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in Environmental Matters

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**Substantive issues: access to information, including
electronic information tools**

Draft updated recommendations on the more effective use of electronic information tools

Addendum

Submitted by the Chair of the Task Force on Access to Information

Supporting explanatory notes

Summary

The present document is addendum to the updated recommendations on the more effective use of electronic information tools (ECE/MP.PP/2021/20) prepared under the auspices of the Task Force on Access to Information pursuant to decision VI/1 on promoting effective access to information (ECE/MP.PP/2017/2/Add.1, para. 13 (b) (i)), adopted by the Meeting of the Parties to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) at its sixth session (Budva, Montenegro, 11–14 September 2017).

At its twenty-fifth meeting (Geneva, 3 May and 7 and 8 June 2021), the Working Group of the Parties revised and approved, as amended at the meeting, the draft updated recommendations on the more effective use of electronic information tools (AC/WGP-25/CRP.2) and requested the secretariat to submit it to the Meeting of the Parties for consideration at its seventh session. The Meeting of the Parties is expected to adopt draft updated recommendations through draft decision VII/1 on promoting effective access to information (ECE/MP.PP/2021/8).

I. Terminology

1. To facilitate the use of the recommendations (see ECE/MP.PP/2021/20), the following terms apply:

(a) “Aarhus Convention” and “Convention”, which mean the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, done at Aarhus, Denmark, on 25 June 1998;

(b) “Accessibility”, which means the set of principles and techniques to be observed when designing, developing, maintaining and upgrading electronic information tools in order to make them more accessible to users, in particular persons with disabilities;

(c) “Akoma Ntoso”, which defines a set of simple technology-neutral electronic representations in Extensible Markup Language (XML) format of parliamentary, legislative and judiciary documents;

(d) “Application programming interface” (API), which means a set of functions, procedures, definitions and protocols for machine-to-machine communication and the seamless exchange of data. Application programming interfaces can have different levels of complexity and can mean a simple link to a database to retrieve specific data sets, a web interface, or more complex set-ups;

(e) “Artificial intelligence”, which refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals;

(f) “Augmented reality”, which refers to an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory;

(g) “Blockchain”, which refers to a growing list of records, called blocks, that are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. By design, a blockchain is resistant to modification of the data;

(h) “Chatbot”, which refers to a menu-based or actionable software application used to conduct an online chat conversation via text or text-to-speech with the aim of providing direct contact with users;

(i) “Citizen science”, which means a form of open collaboration in which members of the public participate voluntarily in the scientific process, engineering research or environmental monitoring in various ways;

(j) “Citizen science observatories”, which refers to community-based environmental monitoring and information systems that invite individuals to share observations, typically via mobile telephone or the web;

(k) “Crowdsourcing”, which means a method of obtaining needed services, ideas or content by soliciting voluntary contributions from members of the public, especially from an online community;

(l) “Data”, which refers to all types of data, including:

(i) “Dynamic data”, which means documents in a digital form, subject to frequent or real-time updates, in particular because of their volatility or rapid obsolescence (for example, data generated by sensors are typically considered to be dynamic data);

(ii) “Primary data”, which means the environmental data received earlier and fixed in any form that could be available for processing;

(iii) “Big data”, which means data that contain greater variety arriving in increasing volumes and with ever-higher velocity;

(iv) “Research data”, which means documents in a digital form, other than scientific publications, which are collected or produced in the course of scientific

research activities and are used as evidence in the research process, or are commonly accepted in the research community as necessary to validate research findings and results;

(v) “Citizen science data”, which means data collected by members of the public, often in collaboration with or under the direction of professional scientists, non-governmental organizations and scientific institutions;

(vi) “Citizen-generated data”, which means data produced through citizen sensing, citizen science and other forms of civic monitoring that share the common denominator that the data collection process is primarily carried out by volunteer individuals actively joining the initiative;

