

Sharing and dissemination of environmental information

Country maturity report: Armenia Roadmap

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Implementation of the Shared Environmental Information System principles and practices in the Eastern Partnership countries (ENI SEIS II East)

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This report was produced by PricewaterhouseCoopers as 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 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 Kyiv, and the second review after the roundtable in May 2019. The report was commented by the local authorities in Armenia 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.



Roadmap¹

In general, it is recommended that Armenia should focus on some key elements for ensuring 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, development, management and funding of the national e-government and open data portals, as well as digital awareness-raising activities for both public authorities and the public itself. In doing so, all available results and good practices 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 an interoperability framework in place or at least its foundation. This is especially required for building an integrated environmental information system(s) and ensuring the smooth exchange of environmental data.
 - *Roadmap in the field of open data and environmental information:* this roadmap should contain key objectives for fostering sharing and dissemination of environmental information.
- **Legal measures:**
 - *Enforcement mechanisms* for the regular collection, sharing and dissemination of environmental information and for monitoring implementation.
- **Technical measures:**
 - *E-government, open data and geo-portals:* the country should have effective e-government, open data and 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 the EU, the International Organisation 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 standard development could be adjusted and introduced in the areas of designing an information system, metadata standards and interoperability standards.

Some of these elements are already in place in Armenia. Nonetheless, it is advised to look at these aspects from an 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.

¹ The proposed roadmap has been updated taking into consideration the presentation made during the 4th ENI SEIS II East Project Steering Committee Meeting on November 12th, 2019 in Copenhagen. Presentations are available here : <https://eni-seis.eionet.europa.eu/east/areas-of-work/communication/events/project-related-events/4th-eni-seis-ii-east-project-steering-committee-meeting>



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 is strongly dependent on clear prioritisation, multi-disciplinary teamwork and regular monitoring and adjustment of 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 environment strategies of the country. Furthermore, this process should not be carried out in isolation. On the contrary, it should also be undertaken by considering the extensive experience already gained in this area by other countries and organisations and in the context of broad regional exchange and international collaboration.

The proposed measures are to be implemented by specific authorities at various levels of decision-making and across disciplines. In this respect, the measures are grouped in three major categories, namely: policy, legal 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, 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 or revision of existing legislation 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 set-up, ensuring clear division of responsibilities and proposing enforcement mechanisms for obligations provided in the legislation.
	Technical	The measures in this category cover the adoption and/or development of technical tools, methodologies and procedures, as well as the introduction and adoption of international standards, where appropriate, at the national level. These measures also



Colour	Type of measure	Description
		embrace developing new competences and training specialists to ensure the successful implementation and sustainability of technology initiatives.

It is recommended for Armenia to implement measures proposed in the roadmap after considering the latest policy, legal and technology changes in the country. The table below suggests a recommended timeframe to implement measures with different priorities assigned. Considering that this domain is very dynamic, the suggested time perspectives could be shortened.

Table 2. The recommended timeframe for measures implementation

Priority	Recommended timeframe for the measure implementation
High	In the next 1-3 years
Medium	In the next 3-5 years
Low	Over the next 5 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 the Good Practices Report “Open data and e-government good practices for fostering environmental information sharing and dissemination” (in brief, the Good Practices Report). This report is an integral part of the present project and provides 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 environment information systems and tools for data harvesting at EU level”;
- Streamlining Environmental Reporting – Action Plan;
- Open Data Maturity in Europe 2019²³;
- Development of an assessment framework on environmental governance in the EU Member States⁴.

² https://www.europeandataportal.eu/sites/default/files/open_data_maturity_report_2019.pdf

