Sharing and dissemination of environmental information

Country maturity report: Ukraine

Roadmap

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Legal notice

This report was produced by PricewaterhouseCoopers as part of the project for developing a roadmap and identify feasible and practical means for integrating environmental information in national e-governance/open data processes and platforms. This action is done in the context of the ENI SEIS II East project 2016-2020. The report was built in 2018 and updated throughout 2019, including a review in March 2019 after the first regional meeting in Kiev, and a second review after the roundtable in November 2019. The report was reviewed by public authorities in Ukraine in January 2020.

This report contains information obtained or derived from a variety of publicly available sources described within the report in more detail and does not intend to be a comprehensive analysis of environmental information, open data and e-government in the country but a collection of the main elements shaping the national environmental information landscape.

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Roadmap

In general, it is recommended that Ukraine should focus on some key elements for following coherent and effective open data and environmental information management and for addressing the common challenges presented above. In brief, the focus should be on the following:

- **Policy measures:**
    - *Long-term digital action plan*: an action plan for e-government and open data should be in place. It should ensure scoping, management and funding of the national e-government and open data portals, as well as digital awareness-raising activities for both governmental institutions and the public. In doing so, all available results acquired from previous activities and projects across the whole economy spectrum should be assessed and put in motion.
    - *General interoperability framework*: the country should have in place an interoperability framework or at least its foundation. This is especially required to further develop "Trembita" system and ensure sustainable integration of other information resources including environmental information systems.
    - *General interoperability framework*: the country should have in place an interoperability framework or at least its foundation. This is especially required to further develop "Trembita" system and ensure sustainable integration of other information resources including environmental information systems.

    - *Roadmap in the field of open data and environmental information*: this roadmap should contain key objectives for fostering sharing and dissemination of environmental information. During the implementation of ENI SEIS II East project the roadmap, introduced in the following section, was developed; it can serve as a basis or inspiration to practically implement suggested measures, create new ones and enhance open data and environmental information sharing initiatives.
- **Legal measures:**
    - *Enforcement mechanisms* for the regular collection, sharing and dissemination of environmental information and for the implementation.
- **Technical measures:**
    - *E-government, open data and geoportals*: the country should have effective e-government, open data, environmental portals on which environmental data and information can be shared/disseminated with spatial attributes, and where services can be built.
    - *Implementation of international standards*: standards developed by EU, the International Organization for Standardisation (ISO), the World Meteorological Organisation, the Open Geospatial Consortium, the World Wide Web Consortium, the National Institute of Standards and Technology and other international organisations which are responsible for standards development could be adjusted

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and introduced in the areas of designing an information system, metadata standards, and interoperability standards.

Some of these elements are already in place in Ukraine (e.g. the data exchange platform "Trembita"). Nonetheless, it is advised to look at all these aspects from the integrated perspective of environmental information sharing and dissemination and to update them where appropriate. These elements are under continuous development; hence a periodic review is necessary.

Guidance for the implementation of the roadmap

The roadmap provided in the following section outlines key areas for further development in the field of open data and environmental information. It also provides recommendations and suggested actions for improvement that are organised according to the following SEIS pillars: content, infrastructure, and cooperation.

The success and rapid advancement of the country in this challenging domain are strongly dependent on clear priority setting, multidisciplinary teamwork and regular monitoring and adjustment of the results. Furthermore, as progress is gradually made in one or several areas proposed for consideration, improvements, readjustments or amendments to the roadmap will be needed to keep it relevant and focused on the key priorities of the country.

To support the implementation process of the proposed measures at the national level, it is recommended to start by establishing an interdisciplinary team that would be responsible for driving and overseeing the overall process. The measures should be prioritised and implemented to support and enhance the e-government, open data and environmental strategies of the country. Furthermore, this process should not be carried out in isolation. On the contrary, it should be undertaken by taking into account the extensive experience already gained in this area by other countries and organisations and in the context of a broad regional exchange and international collaboration.

The measures proposed are to be implemented by specific bodies at various levels of decision-making and across disciplines. In this respect, the measures are grouped into three major categories namely: policy measures, legal measures and technical measures. These categories are indicated by the colour scheme (provided in the table below). They aim to signal the leading expertise or decision-making level required for the implementation of each measure while being considered in an interdisciplinary setting.