(m) “Data catalogue”, which means a collection of metadata, combined with data management and search tools, that helps analysts and other data users to find the data that they need, serves as an inventory of available data, and provides information to evaluate fitness data for intended uses;

(n) “Data cube”, which means a multidimensional ("n-D") array of values and refers to an approach to storing, processing and analysing large collections of environment-related Earth observations and other data. The technology is designed to monitor changes in the state of the environment by being agile and flexible with vast amounts of layered grid data;

(o) “Data harvesting”, which means a process that copies data sets and their metadata between two or more data catalogues;

(p) “Data mining”, which means the practice of examining large databases in order to generate new information;

(q) “Data management”, which refers to management of information and data for secure and structured collection, update, storage, processing and access. Data management tasks include the creation of data governance policies, analysis and architecture; database management system integration; data security and data source identification, segregation and storage;

(r) “Datathon”, which means collaborative computer programming for a data analysis event, typically lasting several days and involving data scientists, software developers, members of the public, etc.;

(s) “Digital transformation”, which refers to the economic, societal and environmental effects of digitization and digitalization;

(t) “Digitization”, which means the technical process of converting analogue information into digital form;

(u) “Digitalization”, which means the organizational or business process of technologically induced change within organizations, markets and branches;

(v) “Digital divide”, which means any uneven distribution in the access to, use of, or impact of information and communication technologies between any distinct groups;

(w) “Digital environmental information system”, which is an electronic system that enables sharing of all types of digital data, information, and knowledge relevant to environmental matters to be made available, discoverable and accessible in accordance with the Convention;

(x) “Digital twin”, which refers to a digital replica of potential and actual physical assets, processes, people, places, systems and devices that can be used for various purposes. The digital representation provides both the elements and the dynamics of how a given Internet of things device operates and lives throughout its life cycle;

(y) “Discoverability”, which refers to users’ ability to find data, information, applications or services;

(z) “Earth observations”, which refers to data and information collected about Earth, whether atmospheric, oceanic or terrestrial;

(aa) “E-government initiatives”, which encompass the activities of public authorities to deploy information and communication technologies for the improvement of knowledge and information in the service of the public;

(bb) “Environmental information”, which means environmental information as defined by article 2 (3) of the Convention;

(cc) “Environmental indicator”, which means an indicator supporting all phases of environmental policymaking, from designing policy frameworks to setting targets, and from policy monitoring and evaluation to communicating to policymakers and the public;

(dd) “Hackathon”, which means a collaborative computer programming or open-hardware event, typically lasting several days and involving computer programmers, software developers, hackers, makers, etc.;

(ee) “Hyperautomation”, which refers to the application of state-of-the-art digital technologies, including artificial intelligence and machine learning, to increasingly automate processes and augment human resources;

(ff) “Internet of things”, which means the interconnection through the Internet of computing devices embedded in everyday objects, enabling them to send and receive data;

(gg) “Interoperability”, which means the ability of a computer system or software to work with other systems or products without special effort on the part of the user. It includes the technical, semantic and legal dimensions;

(hh) “Linked data”, which refers to a method of publishing structured data using standardized vocabularies that can be connected together and read automatically by machines with the support of standard web technologies;

(ii) “Machine learning”, which means the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence;

(jj) “Machine-readable format”, which means a file format structured so that software applications can easily identify, recognize and extract specific data, including individual statements of fact, and their internal structure;

(kk) “Metadata”, which means a set of data that describes and gives information about other data;

(ll) “Microservice architecture”, which refers to a kind of service-oriented architecture that arranges an application as a collection of loosely coupled services;

(mm) “Mobile application”, which means application software designed and developed, by or on behalf of public authorities, for use by the public on mobile devices such as smartphones or tablets. It does not include the software that controls those devices (mobile operating systems) or hardware;

(nn) “Onboarding”, which means the process of familiarizing a new user with electronic information tools, taking into account the user’s needs, behaviour, experiences and goals;