³ https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf



Roadmap measures: Content

The measures proposed to Armenia from the perspective of SEIS pillar: Content are presented 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	High	<p>Adopt or amend, as needed, the legal acts referring to data management and accessibility related to the environmental domain (monitoring, assessment and reporting, management and control of natural resources, ecosystems and pollution) in accordance with the Aarhus Convention and the Protocol on PRTRs (as appropriate). This can include:</p> <ul style="list-style-type: none"> • Improving the environmental information system(s) by defining themes, sources (lists, registers, databases, funds, etc.), formats, metadata, licencing and interoperability requirements; • Improving procedures for environmental data collection and exchange in electronic format, and its accessibility as open data; • Improving procedures for managing environmental data flows and regular updates, quality assurance and control, reporting, inter-institutional sharing and exchange, online dissemination and other means of dissemination; • Setting up the public participation procedures for involving the public at large in the design, use and update of the environmental information system(s); considering ways to take on board citizen science and public engagement initiatives; • Streamlining the responsibilities of public authorities at all levels and across sectors to ensure clear competences and coordination; • Reviewing periodically the application of exceptions in the disclosure of environmental information; • Monitoring the legitimate application of these exceptions and the disclosure of information on emissions in accordance with the Aarhus Convention – (in particular define the practical rules to differentiate the non-confidential information of public importance for its further disclosure⁵). <p><i>For Armenia it is recommended to adopt a new law on</i></p>

⁴ “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.

⁵ Requested during the national roundtable



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Measure	Priority	Description
		<p><i>environmental information dissemination as soon as possible to ensure the coordinated and up to date approach for environmental information dissemination and standardised responsibilities and processes in the area of environment.</i></p> <p><i>As well secondary legislation should be developed including usage of standards.</i></p> <p><i>For guidance, consult the section “Designing an open data legal framework and provision of enforcement mechanism” of the Good Practices Report.</i></p> <p><i>This measure is closely linked with “Establish a collaborative institutional framework for the implementation of open data” in the Cooperation (network) section.</i></p>
2. Adopt guidelines defining the practical arrangements for environmental information management, sharing and dissemination	High	<p>Adopt technical guidelines setting out the practical arrangements for environmental information management, sharing and dissemination specifying:</p> <ul style="list-style-type: none"> • The scope of the environmental information system with 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 of non-confidential information and datasets (e.g. websites of public authorities, environmental portals – one web access point for environmental information, geospatial portals, statistical, open data and other portals) and also making them available online on relevant portals; • Separation of non-confidential information, as appropriate; • Gradual amendment of the data quality assurance procedures in line with EU rules.
3. Develop and adopt an environmental data policy	High	<p>Adoption of an environmental data policy by the authorities in charge of environmental protection to include:</p> <ul style="list-style-type: none"> • 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;



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Measure	Priority	Description
		<ul style="list-style-type: none"> Licensing terms and conditions; Contact point for access to environmental information. <p><i>For an example of data policy, consult the European Environment Agency's website: https://www.eea.europa.eu/legal/eea-data-policy/data-policy</i></p>
4. Develop/update licensing terms and conditions to promote open data access, use and reuse of environmental information using an open licence	High	<p>This measure will involve defining the licensing terms and conditions used on the different portals for publishing and accessing environment data.</p> <p><i>At present, there are no official and clear licensing mechanisms for reuse of the data made available by the public authorities.</i></p> <p><i>According to the Public Sector Information Directive, it is recommended to use open licences as they are available online and provide clear licensing conditions⁶.</i></p> <p><i>More information about licensing is available in the Good Practices Report in the section "Harmonise licensing terms and conditions of environmental data to promote its public use and reuse".</i></p>
5. Regular collection and timely reporting of environmental data and information in accordance with national and international obligations	High	<p>This measure will:</p> <ul style="list-style-type: none"> Ensure the effective implementation of the Aarhus Convention and its decisions and recommendations by the Meeting of the Parties on promoting effective access to information and electronic information tools⁷. Consider the possibility of ratifying the Protocol on PRTRs; Identify the practical arrangements for establishing the Pollutant Release and Transfer Register and for its incorporation within the integrated environmental information system(s) by using good international working practices; Ensure traceability of assessments and indicators by linking them with the available data sources used; Consider becoming a Party to other UNECE MEAs (e.g. Water Convention and Protocols to the Air Convention) to improve environmental governance, monitoring and data management; Ensure the implementation of other international

⁶ Directive (EU) 2019/1024 of the European Parliament and of 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/PDF/?uri=CELEX:32019L1024&from=EN>

⁷ <http://www.unece.org/environmental-policy/conventions/public-participation/aarhus-convention/tfwg/task-force-on-access-to-information/consultations-on-the-recommendation-on-electronic-information-tools.html>