Table 1. Legend for the colour scheme of the roadmap measures

Colour	Type of measure	Description
	Policy	The measures in this category cover the development of specific strategies and policies and their integration into the overall policy framework at the national level. They include establishing clear and measurable targets as well as monitoring the implementation of the strategies and policies. Furthermore, they imply supervision,

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Colour	Type of measure	Description
		coordination and other practical arrangements in terms of interdisciplinary work on open data and e-governance across various areas including the environment.
	Legal	The measures in this category cover the development and adoption of new legislation or the revision of the existing one followed by the development of secondary legislation, guidelines and methodologies in the area of open data and e-governance across various domains, including the environment. Legal measures include governance setup, ensure clear division of responsibilities and propose enforcement mechanisms for obligations defined in the legislation. Legal measures include governance setup, ensure clear division of responsibilities and propose enforcement mechanisms for obligations defined in the legislation.
	Technical	The measures in this category cover the adoption or development of technical tools, methodologies and procedures, as well as the introduction and adoption of international technology standards at a national level. These measures also embrace developing new competencies and training specialists to ensure the successful implementation and sustainability of technology initiatives.

It is recommended that Ukraine should implement measures proposed in the roadmap after consideration of the latest policy, legal and technology changes happening in the country. The table below suggests a recommended timeframe to implement measures with different priorities assigned.

Table 2. The recommended timeframe for the implementation of measures

Priority	Recommended timeframe for the measure implementation
High	In next 1–3 years
Medium	In next 3–5 years
Low	Over the next five years

Priorities proposed in this roadmap were based on information received and aggregated from 2018 to 2020. Depending on the measure implementation, changes in the policy, legislation or technology the suggested priorities might change. To ensure effective implementation of proposed measures and their relevance regular measure monitoring is essential.

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

The implementation of the proposed measures in the roadmap is assisted by a good practices report, the "Open data and e-government good practices for fostering environmental information sharing and dissemination" (the Good Practices Report). This report is an integral part of the present

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project and presents relevant examples from other countries and organisations on the practical implementation of the roadmap measures.

The Good Practices Report is organised into two sections – e-government and open data – each part following the SEIS pillars "content", "infrastructure", and "cooperation (network)". In addition to this, the following resources can also be used to support the implementation of the measures proposed in this roadmap:

- Report on the "Promotion of good practices for national environmental information systems and tools for data harvesting at EU level";
- Streamlining Environmental Reporting in the EU – Action Plan;
- Open Data Maturity in Europe 2019[1, 2];
- Development of an assessment framework on environmental governance in the EU Member States[3].

Roadmap measures: Content

The measures proposed to Ukraine in this SEIS category "Content" are summarised in the table below.

Table 3. Measures from the perspective of SEIS pillar: Content

	Measure	Priority	Description
	1. Revision of the legal framework to promote and regulate the online accessibility and reuse of public sector information (PSI)	High	Adopt or amend as needed, the legal acts referring to data management and accessibility related to environmental domain (monitoring, assessment and reporting, management and control of natural resources, ecosystems and pollution) in accordance with the Aarhus Convention, the Protocol on PRTRs (as appropriate) and the Open Environment concept. This can include: • Improving environmental information system by defining themes, sources (lists, registers, databases, resources, etc.), formats, metadata, licencing and interoperability requirements. In particular, publish the list of potential datasets per domain or thematic area that are open for access (e.g. The Ministry of Justice in its order 897/5[4] [5]from 2016 provides a list of datasets, which will be opened for access);

[1] Report for 2019 available from 2nd December 2019, at https://www.europeandataportal.eu/en/dashboard/2019
[2] https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf
[3] "Development of an assessment framework on environmental governance in the EU Member States" under the contract No 07.0203/2017/764990/SER/ENV.E.4 funded by the European Commission, Final report May 2019.
[4] https://zakon.rada.gov.ua/laws/main/v897_323-16?lang=uk
[5] Requested in the national roundtable.