(oo) “Open data”, which denotes data in an open format that can be freely used, reused and shared by anyone for any purpose;

(pp) “Open format”, which means a file format that is platform-independent and made available to the public without any restriction that impedes the reuse of information;

(qq) “Open licence”, which means standardized public licences available online that allow data and other content to be freely accessed, used, modified and shared by anyone for any purpose, and that rely on open data formats (for example, custom-made licences, creative commons licences, open government licences for public sector information);

(rr) “Open government data initiatives”, which encompass activities to make data or information produced or commissioned by public authorities available for everyone to access, reuse and redistribute without any restrictions;

(ss) “Open science initiatives”, which encompass activities to make the primary outputs of publicly funded scientific and research results – publications and research data – publicly accessible in digital format with no or minimal restriction as a means of accelerating research;

(tt) “Participatory mapping”, which means the use of a growing toolbox of techniques that can help members of the public record and share spatial knowledge through the use of participatory methods and cartographic representations, often in a digital form;

(uu) “Pollutant release and transfer register”, which refers to a coherent, nationwide system of pollution inventories or registers on a structured, computerized and publicly accessible database compiled through standardized reporting. Such a system may include inputs, releases and transfers of a specified range of substances and products, including water, energy and resource use, from a specified range of activities to environmental media and to on-site and off-site treatment and disposal sites;¹

(vv) “Public record”, which means any information or documents that are made by a public authority or public official and are required by law to be kept and maintained;

(ww) “Public-private partnership”, which refers to a scheme that involves cooperation between the public and the private sectors aimed at financing, designing, implementing and operating public sector infrastructure and services supporting the implementation of the Convention;

(xx) “Reuse”, which means the use by the public of environmental information held by public authorities for commercial or non-commercial purposes other than the initial purpose within the performance of public functions or the provision of public services in relation to the environment for which the information was collected. In technical terms, reuse can be supported by data management principles (see sections II and III below);

(yy) “Search engine advertising” (SEA), which means advertising through search engines;

(zz) “Search engine optimization” (SEO), which means the process of maximizing the number of users of a particular website by ensuring that the website appears high on the list of results returned by a search engine;

(aaa) “Semantic web”, which is a mesh of information linked up in such a way as to be easily processable by machines, on a global scale;

(bbb) “Social media optimization” (SMO), which means the use of social media networks to manage and maximize the number of users and the online presence;

(ccc) “Standard licence”, which means a set of predefined reuse conditions in a digital format, preferably compatible with standardized public licences available online;

(ddd) “Text mining”, which means the discovery by machine of new, previously unknown information, by automatically extracting information from different written resources;

(eee) “User feedback”, which refers to a data quality component that includes information about the data directly provided by users based on their experiences using the data. It may include comments, quality assessments, discovered issues, usage reports, etc. It complements the data quality information provided by its producer;

(fff) “Widget”, which refers to a small piece of web programming code that makes environmental data and information appear on a blog, wiki, or web page. Information in a widget can feature updated information or allow the user do something like use a search box.

¹ Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, art. 5 (9).

II. Data sharing and data management principles developed by the Group on Earth Observations

2. “Earth observations” include space-based or remotely sensed data, as well as ground-based or in situ data.

3. The following data sharing principles and data management principles have been developed by the Group on Earth Observations:²

(a) Data sharing principles:

(i) Data, metadata and products will be shared as open data by default, by making them available as part of the Global Earth Observation System of Systems Data Collection of Open Resources for Everyone (Data-CORE) without charge or restrictions on reuse, subject to the conditions of registration and attribution when the data are reused;

(ii) Where international instruments, national policies or legislation preclude the sharing of data as open data, data should be made available with minimal restrictions on use and at no more than the cost of reproduction and distribution;

(iii) All shared data, products and metadata will be made available with minimum time delay;

(b) Data management principles:

(i) Discoverability:

DMP-1. Data and all associated metadata will be discoverable through catalogues and search engines, and data access and use conditions, including licences, will be clearly indicated;