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Measure	Priority	Description
		<p>commitments related to the regular provision of environmental data and information.</p> <p><i>This measure is closely linked with the measures “Enhance interoperability of geospatial, statistical, health and environment information systems” and “Establish an electronic registry of public environmental information” in the Infrastructure section.</i></p>
6. Improve and make publicly available the quality control/ quality assurance mechanisms behind the published environmental data and information	High	<p>The results and methodology used for quality control/ quality assurance 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.</p> <p>This measure will:</p> <ul style="list-style-type: none"> • Assess the current quality control/ quality assurance mechanisms from the collection of environmental data, to aggregation, manipulation, processing and publication across the whole MDIAR chain⁸; • Publish current procedures in place and set minimum standards to respect all stages of the data flow (data collection, data preparation and control, aggregation and data dissemination); • Further develop/amend the legal framework by adding provisions setting up obligations at different levels, regarding the quality control/ quality assurance of environmental data, including penalties for non-compliance; • Monitor the implementation of the quality control/ quality assurance measures and set up an annual reporting process for the evaluation of the quality of environmental data provided. <p><i>The examples of criteria for assessing quality control/ quality assurance mechanisms are depicted in the document “Promotion of good practices for national environmental information systems and tools for data harvesting at EU level”, p. 165.</i></p> <p><i>Examples of standards, mechanisms and measures for quality control/ quality assurance are also presented in the Good Practices Report, in the section “Develop and publish quality control mechanisms for environmental data”.</i></p>
7. Define/adopt and publish metadata description	High	<p>This measure will aim to define metadata standards to facilitate the dissemination/exchange of environmental data and information (including dissemination of</p>

⁸ 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
standards for all environmental data and information in accordance with international standards using a one-stop access point		<p>environmental reports). As a result, it will be easier for institutions to manage and exchange environmental data, while also making it easier for the public to find information.</p> <p><i>An example could be the implementation of the EU DCAT-AP standard, which would also enable integration with other open data portals in Europe.</i></p> <p><i>Refer to the Good Practices Report and forthcoming Aarhus Convention Recommendations on Electronic Information Tools to get more information about metadata standards for environmental data and information.</i></p> <p><i>This measure is closely linked with the measures “Enhance interoperability of geospatial, statistical, health and environment information systems” in the section Infrastructure.</i></p>
8. Expand collection, prepare and publish environmental data in a machine-readable format	Medium	<p>As Armenia does not have an open data portal, this measure is set as a medium priority. Nonetheless, it is important to stress that the real potential of environmental data lies in its usability, hence the need for setting clear rules to publish the data in a machine-readable format.</p> <p>This measure aims to ensure the publication of environmental data in machine-readable format. Additional aspect of the measure focusses on historical data digitalisation. Such a measure can be driven by the establishment of the open data legal framework, setting up the obligation to publish, as a rule, all datasets in machine-readable formats, unless data are not available in such a format and requires processing beforehand.</p> <p>Regularly produce the state of environment report in accordance with the Aarhus Convention provisions and make the report available online. Furthermore, aim towards an assessment-based and interactive report, preferably indicator-based.</p> <p><i>The Good Practices Report provides more details about machine-readable formats in the section “Transformation of data published to machine-readable format”.</i></p> <p><i>This measure is closely linked with the measures “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” in the Content section.</i></p>
9. Inventory, re-engineering and publication of public services as e-	Medium	<p>The current portal in Armenia for e-services is a mixture of services, access points to other portals and documentation over a range of e-government topics. Few e-services are available compare to the number of public</p>



Measure	Priority	Description
services		<p>services, and their description is not comprehensive.</p> <p>This measure will define metadata standards and ensure that environmental services are described and accessible through the electronic service portal, in accordance with national standards.</p> <p>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.</p> <p><i>For an example of implementation, consult the Good Practices Report's "Publishing e-services on a dedicated e-service portal" section.</i></p>

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/ quality assurance 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).