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	Measure	Priority	Description
			• Improving the division of the roles and responsibilities between public authorities and with other stakeholders at all levels and across the sectors to ensure coordination in maintaining, access and use of Open Environmental Information System and Open Data Portal and other relevant information systems (e.g. statistical, geospatial); • Improving procedures for environmental data collection in electronic formats and its accessibility as open data; • Improving procedures for environmental data flows for regular updating, quality assurance and quality control, reporting, inter-institutional sharing and exchange, online dissemination and other means of dissemination; • Setting up the public participation procedures (from early stages) in the design, use and update of the environmental information system(s) and investigate new sources of information to capture needs and feedback of the public; • Including in the new legislation reference to citizen science or citizen-generated data (crowdsourcing) as a potential tool to collect data, filling the data gaps and complementing existing data sources (invasive species, butterflies, marine litter, air quality); • Include in the new legislation earth observation or other remote sensing tools as to complement/alternative of the traditional monitoring/reporting and policy evaluation methods • Reviewing periodically the application of exceptions in the disclosure of environmental information; • Ensuring the legitimate application of these exceptions and the disclosure of information on emissions in accordance with the Aarhus Convention; • Clarifying the practical rules to separate non-confidential information of public importance for its further disclosure and publishing online; • Establishing or updating as needed mechanisms for assessing the implementation of the existing legislation in this area. *For guidance, consult the section "Designing an Open Data legal framework and provision of enforcement mechanism" of the Good Practices Report.* *This measure is closely linked with "Establish a collaborative institutional framework for the*

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	Measure	Priority	Description
			implementation of an open data" in the Cooperation (network) section.
	2. Adopt guidelines defining the practical arrangements for environmental information management, sharing and dissemination	High	Adopt technical guidelines set out by the practical arrangements for environmental information management, sharing and dissemination specifying: • The scope of environmental information system(s) with their metadata description and registry; • The environmental data management structure (including data architecture, data stewardship, system administration, data privacy, data security and data quality); • Decision-making procedures for sharing non-confidential information and datasets and publishing them online on the relevant portals (e.g. websites of public authorities, environmental portals, one web access point for environmental information, geospatial portals, statistical, open data and other portals); • Separation of non-confidential information as appropriate; • Ensuring stakeholder communication, including public participation procedures in the design, use and update of the environmental information system(s).
	3. Develop and adopt an environmental data policy	High	Adoption of an environmental data policy by the authorities in charge of environmental protection to include: • List of varied environmental information available and the scope thereof; • Basic terms of availability and accessibility, including open access and data sharing aspects; • Data-holder support for availability and accessibility by third parties; • Rights and obligations of data and information holders/providers in terms of maintenance, update, quality assurance and reliability of data and information about their responsibility; • Licencing terms and conditions; • Contact point for access to environmental information. *To see an example of data policy, consult the European Environment Agency's website: https://www.eea.europa.eu/legal/eea-data-policy/data-policy*

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	Measure	Priority	Description
	4. Develop/update licencing terms and conditions to promote open data access, use and reuse of environmental information using an open licence	Medium	This measure will involve defining the licencing terms and conditions used on the different portals for publishing and accessing environmental data. *At present, the open data portal defines licencing according to CC BY 4.0. However, data and information published by MENR and other public authorities on thematic portals are not licenced, thus the use and reuse of data are limited.* *More information about licencing is available in the Good Practices Report in the "Harmonise licencing terms and conditions of environmental data to promote its public use and reuse" section.*
	5. Adopt/update interoperability standards for environmental systems	High	This measure will review the existing standards for exchanging environmental data and information with the aim of standardising these exchanges. Based on the completed inventory, this measure will harmonise the use of standards and develop common guidelines for the automated exchange of environmental data and information. Specifically, these standards will include standards of metadata for data and information exchange between environmental information systems (e.g. interfaces could be built using web services). *It is important to note that this measure is a prerequisite for building an effective integrated environmental information system.* *This measure is closely linked with the measures "Enhance interoperability of geospatial, statistical, health and environmental information systems" and "Establish an electronic registry of public environmental information" in the Infrastructure section.*
	6. Regular collection and timely reporting of environmental data and information in accordance with national and international obligations	High[6]	This measure will: • Ensure the effective implementation of the Aarhus Convention and its decisions and recommendations from the Meeting of the Parties on promoting effective access to information and electronic information tools. • Include information on the implementation of this roadmap in the national implementation report on the progress (questions) for the Aarhus Convention

[6] This action was distinguished as a high priority during the national roundtable.