(ii) Accessibility:

DMP-2. Data will be accessible via online services, including, at a minimum, direct download but preferably user-customizable services for visualization and computation;

(iii) Usability:

DMP-3. Data will be structured using encodings that are widely accepted in the target user community and aligned with organizational needs and observing methods, with preference given to non-proprietary international standards;

DMP-4. Data will be comprehensively documented, including all elements necessary access, use, understand and process, preferably via formal structured metadata based on international or community-approved standards. To the extent possible, data will also be described in peer-reviewed publications referenced in the metadata record;

DMP-5. Data will include provenance metadata indicating the origin and processing history of raw observations and derived products, to ensure full traceability of the product chain;

DMP-6. Data will be subjected to quality control and the results of quality control shall be indicated in metadata; data made available in advance of quality control will be flagged in metadata as unchecked;

(iv) Preservation:

² Referenced in the Group on Earth Observations Strategic Plan 2016–2025: Implementing the Global Earth Observation System of Systems (GEOSS) and reaffirmed through the Mexico City Declaration adopted by the Group on Earth Observation at its twelfth plenary session (Mexico City, 11 and 12 November 2015), available at, respectively, http://www.earthobservations.org/open_eo_data.php# and <https://earthobservations.org/geo12.php>.

DMP-7. Data will be protected from loss and preserved for future use; preservation planning will be for the long term and include guidelines for loss prevention, retention schedules and disposal or transfer procedures;

DMP-8. Data and associated metadata held in data management systems will be periodically verified to ensure integrity, authenticity and readability;

(v) Curation:

DMP-9. Data will be managed to perform corrections and updates in accordance with reviews, and to enable reprocessing as appropriate; where applicable this shall follow established and agreed procedures;

DMP-10. Data will be assigned appropriate persistent, resolvable identifiers to enable documents to cite the data on which they are based and to enable data providers to receive acknowledgement of use of their data.

III. Shared Environmental Information System principles

4. A “shared environmental information system” (SEIS) is underpinned by a series of principles that ensure interoperable flow of information about environmental monitoring, data, indicators, assessments and knowledge.³

5. According to the principles of a shared environmental information system, information should be:

(a) Managed as close as possible to its source;

(b) Collected once and shared with others for many purposes;

(c) Readily available to easily fulfil reporting obligations;

(d) Easily accessible to all users;

(e) Accessible to enable comparisons at the appropriate geographical scale and the effective participation of the public in the development and implementation of policies relating to the environment;

(f) Fully available to the public and at the national level, and available in the relevant national language(s);

(g) Supported through common, free, open software standards.

6. A functional shared environmental information system should be structured around three pillars: content, infrastructure and cooperation. First, the system needs to identify the types of content (data) required, as well as potential sources. Second, an effective, web-enabled technical infrastructure is required that takes full advantage of the best available state-of-the-art digital technologies, including web services supported by machine-to-machine communication. Third, governance structure and cooperation among information providers and users are required to manage human resources, inputs and networking.

IV. Standards for a nationwide digital environmental information system

7. All data contained in the nationwide digital environmental information system should be accompanied by traceable and linked standardized metadata developed in accordance with standards established by the International Organization for Standardization,⁴ the World

³ See www.unece.org/environmental-policy/environmental-monitoring-and-assessment/areas-of-work/shared-environmental-information-system.html.

⁴ See www.iso.org/standards-catalogue/browse-by-ics.html.

Meteorological Organization,⁵ the World Wide Web Consortium,⁶ the Open Geospatial Consortium⁷ and other international forums, as mandated.

8. All metadata should be user- and machine-readable, accompanied by an open licence and made accessible, preferably as part of a Hyper Text Markup Language (HTML) web page and via application programming interfaces (APIs).