Roadmap measures: Infrastructure

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



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

Measure	Priority	Description
10. Establish a single and user-friendly web access point for environmental information	High	<p>Environmental information and data are spread on multiple portals, as shown in this report. Particularly, it is not clear which website must have the latest and correct information published. The portals are also built according to different designs, which hinders user experience.</p> <p>To support the implementation of the Decision VI/1 of the Meeting of the Parties of the Aarhus Convention, it is recommended to establish a single web access point to environmental information. Single access implementation is not subjected to the adoption of only one software solution. The principle may be implemented through enabling access to various solutions in a single place.</p> <p>In this regard, Armenia is currently developing a water Ecoportal covering few UNECE environmental indicators for water and biodiversity.</p> <p>The launch of Ecoportal provides a possibility to further test and develop one single platform for key environmental data monitoring. Timely addition of relevant thematic areas (e.g., land, air, waste) would expand the use and benefits of the tool.</p> <p>The following suggestions could assist in the development of an environmental portal (single web access point for environmental information):</p> <ul style="list-style-type: none"> • Design main technological solutions, which will be used as a single and user-friendly web-access point for environmental information – technological solution should be based on the technological platform; • Agree upon a single access point by integrating various data sources of environmental information (e.g. the single access point should provide access to environmental datasets, indicators, links to environmental reports and various applications); • Provide web-services and commonly agreed external application programming interfaces (APIs) to the existing portals so the institutions can easily share their (structured) data and have the possibility to download datasets (e.g. EEA public map services⁹, INSPIRE Directive); • Implement a uniform tool for checking the quality of metadata provided by data providers; • Publish environmental data in accordance with the

⁹ <https://www.eea.europa.eu/code/gis>



Measure	Priority	Description
		<p>rules described in international metadata standards, such as DCAT-AP metadata vocabulary (this measure will also allow automatic synchronisation with other EU open data portals);</p> <ul style="list-style-type: none"> • Develop search functionality to allow the user to apply multiple field search and filter options (e.g. file format) to refine a search; combining keywords with classifiers; • Maintain and enhance the portal by including feedback gathering from the public through public consultation organised by ministries and governmental authorities. <p><i>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).</i></p> <p><i>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”.</i></p> <p><i>This measure is closely linked with the measure “Revision of the legal framework to promote and regulate the online accessibility and reuse of public sector information”, in the Content section, and measure “Establish a collaborative institutional framework for the implementation of open data”, in the Cooperation (network) section.</i></p>
11. Enhance interoperability of geospatial, statistical, health and environmental information systems	High	<p>This measure will facilitate the implementation of the interoperability standards defined for environmental and other thematic data. This measure will:</p> <ul style="list-style-type: none"> • Assess the 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; • Develop APIs for external users; • Provide automated mechanisms for sharing time-series data. <p>These actions could be also considered within an overarching national interoperability framework.</p> <p><i>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.</i></p> <p><i>This measure is linked with the measure “Develop and/or</i></p>



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Measure	Priority	Description
		<i>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.</i>
12. Establish an electronic registry of public environmental information	High	<p>This measure will aim 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 legal framework in place. The registry will be used by public servants to support the continuous development of environmental information systems and the dissemination of environmental information. Particularly, the registry should map the systems, databases, institutions, datasets and reports published.</p> <p>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.</p> <p><i>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”.</i></p>
13. Improve accessibility and usability of available environmental data and information by improving the multilingual aspect	Medium	<p>This measure will provide a full translation of public institutions websites, yearly reports and environmental information metadata to Armenian and English.</p> <p><i>An example of a multilingual portal is the EEA GEMET,¹⁰ which provides a thesaurus of environmental terms, currently translated in 37 languages.</i></p>
14. Develop e-services for the environment	Medium	<p>This initiative will aim to develop environmental e-services according to the national standards (service passports) service interoperability standards (e.g. e-signature, e-payment).</p> <p><i>More information about the description of public services can be found in the Good Practices Report in the section “Building e-services and public information systems according to national and international standards”.</i></p> <p><i>This measure is connected to the measure “Inventory, re-engineering and publication of public services as e-services” from the present roadmap.</i></p>