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	Measure	Priority	Description
			and Protocol on PRTRs to promote the exchange of experience. • Define practical arrangements for establishing Pollutant Release and Transfer Register within the integrated environment information system(s) by using international standards and good practices. • Improve the ability to trace the origin of data and the methodology behind the production of the indicators as a basis to increase data credibility for policymaking and the general public. • Ensure the implementation of national and international commitments related to the regular provision of environmental data and information. • Ensure constant monitoring and timely preparation of reports on the state of the environment.
	7. Improve and make publicly available the quality assurance/quality control mechanisms behind the published environmental data and information	High	The results and methodology used for quality assurance and quality control of environmental data are to be published in a detailed manner in order to enable public and other stakeholders to assess the reliability of the data. This measure will: • Assess the current quality control mechanisms along the whole MDIAR[7] chain, PRTR process and others which are similar; • Publish the current control measures in place and set minimum standards to be respected in all stages of the data flow (data collection, data preparation and control, aggregation and data dissemination); • Complete/amend existing legal framework by adding specific provisions on the obligations of quality control of environmental data at different levels (including penalties for non-compliance); • Monitor systematically the implementation of the quality control measures and set up an annual assessment process for the evaluation of the quality of environmental data provided. *According to the OGP initiatives, the low quality of data is one of the key challenges to be addressed. As described in the report, Ukraine has data quality standards established however it lacks the overall quality control process for the whole data flow.*

[7] The monitoring/data/information/assessment/reporting (MDIAR) chain is the flow of data and information from national monitoring to European reporting.

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	Measure	Priority	Description
			An example of criteria for assessing quality control measures is depicted in the "Promotion of good practices for national environmental information systems and tools for data harvesting at EU level", p. 165. *An example of standards, procedures and measures for quality control are also presented in the good practices report, in the "Develop and publish quality control mechanisms for environmental data" section.*
	8. Define/adopt and publish metadata description standards for all environmental data and information in accordance with international standards using a one-stop access point	High	This measure will aim to define metadata standards to support interoperability and dissemination of environmental data and information, including environmental reports and their discoverability. As a result, it will be easier for institutions to exchange and manage environmental data, while also making it easier for the public to find the information. *Currently, the CKAN/DCAT-AP standard is implemented in the Ukrainian open data portal, but is not in other government software solutions, where datasets are stored for public use. As well as part of metadata standard licencing, metadata should also be implemented at a national level. Currently, in the Ukrainian open data portal, licencing information is not present.* *This measure is closely linked with the measure "Enhance interoperability of geospatial, statistical, health and environmental information systems" in the Infrastructure section.*
	9. Expand collection, prepare and publish environmental data in a machine-readable format	High	Ukraine currently publishes most of its data in a machine-readable format. However, there is still data stored in various public authorities which are not available, hence the need to ensure first their availability/accessibility and preferably in machine-readable formats so that they can be further used and reused. It is recommended that the state of the environment assessment report be regularly produced and made available online as an interactive product, preferably indicator-based. In addition, UNECE indicators should be provided in a timely and consistent manner. This measure aims to ensure the publication of environmental data in a machine-readable format. Such a measure can be driven through the establishment of the Open Data legal framework, setting up the obligation to publish, as a rule, all datasets as machine-readable, unless data are not available in such a format and gradually move

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	Measure	Priority	Description
			to machine-readable formats in case they are currently not available and require extensive processing. *The Good Practices Report provides more details about machine-readable formats in the "Transformation of data published to machine-readable format" section.* *This measure is closely linked with the "Define/adopt and publish metadata description standards for all environmental data and information in accordance with the international standards using a one-stop access point" measures outlined in the Content section.*
	10. Inventory, re-engineering and publication of public services as e-services	Medium	This measure will define metadata standards and ensure that environmental services are described and accessible through the electronic services portal, in accordance with national standards. This measure will ensure that environmental services are described and accessible through the electronic services portal, in accordance with the national standards. For the description of public services, it is recommended that the European Core Vocabularies, such as Core Public Service, Core Person, Core Location and Core Public Organisation, be adapted. This would allow a coherent and standardised description of e-services and improved interoperability to be ensured. *Ukraine has made progress during recent years and developed e-services to foster interoperability, especially for open data, environment, geospatial, health, transport, and energy information. Nonetheless, a further development of e-services is necessary to integrate 'life events' ('Life events' package government services which are usually provided by multiple government agencies around a subject that is relevant sense to citizens.)* *For an example of implementation, consult the Good Practices Report section "Publishing e-services on a dedicated e-service portal". This example shows how the initiative was implemented in the Republic of Moldova.*
	11. Perform an open data impact analysis for the use/reuse of environment data	Medium	This measure will support raising awareness through the regular assessment of the impact of the use/reuse of environmental data, as part of the open data impact assessment framework, and will drive further developments. For example, performance can be evaluated against the following criteria: • Number of environmental datasets downloaded and reused; • User feedback received/collected;