9. The following metadata standards for the digital environmental information system can be used:

- (a) Dublin Core Metadata (DCMI) terms (DCTERMS);⁸
- (b) Data Catalogue Vocabulary (DCAT),⁹ including GeoDCAT-AP and StatDCAT-AP;
- (c) Statistical Data and Metadata eXchange (SDMX);¹⁰
- (d) DDI-Lifecycle standard;¹¹
- (e) [ISO 19115] EN ISO 19115-1:2014, Geographic information – Metadata – Part 1: Fundamentals;¹²
- (f) [ISO 19139] ISO/TS 19139-1:2019, Geographic information – XML schema implementation – Part 1: Encoding rules.¹³

10. Data and metadata contained in the digital environmental information system can be shared and made interoperable using the following standards:

- (a) OGC Web Map Service (WMS);¹⁴
- (b) OGC Web Coverage Service (WCS);¹⁵
- (c) OGC Catalogue Service for the Web (CSW);¹⁶
- (d) OGC Water Markup Language (waterML);¹⁷
- (e) OGC Web Feature Service (WFS);¹⁸
- (f) OGC GEOPackage Encoding Standard;¹⁹
- (g) [RFC 7946] GeoJSON Format;²⁰
- (h) OGC Earth Observation Dataset Metadata GeoJSON(-LD) Encoding Standard;²¹
- (i) OGC OpenSearch Extension for Earth Observation;²²
- (j) OGC OpenSearch Geo and Time Extensions;²³

⁵ See <https://public.wmo.int/en/resources/standards-technical-regulations>.

⁶ See www.w3.org/standards/about.html.

⁷ See www.ogc.org/docs/is.

⁸ See <https://dublincore.org/>.

⁹ See www.w3.org/TR/vocab-dcat-2/#introduction.

¹⁰ See <https://sdmx.org/>.

¹¹ See <https://ddialliance.org/explore-documentation>.

¹² See www.iso.org/standard/53798.html.

¹³ See www.iso.org/standard/67253.html.

¹⁴ See www.ogc.org/standards/wms.

¹⁵ See www.ogc.org/standards/wcs.

¹⁶ See www.ogc.org/standards/cat.

¹⁷ See www.ogc.org/standards/waterml.

¹⁸ See www.ogc.org/standards/wfs.

¹⁹ See www.ogc.org/standards/geopackage.

²⁰ See <https://geojson.org/>.

²¹ See www.ogc.org/standards/eo-geojson.

²² See www.ogc.org/standards/opensearch-eo.

²³ See www.ogc.org/standards/opensearchgeo.

(k) [ISO 13028] ISO/TR 13028:2010, Information and documentation – Implementation guidelines for digitization of records;²⁴

(l) XML for parliamentary, legislative and judiciary documents (Akoma Ntoso).²⁵

11. When complementing and not covered by section II above, the Findable, Accessible, Interoperable and Reusable (FAIR) principles for scientific data management and stewardship²⁶ should be followed to promote accessibility, reuse and interoperability of environmental research data. For promoting public participation in scientific research, the core data and metadata standards (PPSR-CORE)²⁷ could be used.

V. Single one-stop web access point (portal) for environmental information

12. Develop environmental portal serving as a single one-stop web access point for environmental data and information, in accordance with open data sharing principles and data management principles (see also sections II and III of the above-mentioned recommendations and sections II–IV above), to ensure user customization and accessibility, effective maintenance of integral parts of the digital environmental information system and support of harvesting information through standardized reporting at the local, subnational, national and international levels, as appropriate.

13. Link the environmental portal through the use of open application programming interface, Really Simple Syndication (RSS) feeds and other interoperability tools to the thematic portals, platforms and data hubs (local, subnational, national and international), as relevant, to make environmental data and information discoverable and directly accessible.

14. Enable the use, through the environmental portal, of new or emerging digital technologies, including cloud computing services, open data cubes, artificial intelligence, blockchain, linked data, text mining and semantic web tools (see also para. 35 of the above-mentioned recommendations).