¹⁰ <https://www.eionet.europa.eu/gemet/en/concept/4438>



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Measure	Priority	Description
15. Strengthen the technical capability for environmental monitoring	Continuous	<p>This measure aims to strengthen the technical capacity for environmental monitoring for other thematic areas, such as water and forestry. To do so, it is recommended to:</p> <ul style="list-style-type: none"> • Define monitoring parameters at national and local levels for each thematic area. These objectives should include: <ul style="list-style-type: none"> ○ Frequency of observations (e.g. hourly, daily, monthly or yearly); ○ 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. • Conduct critical assessment in relation to the needs of the status and performance capabilities of the current monitoring infrastructure (for each thematic area, starting with priority areas such as, for example, water). This can be achieved through the establishment of a cross-sectional team of experts that could reflect on the existing equipment and provide a complete assessment of the needs aligned with the objectives defined above. • Develop a long-term and realistic national plan for gradual modernisation, taking into consideration all financial possibilities and options; • Follow this process by developing a coherent and stepwise implementation plan to gradually integrate new equipment into the existing system. This point is crucial as a lack of integration of the monitoring process in information systems: 1) renders the exchange of data cumbersome, 2) increases the need for human resources and 3) undermines the quality and availability of data. • Identify potential environmental areas to gradually complement the traditional environmental monitoring system with additional information coming from other sources (e.g. citizen science¹¹, earth observation^{12,13}). <p>The acquisition of monitoring equipment requires</p>

¹¹ Commission Staff Working Document “Best Practices in Citizen Science for Environmental Monitoring”

¹² <https://ec-jrc.github.io/citsci-explorer/>

¹³ <https://www.copernicus.eu/en/services>



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Measure	Priority	Description
		<p>consequent investments. It should be well prioritised, with a long-time perspective. Also, it should take into consideration the local and national needs. It is recommended to prioritise the buying and implementation process, and to make sure that the equipment is well integrated into the existing (or new) information systems in order to facilitate the data flows.</p> <p><i>This measure is linked with the measure “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.</i></p>
16. 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	<p>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:</p> <ul style="list-style-type: none"> • Making an inventory of all systems used for the management of environmental data and information, especially that is not publicly available, at the national level; • Defining the requirements for an integrated system for environmental information management. In particular, the system should provide functionalities such as: <ul style="list-style-type: none"> ○ Workflow (e.g. quality management); ○ Environmental data collection; ○ Automatic dissemination and update of open data; ○ Document management; ○ Integration with external systems (statistical, health, open data, transport, energy and land 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. <p>This measure will foresee the development of an efficient system for integrating various types of environmental data and information at different levels (sub-national, national) by connecting various existing systems. Note: 1) as highlighted during the roundtable in Yerevan, this measure does not recommend centralising or decentralising all environmental functions in a single information system, but instead to provide mechanisms</p>



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Measure	Priority	Description
		<p>for integrating them. Hence the system should provide a standard API and the possibility to upload data manually so that compatibility with legacy and external systems could be maintained, and 2) this measure should be executed even though Armenia has not yet ratified the Protocol on PRTRs.</p> <p><i>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.</i></p> <p><i>This measure is linked to the measure “Enhance Interoperability of geospatial, statistical, health and environmental information systems” from the present roadmap.</i></p> <p><i>The Good Practices Report also presents a few examples of initiatives undertaken for building an integrated information system in the section “Infrastructure”.</i></p>
17. Develop applications to engage the public in environmental monitoring and protection activities	Low	<p>Armenia currently does not have an open data portal, thus civil society initiatives for building software applications (e.g. mobile apps) using public sector information are rare.</p> <p>Consequently, this measure will aim to stimulate the development of a series of software applications (e.g. mobile apps) for the public. Firstly, this action will stimulate the role of e-government to interact with the public and lead to the creation of “environmental data ecosystem”. Secondly, this action will also encourage the public to access, consult and interact with the environmental data.</p> <p>For instance, through the apps the public can:</p> <ul style="list-style-type: none"> • access and consult environmental information in real-time according to their location; • 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. <p><i>This measure is linked with the measures proposed under the pillar “Cooperation” in the present roadmap.</i></p>