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	Measure	Priority	Description
			• Number of applications developed using environmental data and having an impact on the environment (including reuse of environmental data by other sectors, such as transport). *More information about the general open data impact assessment can be found in the Good Practices Report in the "European Data Portal Impact maturity" section. The section provides an example of the European Open Data Portal relevant for this area.* *This measure is closely linked with the "Strengthening of technical capacity for environmental monitoring" measure in the Infrastructure section.*

In order to facilitate the implementation of the provided measures, the Good Practices Report provides the following examples and recommendations:

- Building a digital strategy which includes the environment (example from Lithuania);
- Building e-services and public information systems according to national and international standards (examples from Estonia and the EU);
- Publishing e-services on a dedicated e-service portal (examples from the Lithuania, Romania and the UK);
- Develop a national strategy for open data and a measure plan to implement it for specific types of information (example from Ireland);
- Adopt an action plan based on the open data strategy and the digital strategy (example from the OGP);
- Adopt an open data policy, and extend it to environmental data (example from the EU);
- Designing an open data legal framework and provision of enforcement mechanisms (example from the EU);
- Definition of metadata description standard for all environmental information (examples from the EU and the UK);
- Transformation of data published to machine-readable format;
- Develop and publish quality control mechanisms for environmental data (example from the European Open Data Portal);
- Adopt/update licencing terms and conditions of environmental data to promote its public use and reuse (example from the European Open Data Portal);
- Evaluate the impact of open data (examples from the European Open Data Portal);
- Improve accessibility and use of available environmental data and information by improving the multilingual aspect of portals (example from the EEA).

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Roadmap measures: Infrastructure

The measures proposed to Ukraine in support of the SEIS pillar "Infrastructure" are presented in the table below.

Table 4. Measures from the perspective of SEIS pillar: Infrastructure

	Measure	Priority	Description
	12. Establish a single and user-friendly web access point for environmental information	High	To support the implementation of Decision VI/1 of the Meeting of the Parties of the Aarhus Convention, it is recommended that a single web access point to environmental information be established. In this regard, Ukraine developed an Open Environment concept to integrate the environmental data held by central and local governmental bodies into one system served by a single portal. The following suggestions are aimed at assisting the development of the proposed portal: • The portal should be designed so that agencies and institutions can share easily their (structured) data via application programming interfaces or APIs (e.g. EEA public map services [8] or provisions of the INSPIRE Directive). The portal should have a tool for checking the quality of metadata provided by data providers; • The portal could be automatically synchronised with other "data publication" portals such as the Open Data Portal (e.g. publish open data according to Data Catalogue Vocabulary – DCAT on all portals containing and disseminating environmental data); • The portal should have a developed search functionality to allow the user to use multiple field search and filter options (e.g. file format) to refine the search, combining the keywords with classifiers; • The portal should be user-friendly and – if needed – have an integrated content management system[9]; • The portal should be maintained/updated and enhanced taking into consideration the feedback received (from the public, governmental bodies and other users). *Environmental information and data are spread on multiple portals, as shown in this report. It is not clear which website has the latest or correct information published. The portals*

[8] https://www.eea.europa.eu/code/gis

[9] The UK provides a series of good practices for developing a management system for environmental permits. These good practices can be considered when introducing a content management system for the environment, including standards such as (for example) Eco-management and Audit Scheme (EMAS), EMAS Easy, ISO 14001, Green Dragon, phases 1 to 5 of British Standard (BS) 8555. Link: https://www.gov.uk/guidance/develop-a-management-system-environmental-permits

