**	

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