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 Armenia 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
18. Establish a collaborative institutional framework for the implementation of open data	High	<p>Armenia currently does not have a national open data concept or an open data policy and strategy. It is crucial to establish a collaborative institutional framework for open data and to foster open data across institutions, e.g. it is suggested to establish a working group under the Prime Minister of the Republic of Armenia for collaboration in the field of environment.</p> <p>In addition it is recommended to provide information on the Ministry structure and links to subordinate institutions.</p> <p>This measure will strengthen the necessary institutional framework for managing open data, especially taking into consideration the environmental component.</p> <p>This measure will also focus on the need to create strong cooperation links between institutions to ensure the sharing, (re)using and publication of the environmental data and information.</p> <p>An example of an approach to establishing a collaborative institutional framework for open data involves:</p> <ul style="list-style-type: none"> • Amendment to the existing legal framework or adoption of additional secondary regulations to foresee clear responsibilities of the various actors and ensure the clear division of responsibilities on 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); • 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);



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Measure	Priority	Description
		<ul style="list-style-type: none"> • Organisation of events/fora/regular dialogues to foster collaboration between national stakeholders and various data users. <p>Also, it is recommended to ensure the operation of the Aarhus centres.</p> <p><i>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”¹⁴ also provides good practices to establish an institutional framework for environmental governance.</i></p> <p><i>This measure is linked with the recommendations presented in the section “Content” of the present roadmap and targeting the revision of the legal framework.</i></p>
19. Develop and ensure increased capacity for handling environmental and open data	Medium	<p>Components of this measure cover:</p> <ul style="list-style-type: none"> • Assessment of the capacities needed (human resources and tools) for managing and making available environmental data and information at national and local levels; • Recruitment of specialised staff and gradual acquisition of necessary tools for open data and environmental data management; • 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 working with data. In this regard, it is possible to foresee official training programmes (mandatory) for staff in charge of data handling and to recognise these trainings through certificates. <p><i>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 “3.5.2. Administrative capacity (environmental</i></p>

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https://ec.europa.eu/environment/environmental_governance/pdf/development_assessment_framework_environmental_governance.pdf



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Measure	Priority	Description
		<p><i>inspectories, police, customs, prosecution services and audit bodies)” focuses strongly on the example of capacity-building in the EU.</i></p> <p><i>This measure is linked with the measures “Strengthening of technical capacity for environmental monitoring” and “Develop and/or continue to enhance an integrated system for environmental information management in accordance with the Aarhus Convention and the Protocol on PRTRs” of the present roadmap.</i></p>
20. Promote international and regional cooperation to facilitate the implementation of the roadmap	High	<p>Armenia currently has little cooperation with other countries for open data.</p> <p>This measure aims to support Armenia with international expertise and good practices to assist in the implementation of the present roadmap. To do so, it is recommended that:</p> <ul style="list-style-type: none"> • 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. <p><i>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”.</i></p>
21. Raise awareness of open government and open data for the environment among citizens and economic operators	Continuous	<p>Armenia does not have currently an open data portal, and in general, the open data concept is not well developed in the country.</p> <p>The roundtable in Armenia highlighted that multiple requests for environmental information are received. This aspect indicated that the public need awareness campaigns to be regularly informed about environmental information and open data.</p> <p>Under these circumstances, this measure is extremely important and will stimulate the demand for open government and open data by showcasing its benefits and usefulness at all levels and across various categories of potential users.</p> <p>This measure will focus on raising public awareness on the role of environmental information, its accessibility, usability and other related aspects, by pursuing ongoing activities, strengthening and expanding them where and when appropriate. The focus of above-mentioned activities could be directed to promotion of environmental applications and enhancement of their</p>



Measure	Priority	Description
		<p>usage.</p> <p>Additionally, the measure will focus on undertaking a series of activities to promote the use/re-use and sharing of environmental information, such as:</p> <ul style="list-style-type: none"> • Hackathons; • Fora; • Promotion campaigns; • Development of incubators; • Development of public-private partnerships; • Facilitating dialogue and cooperation between national authorities, NGOs and the academic community. <p><i>The Good Practices Report provides examples of initiatives that can be undertaken to implement this measure, in the section “Increasing public administration, citizens and business awareness over open data and environmental data”.</i></p>

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).