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	Measure	Priority	Description
			are also built according to different designs, which hinders the searchability of information. *More information about single access points can be found in the Good Practices Report in the "Establish a single and user-friendly web access point for environmental information" section (examples from the EU, EEA and Ireland).* *The design of the environmental information system is also widely described in the document "Promotion of good practices for national environmental information systems and tools for data harvesting at EU level".*
	13. Enhance interoperability of geospatial, statistical, health and environmental information systems	High	This measure will facilitate the implementation of the interoperability standards defined for the environment and other thematic data. This measure will: • Assess existing compatibility of various information systems with defined interoperability standards, in particular with the geoportal; • Adopt/update and implement standards for metadata and data interoperability in accordance with international standards and good practices; • Implement the standards defined and develop APIs for all external users; • Provide automated mechanisms for sharing time-series data. The "Trembita" information system is used as an interoperability platform in Ukraine. It will be useful that, even from the design and development stages of the information system, public authorities implement common interoperability standards and integrate their electronic resources with the "Trembita" information system. These actions can also be included in the national interoperability framework. *Refer to the good practices report for more details about the development of interoperability in Lithuania and the EU in the "Establishing an interoperability framework" section.* *This measure is linked with the measures "Develop and/or continue to enhance an integrated system for environmental information management in accordance with the Aarhus Convention and the Protocol on PRTRs" and "Update/adopt interoperability standards for environmental systems and establishment of norms regarding inter-institutional data flow exchange/sharing,*

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	Measure	Priority	Description
			its format and improvement of the management of data collected" from the present roadmap.
	14. Establish an electronic registry of public environmental information	High	This measure aims to establish a registry of environmental information and data available in each institution and system (i.e. the metadata management system), as well as data that is publishable taking into consideration the existing legal framework. The registry will be used by civil servants to support the continuous development and improvement of environmental information systems and the dissemination of environmental information. Specifically, the registry will map the systems, databases, institutions responsible, datasets and reports published/available. This measure could be coupled with the standardisation of metadata for environmental information and with the development of a single web access point for environmental information, which would be automatically refreshed based on the registry of environmental information. *Ukraine is currently developing an Open Environment platform. This measure would support the ongoing initiatives.* *The inventory of environmental information systems is widely described in the document "Promotion of good practices for national environmental information systems and tools for data harvesting at EU level", in the section "Inventory of the environmental information system", p. 25.*
	15. Improve accessibility and usability of available environmental data and information by improving the multilingual aspect	Medium	This measure recommends a comprehensive translation and regular update into Ukrainian/English of the websites of public authorities, key reports and environmental information metadata. *An example of a multilingual portal is the EEA GEMET[10], which provides a thesaurus of environmental terms, currently translated into 37 languages.*
	16. Develop e-services for the environment	Medium	At present, few e-services are available for the environment. This initiative will aim to develop environmental e-services according to the national standards (service passports) and service interoperability standards (e.g. e-signature, e-payment).

[10] https://www.eionet.europa.eu/gemet/en/concept/4438

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	Measure	Priority	Description
			More information about the description of public services can be found in the Good Practices Report in the "Building e-services and public information systems according to national and international standards" section. *This measure is connected to the measure "Inventory, re-engineering and publication of public services as e-services" from the present roadmap.*

	17. Strengthen the technical capability for environmental monitoring	Continuous	This measure aims to strengthen the technical capability for environmental monitoring to thematic areas, for example water.
			In this context, the gradual provision of modernised monitoring equipment should be foreseen, planned and budgeted. To do so, the following is recommended:
			• Assess the current monitoring infrastructure for selected thematic areas (e.g. water, air as a start). This can be achieved through the establishment of a cross-thematic team of experts that could evaluate the existing infrastructure against reporting requirements and provide a complete assessment of the needs.
			• Define priorities for monitoring as part of the national monitoring system based on national needs and international commitments.
			• Define specific monitoring requirements for each thematic area. These objectives should include:
			  ○ Frequency of observation (e.g. hourly, daily, monthly or yearly);
			  ○ The granularity of data gathered (accuracy);
			  ○ Space coverage (taking into consideration the spatial requirements – urban vs rural areas, industrial areas);
			  ○ Quality of data;
			  ○ Compatibility with existing equipment and information systems and, where possible, compliance with EU requirements as part of the approximation process.
			• Develop a long-term and realistic programme for acquisition and replacement of the existing infrastructure, taking into consideration the financial possibilities and other possible options.
			• If possible, develop public-private partnerships and establish a public framework for combining data collected by the public in this process. In Ukraine, for example, the public has developed a system that integrates data from privately-owned air monitoring