15. Provide opportunities for the public to participate in the design, development and upgrade of the environmental portal, taking into account good practices to ensure that the needs of different users are met.

16. Develop the onboarding system for different types of users and take the necessary measures to make the portal accessible taking into account their needs (see also section V of the above-mentioned recommendations).

17. Ensure high visibility of the portal to the public through the use of search engine optimization, social media optimization and search engine advertising, as appropriate.

18. Ensure direct access through the environmental portal to disaggregated, real-time and other dynamic data, as appropriate, including to space-based, citizen science, crowdsourced and other data outlined in paragraph 23 (d) of the above-mentioned recommendations.

19. Provide information on the points of contact to support the public in seeking access to information under the Convention.

20. Ensure that each web page of the environmental portal containing information and links is updated regularly and contains the date of the last update and the information source.

21. The content of the environmental portal can include the following themes:

- (a) Introduction;
- (b) Reports on the state of the environment;

²⁴ See www.iso.org/standard/52391.html.

²⁵ See www.akomantoso.org/.

²⁶ See www.go-fair.org/fair-principles/.

²⁷ See <https://github.com/CitSciAssoc/DMWG-PPSR-Core>.

(c) Environment themes (overview of legislation, policy, programmes, plans, international commitments, monitoring, data/data sources, environmental indicators, assessments, map viewers, scenarios, good practices in accordance with section III of the above-mentioned recommendations):

- (i) Air and atmosphere;
- (ii) Climate;
- (iii) Water;
- (iv) Soil;
- (v) Land;
- (vi) Ocean and sea;
- (vii) Subsoil and mineral resources;
- (viii) Natural sites and landscape;
- (ix) Forests;
- (x) Biological diversity;
- (xi) Genetically modified organisms;

(d) Factors (overview of legislation, policy, programmes, plans, international commitments, data/data sources):

- (i) Pollutant release and transfer register;
- (ii) Chemicals management;
- (iii) Waste management;
- (iv) Energy efficiency and consumption;
- (v) Noise and odour;
- (vi) Radiation;
- (vii) Use of natural resources;
- (viii) Product passports and other product-related information;

(e) Decision-making in environmental matters:

- (i) Public consultations;
- (ii) Strategic environmental assessment;
- (iii) Environmental impact assessment and State ecological expertise;
- (iv) Licensing and permitting;

(f) Activities, measures and good practices:

- (i) Economic-environmental accounting;
- (ii) Eco-labelling scheme;
- (iii) Eco-audit scheme;
- (iv) Producer responsibilities;
- (v) Green procurement;
- (vi) Public-private partnerships and environmental agreements;
- (vii) Funded environmental projects;

(viii) Good practices on better environmental management, sustainable consumption and production, best available techniques, green procurement, green and circular economy and sustainable development;

(g) Environmental compliance and enforcement;

- (h) Environment-related hazards and their zones, risks and emergencies:
 - (i) Dashboard and maps;
 - (ii) Situation reports and scenarios;
 - (iii) Mitigation and remediation measures taken by public authorities;
 - (iv) Prevention, mitigation and remediation measures for the public concerned, in particular for groups and communities in vulnerable situations;
 - (v) Citizen science and crowdsourcing data;
 - (vi) Media resources;
 - (vii) Training and e-learning;
 - (i) Public records;
 - (j) Data explorer;
 - (k) Research and education;
 - (l) Publications and downloads;
 - (m) Public engagement:
 - (i) Official notice board;
 - (ii) Aarhus Convention, its implementation and compliance;
 - (iii) Access to information;
 - (iv) Citizen science and crowdsourcing;
 - (v) Participation in decision-making in environmental matters;
 - (vi) Access to justice;
 - (vii) Accessibility menu and accessibility statement for access by persons with disabilities, and capacity-building for onboarding process tailored to different user needs;
 - (n) Media news and resources;
 - (o) Points of contact and user support and feedback services;
 - (p) Specifications for reuse of data and information;
 - (q) Terms and conditions of use.
-