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	Measure	Priority	Description
			equipment. Any person can buy a device and connect to it. This could eventually be extended to other areas. • Follow up by adopting a detailed and stepwise implementation plan for gradually replacing equipment and putting the new equipment into the existing system (taking into consideration available financial resources and national priorities). This point is crucial as lack of integration could: 1) render the exchange of data cumbersome, 2) increase the need for human resources and 3) undermine the quality and availability of data; • Identify potential environmental areas which could gradually be used to complement the traditional environmental monitoring system with additional information coming from other sources (e.g. citizen science, earth observation). The acquisition of monitoring equipment requires consequent investments and should be well prioritised, bearing in mind the national needs, a long-term perspective and the approximation of the respective EU legislation. *This measure is linked with the measures "Develop and/or continue to enhance an integrated system for the management of environmental information in accordance with the Aarhus Convention and the Protocol on PRTRs" from the present roadmap.*

	18. Develop and/or continue to enhance an integrated system for the management of environmental information in accordance with the Aarhus Convention and the Protocol on PRTRs	Medium	This measure recommends the development of an integrated environmental management system, which will ensure the coordinated management and exchange of environmental data and information. To do so, this measure recommends:
			• Producing an inventory of all systems available and used for the management of environmental data and information at the national level;
			• Defining requirements for an integrated but distributed system for environmental information management. In particular, the system will provide functionalities, such as:
			  ○ Workflow (e.g. quality management);
			  ○ Environmental data collection;
			  ○ Automatic dissemination and updating of open data;
			  ○ Document management;

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	Measure	Priority	Description
			○ Integration with external systems (statistical, health, open data, transport, energy, cadastral, etc. as needed); ○ Advanced visualisation tools and capabilities for integration with business intelligence tools; • Gradual implementation of the system; • Training of potential users and institutions involved on the benefits, functionalities and usability of the integrated system; • Regular assessment of the performance and update of the system when needed. This measure will foresee the development of an efficient integrated system by connecting various existing environmental information systems. *The document "Promotion of good practices for national environmental information systems and tools for data harvesting at EU level" presents guidelines for the development of environmental information systems.* *This measure is linked to the measures "Enhance Interoperability of geospatial, statistical, health and environmental information systems" from the present roadmap.*
	19. Develop applications to engage the public in environmental monitoring and protection activities	Low	This measure aims to develop a series of software applications (e.g. mobile apps) that will expand the potential for e-government to create an "environmental data ecosystem" and enable the public to access, consult and interact with environmental data. For instance, through apps the public can: • access and consult environmental information in real-time according to their location; • report poaching, and identify and signal polluted areas, etc.; • report poaching, and mark and signal polluted areas, etc.; • participate in environmentally-friendly events in their neighbourhood; • integrate environmental data they have collected with government apps, where possible; • use crowdsourcing (citizen-generated data) to capture environment monitoring data throughout the territory of Ukraine.

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	Measure	Priority	Description
			This measure is linked with the measures proposed in the Cooperation (network) section in the present roadmap.

In order to facilitate the implementation of the provided measures, the Good Practices Report provides the following examples and recommendations:

- Establishing an interoperability framework (examples from the EU and Lithuania);
- Building an integrated environmental monitoring system at national level (example from Ukraine);
- Building an Open Data Portal and foster publication of public sector information (examples from Ireland, the Netherlands and Spain);
- Establishing a single and user-friendly web access point for environmental information (examples from Ireland and the EEA);
- Developing infrastructure on the most advanced platforms based on geospatial data and GIS technologies (examples from the EU and Lithuania);
- Providing technological support for sharing environmental data at the regional level.

Roadmap measures: Cooperation (Network)

The measures proposed to Georgia from the perspective of SEIS pillar: Cooperation are presented in the table below.

Table 5. Measures from the perspective of SEIS pillar: Cooperation

	Measure	Priority	Description
	20. Establish a collaborative institutional framework for the implementation of open data	High	This measure will strengthen the necessary institutional framework for managing open data, especially in relation to the environmental component. This measure will focus on the need to create strong cooperation between institutions to ensure the exchange, sharing, reuse and publication of public sector information (PSI). An example of an approach to establishing a collaborative institutional framework for open data involves: • Amendment/supplementation of the existing legal framework to foresee clear responsibilities of the various actors and ensure the clear division of responsibilities for open data at national and thematic levels (e.g. there should be general rules for governing the open data framework and specific rules for individual environmental data providers on how to organise an open data publishing process internally);

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	Measure	Priority	Description
			• Establishment of a cross-sectoral working group which will assist/support and facilitate in the establishment of the operational mechanisms of collaboration (i.e. processes, procedures and good practices); • Organisation of events/fora/regular dialogues to foster collaboration between national stakeholders and various data users. *During a national roundtable in Ukraine, the cross-sectoral collaboration was identified as one of the key areas for successful implementation of an open data concept.* *The good practices report provides examples of initiatives undertaken in the EU to foster inter-institutional and international cooperation in the field of open data. The open data maturity report 2019 provides criteria to assess the maturity of the institutional framework in a country. The document "Development of an assessment framework on environmental governance in the EU Member States" also provides good practices to establish an institutional framework for environmental governance.* *This measure is linked with the recommendations presented in the Content section of the present roadmap and the targeting of the revision of the legal framework.*
	21. Develop and ensure increased capacity for handling environmental and open data	High	Components of this measure cover: • Assessment of the capacities needed (human and financial resources and tools) for managing and making available environmental data and information at national and local levels; • Allocation of necessary resources in the national and local budgets (annual estimates and allocations) based on the planned activities; • Recruitment of specialised staff and acquisition of necessary tools; • Development and integration of procedures and processes for preparing and disseminating environmental data and information; • Professional development/training plans for civil servants and/or data stewards or data officers. In this regard, it is necessary to develop official training programmes (mandatory) for staff in charge of data management and to recognise these training programmes through certificates. *During the national roundtable in Ukraine, it was highlighted that this measure should be set as a high*

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	Measure	Priority	Description
			priority because a lack of capacity and appropriate skills were indicated as one of the main issues. *The document "Development of an assessment framework on environmental governance in the EU Member States" provides multiple examples of initiatives undertaken to build capacity in this area. The section "2. Administrative capacity (environmental inspectorates, police, customs, prosecution services and audit bodies)" focuses strongly on the example of capacity-building in the EU.* *This measure is linked with the measures "*Strengthen the technical capability for environmental monitoring*" and "Develop and/or continue to enhance an integrated system for the management of environmental information in accordance with the Aarhus Convention and the Protocol on PRTRs" of the present roadmap.*
	22. Promote international and regional cooperation to facilitate the implementation of the roadmap	High	This measure aims to support Ukraine with international expertise and good practices to assist in the implementation of the present roadmap. To do so, it is recommended that: • Fora and other platforms where experience can be shared be identified; • Contacts with key stakeholders at the regional and international level be established to share experience and good practices; • An inventory of international and regional initiatives be built, and their potential assessed. *The good practices report provides examples of initiatives that can be undertaken to implement this measure, in the section "Increasing public administration, public and business awareness over open data and environmental data".*
	23. Raise awareness of open government and open data for the environment among citizens and economic operators	Continuous	This measure will increase the demand for open government and open data by raising awareness and conducting other promotional campaigns at national and local levels. This measure will focus on raising public awareness of the role and impact of environmental information, its accessibility, usability and other related aspects, by pursuing ongoing activities and strengthening and expanding them where and when appropriate. Additionally, a series of activities for promoting the use/reuse and sharing of environmental information could be undertaken, such as:

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	Measure	Priority	Description
			• Hackathons; • Fora; • Promotion campaigns; • Development of incubators; • Development of public-private partnerships; • Facilitating dialogue and cooperation between national bodies, NGOs and the academic community. *The good practices report provides examples of initiatives that can be undertaken to implement this measure, in the "Increasing public administration, citizens and business awareness over open data and environmental data" section.*

In order to facilitate the implementation of the provided measures, the Good Practices Report provides examples and recommendations on the following topics:

- Increasing awareness and motivation among public institutions over e-government and digital solutions (example from the EU);
- Increasing awareness of e-government among the public and businesses (example from the EU);
- Coordinating open data initiative(s) (example from Ireland);
- Establishing processes and procedures for managing open data (example from Lithuania);
- Increasing public administration, public and business awareness of open data and environmental data (example from Belgium, Cyprus, the EU, Italy and Luxembourg);
- Promoting open data to organisations;
- Collecting user feedback and providing new means of communication between open data providers and users (example from Spain).

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